YARRALUMLA BRICKWORKS

HERITAGE IMPACT STATEMENT

Block 1, 7 and 20, Section 102, Yarralumla ACT 2600



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Prepared for

DOMA

Prepared by

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Cover image: View from the Brickyards looking north to Hardy Patent Kiln I and the Hardy Patent Kiln II Chimney (Source: Lovell Chen, 2021)

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1.0 INTRODUCTION

This report is a specialist study of potential and likely heritage impacts relating to the proposed reactivation of the Yarralumla Brickworks by DOMA. It describes the proposed development as understood at the time of writing (May 2022) and sets out undertakings made by DOMA to minimise and mitigate effects on heritage values.

This report is intended to inform the Environmental Impact Statement (EIS) prepared by Umwelt (March 2022) and updates the study 'Statement of Heritage Effects' (GML, 2017) to reflect the masterplan and design approach as currently proposed.

1.1 Previous research and reports

The precinct has been the subject of extensive research and analysis over a long period (since at least the mid-1980s). The documents produced variously provide extensive coverage of the history and development of the brickworks complex, and its cultural heritage values. As relevant, these sources have been referenced, and their content relied upon, in the preparation of this report.

Documents of particular relevance to this report include:

- Lovell Chen, Interpretation Strategy Yarralumla Brickworks Precinct, February 2022
- GML Heritage, Canberra Brickworks Precinct, Archaeological Excavation Report and Statement of Heritage Effects, December 2021 (draft)
- GML, Canberra Brickworks Precinct, Conservation Management Plan, September 2021
- ACT Geotechnical Engineers Pty Ltd, Canberra Brickworks Redevelopment, Geological Fossil Study, March 2021
- Navin Officer Heritage Consultants, Archaeological Assessment Canberra Brickworks and Environs, September 2016
- Navin Officer, Canberra Brickworks, Aboriginal Cultural Heritage Assessment, August 2014
- Geological Society of Australia (ACT Division), 'Site 28 – Yarralumla Brickpits', 2013
- Lovell Chen, Canberra Brickworks Conservation Management Plan, April 2010 (updated April 2016)
- Susan Conroy and Munns Sly Architects, Yarralumla Brickworks and Environs Planning Review, 2005
- Connell Wagner Pty Ltd, The Old Canberra Brickworks and Environs Development Control Plan, February 2001
- National Capital Development Commission, Canberra Brickworks, South Canberra, Policy Plan, October 1988
- Lester Firth Associates, Old Canberra Brickworks, Conservation Plan, June 1986

1.2 Statutory heritage controls

1.2.1 Heritage Act 2004 (ACT)

The *Heritage Act*, 2004 (the Act) establishes a system for recognition, registration and conservation of places and objects of natural or cultural heritage significance, and Aboriginal places and objects in the

ACT. It establishes civil protection and offence provisions to prevent conduct that diminishes the heritage significance of a registered place or object (s 74), or damages an Aboriginal place or object (s 75), with exceptions for conduct that is in accordance with (among other things) a heritage guideline, an approved conservation management plan, development approval under the Planning and Development Act 2007 or approved statement of heritage effect (s 76).

Registered heritage places

The subject site includes two places that are inscribed in the ACT Heritage Register and are subject to controls under the Act: Yarralumla Brickworks (Block 1, Section 102) and the Yarralumla Brickworks Railway Remnants (Part Block 7, Section 102).

The Register Entry for the Brickworks describes the values of the place and identifies a schedule of buildings/structures on the site that are of 'exceptional significance' (Schedule 1) and a further schedule of buildings/structures that are of 'moderate significance' (Schedule 2). It also sets out 'Specific Requirements' (Heritage Guidelines under the current Act) that provide guidance on the management of heritage values in the context of future change. Archaeological investigations conducted by GML in 2021, informed by an Archaeological Assessment (Navin Officer, 2016) and Archaeological Research Design (GML, 2020) provided further information on the archaeological significance of parts of these registered areas.

The 2014 Cultural Heritage Assessment (Stage 1), undertaken by Navin Officer identified no Aboriginal sites within the study area (a 47-hectare area including the brickworks precinct), and no areas of Aboriginal archaeological potential were identified during fieldwork.[1] As an outcome of the Cultural Heritage Assessment, no statutory implications regarding cultural heritage apply to the study area. The Cultural Heritage Assessment was approved by the ACT Heritage Council on 11 September 2014.[2]

Approved conservation management plan

In August 2021, a Conservation Management Plan (CMP) for the Yarralumla Brickworks (including the Railway Remnants) was approved by the ACT Heritage Council under section 61K of the *Heritage Act 2004* (GML Heritage, August 2021). The CMP also establishes a hierarchy of significant elements, which are termed core, supporting and incidental. The CMP anticipates a level of change, adaptation and demolition in the sustainable redevelopment of the brickworks site. The CMP contains an 'Inventory of Individual Historic Elements', which describes the significance of buildings or structures and sets out applicable conservation policy and adaptation guidelines.

Statement of Heritage Effects

Under the *Heritage Act 2004* s 61G 'a person or entity proposing to undertake an activity that is likely to diminish the heritage significance of a place can apply to the ACT Heritage Council for approval of a Statement of Heritage Effects (SHE). Under s 61H, the Council must approve the SHE if (in summary):

- the proposal is justifiable
- there are no reasonably practicable alternative ways to carry out the proposal, and
- the applicant has identified reasonable steps it will take to reduce the risk of diminishing the heritage significance of the heritage site.

A SHE will be lodged for approval by the ACT Heritage Council prior to submission of detailed development applications.

1.2.2 Planning and Development Act 2007 (ACT)

The Planning and Development Act (s 148-149) and regulations (r 26) establishes the ACT Heritage Council as a referral authority for development applications. Under the *Heritage Act 2004* s 61, the Council's advice:

- **Must include** an outline of the effect of the development on the heritage significance of the place and advice about ways of avoiding/minimising the impact of the development
- **May set out conditions**, including conditions relating to reasonable steps to minimise the extent of harm, conservation requirements under applicable heritage guidelines, or a requirement to comply with an approved conservation management plan.

It is understood that future development applications relating to Yarralumla Brickworks will be referred to the ACT Heritage Council for advice.

1.3 Documentation

This report has relied on the following documentation:

- Architectural drawings (Draft), prepared by SJB Architects, current at April 2022
- Landscape Master Plan (Draft), prepared by McGregor Coxall, 'Schematic design', dated 5 November 2021 (F46 to the EIS)
- Civil drawings, prepared by Sellick Consultants, titled 'Concept EDP – Gazetted Road Plan', dated 30 April 2020 (F09 to the EIS) and 'Draft EDP – Fill Plan', dated 16 December 2019, 27-00-H
- ACT Geotechnical Engineers, Geological Fossil Study, dated 5 March 2021, (F48 to the EIS)

2.0 DETAILS OF THE PLACE

The former Brickworks is a site of significance to Canberra and the Australian Capital Territory (ACT). It is a place that is intimately associated with the origins and evolution of the national capital. The site includes physical evidence of historical brick-making processes, including a quarry pit; brick kilns of various type and age; the remnants of a railway; and several other archaeological remnants.

2.1 Description of the place

The site is the remains of the former Yarralumla Brickworks which operated (with a period of closure during World War I) from 1913 to 1976. The subject site is located to the south-west of the suburb of Yarralumla, 5km west of the Parliamentary Triangle. It is an approximately 16ha site comprising Blocks 1, 7 and 20 Section 102 (Figure 1). As noted, within the site are two heritage places: Yarralumla Brickworks (Block 1, Section 102) and the Yarralumla Brickworks Railway Remnants (Part Block 7, Section 102).

The registered area includes a complex of former brick manufacturing infrastructure arranged in a broadly orthogonal north-south arrangement, parallel to the remains of a quarry pit. The complex, referred to as the heritage core, comprises several types of kilns dating to different periods, accompanying fan houses, stacks and underground flues and a variety of ancillary buildings including a powerhouse, former offices and machine sheds. Some buildings retain fragmentary remains of industrial plant, and there are some moveable objects remaining on the site.

The Quarry is to the east of the heritage core. It comprises an excavated former 'pit' that retains a series of rocky outcrops, with higher ground to the north and east. The area is now vegetated with grasses and self-sown shrubs, with some trees (in particular, conifers and acacias) especially on areas of higher ground. Some remnant/self-sown native grasses and flowering plants have been identified on areas of higher ground. A remnant concrete and stone walkway constructed by AR Marr Pty Ltd after the closure of the quarry is located towards the east of the quarry pit.

To the southwest of the heritage core, the Brickworks Railway Remnants comprises the remains of earth embankments which served a short-lived but early railway to the site. These embankments are substantially overgrown with shrubs and trees.

Since 1976 the site has been largely (but not entirely) dis-used. A late-1970s proposal to adapt it as a tourist destination – initiated by A R Marr Pty Ltd – foundered by the early 1980s. Subsequent ideas for site-wide reactivation, typically proposed to be funded by residential development to the periphery, also failed to gain traction. Legacies of these aborted redevelopment initiatives include the removal of much of the original brick making plant and machinery, and the introduction of some new buildings.



Figure 1 Aerial photograph of the study area (solid red line) and environs: Block 1 is the registered extent of the Yarralumla Brickworks
Source: www.nearmap.com (base photograph)

2.2 Significance of the place

2.2.1 Summary of heritage significance

The Register Entries for the site include statements of significance, but do not include an assessment against criteria (see Appendix A). The CMP 2021 for the site accepts these statements but augments it with a heritage assessment, which draws on the register entries, the CMP 2010 and Archaeological Assessment 2016. In 2021, GML Heritage Pty Ltd (GML) undertook historical archaeological test excavations across several areas of archaeological potential, which provided further information about the site's archaeological features.

The following is a summary of the values expressed in the CMP 2021 heritage assessment, augmented with findings from the Archaeological Report 2021. Where the CMP or Excavation report goes beyond the Register Entry, this is indicated in italics.

Criterion A (Historic), Criterion B (Rarity), Criterion D (Representative))

The brickworks complex is important:

- As the first industrial manufacturing facility commissioned/constructed for the ACT
- As the source of bricks for early construction, including Provisional Parliament House, Kingston Powerhouse and Hotel Canberra
- As a site that is reflective of different phases in the construction of Canberra (1920s, and post-World War II), through the presence of six extant kilns and their subsurface flues
- For the relatively rare Staffordshire and Hardy patent kilns, with the Staffordshire Kiln (with its complex system of dampers and flues) the only known remaining Australian example of its type
- As a representative and unusual example of a large-scale, twentieth century urban brickworks, including buildings, structures, site layout and archaeological remnants
- For archaeological remains of the experimental plant which is linked to early construction of Canberra, allowing early brickmakers to experiment with the brick production process and kiln construction, and providing the means to manufacture the bricks for the construction of the Staffordshire Kiln and the Kingston Powerhouse. (*This was updated by GML following the Excavation Report 2021)*
- Geological significance as the type locality for the Yarralumla Formation, a major sedimentary sequence dating from the Silurian Period, 424-423 million years ago.[1] The rock units at the site provide the reference section for comparison of other outcrops within the Yarralumla Formation, and can be used for research and teaching.

The railway remnants are important:

- As evidence of the bulk transportation of bricks, particularly during the period of expansion from 1923 to 1927
- As a relatively rare remnant of Canberra's former rail network

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1 A type locality is the location of deposits that are considered to define the characteristics/qualities of a particular geological formation or period.

Research potential of archaeological remains (Criterion C)

- Potential of archaeological remains to yield information about the operations of the Brickworks, specifically the operation of the experimental kilns and the subsurface flue components
- Potential to yield information about the construction, nature and configuration of the railway (*noting that this is not indicated in the Register Entry; and that nil-low archaeological potential was identified following the GML Archaeological investigation 2021*)

Aesthetic importance of the Brickworks (Criterion E)

The Brickworks is important:

- As a distinctive industrial landscape, through the combination of robust and dramatic building forms, structures, larger elements of equipment, dominance of brick and corrugated iron and the visual qualities of the quarry (open space and exposed rock outcrops)
- For the low setting of the site within the landscape
- For the landmark quality of the 1953 brick stack

Association with the ACT community (Criterion G)

- The Brickworks holds strong associations with the local Yarralumla community
- Canberra Reds (brick type) are sought after as a building material (*indicated in the CMP, but not included in the Register Entry)*

It is noted that the CMP 2021 found that the brickwork production process and railway remnants did not meet the threshold for Criterion F as, while the kilns demonstrate technical processes, they do not display innovation or technical achievement. Similarly, the Excavation Report 2021 concluded that, although the experimental plant demonstrated that technical processes were being trialled, the archaeological resource of the area does not demonstrate a high degree of technical achievement.

2.2.2 Hierarchy of significant buildings and elements

The CMP establishes a three-tier hierarchy of significance for buildings, elements, areas and attributes at the site: core, supporting and incidental. This differs from the Register Entry, which lists the elements in two schedules of 'intrinsic features of the place', termed exceptional and moderate significance. In general, the CMP accepts the Register Entry, but goes beyond it to suggest that some elements that are not identified in the Register Entry are significant, or that conservation policies apply.

The Register Entry for the Railway Remnants recognises the intrinsic features of the place as 'remnants of the original earthen railway embankment, cutting and terraces'.

Both the CMP and the Register Entry specific requirements respond to this hierarchy of significance through differing adaptation guidance, which indicates a greater tolerance for change in elements of lesser significance.

2.2.3 Plant and equipment

The ACT Heritage Register entry for the Yarralumla Brickworks includes 'specific requirements' for Industrial Equipment, as follows:

a. Major equipment and machinery associated with the historical industrial use of the place shall be retained and conserved in situ. Minor equipment should be retained and conserved but may be relocated to a new location within the site for interpretive purposes and/or its own protection.

b. The Primary Crusher House (20), including the integral equipment and machinery, and the Elevator Conveyor (22) shall be conserved for their ability to demonstrate and interpret industrial processes and secondary aesthetic values.

Consistent with Policy 9 in the CMP, moveable relics on the site have been investigated and recorded through an Inventory of Moveable Relics (GML 2020, Appendix H to the Approved CMP). A formal assessment of significance or historic research (including into provenance, origin, manufacture date or purpose) was not undertaken as part of the Inventory, and there was no distinction made between 'major' and 'minor' equipment. However, preliminary recommendations on investigation, salvage, storage or re-use were made as part of the Inventory, and the Report recommended (in summary):

- research to establish provenance and function of items, and connection to history and significance of the Brickworks
- retention of fixed industrial equipment for re-use and/or interpretive purposes
- recording, conservation and salvage works prior to construction commencing

Items were included in the inventory if they were thought to have had 'an integral association with the industrial function of the Brickworks (ie Brickmaking)'.[3]

2.2.4 Archaeology and Artefact Management

The Yarralumla Brickworks Precinct has long been identified as a place of (non-Aboriginal) archaeological potential (see for instance Policy 15 of the Canberra Brickworks CMP by Lovell Chen, dated April 2010). The Archaeological Assessment prepared by Navin Officer in 2016 identified 12 areas of archaeological sensitivity and recommended that areas of moderate and high archaeological potential be subjected to an archaeological testing programme prior to any works or development in these areas (see Figure 2).

Archaeological investigations undertaken in 2021 were informed by an Archaeological Research Design, (GML, September 2020). The objective was to determine the nature and extent of archaeological deposits at the site and develop recommendations for management requirements for archaeological deposits. Based on a review of the Archaeological Assessment (2016) and an inspection of the site it was determined that eight of the 12 areas of archaeological sensitivity identified in the Archaeological Assessment should be subjected to further archaeological testing (BRW1, BRW2, BRW3, BRW7, BRW8, BRW10, BRW11 and BRW12). The outcomes of the investigations are summarised in the Canberra Brickworks Precinct, Draft Archaeological Excavation Report (GML, December 2021).

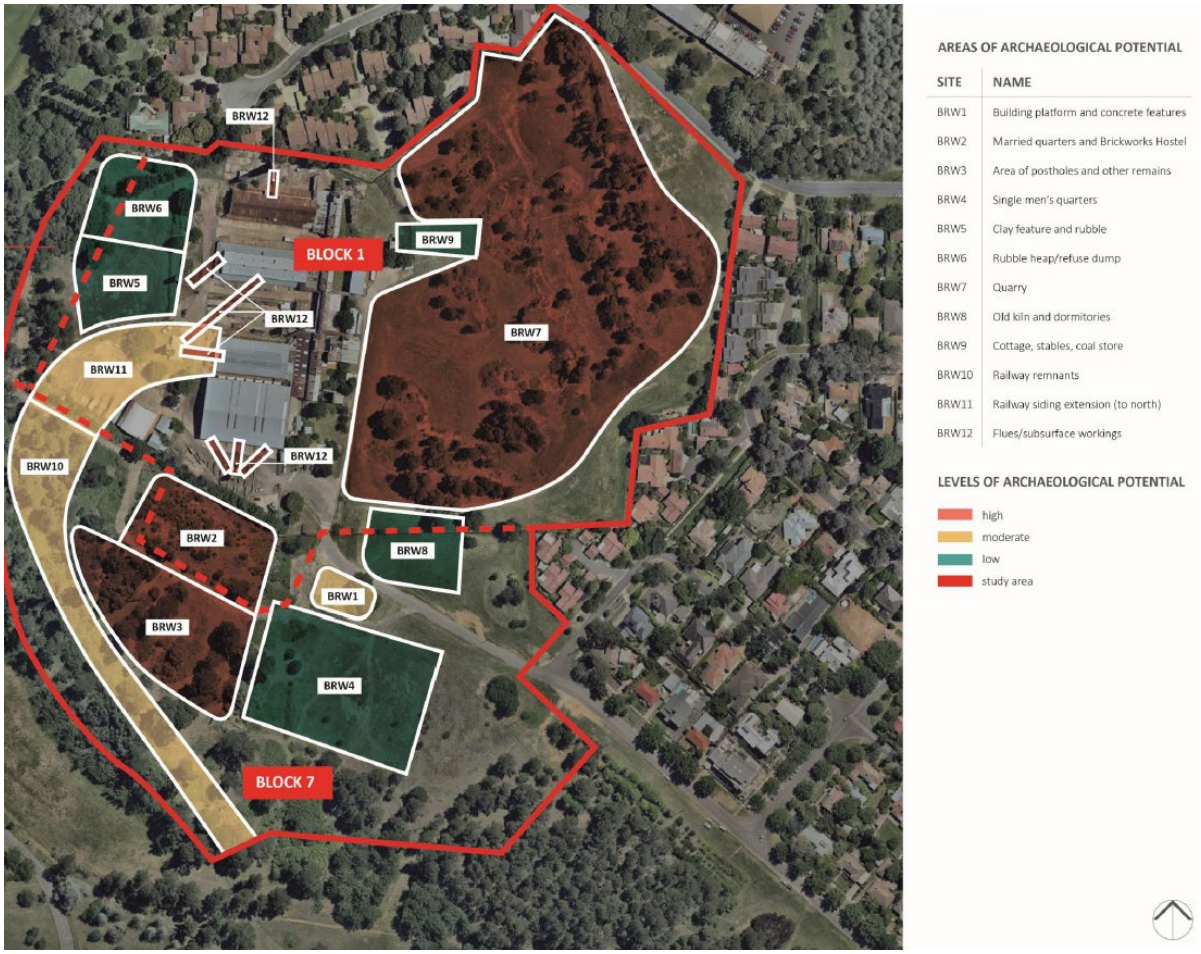


Figure 2 Areas of archaeological potential identified in 2016: BRW8, BRW10 and BRW 12 were assessed as significant following investigations carried out in 2021
Source: Navin Officer, Archaeological Assessment, September 2016

The Statement of Significance from the Archaeological Excavation Report states that:

> The Canberra Brickworks Precinct is significant as the first industrial manufacturing facility commissioned for and constructed in the ACT, developed specifically to facilitate the construction of the new capital city. On the surface, the Precinct is an unusually complete example of a complex demonstrating aspects of the operation of a twentieth century large scale urban brickworks. It has a diverse range of heritage values, such as the role it has played in the course of the ACT's history, its aesthetic qualities, and the connection it holds with both the local Yarralumla community and the wider Canberran population. These values are manifested in the intact industrial landscape and the key role it played in the course of the ACT's history.
>
> The archaeological remnants identified in this investigation are only partially reflective of these values. The site has undergone several distinct phases of operation, the later ones often obscuring the earlier activities. However, where archaeological remains that demonstrate the early and complex nature of the site are present, these have the ability to contribute to understanding both of the site and brick making processes more widely.

> The Precinct underwent several distinct phases of operations, each reflective of the broader political contexts that have determined the fluctuation of construction in the capital city…

It assesses each of the phases, and provides the following summary of significant archaeological remains:

- The archaeological remains of the experimental plant (BRW8) have been assessed as meeting criteria a), b), c), and d). They are highly significant.
- The archaeological remains of the railway remnants (BRW10) have been assessed as meeting criteria a) and b). They are moderately significant.
- The subsurface flues (BRW12) have been assessed as meeting criteria a), b), c), d), e), and f). They are highly significant.

Following the GML investigations, the predicted archaeological potential of sites was updated, as summarised in the following table:

Table 1 Summary of updated archaeological potential (GML 2021)[4]

Area	2016 Assessment (Navin Officer)	2021 Update (GML)
BRW1 Building platform and concrete features	Moderate	Nil
BRW2 Married Quarters and Brick Hostel	High	Moderate
BRW3 Area of postholes and other remains	High	Low
BRW 4 Single men's quarters BRW 5 Clay feature and rubble BRW 6 Rubble heap/refuse dump	Low	Not investigated
BRW7 Quarry	High	High
BRW8 Old kiln and dormitories	Low	High
BRW9 Cottage, stables, coal store	Low	Not investigated
BRW 10 Railway remnants	Moderate	Low
BRW 11 Railway siding extension	Moderate	Nil
BRW 12 Flues and subsurface workings	High	High

2.2.5 Implications of significance

The register entry expresses the following overall objective for conservation of the site:

> The identified heritage values and intrinsic features of the place shall be conserved whilst allowing for the integrated and sympathetic redevelopment of the place as a single entity, consistent with contemporary practices for the adaptive reuse of industrial and commercial heritage places. In conserving and developing the place, its significant historical use as an industrial site for the production of bricks and clay products shall continue to be evident and accessible to the public.

In endorsing the CMP, the ACT Heritage Council has indicated that the *Heritage Act 2004* would 'require the conservation and responsible management of all significant features of the place, as set out in Section 5 of the CMP.'[5] Consequently, a key ambition of this project has been to stabilise, conserve and retain all significant buildings, repurposing where possible with a viable and sustainable new use.

It is recognised that in accordance with the Burra Charter, conservation means all the processes of looking after a place so as to retain its cultural significance:

> Conservation may, according to circumstance, include the processes of: retention or reintroduction of a use; retention of associations and meanings; maintenance, preservation, restoration, reconstruction, adaptation and interpretation; and will commonly include a combination of more than one of these. Conservation may also include retention of the contribution that related places and related objects make to the cultural significance of a place.

Given the complexity of the site, it is to be expected that a spectrum of approaches will be used. The selection of the approach will be calibrated to the degree and nature of significance, and be balanced across the site and within key buildings. The framework to achieve this balance is established by the approved CMP, in particular Appendix A, which provides specific guidance on the adaptation and conservation of significant elements. The CMP 2021 also emphasises the need to conserve the heritage significance of the site as a whole. This has been approached through a coordinated approach to development, guided by design principles that respond to the CMP and Register Entry.

3.0 DETAILS OF THE PROPOSAL

3.1 Summary of the proposal

The proposed redevelopment would include a mix of re-purposed heritage buildings and spaces (the 'Heritage Core'), with a maximum of 380 residential dwellings, and recreational parkland in the former Quarry. The intent of the proposal is to reactivate the Brickworks complex with a mix of residential, commercial, retail and food and beverage facilities. A health and wellness centre is proposed, incorporating the Staffordshire kiln and two of the three downdraft kilns. The Hardy Patent Kilns and process buildings will be repurposed for a mix of commercial, retail and hospitality uses.

3.1.1 Conservation of heritage buildings

The primary strategy for conservation of heritage buildings is through a mix of in-situ retention and adaptive re-use.

With the objective of managing the site holistically, the proposal includes:

- *Adaptive reuse:* Buildings to be adapted to new uses include the powerhouse and office, downdraft kilns, Staffordshire Kiln, Hardy Patent kilns (I and II) machine bays (I, II and III), Staffordshire Kiln fan house and the workshop and White Pan Room (Large Crusher House II);

- *New works to support adaptive reuse:* Limited new built form is proposed to support the re-use of retained buildings. Interventions include elevated 'walkways' to provide access to the upper levels of the major kiln structures; and additions to the kiln structures, to facilitate repurposing.
- *Conservation works:* Stabilisation and retention of original fabric during adaptation, and of buildings/elements as 'features' within the landscape, including crusher houses and brick stacks; and
- *Landscaping:* The introduction of a landscaping treatment across the site to assist with 'softening' the industrial environment and providing an appropriate level of amenity and sustainability.

Given the varying condition, intactness and levels of significance of the extant elements a building-specific approach will be adopted for the conservation works. Over-arching objectives are for the retention of original fabric, plant/infrastructure and the powerful forms of the primary built elements comprising kilns, stacks and process buildings/machine bays.

3.1.2 Site access and urban design

The principal vehicular point of arrival to the brickworks will be 'Quarry Drive', a new roadway at the south of the site. Quarry Drive leads to a roadway extending east-west across the south of the heritage core. At the west end of this roadway is a parking structure, located opposite a linear north-south spine to the west of the kilns.

New accessible open spaces will include the brickyards (the open area to the north of the Staffordshire kiln and south of Hardy Patent kiln no. 1) and the quarry park, with access through the site via a linear open space between the kilns and fan houses (sometimes referred to as the 'village green').

The area between the two Hardy-patent kilns (sometimes referred to as Brickyard 2) will be a controlled access – accessible only by the people attending associated restaurants and offices. The pool area to the north of the heritage core (north of Hardy Patent kiln no. 2) will not be publicly accessible.

A landscape and urban design masterplan has been prepared for the brickworks precinct by McGregor Coxall. The design approach seeks to respond to the landscape setting of the site, maintain the strong definition of the heritage core and celebrate the existing materiality of the site, while creating new, sustainable and comfortable places for recreation. As conceived a 'key design principle for [the] public domain is to celebrate the site's industrial past and improve access and legibility to its history'.[2] Interpretation will be integrated into landscape treatments, as described in the Interpretation Strategy (Lovell Chen, 2022).

3.2 Reasons for the proposal

The Brickworks site has long been disused and inaccessible. Since the closure of the Brickworks in 1976, there have been a series of proposals for mixed commercial, residential and public space developments—all have failed to progress. Meanwhile, the site and its fabric have deteriorated, with some buildings in an advanced state of decay.

As anticipated by the Register Entry and the CMP 2021, the proposal takes an integrated approach to adaptive reuse and development. By introducing new uses which are economically and socially

2 MacGregor Coxall, Landscape and Urban Design Package, 2017.

sustainable, the proposal offers an opportunity to establish a framework for ongoing care of the heritage significance of the place. At the same time, it establishes a new identity for the place, as a destination where the history of the site, and the connection to the broader history of Canberra, is evident and accessible to the public.

3.3 Practicability of alternatives

3.3.1 Conservation through adaptive re-use

It is widely accepted that the best way to conserve a heritage building, structure or site is to use it.[6] Adapting buildings to a viable new use provides a framework for retaining and sustaining those structures into the future.

In the context of the Brickworks, the largest and most prominent buildings on the site are also the most significant. The arrangement of kilns and process buildings within the heritage core provides a natural centre to the site, where the significance of the site is most readily understood. For the values of the site to remain 'evident and accessible', there is a need to locate most public experiences within key heritage locations: the heritage core, the quarry and the railway remnants.

The quarry and railway remnants are to be retained as public open space—an approach that naturally minimises the impact of change. However, to anchor public experiences around the heritage core, it is necessary to find viable and sustainable uses for component structures, particularly kilns and process buildings. From a heritage perspective, it is desirable that these uses will bring people to and through the site, will allow the fabric and form of these buildings to be appreciated and understood, and will connect to the significant open space areas planned for the site. From a social and economic perspective, it is essential that these proposed uses respond to an analysis of likely commercial, demographic and property market conditions and forecasting. This includes the need for the development to create sufficient value to support the costs of conservation of valued fabric.

3.3.2 Consideration of potential uses

In developing proposals for potential adaptive re-use of significant structures, DOMA has considered the need to:

- Provide for the needs of future residents, while also attracting visitors
- Provide alternative housing options that are currently in limited supply (for example, townhouses, terraces and apartments)
- Integrate the development as a significant new precinct within a broader Canberra setting
- Strategically locate access points and relationships between new public areas and surrounding residences
- Calibrate potential uses to minimise impacts on the most significant elements and original fabric (where present), with more intervention
- Ensure commercial viability by responding to minimum space requirements and expectations of potential tenants

3.3.3 Degree of change to fabric to accommodate proposed uses

It is accepted that a significant degree of physical change will be required to adapt some structures as habitable, comfortable and compliant with contemporary codes/standards. For example, re-building of the roofs and walls of process buildings and the upper levels and roofs of kiln structures to comply with

building standards is considered the only reasonably practicable alternative to secure a viable new use for these structures.

In some cases, retention of existing fabric is not a practicable alternative because of structural instability or the presence of hazardous materials.

Consistent with the CMP, the approach to adaptation is one that anticipates a greater degree of change to elements of more moderate significance, such as process buildings. Within more significant buildings, the approach to change is also balanced, with areas of greater intervention balanced with areas where original fabric and form is carefully retained. This 'balanced' approach is considered essential to facilitating new uses and the commercial viability of the development.

4.0 DESIGN PRINCIPLES

The Register Entry expresses an objective that 'significant historical use as an industrial site for the production of bricks and clay products shall continue to be evident and accessible to the public.' This objective is reflected in the 2021 CMP.

It is considered that this objective can be achieved by managing heritage impacts through the design process. Consequently, the design team has established the following principles to ensure that this history is legible and central to the human experience of the new development. These principles are intended to embed the relevant sections of the CMP and Register Entry in the overall design approach.

4.1 Holistic planning

Heritage is integrated within the overall vision for the site and the development outcome is coordinated across the complex. New uses of the site and its components are sustainable economically and socially, supporting long-term conservation of heritage values. All significant elements are retained and conserved and the heritage significance of the site as a whole is respected and celebrated.

Key references are CMP Policy 7 (whole of site approach to conservation), 17 (explore adaptation opportunities) and 18 (respect heritage significance when planning new development).

4.2 Sustainable adaptation

All significant buildings and elements on the site will be retained, stabilised and conserved. Significant buildings will be repurposed, considering the site as a whole and balancing fabric conservation with the changes required to deliver a sustainable and viable new use.

Key references are CMP policies 6 and 8 (conservation in accordance with assessed significance), 12 (encourage public access), 15 (planning for sustainable future), 16 (compatibles uses) and 17 (explore adaptation opportunities).

4.3 Spatial planning

The design and arrangement of the new development responds to the spatial qualities of the site. The design approach avoids fragmentation of the site by maintaining key views, relationships, circulation patterns and spaces. In particular, the historical approach from the south, the connections between kiln structures and their chimneys/fan houses, and the north-south connection to the Brickyard will be maintained, and the heritage structures will remain the dominant visual elements in these areas.

Key references are CMP Policy 7 (whole of site approach to conservation), 12 (encourage public access), 13 (respect historic circulation and road layout) 15 (planning for sustainable future), 22 (respect for views) and 23 (respect for spatial qualities and relationships).

4.4 Conservation

A full program of conservation and remediation works will be integrated into the development, informed by expert advice and investigations.

The key reference is policy 10 (conditions maintenance program to conserve core and supporting heritage elements on site).

4.5 New built form

New built form will be introduced that supports sustainable and viable new uses of the site and its elements. New buildings and elements (such as elevated walkways) will be located and designed to maintain key visual and spatial relationships and points of appreciation of significant structures. New structures will be recessive in height and scale, and adopt a complementary form, character, detailing and material palette.

Key references are CMP policy 19 planning infill development, 20 (retain industrial character) and 23 (respect spatial qualities and relationships)

4.6 Landscape

The landscape treatment will enhance and interpret the distinctive qualities of the heritage core, the quarry and geological features and railway remnants. As set out in the *Yarralumla Brickworks Precinct Interpretation Strategy* (Lovell Chen, February 2022) interpretive elements will be integrated with landscaping and wayfinding.

Key references are policy 21 (retain historic industrial character) and 23 (respect spatial qualities and relationships).

4.7 Plant and equipment

Plant and equipment will be maintained consistent with the CMP where it contributes to the significance of the site/or an understanding of the operation of the place as a Brickworks. Some fragmentary industrial equipment may be retained where possible for its contribution to an industrial aesthetic.

The key reference is policy 9 record, investigate and conserve plant and equipment where it relates to the former operation of the site.

4.8 Archaeology

The design has been informed by archaeological assessments conducted by Navin Officer (2016) and investigations and assessments conducted by GML (2020). Consistent with the recommendations in the GML report, archaeological findings will be interpreted through interpretation/landscape treatment, subsurface flues will be stabilised, works will be monitored in selected un-investigated areas, and works in other areas will follow an unanticipated finds protocol.

The key reference is policy 28 (assess for impacts from development on areas of archaeological potential).

5.0 ANALYSIS OF HERITAGE IMPACTS

The following analysis considers the proposed development as understood at the time of writing (April 2022) to identify the likely impacts on buildings and structures of identified heritage significance. Some aspects of the design are yet to be resolved, but the core aspiration is for retention of the values of significant elements, consistent with the CMP 2021 and Register Entry.

5.1 Summary of Register Heritage Guidelines

The Register Entry contains heritage guidelines addressing demolition, adaptation, landscaping and new buildings.

In summary, where a building is identified as of 'exceptional significance':

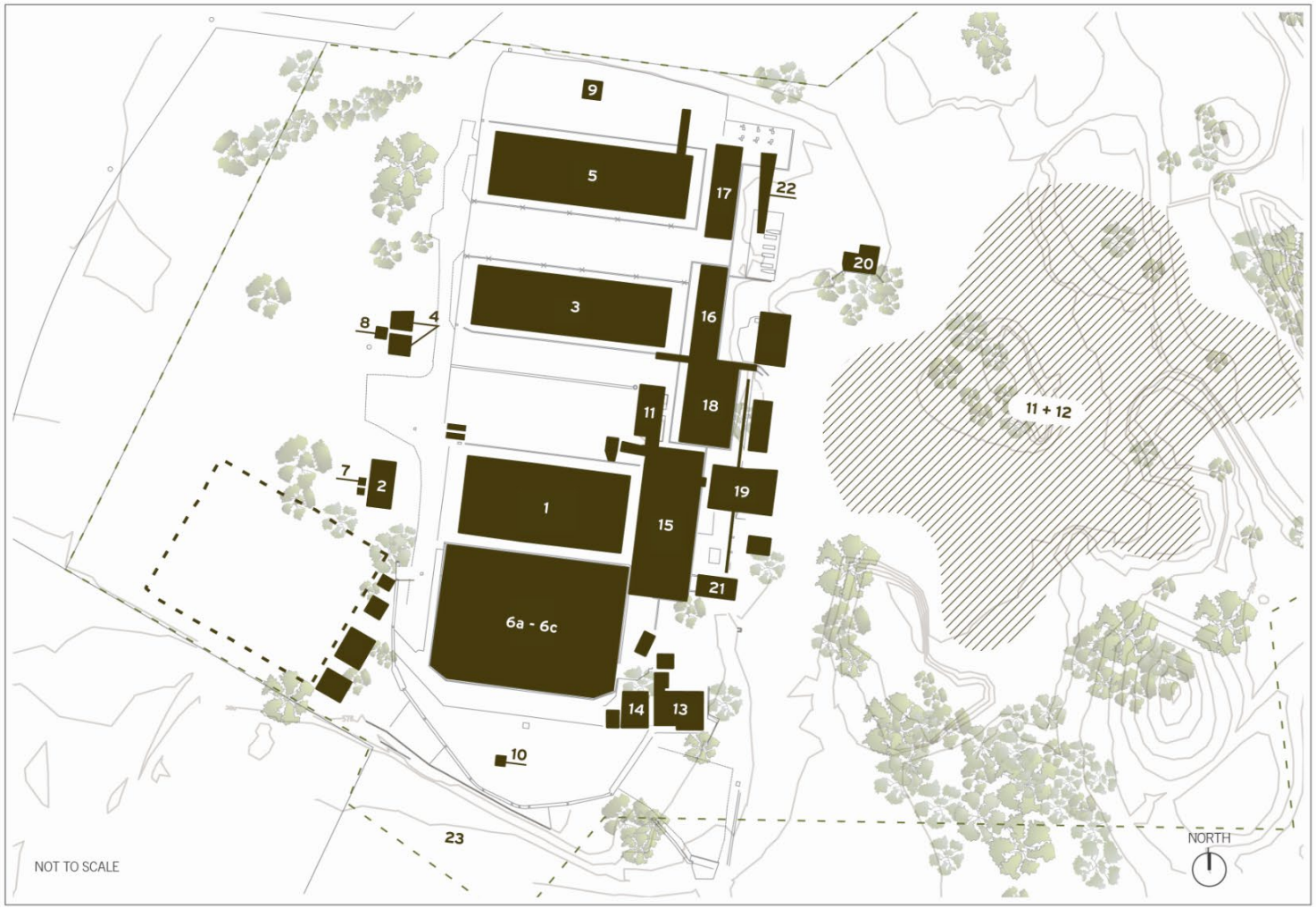
- The external form, including the arrangement of openings and detailing that reflects the industrial use of the building or element should be retained
- Minor external alterations and additions and major internal alterations to the building or element may be permitted to suit a new use where the proposed works will not adversely affect the heritage significance of the elements or the place as a whole
- Alterations and additions to the original built fabric, including alterations to external finishes, should complement the historical industrial use and architectural style of the place
- Demolition of the original internal fabric should only occur in the context of sympathetic alteration and additions, as identified within the CMP

Where a building is of 'moderate' significance:

- Subject to the recommendations of the CMP, the building or element 'may be conserved to interpret the historical use of the place or adapted to suit a new use for the place'.
- Elements that no longer include substantial evidence to describe industrial processes (specifically buildings 15 to 18 (Machine Bays I to III), Building 18 (the Workshop), 19 (Large Crusher House/White Pan Room) and 21 (Small Crusher House)) 'may be replaced with new development that is generally consistent with the scale, form, external materials and industrial character of the place'
- The Primary Crusher House (20), including the integral equipment and machinery, and the Elevator Conveyor (22) shall be conserved for their ability to demonstrate and interpret industrial processes and secondary aesthetic values.

5.2 Analysis of specific elements

Figure 3 provides a numbered site plan indicating the location of significant elements. Table 2 below lists all buildings or structures on the site, summarises relevant policies from the CMP (and register entry, where these go beyond the general guidelines at section 5.1) and comments on the compliance of the proposal with this guidance.



Number	Element
01	Staffordshire Kiln
02	Fan House for Staffordshire Kiln
03	Hardy-Patent Kiln
04	Fan House for Hardy-Patent Kiln
05	Hardy-Patent Kiln
06 a-c	Downdraft Kilns
07	Chimney Stack for Staffordshire Kiln
08	Chimney Stack for Hardy-Patent Kiln
09	Chimney Stack for Hardy-Patent Kiln
10	Chimney Stack for Downdraft Kilns
11	Quarry
12	Geological features
13	Office
14	Power House
15	Machine Bay for Staffordshire and Downdraft Kilns
16	Machine Bay for Hardy-Patent
17	Machine Bay for Hardy-Patent
18	Workshop
19	Large Crusher House
20	Primary Crusher House
21	Small Crusher House
22	Elevator Conveyor
23	Brickworks Accommodation Village

Figure 3 Yarralumla Brickworks site plan: built form and site infrastructure: numbers correspond with the ACT Heritage Register entry for the brickworks

Table 2 Comment on consistency with CMP Policies for specific elements

Element	Register entry	CMP 2021	Summary of applicable CMP policies/guidelines	Comment on consistency of proposal
1: Staffordshire kiln (1914-15)	Exceptional	Core	• Retain original external fabric and restore brickwork • Internal adaptation is acceptable, provided that a representative example of a kiln chamber and a section of the firing floor are retained • Retain the form of kiln entries (allowing for introduction of recessed doors) • Ensure new structures reference the industrial character of the place • Minor exterior changes are acceptable including new roof lights, solar panels or other ESD measures	The proposal is to retain and adapt the Staffordshire Kiln for use as a wellness centre, with associated hospitality and retail spaces. Most of the original brickwork and kiln forms (16 of 20) at ground level will be retained. Level 1 walls and roof will be rebuilt to contemporary standards, retaining the original roof form and detail, with new corrugated metal cladding and new window openings. New built form will be inserted to the north (a glazed ground level café) and south (a two-storey glazed structure linking to two of the downdraught kilns), to create new spaces and access points. The works will involve impacts on both original and non-original fabric, extensive internal change, and changes to the setting and external presentation of the kiln. However, these impacts are necessary to support the proposed new uses and will be minimised by: • Retaining the form and materiality of the building • Retaining and conserving original brickwork at ground level and where present at level 1 • Careful and respectful design of new structures, with attention to materials, form, bulk and the connection between old and new fabric • Retention of distinctive interior and exterior qualities where possible, including representative examples of kiln firing holes and firing marks, extensive retention of roof trusses and overhead equipment, minimisation of the visual and material impact of services, and retention of original brick details and kiln numbers • Use of lighting, ground plane treatments and signage to interpret and celebrate the history and operation of the kiln

Element	Register entry	CMP 2021	Summary of applicable CMP policies/guidelines	Comment on consistency of proposal
				Overall, the proposal is a balanced outcome that is consistent with the CMP policies and Register Entry, and will provide for the ongoing conservation of the kiln structure.
1A: Railway remnants (1923)	Significant	Core	• Retention as an open landscaped space that reflects its origins through the form of embankments and earth terraces • Adaptation of this area should ensure legibility as a former railway • Note contents of ACAT Orders (2013) that the zone shall be treated as landscaped open space, celebrating the history of the railway remnants	The proposal is for retention of the area as landscaped open space, with a strong interpretive dimension. It is noted that there is very little remnant fabric or archaeological potential associated with the railway remnants. The landscape treatment will retain and reinforce the cutting alignment. Interpretive signage, furniture and play structures will respond to the history of the railway remnants, and their significance as a point of departure and connection to major built landmarks in Canberra (such as the Provisional Parliament House). This proposal is consistent with the CMP policies and represents a positive heritage outcome.
2: Fan house for Staffordshire kiln (1914-15)	Exceptional	Core	• Retain original form, openings, fabric, internal configuration and concrete platforms • New removable flooring could be introduced to facilitate use of the space • Replace deteriorated fabric to match or be complementary to existing materials	The proposal is for retention and conservation of the Fan House. Decayed fabric will be replaced in a like-for-like manner, water ingress will be addressed, the roof will be re-built to meet current standards and doors will be installed to ensure the building is secure and weather-tight. The potential for the introduction of a new floor will be explored to facilitate future use. This proposal will have some heritage impacts including demolition of early fabric and impact on the ability to perceive the connection with underground flues. However, these changes are necessary given the extent of decay and the need to secure a sustainable new use. Measures to minimise impact including retaining the original form, openings and fabric where possible, replacing decayed fabric to match or complement existing and exploring options for retention of some extant,

Element	Register entry	CMP 2021	Summary of applicable CMP policies/guidelines	Comment on consistency of proposal
			• Investigate and address water ingress • Investigate possibility of retention of fan function or elements	fragmentary equipment. Overall, the proposal is consistent with CMP policies and represents a positive heritage outcome.
3: Hardy-Patent kiln 1 (1927)	Exceptional	Core	• Retain, conserve and stabilise external original form and fabric (brick), replacing (or refixing) wall and roof sheeting • External modifications (including new first floor openings, windows, recessed doors) are anticipated • The verandah should be retained or re-interpreted to reference the original • Internal modifications including carefully designed subdivisions in the kiln chambers and installation of concrete slab are anticipated; if possible, roof trusses should be retained/exposed	The proposal is for the adaptation of Hardy Patent Kiln I for new hospitality and commercial uses. The building's external form and original brickwork at ground level will generally be retained and conserved. The verandah will be replaced with a new awning structure and the recessed glass doors will be introduced. The upper-level metal clad walls and roof will be replaced, with the addition of windows, roof lights and vents to support the new use. A new elevated catwalk will be inserted to the south (eastern end), east and north of the building. Internally a limited number of carefully designed new openings will be inserted in the wall dividing the two kiln chambers and finished in a way that is visually differentiated. Floors at ground and level one will be excavated with new concrete slab floors installed. The proposal will result in heritage impacts including changes to original fabric, the external appearance and the setting of the kiln. However, the changes are necessary to support a sustainable new use for the kiln, and are limited in line with CMP guidance, so that the history of the use of the kiln will be legible in the new development. Minimisation and mitigation measures include retention and conservation of most of the original brickwork and roof trusses, design of modifications and additions to be respectful and complementary to original fabric and form, and interpretation to support continued understanding of the history and operation of the kilns. Overall, the proposal is a balanced outcome that is consistent with the CMP policies and Register Entry, and will provide for the ongoing conservation of the kiln structure.

Element	Register entry	CMP 2021	Summary of applicable CMP policies/guidelines	Comment on consistency of proposal
4: Fan house for Hardy-Patent kiln I (c 1926, 1953)	Exceptional	Core	• Retain and stabilise in-situ, retaining the internal configuration as evidence of the original function of the building. • No new openings should be introduced • Substantially dismantled plant could be retained or removed and recorded	The proposal is for retention and stabilisation of the Fan House. Cladding that cannot be refixed will be removed, and timber framing, windows and openings will be repaired. Ductwork and remnant machinery will be retained. The proposal is consistent with the CMP and Register Entry and represents a positive heritage outcome.
5 Hardy Patent Kiln II (1953)	Exceptional	Core	• Policies are comparable with the policies for Hardy Patent Kiln I (see above).	The proposal is broadly similar to the proposal for Hardy Patent Kiln I, including retention of original brickwork, rebuilding of upper walls and roof with new openings, replacement of verandah structure and internal demolition (limited openings between kiln structures, and excavation of the firing floor). These interventions will support the introduction of new specialty retail and commercial uses. As for the analysis of the Hardy Patent Hardy Patent Kiln I proposal, while the proposal involves loss of fabric and change to presentation and of understanding of the operation of the kiln, this is a balanced outcome that includes minimisation/mitigation measures, including retention of the building's overall form, conservation of original fabric where possible and design of complementary alterations and additions, supported by interpretation. The proposal is consistent with the policies of the CMP and Register Entry and is necessary to introduce a new viable use to the place.
6 Downdraught Kilns (1963)	Exceptional	Core	• The enclosing shed roof structure could be retained or demolished as required.	One of the downdraught kilns will be retained and adapted for a hospitality (bakery/café) use, with the remaining two connected to the Staffordshire Kiln to the north will be adapted for use a wellness centre. Interventions include

Element	Register entry	CMP 2021	Summary of applicable CMP policies/guidelines	Comment on consistency of proposal
			• Adaptive reuse should be explored, including internal subdivision.	demolition of the shed, installation of new metal roofs to a complementary design, introduction of lightweight internal partitions and new glazed north and south openings and fresh air louvres (with existing metal doors fixed open and retained). Existing vertical steel beams and tensioned cables are to be retained where possible. Opportunities will be explored to remove the infill from feedholes, stabilise the brick and install a new steel lintel and window, to allow natural light into the kilns, or to retain the rhythm and form of feedholes where full retention is not structurally possible. Care will be taken to minimise the visibility and impact of services, including through floor reticulation.
7 Chimney Stack for Staffordshire Kiln (1915)	Exceptional	Core	Element should be retained and conserved.	The proposal is for retention, stabilisation and conservation. This is consistent with the CMP and represents a positive heritage outcome.
8 Chimney stack for Hardy-Patent kiln I (1927)	Exceptional	Core	Element should be retained and conserved.	The proposal is for retention, stabilisation and conservation. This is consistent with the CMP and represents a positive heritage outcome.
9 Hardy-Patent kiln 2 chimney stack (1953)	Exceptional	Core	Element should be retained and conserved.	The proposal is for retention, stabilisation and conservation. This is consistent with the CMP and represents a positive heritage outcome.
10 Chimney Stack for Downdraft Kiln (1963)	Exceptional	Core	Element should be retained and conserved.	The proposal is for retention, stabilisation and conservation. This is consistent with the CMP and represents a positive heritage outcome.
11 and 12 Quarry and geological features A, B, C and D	Exceptional	Core	• Retain as a landscape element that reflects in its form and presentation its origins as an excavated brick pit.	The proposal is to develop the Quarry as a landscaped public park, including an interpretive water feature linking to the Brickyard. Housing will be located on the elevated areas to the south and east. Limited excavation and fill works are proposed in two areas to the east of the quarry—one area well removed from geological features to the east of the lake, and another area to the east and south of geological feature C.

Element	Register entry	CMP 2021	Summary of applicable CMP policies/guidelines	Comment on consistency of proposal
			• Landscaping and low-medium height building may be permitted • Minor modification to the shape of the quarry is acceptable, utilising existing access points • Retain and protect identified geological features (rock outcrops) • Retain the western section of the Quarry closest to the Brickworks buildings as open space • Integrate geological features into site landscaping and avoid disturbance of immediate surface, retain immediate environs as landscape open space	The proposal retains the quarry largely intact, with large areas of the excavated brick pit to be exposed. Excavation and fill works are limited and will avoid significant geological features. Archaeological Investigations of the area to be disturbed (GML 2021) found that while there are archaeological deposits, they are of no heritage significance (and consequently, do not represent a heritage impact). Investigation by ACT Geotechnical Engineers (2021) (assessing a more extensive proposal) concluded that there is no geological reason to prevent cut and fill works in proposed areas, and that geological feature C could be protected with a fenced exclusion zone. Since then, the potential impact has been further minimised with a reduced fill area proposed to the south, and removed from, geological feature C. The proposed landscape design for the park will enable public access to the area and interpretation of historical and geological significance of the quarry. The immediate environs of the geological features and the area to the west linking to the Brickyards will remain as landscaped open space. The proposed cut and fill works should be regarded as minor modifications to the shape of the Quarry. The proposal complies with the CMP and register entry policies and will result in a positive heritage outcome.
13 Office (1916) 14 Power House (1915)	Moderate	Supporting, but c 1953 and 1970s extensions are incidental	• Buildings could be adapted internally, with remnant equipment in the Power House retained or removed as required	The proposal is for the removal of later additions and adaptation of these buildings for the provision of concierge (and possibly retail) uses. While the final design is not resolved, the proposal will include demolition of non-significant (incidental) extensions, replacement of doors and windows in existing openings and internal demolition including removal of equipment. The proposal may include the introduction of lower scale and sympathetically designed

Element	Register entry	CMP 2021	Summary of applicable CMP policies/guidelines	Comment on consistency of proposal
			• 1953 and 1970s extensions are not significant and could be removed • Remove intrusive ad hoc additions, and consider repairing and reinstating infilled openings (doors and windows) if required	additions (such as glass walkway connection or low scale addition to the north of the Office). While there may be some minor impacts associated with demolition, the result will, on balance, be positive and is consistent with the CMP. It will result in retention of the buildings, removal of intrusive additions and the introduction of a sympathetic new use.
15 Machine Bay I (c 1955) 16 Machine Bay II (c 1955) 17 Machine Bay III (c 1955) 18 Workshop (1955) 19 Large crusher house/ White Pan Room (c 1955) 21 Small crusher house (mid-late 1950s)	Moderate	Supporting	• These buildings are all of moderate/supporting significance and have broadly similar adaptation policies: • There is scope for external modification (including windows and other openings to allow for adaptive reuse) and internal adaptation • Remnant conveyors, platforms, hoppers and walkways could be retained or replaced with new development that is generally consistent with the industrial character of the place	The proposed approach for the adaptation of these buildings will result in a significant degree of internal change and smaller scale glazed extensions, while retaining the overall effect of the external cladding and roof forms of the buildings. The approach to adaptation of these buildings follows a similar set of principles: • the walls will be rebuilt to meet code requirements, including insulation and internal sheeting, but retaining/repairing/refixing external corrugated iron (original or salvaged material); and • new rainwater goods will be installed to match existing, and opportunities to replicate external details (such as roof vents) will be explored • existing openings will be glazed and new external openings (doors and windows) in new metal frames will be inserted to support the adaptation of the space and need for access, ventilation and light • new 'glass box' steel and glazed extensions will be added to the east of the Machine Bays at level 1 • the gantry crane/conveyor that links the Machine Bays will be retained, and opportunities to retain existing upper level hoppers and other equipment, will be explored • lightweight internal walls will be inserted to support new uses

Element	Register entry	CMP 2021	Summary of applicable CMP policies/guidelines	Comment on consistency of proposal
				• some areas of existing concrete slab and platforms will be retained and repaired, with new concrete slab inserted at new levels and extensions. This proposal represents a balanced approach, which is consistent with the CMP and register entry policies. Overall the works will make a significant contribution to the retention of significance of the place, and the understanding of the Brickworks as a cohesive site.
20 Primary crusher house (1955)	Moderate	Supporting	• Not included in CMP Appendix A. • Register Entry guidelines to retain external form and detailing, and to conserve for ability to demonstrate/interpret industrial processes and secondary aesthetic values.	The proposal is for retention, stabilisation and conservation. This is consistent with the Register Entry and represents a positive heritage outcome.
22 Elevator conveyor (c 1955)	Moderate	Supporting	• Preferably retain and conserve, although could be relocated • Requires structural assessment and securing of loose sheeting	The proposal is for retention, stabilisation and conservation. This is consistent with the CMP and represents a positive heritage outcome.
23 Remains of the Brickworks Accommodation Village	Moderate	Area identified as BRW2 and BRW3 identified as of high	Not included in CMP Appendix A.	The proposal is to develop this area to include residences (townhouses and apartments) and landscaping for amenity and services installation. BRW2 and BRW3 were included in archaeological investigations that took place in 2021 (GML, 2021). These investigations concluded that the proposed works would result in negligible impact to archaeological features. This was because, although archaeological features were identified in the area, they were assessed as having

Element	Register entry	CMP 2021	Summary of applicable CMP policies/guidelines	Comment on consistency of proposal
		archaeological potential (2016 Navin Officer); updated following investigations in 2021		no significance (see also Chapter 7 'Impact Assessment' in Canberra Brickworks Precinct Archaeological Report and Statement of Heritage Effects, GML Heritage, December 2021)
24 Concrete Retaining Wall	Not identified	Core significance at p 79, but not of heritage significance at Appendix A; but conservation policies apply	• Not required to be retained—but where retained it should be stabilised. • Model railway workshop and non-original wall could be demolished as required.	The proposal is largely for in situ retention with limited proposed demolition at the site of the former Model Railway Workshop, consistent with the CMP.
25 Amenities Block (c 1950, c 1977)	Not identified	Incidental	Retain or demolish as required	Demolition of incidental elements is consistent with the CMP and does not present an impact on heritage significance.
26 Downdraught kiln control room (c 1961)	Not identified	Moderate significance at p 80, but not of significance at Appendix A; retain or demolish as required	Retain or demolish as required	The proposal for demolition is consistent with the policy guidance contained in Appendix A of the approved CMP, that the control room could be retained or demolished as required. It is also noted that the control room is not a significant element in the Register Entry.

Element	Register entry	CMP 2021	Summary of applicable CMP policies/guidelines	Comment on consistency of proposal
27 Toilet Block (c 1971) 28 Ancillary Storage Building (c 1971) 29 Substation/Control Room (c 1971) 30 Boiler House (c 1971) 31 Amenities Block 2 (c 1960s) 32 Brick Extrusion Plant (remnants) (c 1971) 33 Ancillary Storage Building 2 (c 1960s) 34 Storage shed (c 1960s) 35 Model railway workshop (c 1979) 36 Model railway workshop (c 1979)	Not identified	Incidental	Retain or demolish as required	Demolition of incidental elements is consistent with the CMP and does not constitute an impact on heritage significance.
37 and 38 Brickyards	Not identified	Core significance at page 79; Appendix A,	• Retain and conserve as a landscape element • Manage new development is managed in a way that	The Brickyards will be largely retained as open space, with addition of lower-scale built form to enable circulation and provide a new café space to the north of the Staffordshire Kiln. There will also be extensive landscaping, which is of a low scale, including the introduction of hard and soft elements and a new interpretive water feature. New development will frame this space as central to the experience of

Element	Register entry	CMP 2021	Summary of applicable CMP policies/guidelines	Comment on consistency of proposal
		conservation policies apply	retains an understanding of historic function • Respect industrial character, massing, scale, form and orthogonal layout of existing buildings • Repair or replace surfaces, avoiding impact on underground flues	the revitalised Brickyards, and will be a key location for interpretation and enjoyment of historic structures. There will be some impacts relating to the transformation of the setting of kiln structures from a starkly industrial, to a softened environment. This approach can, however, be justified to adapt these new spaces to the needs of people and the realities of Canberra climate. Impacts will be minimised through a recessive and respectful design approach that showcases heritage buildings, employs complementary materials and incorporates interpretive elements. The approach is consistent with the CMP and represents a positive heritage outcome.

5.3 Impact on archaeological features

It is noted that GML undertook an assessment of impacts on archaeological features following its excavation activities. In summary, GML concluded that the proposed development would have nil to negligible impact on all investigated areas except for BRW8, where there would be severe impacts on significant remnants of experimental plant. Methods for managing these impacts included a recommendation that the findings of the excavation be interpreted and presented to the public, and that works in this area be monitored for the potential presence of additional kilns.

GML did not come to a conclusion on impacts to areas that were not investigated. It recommended that potential impacts be managed by monitoring during construction in BRW 2, 4, 5, 6, and 9 and by following the unanticipated finds protocol in other areas.

6.0 SITE-WIDE ANALYSIS

6.1 Comment on site-wide approach

As indicated in both the Register Entry and the CMP, the effect of any activity on the cultural heritage significance of the Brickworks needs to be assessed both for impact on individual significant elements and on the site as an integrated whole.

Currently, the site is understood an industrial place, which has high degree of intactness in terms of the layout of key buildings, remnant (if decaying) fabric and evidence of former uses. Key relationships—between the Kilns and their fan-houses/chimney stacks, with the process buildings and with the Quarry—are evident within this environment.

The proposed activity will change understandings and uses of the site, which will offer new spaces for living and for social and commercial activity. The ambition is to create a vibrant and sustainable environment. To achieve this, as outlined above, a degree of change to the fabric and setting of the place is necessary. This will include, as described, alterations, additions, new built form and a new approach to landscaping, lighting and wayfinding at the site. The broader site will also be transformed with new development. This transformation will alter the ability of the site to be understood as a former brickworks. However, these impacts have been mitigated and minimised through a variety of design strategies.

6.2 Summary of mitigation and minimisation measures

In summary, the proposal includes the following measures:

- Minimisation of impact through an integrated and whole-of site proposal
- Retention of the broad orthogonal layout of the site and the historical approach from the south, locating new buildings towards the east of the heritage core to preserve key relationships and appreciation of the most significant elements of the site
- Adoption of a consistent architectural and landscape language, which clearly delineates new fabric and positions it as a complementary backdrop to retained heritage fabric
- Integration of fabric conservation into the proposal for adaptive reuse
- A balanced approach to retention of heritage fabric, allowing appreciation of significance at various scales from the monumental (for example, the form of kiln structures and the open

space of the Quarry) to the detailed (for example, retention of remnant machinery, kiln numbers, patina of heritage fabric)

- An integrated approach to interpretation, with the overarching objective of ensuring that identity and cultural heritage values of the precinct remain central to its character once works for the reactivation of the precinct are complete

7.0 CONCLUSION

As reflected in the Register Entry for the Brickworks, the overall objective for minimising heritage impacts is that the 'significant historical use as an industrial site for the production of bricks and clay products shall continue to be evident and accessible to the public.' The adaptation proposal has been designed with reference to this overall objective and to respond to specific guidance in the CMP.

It is considered that the proposal achieves a high degree of compliance with the policy contained in the CMP and Register Entry, and includes a significant commitment to minimisation and mitigation of impacts on heritage significance across the site. It will result in an outcome where the site is accessible and attractive to Canberra residents and visitors, allowing the significance of the site to be seen and appreciated. The proposal will include a program of conservation works, and will establish a framework for conservation of the site through adaptive re-use.

It is concluded that while the proposal will impact some aspects of the heritage significance of the site, these impacts are justifiable, and efforts have been made to minimise impacts and conserve and interpret significance into the future.

ENDNOTES

1 Navin Officer, Canberra Brickworks, Aboriginal Cultural Heritage Assessment, August 2014, Section 6.1.

2 ACT Heritage Council, Heritage Advice to Navin Officer Heritage Consultants, 10 September 2014.

3 'Appendix H, Inventory of Moveable Relics, GML Heritage 2021 ' in Canberra Brickworks CMP Vol 2, GML Heritage, 2021, p 345.

4 GML Heritage, Canberra Brickworks Precinct, Archaeological Excavation Report and Statement of Heritage Effects, December 2021 (draft) (Archaeological Report 2021), Table 5.1, p 139-143.

5 Conservation Management Plan Approval, ACT Heritage Council to Doma Group, August 2021.

6 For example, Heritage Council of NSW and RAIA, New uses for heritage places: Guidelines for the adaptation of historic buildings and sites, NSW Department of Planning, 2008, p 4.

GML HERITAGE

Canberra Brickworks—Geotechnical Investigations

Statement of Heritage Effects

Report prepared for Doma Group

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Report Register

The following report register documents the development and issue of the report entitled Canberra Brickworks, Geotechnical Investigations—Statement of Heritage Effects, undertaken by GML Heritage Pty Ltd in accordance with its quality management system.

Job No.	Issue No.	Notes/Description	Issue Date
18-0010	1	Draft Report	20 February 2018
18-0010	2	Final Report	21 February 2018
18-0010	3	Revised Final Report	11 November 2019

Quality Assurance

GML Heritage Pty Ltd operates under a quality management system which has been certified as complying with the Australian/New Zealand Standard for quality management systems AS/NZS ISO 9001:2008. The report has been reviewed and approved for issue in accordance with the GML quality assurance policy and procedures.

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Executive Summary

The Canberra Brickworks is a significant historic site, with a distinctive industrial character. It has recognised heritage significance as shown in its listing on the ACT Heritage Register as the 'Yarralumla Brickworks' and the 'Railway Remnants'.

GML Heritage (GML) has been engaged by Bloc on behalf of Doma Group to assess the potential heritage impacts associated with proposed geotechnical investigations as part of the redevelopment of the Canberra Brickworks.

This Statement of Heritage Effects (SHE) has been prepared to assess the proposed geotechnical investigations, for potential heritage impacts.

The proposed investigation locations have been considered in relation to the identified heritage significance and archaeological potential identified in the SHE prepared by Navin Officer for a contamination testing program in late 2016.

The following SHE determines that the proposed geotechnical investigations may result in impacts to significant archaeological remains in some areas of the site.

In most cases, where proposed works are to be undertaken in areas identified as having archaeological potential, they are not considered likely to result in an adverse impact on the significance, due to the ephemeral nature of the remains and the small scale of the excavations. Furthermore, impacts can be avoided through the implementation of recommended mitigative measures. These include; siting investigations so as to avoid impacts to known archaeological features and archaeological monitoring of excavations.

1.0 Introduction

1.1 Background and Purpose

The Canberra Brickworks Precinct contains the significant industrial landscape listed on the ACT Heritage register as the as the 'Yarralumla Brickworks' and the 'Yarralumla Brickworks Railway Remnants'. Previous heritage studies have been undertaken at the site to understand the site's heritage and archaeological significance. These have informed the adaptive re-use and development concepts for the Canberra Brickworks site and have been integrated into plans for the redevelopment of the precinct by the Doma Group.

This Statement of Heritage Effects (SHE) has been prepared by GML Heritage (GML) for Bloc, on behalf of the Doma Group. It considers potential heritage impacts arising from environmental and geotechnical investigations to be undertaken across the Canberra Brickworks. The proposed works supplement previous investigations undertaken at the site to inform site characterisation and remediation requirements.

The SHE provides an overview of the proposed sampling locations and an assessment of potential heritage impacts. It also provides recommendations regarding mitigation measures that may be implemented to eliminate or reduce adverse heritage impacts.

1.2 Site Location

The Canberra Brickworks Precinct is located at Blocks 1, 7 and 20, Section 102, Yarralumla. The site is bordered to the north and east by low density residential development, to the west by the Royal Canberra Golf Course and Westbourne Woods, and to the south by open space (Figure 1.1 and **Figure 1.2**). It comprises the listed sites, and additional unlisted lands which were part of the ancillary operation of the brickworks, including workers' accommodation (Figure 1.3).



Figure 1.1 Location of Canberra Brickworks Precinct in the Canberra context. (Source: Google Earth with GML overlay)



Figure 1.2 Location of the Canberra Brickworks in its immediate setting within Yarralumla. (Source: Google Earth with GML overlay)



Figure 1.3 The Canberra brickworks precinct, showing the curtilage of listings for the Canberra Brickworks and Railway Remnants. (Source: Google Earth with GML overlay)

1.3 Relevant Heritage Legislation

The *Heritage Act 2004* (ACT) (Heritage Act) aims to represent and protect the rich natural and cultural heritage of the ACT. The legislation establishes a system for the recognition, registration and conservation of natural and cultural heritage places and objects, including Aboriginal places and objects.

1.3.1 Heritage Listings for Canberra Brickworks

The 'Yarralumla Brickworks' (Block 1, Section 102 Yarralumla) and the 'Yarralumla Brickworks Railway Remnants' (Part Block 7, Section 102 Yarralumla) are recognised as having heritage significance by their inclusion in the ACT Heritage Register. As registered places, proposed works should be assessed for any potential negative effects on the identified heritage significance. This requires a SHE for proposed works with a potential to impact significant fabric or other heritage values.

The Yarralumla Brickworks is also listed on the Register of Significant Twentieth Century Architecture (RSTCA), item No. R063.

The heritage significance of the site is explained further in Section 2.0.

1.4 Project Methodology

In preparing the SHE, GML reviewed the proposed locations and methodologies for testing and sample collection provided within the Sampling and Analytical Program.[1] This SHE was prepared with reference to the Conservation Management Plan prepared by Lovell Chen in 2010 (CMP 2010) and assessment of archaeological potential provided in the Statement of Heritage Effects—Canberra Brickworks Precinct, prepared by Navin Officer in, July 2016. The Conservation Management Plan (CMP 2017)—Final Draft report prepared by GML in August 2017 has also been referred to. This CMP provided a revised significance assessment to verify and add detail to the ACT Heritage Register listings and the endorsed 2010 CMP. The 2017 CMP also updates the 2010 significance assessment prepared prior to listing of the Railway remnants, and the adoption of the ACT Heritage HERCON criteria.

A site inspection was conducted in January 2018 to examine site conditions and the proposed locations.

1.4.1 Burra Charter Principles

This SHE was prepared with reference to the *Australia ICOMOS Burra Charter for Places of Cultural Significance, 2013* (the Burra Charter) and its practice notes.

The term 'cultural significance' used in the Burra Charter is synonymous with the term 'heritage significance' or 'heritage values'. This report uses the term 'heritage significance'. The Burra Charter's definition of cultural significance is as follows:

> *Cultural significance means aesthetic, historic, scientific, social or spiritual value for past, present and future generations. Cultural significance is embodied in the place itself, its fabric and setting, use, associations, meanings, records, related places and related objects.*

1.4.2 Limitations

This SHE does not assess the potential impacts on Aboriginal heritage values or natural heritage values. The Statement of Heritage Effects—Canberra Brickworks Precinct prepared by Navin Officer in July 2016 notes that the site does not have potential Aboriginal heritage values due to the extent of disturbance caused by the excavation of the quarry and the construction of the brickworks facilities and

in-ground infrastructure. Similarly, the extent of disturbance, which includes replanting for the Westbourne Woods, has removed the potential for natural heritage values.

1.4.3 Relevant Documentation

The following documentation has been referenced in the preparation of this report:

- GML Heritage, Canberra Brickworks Conservation Management Plan, August 2017, prepared for Doma Group (unendorsed);
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013;*
- ACT Heritage Register citations for the Yarralumla Brickworks and the Yarralumla Brickworks Railway Remnants; and,
- Navin Officer, Statement of Heritage Effects—Canberra Brickworks Precinct, prepared for the LDA, July 2016;
- Navin Officer, and Lovell Chen, Archaeological Assessment—Canberra Brickworks & Environs, report prepared for the LDA, September 2016.
- Arcadis, Sampling Analysis and Quality Plan, prepared for DOMA Group, 2016.

1.5 Authorship and Acknowledgements

This report has been prepared by a GML project team comprising Jane McMahon, Senior Consultant; Martin Rowney, Principal; and Rachel Jackson, Principal. GML would like to acknowledge the assistance of the Bloc project team in the preparation of this report.

2.0 Heritage Context

2.1 Introduction

The Canberra Brickworks is an important industrial heritage site in the ACT, with identified historic, technological, aesthetic and social significance. The heritage significance of the Canberra Brickworks is recognised through the two heritage listings for the 'Yarralumla Brickworks' and the 'Yarralumla Brickworks Railway Remnants' on the ACT Heritage Register. The ACT Heritage Register citations for the Brickworks and the Railway Remnants, which include plans showing the respective listing boundaries, are provided in Appendix A.

This section is based on the draft CMP prepared by GML in 2017, which provides a revised significance assessment to verify and add detail to the ACT Heritage Register listings and the endorsed 2010 CMP. The 2017 CMP also assesses the significance of the site (the Brickworks and Railway Remnants) against the adopted ACT Heritage HERCON criteria.

2.2 Archaeological Potential and Significance

This report utilises the assessment of archaeological potential and significance drawn from the SHE prepared by Navin Officer for a contamination testing program in late 2016.[2] This report identified seven areas with surface scatters, which were labelled as BRW1–BRW7. Another six historical features with archaeological potential were also identified but not numbered. One of these, the Amusement Hall was located outside the current project study area and is not considered here.

The areas of archaeological potential are mapped and labelled in Figure 2.1. A summary of site types, level of potential, and significance are provided in **Table 2.1**.

Table 2.1 Areas of Archaeological Potential and Significance[3]

Recording Code	Name	Type of site	Archaeological Potential	HERCON Criteria
BRW1	Possible building platform and concrete features	Surface feature and Area of archaeological sensitivity	Moderate	a, b, c, d
BRW2	Married Quarters and Brickworks Hostel	Surface feature and Area of archaeological sensitivity	High	a, b, c, d
BRW3	Area of postholes and other remains	Surface feature and Area of archaeological sensitivity	High	a, b, c, d
BRW4	Single Mens Quarters	Surface feature and Area of archaeological sensitivity	Low	a

BRW5	Clay Feature and Rubble	Surface feature and Area of archaeological sensitivity	Low	a, b, c, d
BRW6	Rubble heap/refuse dump	Surface feature and Area of archaeological sensitivity	Low	a
BRW7	Quarry	Surface feature and Area of archaeological sensitivity	High	a, b, c, d
BRW8	Old kiln and dormitories	Area of archaeological sensitivity	Low	a, b, c, d, f
BRW9	Cottage, stables, coal store	Area of archaeological sensitivity	Low	a
BRW10	Railway remnants	Area of archaeological sensitivity	High	a, b, c, d, f
BRW11	Railway siding extension	Area of archaeological sensitivity	Moderate	a, b, c, d, f
BRW12	Flues/subsurface workings	Area of archaeological sensitivity	High	a, b, c, d, f

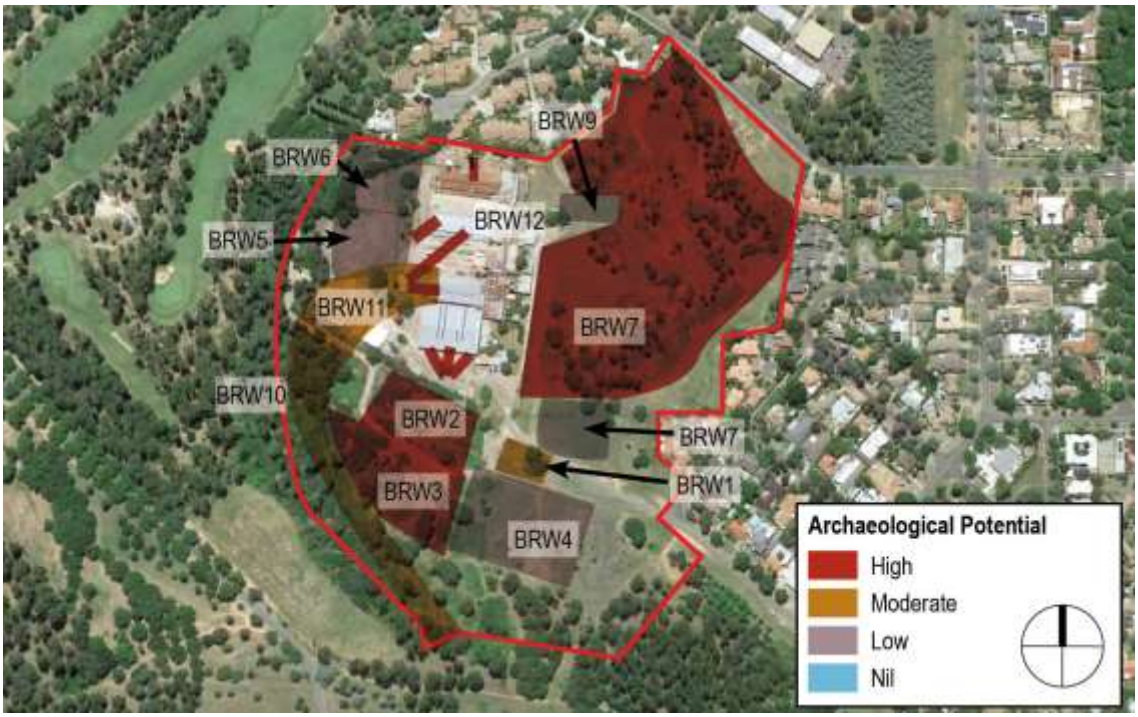


Figure 2.1 Areas of archaeological potential within the Canberra Brickworks precinct. (Source: Navin Officer[4])

2.2.1 Revised Summary Statements of Significance

Canberra Brickworks

The Canberra Brickworks is a significant heritage place as the first industrial manufacturing facility commissioned for and constructed in the Territory, developed specifically to facilitate the construction of the new Federal Capital. It provides tangible evidence of the early establishment of the city, following the Commonwealth decision to construct a national capital in the Yass-Canberra district in October 1908.

Bricks manufactured at the site were used to construct many residential and public buildings in Canberra, including Provisional Parliament House, the Kingston Powerhouse and Hotel Canberra. Subsequent phases in the development of the Brickworks, until its closure, reflect the broader political context that determined the fluctuation of construction of the Federal Capital, with major phases of the development in the 1920s and post-World War II period.

The Brickworks site is of scientific (geological) significance as the type locality for the Yarralumla Formation, a major sedimentary sequence dating from the Silurian Period, 424–423 million years ago. The rock units at the site provide the reference section for comparison of other outcrops within the Yarralumla Formation and in this context are of research and educative value.

The Brickworks is an unusually complete example of a complex demonstrating aspects of the operation of twentieth-century large-scale urban brickworks, with the extant buildings, structures and layout of the site demonstrating aspects of the processes and operations common to industrial brick production. A range of remnant production and ancillary buildings also contribute to the understanding of the function of the site.

The Staffordshire Kiln is the only known remaining example in Australia of this particular type of continuous kiln.

The site has research potential to further the understanding of past technology and industrial processes related to brickmaking in the ACT. Elements of the Brickworks have potential to yield information that may contribute to a greater understanding of the detailed operations of the site. The archaeological potential of the subsurface features, quarry and former accommodation village area may yield information that would contribute to an understanding of the history and changing use over time of the Brickworks.

The extant building forms and structures of the Canberra Brickworks have industrial aesthetic characteristics in the built form and, combined with the visual qualities of the quarry, a distinctive industrial landscape character. The aesthetic qualities are experienced from within the site, which is set low in the landscape, so as not to intrude on the Federal Capital, and the original kilns had low, fan-forced chimneys. The 1953 brick chimney stack (approximately 45 metres tall) is a prominent feature in the landscape and an iconic local landmark. The scale, location and idiosyncratic forms of the kilns and chimneys as well as dominance of red brick and corrugated iron across the site contributes to the aesthetic character of the site. Other characteristics include the brick forms and tall pitched iron clad roofs which create interesting and dramatic external massing and internal spaces, and contrast with the dark interiors of the kilns. The quarry has a particular aesthetic quality, comprising a combination of open space and the exposed rock outcrops.

The Canberra Brickworks holds strong associations with the local Yarralumla community as well as the ACT community more generally. Consultation regarding proposed development has indicated that

the local community is concerned about the future of the Brickworks, and keen to see the restoration and adaptation of the site as a community space which is accessible to all Canberrans.

Railway Remnants

The Railway Remnants of the former Canberra Brickworks are an important example of the once extensive rail network associated with the development of Canberra, initially between 1923–1927. Bricks (colloquially known as 'Canberra Reds') manufactured at the Brickworks were loaded onto timber tip wagons and transported via a narrow-gauge rail line to major developments across the city such as the Provisional Parliament House, the Kingston Powerhouse, Hotel Canberra, buildings in Civic as well as homes for the growing population.

The railway enabled faster transport of the bricks than the previous use of steam traction engines that hauled heavy iron wheeled trailers on mostly unmade roads. The railway transported up to six million bricks per annum.

The remnants of the embankment, cuttings and terraces are important as evidence of the process by which bricks used in the construction and development of the new city were transported. They are rare aspects of Canberra's industrial heritage—evidence of the infrastructure that was used to build the national capital.

3.0 Description of Proposal

3.1 Introduction

A Sampling Analysis and Quality Plan (SAQP) was prepared for the site in 2016 by Arcadis. The plan outlines the methodology and sampling strategy to be carried out for the purpose of site characterisation and assessment of land use suitability for future redevelopment of the area. Environmental investigations have previously been undertaken across the Canberra Brickworks precinct, to assess the soil, water and groundwater within the study area.

3.2 Proposed Works

The relevant section of the SAQP for this SHE is provided in Appendix B. Listed below is a summary of the proposed investigations (shown in**Figure 3.1** Proposed locations for environmental and geotechnical investigations. (Source: Arcadis, Sampling Analysis and Quality Plan, 2016) Figure 3.1).

- *Thirty-two (32) test pits/300mm boreholes across previously unassessed areas below proposed residential buildings.*
- *Five (5) test pits/300mm boreholes across the pit area to horizontally and vertically assess fill material.*
- *Three (3) 150mm boreholes across the footprint of the brickworks facility to assess soil conditions.*
- *Five (5) test pits within the Asbestos Dump area to further characterise the nature of waste material in the dump and provide information regarding the potential bulking factor of this material.*

The target depth of each test pit would be either 1.0 m bgl or where fill is encountered, the test pit would be terminated at least 0.5 m below the boundary between fill and the natural soil. Soil samples would be collected at the surface, 0.5 m bgl, 1 m bgl and then each metre thereafter until the target depth or at changes in lithology (e.g. at the interface between capping material and landfill material) or lenses of contamination. Soil will be removed from each test pit using an excavator or backhoe and sampled by hand from the inside of the bucket. Soil samples will be sampled by hand using new, disposable nitrile gloves.

In addition to the collection of soil samples from boreholes, three boreholes across the footprint of the Brickworks facility and one borehole within the pit will be converted groundwater monitoring wells. These monitoring wells are in addition to five existing wells currently installed on the site.

Six samples will be collected from within the kilns to assess for lead impacted soils.

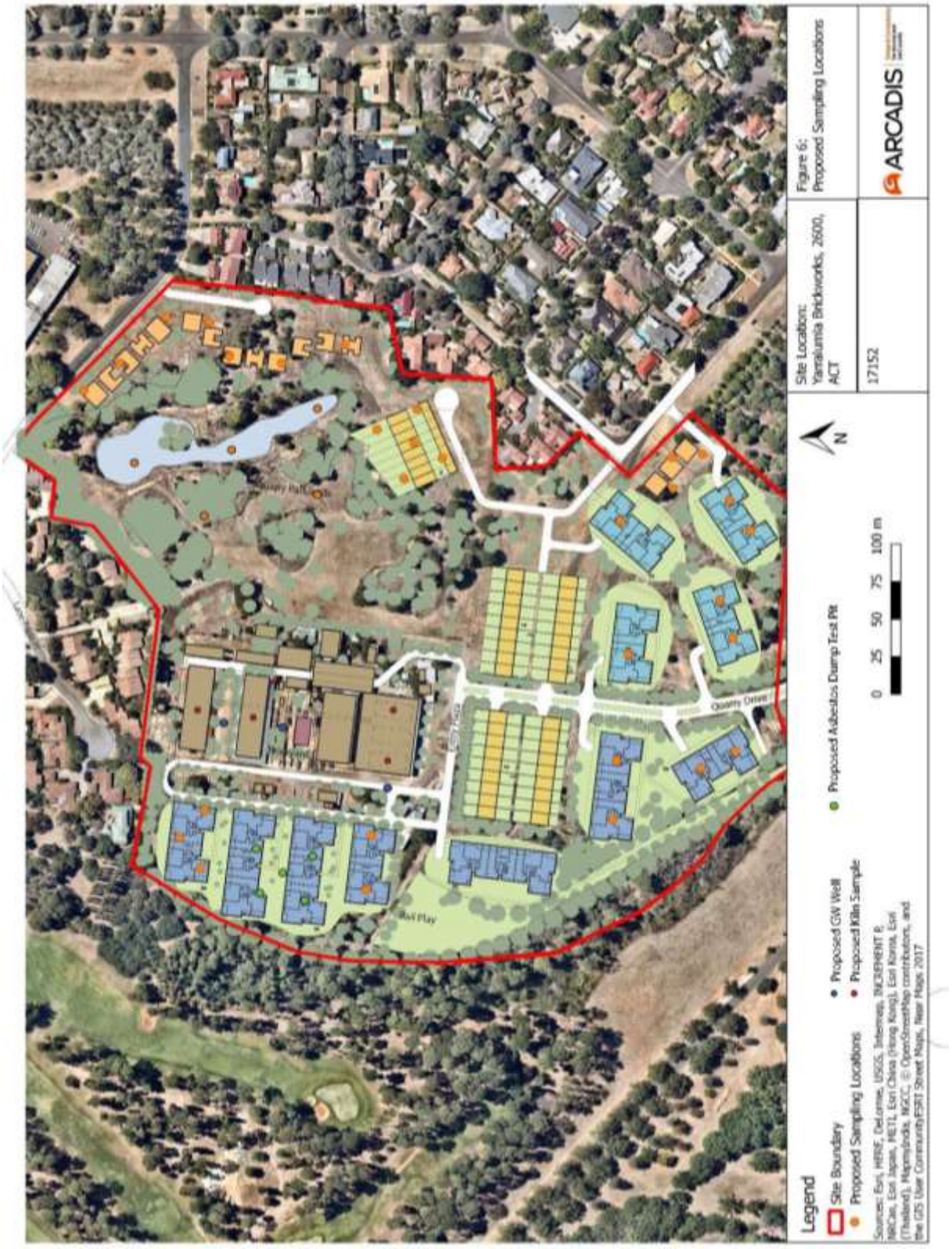


Figure 3.1 Proposed locations for environmental and geotechnical investigations. (Source: Arcadis, Sampling Analysis and Quality Plan, 2016)

4.0 Statement of Heritage Effects

4.1 Introduction

This SHE assesses the potential heritage impacts from the proposed soil and groundwater investigations in relation to the identified archaeological and heritage values for the Canberra Brickworks Precinct.

4.2 Assessment of Impacts

Due to the low potential and nature of the anticipated remains, excavations within the following areas are unlikely to impact significant archaeological remains:

- Single Men's Quarters (BRW4);
- Clay Feature and Rubble (BRW5);
- Rubble Heap/Refuse Dump (BRW6);
- Quarry (BRW7);
- Railway Remnants (BRW10); and
- Railway Extension (BRW11).

These areas generally have low potential—such as BRW4, where there is minimal topsoil remaining—or the nature of the archaeological remains is such that that the proposed excavations will not impact on their significance, such as BRW5 and BRW6 which are large scale industrial remnants.

The quarry pit is identified as being significant for its geological characteristics, typical of the Yarralumla Formation, and its overall form and aesthetic qualities. The works are not likely to impact on these aspects of significance.

Although there is high potential for archaeological features within the quarry (BRW7), these primarily relate to later phases of the sites occupation, such as evidence of filling events around the perimeter of the quarry as part of the preparation of the site as a tourist attraction. These features are not integral to the significance of the quarry, however do have research potential. Impacts to these archaeological features should be avoided through mitigative measures implemented during the works

The significance of the Railway Remnants (BRW10 and BRW11) lies mainly in its modified landform, while the subsurface archaeological remains associated with it—comprising isolated elements of the railway system such as sleepers and rails not removed in 1929—are likely to be of relatively low significance. As such there is low potential for impacts to the significance of this feature or significant archaeological deposits.

Excavations within the area of high potential, referred to as 'Area of postholes and other remains' (BRW3) may impact on significant archaeological remains. Mitigation measures for these works will be required.

Investigations within the footprint of the Brickworks facilities have some potential to impact the extant flues and subsurface workings of the kilns, which are located beneath the courtyards as shown in

Figure 2.1. These boreholes should be carefully sited to avoid any potential impacts to these significant elements.

Due to the nature of the proposed works, being limited to excavation, they will not result in adverse impacts to the heritage structures of the Canberra Brickworks Precinct. The six samples to be taken within kiln structures will not require the removal of flooring, and are unlikely to impact the heritage significance of the structure.

A summary of the areas of potential impacts to heritage significance are provided in Table 4.1. The location of proposed excavations in relation to areas of archaeological potential is shown in Figure 4.1.

Table 4.1 Summary of Archaeological Impacts

Recording Code	Name	Archaeological Potential	HERCON Criteria	Impacts
BRW1	Possible building platform and concrete features	Moderate	a, b, c, d	NA
BRW2	Married Quarters and Brickworks Hostel	High	a, b, c, d	NA
BRW3	Area of postholes and other remains	High	a, b, c, d	Potential impacts to significant archaeological remains
BRW4	Single Men's Quarters	Low	a	None
BRW5	Clay Feature and Rubble	Low	a, b, c, d	None
BRW6	Rubble heap/refuse dump	Low	A	None
BRW7	Quarry	High	a, b, c, d	None
BRW8	Old kiln and dormitories	Low	a, b, c, d, f	NA
BRW9	Cottage, stables, coal store	Low	a	NA
BRW10	Railway Remnants	High	a, b, c, d, f	None
BRW11	Railway siding extension	Moderate	a, b, c, d, f	None
BRW12	Flues/subsurface workings	High	a, b, c, d, f	Potential impacts to significant archaeological remains

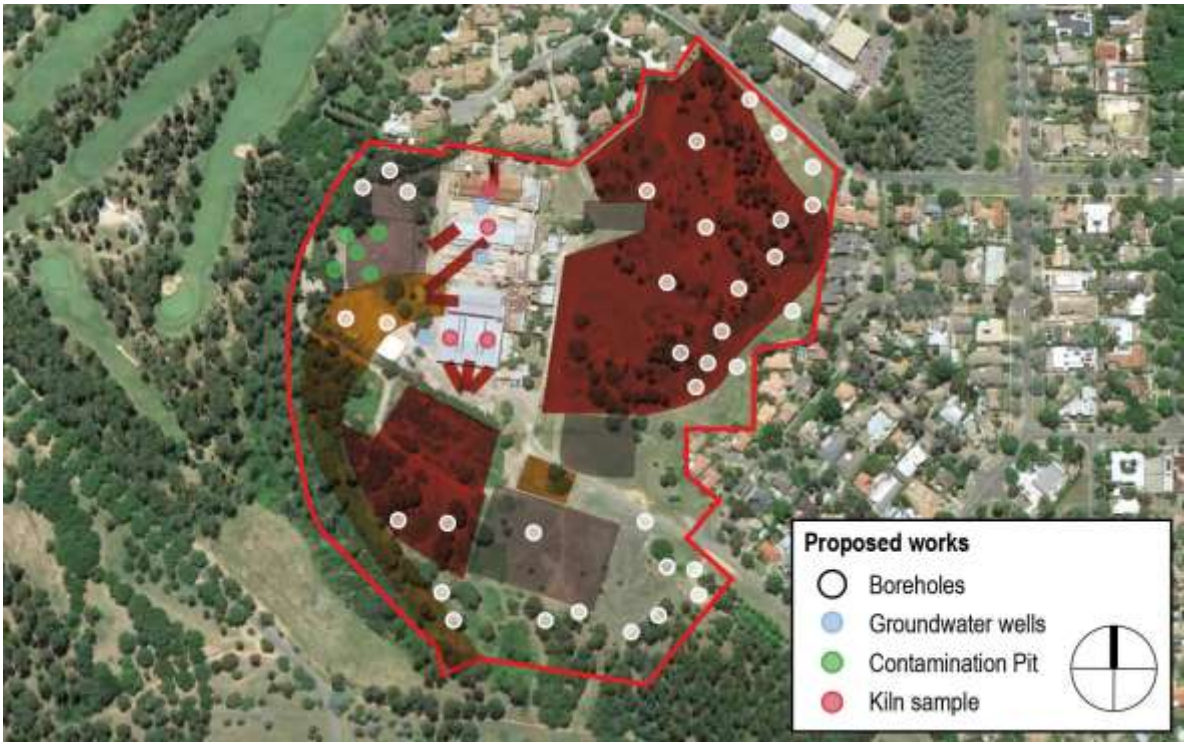


Figure 4.1 Location of proposed investigations in relation to areas of archaeological potential. (Source: Navin Officer[5], with GML overlay)

4.3 Conclusion

Impacts to the heritage significance of the Canberra Brickworks Precinct are limited to the removal of archaeological remains in some areas of the site. The proposed investigations are located within areas assessed as having varying levels of archaeological potential. Investigation locations have the potential to impact significant archaeological remains within BRW3, however all other excavations located in areas identified as having potential are not considered likely to result in an adverse impact on the significance. This is due to the ephemeral nature of the remains or the small scale of the excavations.

5.0 Recommendations

The proposed works will generally have no heritage impact on the significance of the Canberra Brickworks Precinct, however there are identified impacts to significant archaeological remains which should be proactively managed in accordance with the mitigation measures outlined below.

5.1 Mitigation Measures

5.1.1 Location Specific Measures

- The location of the flues and subsurface workings in the vicinity of the kiln structures should be surveyed to ensure investigations can be located to avoid any impacts.
- Locations of proposed boreholes should be cross checked with the surveyed location of the flues and subsurface features to avoid any potential impacts in BRW12.
- For works within BRW3:
  - An archaeologist should be on site to supervise the locating of the boreholes and ground truth the location of archaeological features so as to avoid impacts to surface features any potentially significant archaeological remains;
  - Excavations should be supervised by an archaeologist, to record soil profiles and any archaeological remains identified during the works;
  - Test pits should be excavated with a 300mm wide flat bucket; and
  - Test pits should be excavated under the supervision of an archaeologist, in controlled increments to allow for inspection and recording of any archaeological features.
- For works within BRW7:
  - An archaeologist should be on site to supervise the locating of the boreholes within the base of the pit, where works have potential to impact significant archaeological features, and ground truth the location of archaeological features so as to avoid impacts to any potentially significant archaeological remains.

5.2 General Measures

- If archaeological material—including structural remains and artefact deposits—is identified during works the Unanticipated Discovery Protocols[6] should be implemented (Appendix C).
- Under the Unanticipated Discovery Protocols, works should stop to allow for the inspection and recording of the finds by an archaeologist. If isolated objects not in-situ are found, then these items will be collected. If structural features and/or in-situ deposits are found, then effort will be made to move or discontinue the sample location. If the test sample location is required to proceed where structural features and/or in-situ deposits are found, then these features will be excavated using an archaeological methodology.

6.0 Endnotes

1 Arcadis, Sampling Analysis and Quality Plan, prepared for DOMA Group, 2016.
2 Navin Officer Heritage Consultants, Statement of Heritage Effects: Canberra Brickworks Precinct, report prepared for the Land Development Agency, July 2016.
3 Navin Officer Heritage Consultants, Statement of Heritage Effects: Canberra Brickworks Precinct, report prepared for the Land Development Agency, July 2016.
4 Navin Officer, Statement of Heritage Effects—Canberra Brickworks Precinct, prepared for the LDA, July 2016.
5 Navin Officer, Statement of Heritage Effects—Canberra Brickworks Precinct, prepared for the LDA, July 2016.
6 Appendix A, Navin Officer Heritage Consultants, Statement of Heritage Effects: Canberra Brickworks Precinct, report prepared for the Land Development Agency, July 2016.

Canberra Brickworks Precinct

Conservation Management Plan

Volume One

Report prepared for Doma Group

August 2021



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Report Register

The following report register documents the development and issue of the report entitled Canberra Brickworks—Conservation Management Plan, undertaken by GML Heritage Pty Ltd in accordance with its quality management system.

Job No.	Issue No.	Notes/Description	Issue Date
17-0170	1	Draft Report	18 July 2017
17-0170	2	Second Draft Report	31 August 2017
19-0443	3	Final Draft Report	11 December 2019
19-0443	4	Final Draft Report—issued to ACT Heritage CMP Taskforce	19 February 2020
19-0443	5	Final Draft Report—Volume 1 and 2 (addressing ACT Heritage October 2020 comments)—for client review	23 December 2020
19-0443	6	Final Draft Report—Volume 1 and 2 (addressing ACT Heritage October 2020 comments)	13 January 2021
19-0443	7	Final Report—ACT Heritage Council approval	12 August 2021

Quality Assurance

GML Heritage Pty Ltd operates under a quality management system which has been certified as complying with the Australian/New Zealand Standard for quality management systems AS/NZS ISO 9001:2008.

The report has been reviewed and approved for issue in accordance with the GML quality assurance policy and procedures.

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Cover Image: Canberra Brickworks, May 2017. (Source: GML Heritage)

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Executive Summary

The Canberra Brickworks Precinct is a significant historic site with a distinctive historic industrial character. It has recognised heritage significance through listing on the ACT Heritage Register as the 'Yarralumla Brickworks', and the associated 'Yarralumla Brickworks Railway Remnants'.

Doma engaged GML Heritage Pty Ltd (GML) to prepare an updated Conservation Management Plan (CMP) for the Canberra Brickworks Precinct.

The study area referred to in the CMP is the 'Canberra Brickworks Precinct'—Blocks 1, 7 and 20, Section 102. The Precinct includes two ACT Heritage Register places:

- 'Yarralumla Brickworks' ('Canberra Brickworks' or 'Brickworks')—located in Block 1, Section 102; and
- 'Yarralumla Brickworks Railway Remnants' ('Railway Remnants')—located in part of Block 7, Section 102) (refer to Figure 1.2).

This CMP has been prepared to revise the existing 2010 CMP and to include the associated Railway Remnants heritage place (listed on the ACT Heritage Register in 2013). The provisions of the ACT Heritage Act 2004 apply only to the registered heritage boundaries and citation of the two places within the Canberra Brickworks Precinct.

Conservation policies guide the ongoing management of the Precinct, to support strategic decision making for the future, as well as assist with legislative compliance and conservation of the site's heritage significance.

The following principles form the basis for the conservation policies, including:

- retention, conservation, management and interpretation of the heritage significance, which is embodied in the attributes and elements of the site;
- identification of where and how change, adaptation (including identifying new appropriate uses) and new development can be undertaken on the site, that is compatible with the heritage significance and can provide for the conservation of significant elements;
- seeking professional heritage and building conservation advice for proposed works and redevelopment; and













- exploring opportunities to interpret the heritage significance, and maintaining records in relation to proposed and/or implemented changes to the place.

An inventory of individual elements is provided at Appendix A to the CMP. The inventory provides conservation guidance for intrinsic features, that are core and supporting elements of the site's heritage significance. An inventory of Moveable Relics is provided in Appendix H.

1.0 Introduction

1.1 Background and Objectives

1.1.1 Overview

The Canberra Brickworks Precinct is a significant historic site with a distinctive industrial character. It has recognised heritage significance through its listing on the ACT Heritage Register as the 'Yarralumla Brickworks', and the associated 'Yarralumla Brickworks Railway Remnants'.

Doma engaged GML Heritage Pty Ltd ("GML") to prepare an updated Conservation Management Plan (CMP) for the ACT Heritage Register places: 'Yarralumla Brickworks' ("Canberra Brickworks"), and the associated 'Yarralumla Brickworks Railway Remnants' ("Railway Remnants"). This is referred to throughout this CMP as the "Heritage Places", shown in Figures 1.1 and 1.2 and defined in Section 1.2.

1.1.2 Purpose of the CMP

This CMP has been prepared in accordance with the provisions of the *Heritage Act 2004 (ACT)* ("Heritage Act"). The CMP is a revision of the document prepared by Lovell Chen in 2010 ("2010 CMP").

The 2010 CMP required updating to:

- address changes to the ACT Heritage legislation since the 2010 CMP was prepared;
- include the associated Railway Remnants heritage place (listed on the ACT Heritage Register in 2013);
- provide an update of the condition of the site and its elements, and
- understand the site in the context of proposed redevelopment to allow the ongoing use of the site.

1.2 Site Identification

1.2.1 Location and Study Area

The Canberra Brickworks Precinct is in the suburb of Yarralumla, to the west of central Canberra, shown in Figure 1.1. The site is bordered to the north and east by low density residential development, to the west by the Royal Canberra Golf Course and Westbourne Woods, and to the south by open space.

The study area for this CMP, is shown in Figure 1.2. The Heritage Act provisions only apply to the registered heritage boundaries and there are two registered places within the site of the Canberra Brickworks Precinct.

The whole study area is Canberra Brickworks Precinct – Blocks 1, 7 and 20, Section 102. The registered Heritage Places include:

- the Yarralumla Brickworks located in Block 1 Section 102 Yarralumla ("Canberra Brickworks"); and
- the Yarralumla Brickworks Railway Remnants located in a small part of Block 7 Section 102 Yarralumla ("Railway Remnants") (refer to Figure 1.2).



Figure 1.1 Location of the Canberra Brickworks Precinct, in the broader context of Canberra. (Source: Google Earth with GML overlay, 2017)

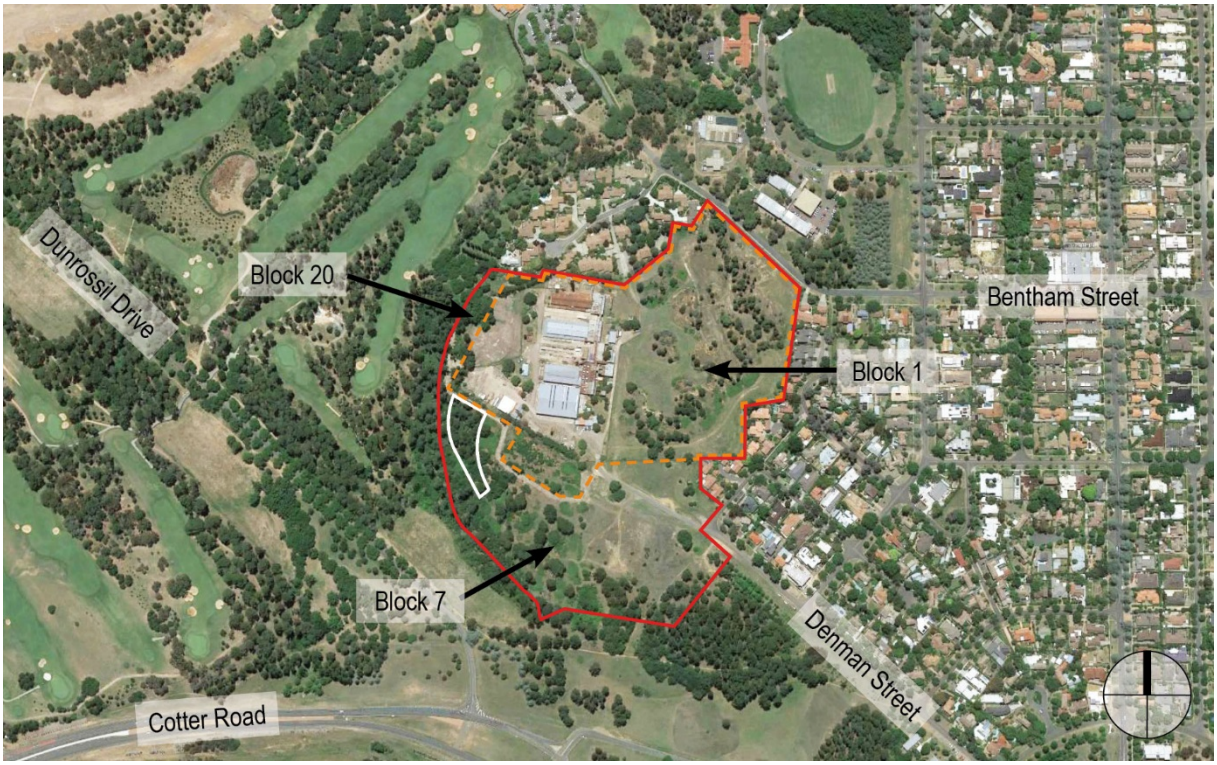


Figure 1.2 CMP study area—Canberra Brickworks Precinct—shown in the red solid boundary. The study area consists of Blocks 1, 7 and 20, Section 102 and includes the registered Heritage Places being the Canberra Brickworks (shown within the orange dashed boundary) and the Railway Remnants (shown within the white solid boundary. (Source: Google Earth with GML overlay, 2017)

1.2.2 Terminology

Terminology used in this CMP is explained here, given the site is referred to historically by many names including the Old Canberra Brickworks, Yarralumla Brickworks, Westridge Brickworks, the Commonwealth Brickworks, and the Government Brickworks.

For consistency, the following names are used in this CMP (refer also to Figure 1.3):

- **Canberra Brickworks Precinct.** This is the CMP study area comprising Blocks 1, 7 & 20 and is also referred to as "the site".
- **'Canberra Brickworks'**, referred to in the ACT Heritage Register citation as 'Yarralumla Brickworks'. This is one of the two heritage-listed areas and has a specific legislative boundary that contains the historic industrial heritage elements and the former quarry. The area is referred to as the "Canberra Brickworks" in this CMP.
- **'Railway Remnants'**, referred to in the ACT Heritage Register citation as 'Yarralumla Brickworks Railway Remnants'. This is one of the two heritage-listed areas and has a specific legislative boundary that contains the historic railway remnants associated with the Brickworks. It is referred to as the "Railway Remnants" in this CMP.

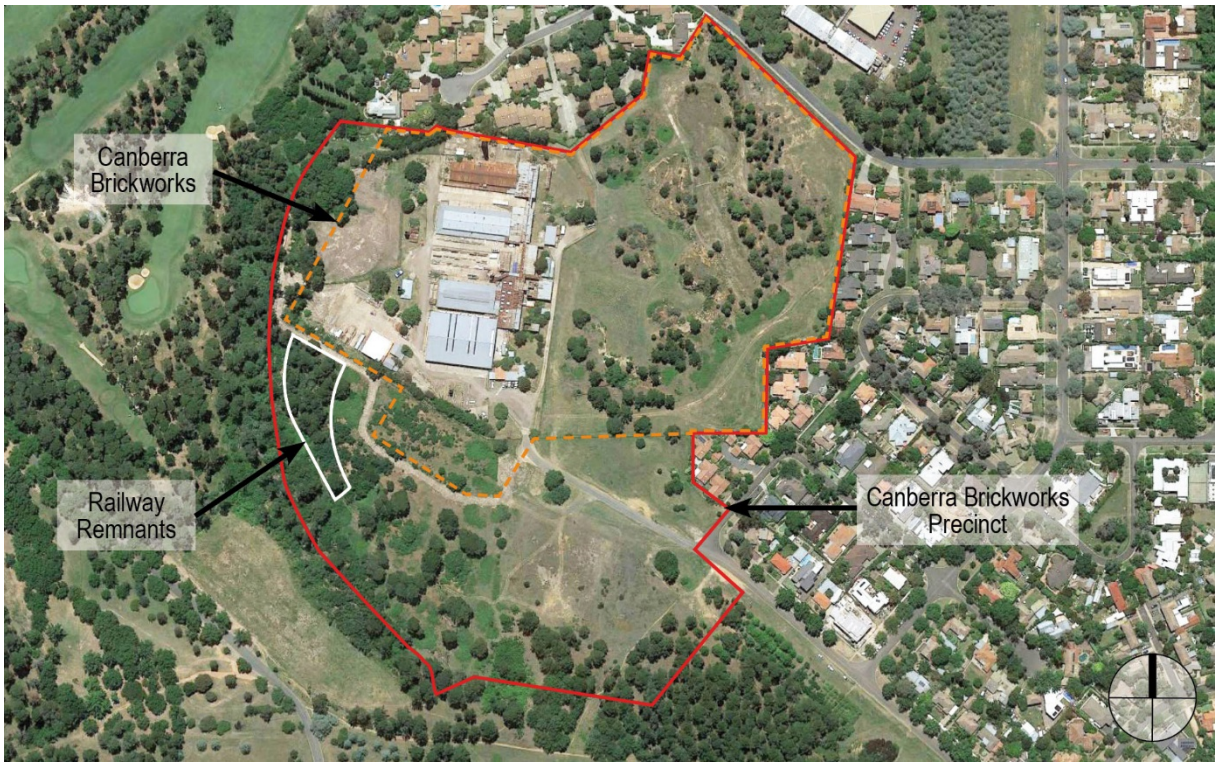


Figure 1.3 Location and boundaries of the site—Canberra Brickworks Precinct (red boundary), Canberra Brickworks (orange dashed boundary) and Railway Remnants (white boundary). (Source: Google Earth with GML overlay, 2017)

Individual Elements—Names and Numbers

Individual elements on the site are referred to in this CMP by their name and number used by the ACT Heritage Register. Numbers 24 to 38 have been imposed on site elements identified in addition to the ones listed in the ACT Heritage Register.

The ACT Heritage Register refers to the elements as 'Features Intrinsic to the Heritage Significance of the Place'. Table 1.1 provides the corresponding numbers and naming from the ACT Heritage Register citations (also refer to Figure 1.5), and the location of individual elements is shown in Figure 1.4.

It is important to note the ACT Heritage Register citation for the Yarralumla Brickworks includes a grading of heritage significance—Schedule 1: Elements of 'Exceptional Significance', referred to as 'core elements' and Schedule 2: Elements of 'Moderate Significance', referred to as 'supporting elements'. All graded elements are tabled in Section 4.3.4.

Table 1.1 Names and numbers of elements used in this CMP, with ACT Heritage Register nomenclature. Shading indicates the ACT Heritage Register grading—red for Schedule 1 Elements of 'Exceptional Significance', referred to as 'core elements' and blue for Schedule 2 Elements of 'Moderate Significance', referred to as 'supporting elements'.

CMP Number	ACT Heritage Register Intrinsic Features: Core and Supporting	Naming used in the CMP for Individual Historic - Elements
1	Kiln – Staffordshire (1915)	Staffordshire Kiln
2	Fan House for Staffordshire Kiln (1915)	Fan House for Staffordshire Kiln
3	Kiln – Hardy-Patent (1927)	Hardy Patent Kiln 1
4	Fan House for Hardy Patent Kiln 1 (1953)	Fan House for Hardy Patent Kiln 1
5	Hardy Patent Kiln (1953)	Hardy Patent Kiln 2
6	Kilns – Downdraft a, b, c (1963)	Downdraught Kilns
7	Chimney Stacks for Staffordshire Kiln (1915)	Chimney Stack for Staffordshire Kiln
8	Chimney Stack for Hardy Patent Kiln (1927)	Chimney Stack for Hardy Patent Kiln 1
9	Chimney Stack for Hardy Patent Kiln (1953)	Chimney Stack for Hardy Patent Kiln 2
10	Chimney Stack for Downdraft Kiln (1963)	Chimney Stack for Downdraught Kilns
11	Quarry	Quarry
12	Geological features A, B, C, D	Geological features in the Quarry
13	Office (1916)	Offices
14	Power House (1915)	Power House
15	Machine Bay 1 for Staffordshire and Downdraught Kilns (1955)	Machine Bay 1 for Staffordshire Kiln and Downdraught Kilns
16	Machine Bay for Hardy-Patent (1955)	Machine Bay 2 for Hardy Patent Kiln 1
17	Machine Bay for Hardy-Patent (1955)	Machine Bay 3 for Hardy Patent Kiln 2
18	Workshop (1955)	Workshop
19	Large Crusher House (1955)	White Pan Room (Large Crusher House/Crusher House II)
20	Primary Crusher House (1955)	Primary Crusher House (Crusher House III)
21	Small Crusher House	Small Crusher House (Crusher House I)
22	Elevator Conveyor (1955)	Elevator/Conveyor
23	Remains of the Brickworks Accommodation Village	Remains of the Brickworks Accommodation Village
24	—	Concrete retaining wall
25	—	Amenities Block
26	—	Downdraught Kilns Control Room

CMP Number	ACT Heritage Register Intrinsic Features: Core and Supporting	Naming used in the CMP for Individual Historic - Elements
27	—	Toilet Block
28	—	Ancillary Storage Building
29	—	Substation/Control Room
30	—	Boiler House
31	—	Amenities Block 2
32	—	Extrusion Plant (Remnants)
33	—	Ancillary Storage Building 2
34	—	Storage Shed
35	—	Model Railway Workshop
36	—	Model Railway Storage Shed
37	—	Original brickyard (first)
38	—	Brickyard 2 (second)
1A	Yarralumla Brickworks Railway Remnants	Railway Remnants Registration Area

1.3 Heritage Status

1.3.1 ACT Heritage Register

The *Heritage Act 2004* (ACT) (Heritage Act) aims to represent and protect the rich natural and cultural heritage of the ACT. The legislation establishes a system for the recognition, registration and conservation of natural and cultural heritage places and objects, including Aboriginal places and objects.

As described previously, the 'Yarralumla Brickworks' and the 'Yarralumla Brickworks Railway Remnants' are included in the ACT Heritage Register (the two citations included at Appendix B). The provisions of the Heritage Act only apply to the registered heritage boundaries of these two places within the Canberra Brickworks Precinct. Places not listed in the citations as 'features intrinsic', or outside the heritage register boundaries (but inside the Canberra Brickworks Precinct study area of this CMP), are not protected by the Heritage Act.

The heritage significance of the site is explained further in Section 4.0 of this report. The management of the Heritage Register places, and of the study area, as a whole, is provided in Sections 5.0 and 6.0.

1.3.2 Non-Statutory Listings

- 'Yarralumla Brickworks' is listed on the Australian Institute of Architects (AIA) ACT Chapter Register of Significant Twentieth Century Architecture (RSTCA), item No. R063.
- 'Canberra Brickworks' was identified as a 'Classified' place by the National Trust of Australia (ACT) on 20 July 1981.

1.3.3 Heritage Places in the Vicinity

The site is in close proximity to four heritage places included on the ACT Heritage Register and the Commonwealth Heritage List (CHL):

- Government House and Surrounds (CHL Place ID: 105381);
- The CSIRO Forestry Precinct (CHL Place ID: 105595);
- Westbourne Woods (ACT Heritage ID: 444); and
- Early Canberra Brickworks Housing Precinct (ACT Heritage ID: 1002).

1.4 Methodology

1.4.1 Burra Charter Principles

This CMP was prepared in accordance with *The Australia ICOMOS Charter for Places of Cultural Significance, 2013* (the Burra Charter). The Burra Charter is included at Appendix D.

Definitions

The conservation terminology used in this report is consistent with the Burra Charter. The term 'cultural significance' used in the Burra Charter is synonymous with the term 'heritage significance' or 'heritage values'. This CMP uses the term 'heritage significance'. The Burra Charter's definition of cultural significance is as follows:

> *Cultural significance means aesthetic historic scientific social or spiritual value for past, present and future generations. Cultural significance is embodied in the place itself, its fabric and setting, use, associations, meanings, records, related places and related objects.*

1.4.2 ACT Heritage Guiding Principles for CMPs

This CMP has been written according to the Heritage Act, ACT Heritage Council's *Conservation Management Plans—Guiding Principles,* February 2015*,* and *Heritage Assessment Policy*, February 2015.

1.4.3 Structure of the Report

This CMP has been prepared to assist the site owners in the future management of the Brickworks. The structure of the CMP – two volumes – is outlined below with a brief description of each section and its content.

Table 1.2 Canberra Brickworks Precinct CMP Report Structure.

Volume 1	CMP Canberra Brickworks Precinct
Executive Summary	An overview of the CMP.
Section 1.0	**Introduction**: A background to the CMP, the location, heritage status of the Canberra Brickworks Precinct, as well as the methodology, authorship and acknowledgements.
Section 2.0	**Understanding the Place—Historical Context**: An overview of the historic development of the Canberra Brickworks Precinct, including a comparative analysis.
Section 3.0	**Understanding the Place—Physical Context**: An overview description of the Canberra Brickworks Precinct, including the setting, key views, and individual elements. The section includes a discussion of the historic archaeological potential of the site.
Section 4.0	**Heritage Significance**: ACT Heritage Register assessments for Yarralumla Brickworks and the Railway Remnants, including a revised assessment against the HERCON criteria. The section identifies the elements and features intrinsic to the heritage significance.

Volume 1	CMP Canberra Brickworks Precinct
Section 5.0	**Conservation Policy**: Constraints and opportunities associated with the conservation, management, in the context of proposed redevelopment, and interpretation of the heritage significance of the Canberra Brickworks Precinct. The Constraints and opportunities inform the conservation policies listed in this section for the future management of the site
Section 6.0	**Conservation Policy Implementation Schedule**: Summary of conservation policies with defined actions and timing for effective implementation, to conserve heritage significance.

Volume 2	CMP Appendices Canberra Brickworks Precinct
Appendix A	Inventory of Individual Historic Elements
Appendix B	ACT Heritage Register citations for 'Yarralumla Brickworks' (Canberra Brickworks) and the 'Yarralumla Brickworks Railway Remnants' (Railway Remnants)
Appendix C	History of the Canberra Brickworks for the CMP
Appendix D	The Australia ICOMOS Charter for Places of Cultural Significance, The Burra Charter, 2013 (Burra Charter)
Appendix E	Unanticipated Finds Protocol
Appendix F	Archaeological Assessment, Navin Officer, Draft Report, September 2016
Appendix G	Yarralumla Brickworks Inspection Report, Sellick Consultants, December 2019
Appendix H	Inventory of Moveable Relics, December 2020

1.4.4 Relevant Documentation

The following documentation has been referenced in the preparation of this report:

- Masterplan and Development Design Strategy (2017 RFT Masterplan) Doma, 2017;
- Statement of Heritage Effects (SHE), January 2017, to assess the proposed Masterplan and Development Design Strategy (2017 RFT Masterplan) prepared by GML, January 2017;
- Lovell Chen, Canberra Brickworks Conservation Management Plan, prepared for the Land Development Agency, April 2010;
- Lovell Chen, Canberra Brickworks Conservation Development Strategy, prepared for the Land Development Agency, February 2015;
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013* (the Burra Charter);
- ACT Heritage Register citations for the Yarralumla Brickworks and the Railway Remnants;
- ACT Civil and Administrative Tribunal Orders, No. AT13/17 Railway Remnants, 2013;
- Sellick Consultants, Yarralumla Brickworks Inspection Report, prepared for Doma, 6 December 2019;
- Navin Officer Heritage Consultants, Archaeological Assessment Canberra Brickworks and Environs, Draft Report prepared for Land Development Agency, September 2016
- Northrop, Canberra Brickworks Complex Structural Audit, prepared for MacroPlan Dimasi February 2013;

- dsb Landscape Architects, Yarralumla Brickworks Precinct Tree Assessment, Tree Management Report, 25 November 2015;
- National Trust (ACT), Yarralumla Brickworks Adaptive Re-use, December 2015;
- the International Committee for the Conservation of Industrial Heritage (TICCIH) Charter for Industrial Heritage, 2003; and
- Joint ICOMOS–TICCIH 'Dublin Principles' for the Conservation of Industrial Heritage Sites, Structures, Areas and Landscapes, 2011.

1.4.5 Limitations

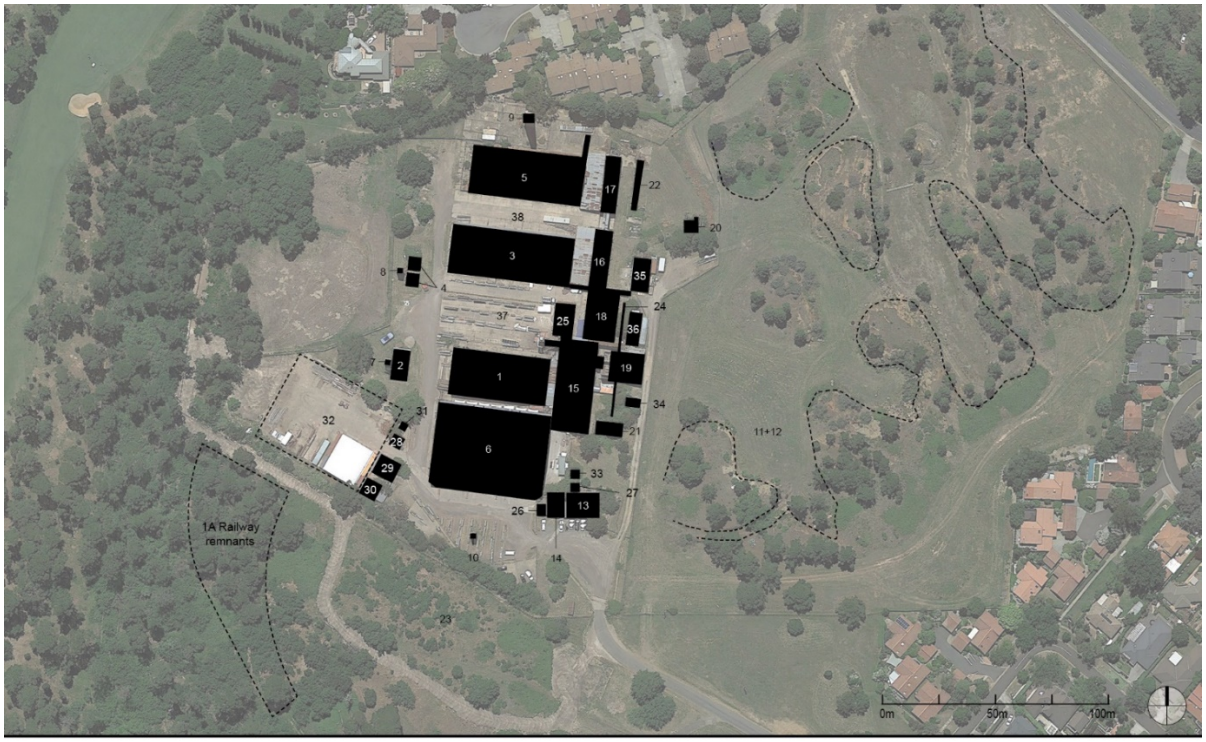
The following tasks were not undertaken as part of this CMP.

- Consultation to determine the community-held values of the site – an understanding of the community's views on the Brickworks to inform the social and aesthetic values was drawn from the Canberra Brickworks Community Panel Parameters and Perspectives Report, March 2016.
- New detailed structural condition assessments – sufficient information on the condition of the elements was able to be drawn from the Sellick Consultants and Northrop structural inspection documents.
- Assessment of natural heritage values or research into Aboriginal heritage values or survey of Aboriginal sites.
- Archaeological assessment – information for the archaeological analysis in the CMP is drawn from the Draft Archaeological Assessment report prepared by Navin Officer in September 2016.

1.5 Authorship and Acknowledgements

This report was prepared by a team of heritage consultants and archaeologists from GML (2016–2021).

GML acknowledges the assistance of Doma, ACT Heritage and the Suburban Land Agency (SLA) (the former Land Development Agency [LDA]), for their assistance.



Legend:

1	Staffordshire Kiln (1915)	9	Chimney Stack for Hardy Patent Kiln 2 (1953)	17	Machine Bay 3 for Hardy Patent Kiln 2 (1955)	24	Concrete retaining wall	33	Ancillary Storage Building 2
2	Fan House for Staffordshire Kiln (1915)	10	Chimney Stack for Downdraught Kilns (1963)	18	Workshop (1955)	25	Amenities Block	34	Storage Shed
3	Hardy Patent Kiln 1 (1927)	11	Quarry	19	White Pan Room (Large Crusher House/Crusher House II) (1955)	26	Downdraught Kilns Control Room	35	Model Railway Workshop
4	Fan house for Hardy Patent Kiln 1 (1953)	12	Geological features	20	Primary Crusher House (Crusher House III) (1955)	27	Toilet Block	36	Model Railway Storage Shed
5	Hardy Patent Kiln 2 (1953)	13	Offices (1916)	21	Small Crusher House (Crusher House I)	28	Ancillary Storage Building	37	Original Brickyard
6	Downdraught Kilns (1963)	14	Power House (1915)	22	Elevator/Conveyor	29	Substation/Control Room	38	Brickyard 2
7	Chimney Stack for Staffordshire Kiln (1915)	15	Machine Bay 1 for Staffordshire Kiln and Downdraught Kilns (1955)	23	Remains of the Brickworks Accommodation Village	30	Boiler House	1A	Railway remnants registration area
8	Chimney stack for Hardy Patent Kiln 1 (1927)	16	Machine Bay 2 for Hardy Patent Kiln 1 (1955)			31	Amenities Block 2	Refer also to figure 3.38 Areas of Archaeological Potential	
						32	Extrusion Plant (Remnants)		

Figure 1.4 Location of Canberra Brickworks Precinct, with numbering of site elements used in the ACT Heritage Register citations (also refer to Figure 1.5, and Table 1.1 for naming used in the register and throughout the CMP). (Source: GML edits on Google Earth base plan, 2017)

Figure 68a: Yarralumla Brickworks, Yarralumla: Significant Features

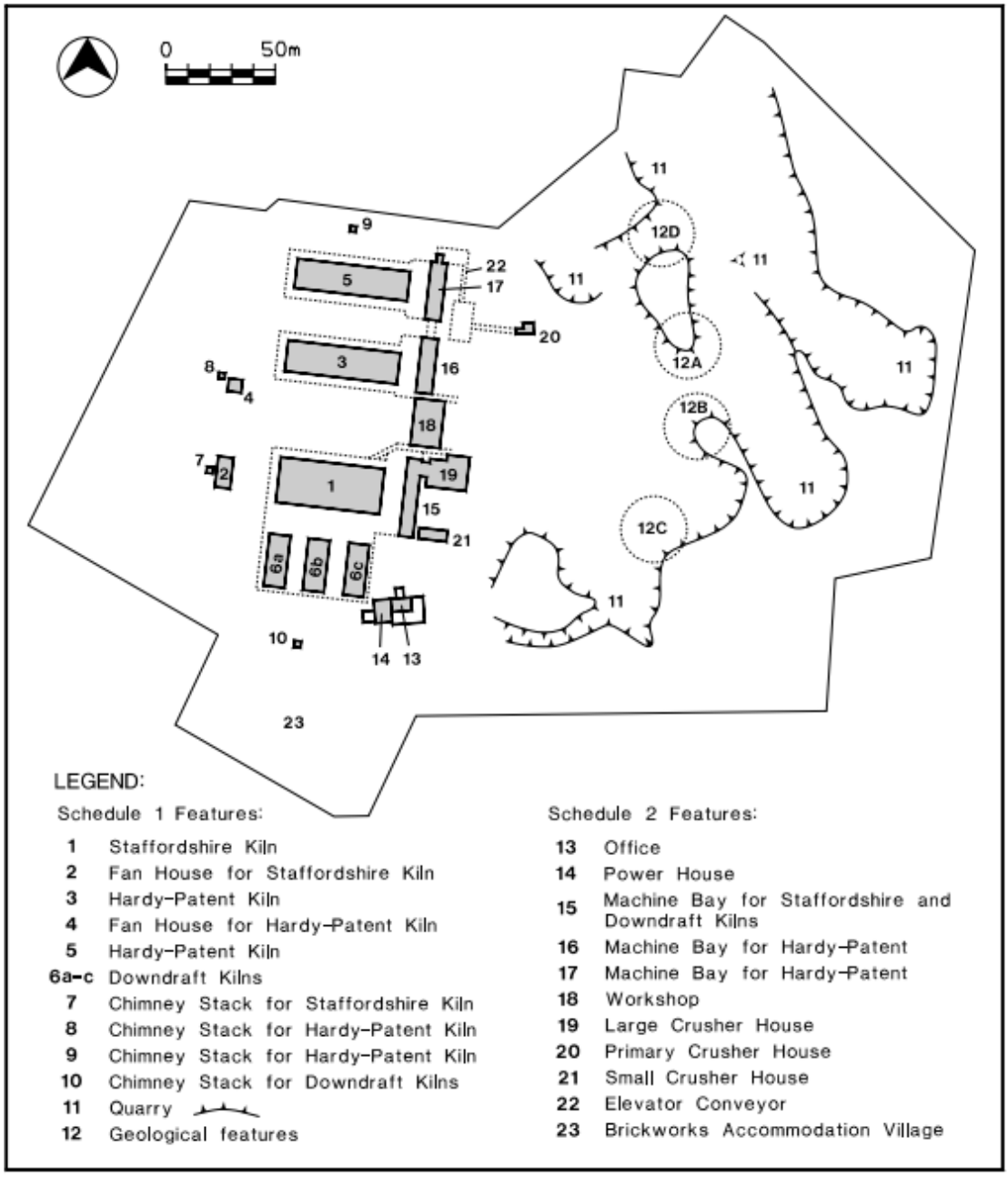


Figure 1.5 Excerpt from the ACT Heritage Register entry for the 'Yarralumla Brickworks' (Canberra Brickworks). The names and number for each element have a corresponding number used in this CMP (refer to Table 1.1 and Figure 1.4).

2.0 Understanding the Place—Historical Context

2.1 Introduction

This section provides a summary of the historical development of the Canberra Brickworks Precinct including a background history of Canberra, a contextual history of the site, and a comparative analysis of other Australian brickworks.

A comprehensive history of the development of the site, and the process of brick production is provided at Appendix C, and specific detail of the individual elements is provided at Appendix A. The history and comparative analysis have been drawn predominantly from the 2010 CMP and revised and updated where necessary.

2.2 Background History of Canberra

2.2.1 Yarralumla Formation

The underlying geology of Canberra is made up of sedimentary and volcanic rock types formed when the landscapes were positioned on the margins of the supercontinent, Gondwana.[1] The Brickworks site lies on the Yarralumla Formation created 425 million years ago by sedimentary mudstone or siltstone deposited in a shallow sea. Evidence of fossils including brachiopods, trilobites, corals, bivalves, bryozoans and crinoids remain as evidence of this ancient landscape.[2] This geological composition included shale, a fine-grained sedimentary rock, ideal for brickmaking as it was both hard and porous. However, the shale varied greatly in quality and limestone and sandstone intrusions into seams of the rock made processing more expensive and some material unusable.

From the 1950s, geologists in Canberra explained in greater detail the geological significance of the Brickworks. They traced the sedimentary sequences of the Yarralumla Formation identifying in the centre of Canberra principally at the Brickworks but also at Red Hill, the outcrops in suburbs of Deakin, Hughes and west of Curtin.

2.2.2 Ngunnawal Country

The Brickworks is located on traditional lands held by the Ngunnawal group. The Ngunnawal people have occupied the land for thousands of years and their descendants continue to live in Canberra and the surrounding region. Several Indigenous groups, including the Ngunnawal and Ngambri, were recorded to have settled along the sandy banks of the Molonglo River. As an important resource, the Molonglo River corridor attracted a hunter-gatherer lifestyle and Aboriginal people set up shelter and camps throughout the area as they travelled in response to the availability of natural resources.[3]

The Aboriginal people were displaced from their land following European settlement of the area and their numbers dwindled dramatically, possibly associated with a smallpox epidemic in 1830, influenza and a measles epidemic in the 1860s.[4] There are few records of Aboriginal people on the Limestone Plains after it was settled by pastoralists, perhaps because of Indigenous seasonal lifestyles, or because they retreated from settlers and their horses and moved to the hills.[5] The new settlers may also have simply failed to record their ongoing presence in any detail.

2.2.3 Colonial History

European colonisation of the area commenced in the 1820s with small and large estates for farming and grazing. The Brickworks site was established on part of a large sheep grazing property held by Frederick Campbell, a descendant of Robert Campbell who owned the early Canberra pastoral estate 'Duntroon'.

During the late 1890s, there was much debate over the location of the seat of government for the new Commonwealth of Australia. It was eventually decided that the future capital's location would be selected by the new Parliament following Federation in 1901.[6] On the recommendation of Commonwealth surveyor Charles Scrivener, the district of Yass–Canberra was chosen in 1908. Scrivener's specific choice was an elevated site straddling the Molonglo River with mountains and hills to the northwest, northeast and south.

2.2.4 Planning the National Capital

The Griffin Plan

In 1911, an international competition to design the new city was launched and 137 entries were received. After considerable debate, Chicago architect Walter Burley Griffin was announced as the winner of the competition in May 1912.

Griffin's 1911 plan for the national capital was based on a geometry dictated by the landscape rather than the principal points of the compass, with a water axis formed from the flow of the Molonglo River at right angles to a land axis between two hill summits. A municipal axis lay just to the north of, and parallel to, the water axis. The central land axis ran from Mount Ainslie through Camp Hill (the site of Old Parliament House) to Capital Hill (the site of New Parliament House) and then nearly 50 kilometres further inland to Mount Bimberi.[7]



Figure 2.1 The Griffin Plan of Design for the Federal Capital showing the land, water and municipal axes, 1911. (Source: National Archives of Australia [NAA] A1, 1917/7242)

The Departmental Plan

Following the announcement of the top four winning entrants to the design competition, the Minister for Home Affairs, King O'Malley, appointed a Department Board to evaluate the winning proposals and create a plan for their practical implementation.

The Departmental Plan was completed by November 1912 and officially endorsed by King O'Malley in January 1913. Hearing of the Departmental Plan, Walter Burley Griffin visited Australia in an attempt to view the site, understand the proposed amendments and deter the government from changing his vision. Of note in the Departmental Plan was the allocation of a brickworks site, which had not been included in Griffin's plan. A compromise between Griffin and the Board could not be reached and in October 1913 the incoming Minister for Home Affairs, William Kelly, dismissed the Board. Griffin was appointed as Federal Capital Director of Design and Construction to implement his original plan.[8]

By 1918 Griffin had developed his scheme into a practical plan that could be implemented. In 1920, the Commonwealth Government established a Federal Capital Advisory Committee (FCAC) to ensure the plan's timely execution. Griffin did not approve of the Advisory Committee's appointment and this, along with other ongoing unease and tension between Griffin and other staff and governmental departments, led to him to leaving Canberra in 1920 on the completion of his contract.[9]

While Griffin was no longer involved in the process, the 'Griffin Plan' for Canberra of 1925 (called the 'Statutory Plan for Canberra') was gazetted as a result of *Seat of Government (Administration) Act 1910* (Cwlth). This plan effectively set the agenda for city planning until the 1950s. The National Capital Authority refers to the 'Griffin Plan' as both the 1918 plan and the 1925 Gazetted Plan.

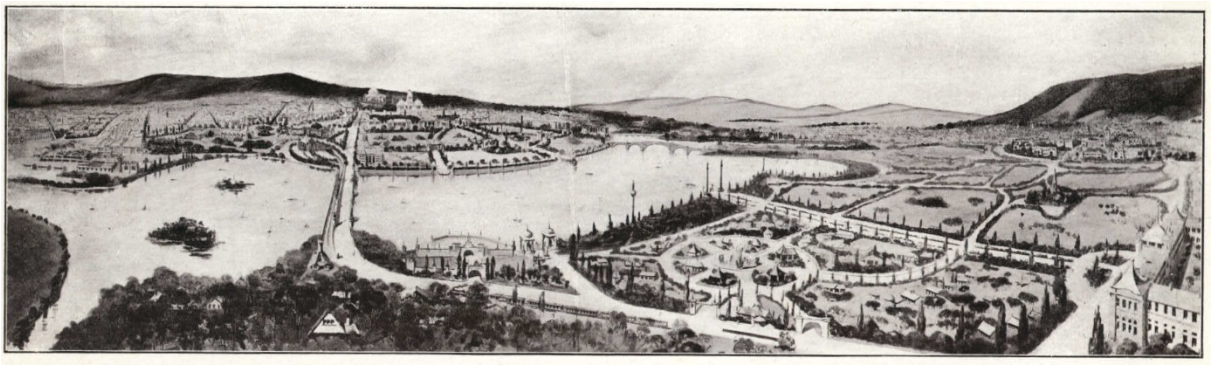


Figure 2.2 An artist's impression of the city's layout according to the Departmental Plan in Figure 2.3. (Source: NAA: M4071, 48, 1913, p70)

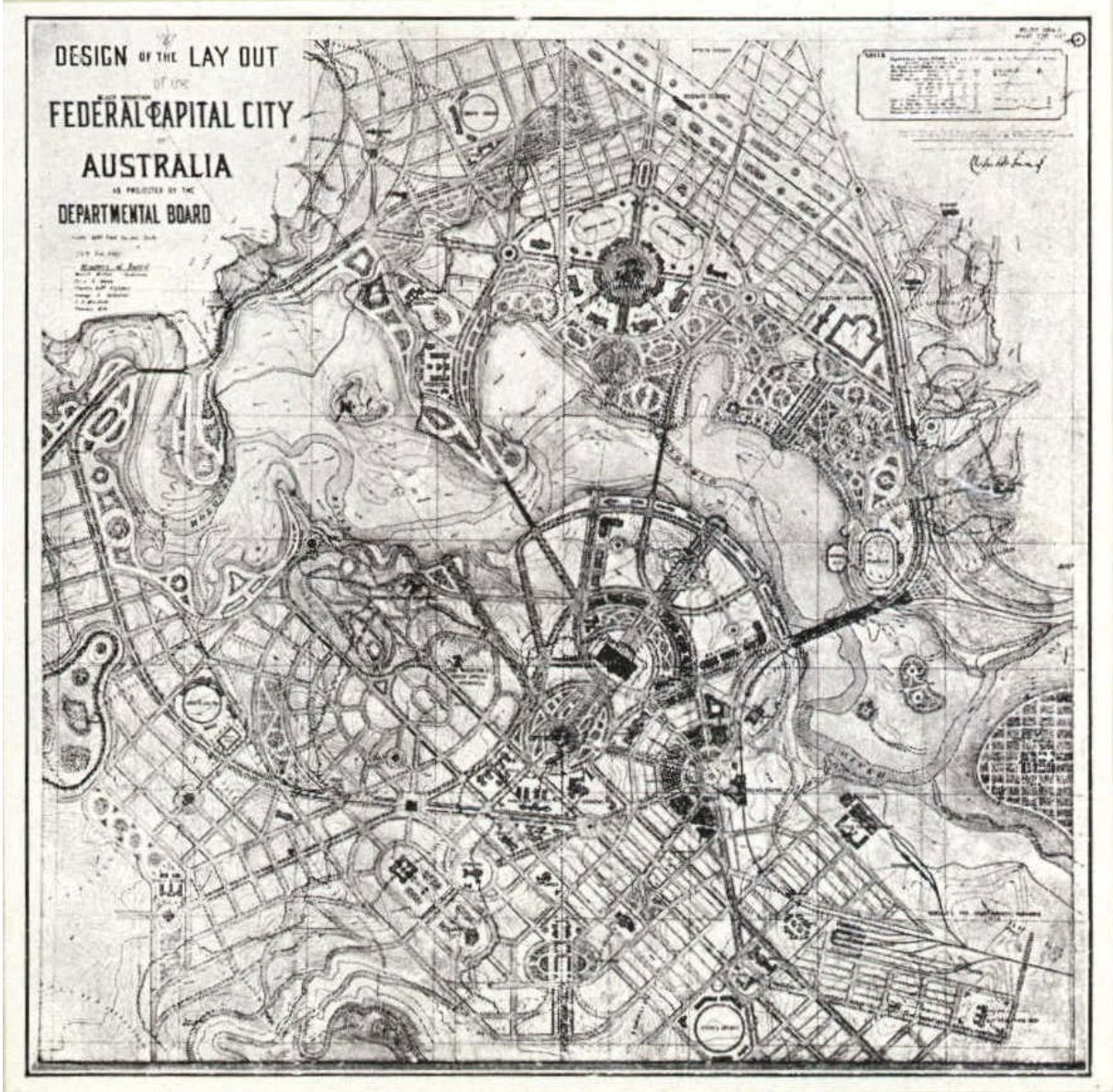


Figure 2.3 The 1913 Departmental Plan, of the Federal Capital Commission, was a combination of two of the winning designs and considered to lack the clarity and structured form of the Griffin Plan. (Source: NAA: M4071, 48, 1913, p 68)

2.3 Overview History of the Brickworks

2.3.1 Phases of Development

The Brickworks site contains evidence from each of its main phases of development: establishment, expansion, post-war, and post closure, when the site was permanently closed as a brick manufacturing facility.

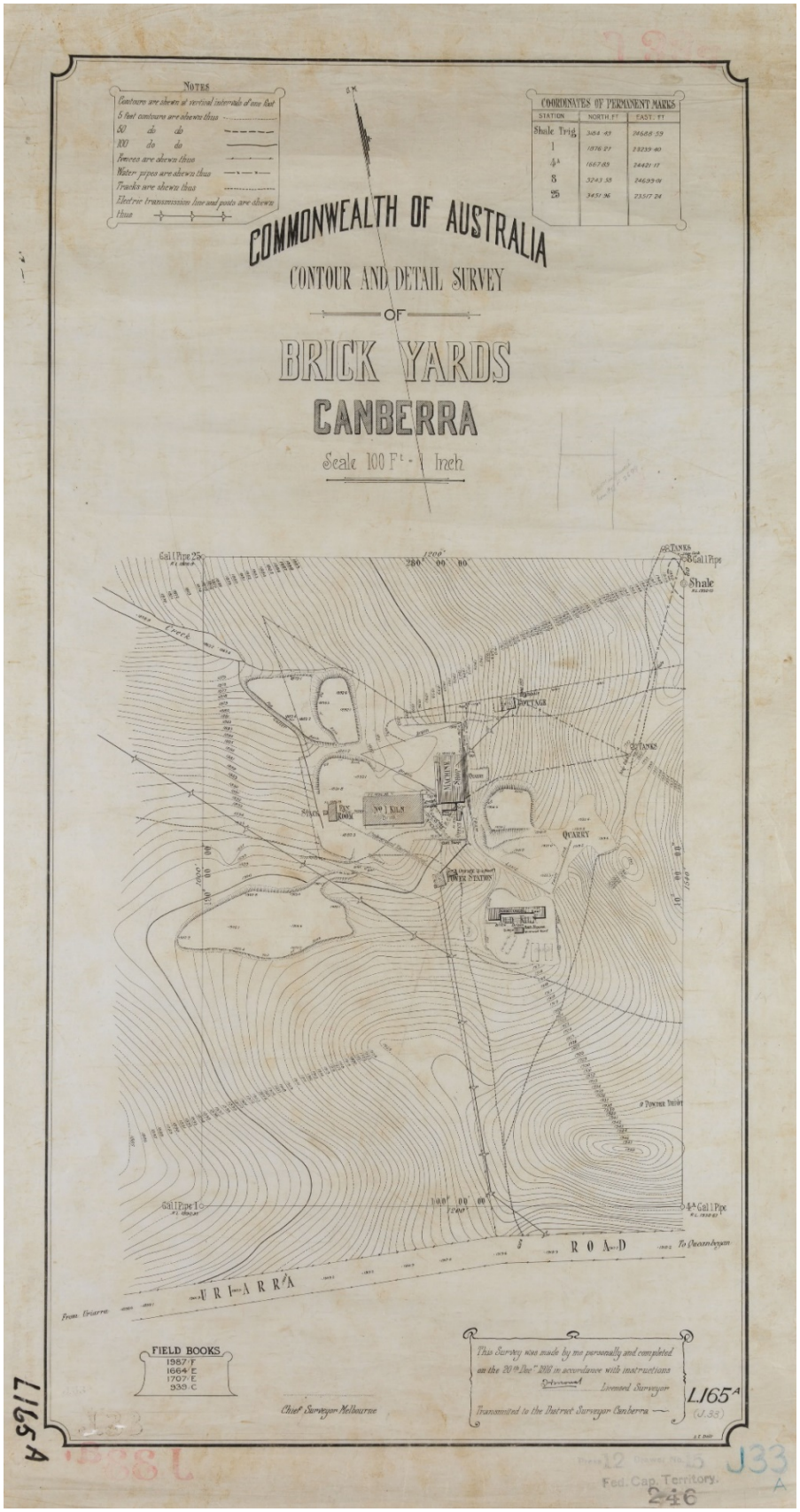


Figure 2.4 1916 contour and detail survey of the Brick Yards Canberra. Note: close-up details of this plan can be seen throughout Appendix C. (Source: NAA: A6664, L165A, 1916)

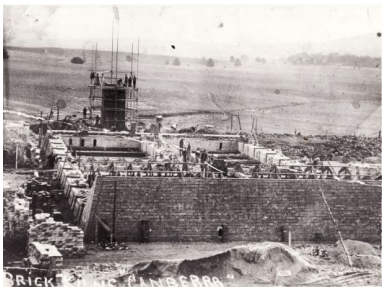


Figure 2.5 Staffordshire kiln construction at the Brickworks, c1915. (Source: Canberra District Historical Society, ID15652)



Figure 2.6 Chimney stack under construction, c1926. (Source: NAA, A3560, 2455)



Figure 2.7 Scotch kilns were in operation at the Brickworks till the mid-1920s. (Source: NAA, A3560, 1968)

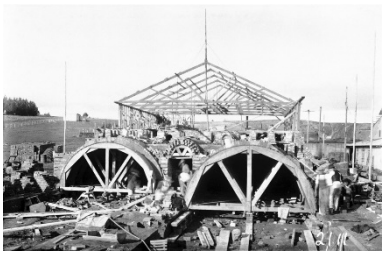


Figure 2.8 Hardy patent kiln 1 under construction, c1926. (Source: NAA, A3560, 2111)

2.3.2 Establishment Phase, 1911–1920

The 0020 Brickworks was established by the Commonwealth Government in the early days of Canberra's development as the Federal Capital. Due to the costs associated with transporting bricks from outside of the Territory, it was decided that a local quarry and brickworks be established to support the construction of houses and government buildings, and the population growth in the new town.

Of the two sites investigated, 38 acres of sheep grazing land on Frederick Campbell's property 'Yarralumla Station' was selected for its potential to produce bricks of an excellent quality, equal to the best commercially produced bricks for hardness and porosity.[10]

Development of the Brickworks began in 1913 with initial infrastructure comprising a grinding pan, brick making machine and elevator, portable steam engine, and four open kilns. It was expected that much of this equipment would be temporary and that more permanent infrastructure would be established in 1914. A single 20-chamber Staffordshire kiln, the first to be built in Australia, was completed in 1915. The arrival of World War I led to a shift in government priorities and commitments and resulted in restrictions on the works program for Canberra. This shift, together with a coal strike, caused the first closure of the Canberra Brickworks in December 1916. A 1916 contour and detail survey identified early Brickworks infrastructure including: a 'Machine Shop', 'No.1 Kiln', 'Fan Room', 'Stack', 'Office', and 'Power Station' (see Figure 2.4).

Many workers from the Brickworks were housed in two tent camps (single and married quarters) in an area popularly known as 'Westridge', part of Griffin's planned suburb of Westlake (now part of the suburb of Yarralumla). The first permanent dwellings for workers were constructed in the 1920s.

2.3.3 Expansion Phase, 1921–1942

With the end of World War I, the government proceeded with the construction of Canberra and formally reopened the Brickworks in 1921, which had undergone machinery repairs the previous year. A tile making plant was constructed in 1922 but it was reported in 1925 that the tiles were of a poor quality and the government invested £2000 into improving the product. The 1920s saw an increase in residential construction and major civic construction projects throughout Canberra, in response to government plans to move public servants from Melbourne, and the completion of the Provisional Parliament House in 1927 was a significant achievement for the fledgling capital. To cope with the increased demand, a Hardy patent kiln and two 'temporary' Downdraught kilns and associated stack were constructed. The brick manufacturing

Machine Shop established c1916 near the quarry was expanded by two bays to accommodate brick machines and grinding pans.

During the 1920s, more permanent workers' accommodation was established in the form of timber tenements and brick cottages adjacent to the earlier accommodation camps. In 1927, additional married quarters and a single men's camp were constructed in response to the growing workforce.

To assist in the accelerated residential and civic construction of Canberra, a steam powered narrow-gauge railway was built in 1923 to improve the mass transportation of bricks. The bricks had previously been transported by steam traction engines, but this was a slow process unsuited to the capital's rapid growth and underdeveloped roads. A track leading from the Brickworks was constructed and branched out to the site of the new Hotel Canberra (now the Hyatt Hotel) and the Provisional Parliament House, and the Kingston Powerhouse. A track was originally proposed to extend over the Molonglo River into Civic, but the 1922 floods destroyed the connecting bridge. Eventually the Civic branch was established by narrowing an existing abandoned standard gauge track.[11] From 1927 the railway infrastructure was gradually removed and transportation continued by motor lorry.[12]

The Depression curtailed production at the Brickworks and timber was used instead of the more expensive coal to operate the kilns. With significant reduction in demand, the Brickworks closed for a second time in 1931. It reopened in 1935, but this proved to be short-lived due to the arrival of World War II. The Brickworks closed for a third time in 1942 and staff were laid off with a caretaker instituted to issue bricks for essential works only.

2.3.4 Post-World War II Phase, 1944–1976

In 1944 the Brickworks reopened on a limited scale. This soon increased to respond to the postwar housing shortage, which led to major expansion and redevelopment works at the Brickworks. Efforts were made to seek out experienced and qualified workers to meet the increased demand on the Brickworks. However, recruitment proved challenging and in an effort to attract workers, a new amenities block was constructed, as was the 'Brickworks Hostel' which was positioned south of the site and completed in 1945.

In 1952, plans and equipment for a new 'Tunnel' kiln were purchased and foundations laid, but the project was soon abandoned amid spiralling costs. A second Hardy patent 20-chamber kiln (Hardy Patent Kiln 2) was constructed c1954 on the foundations of the abandoned Tunnel kiln. It utilised natural draught for firing, as opposed to being fan-induced, which required a tall



Figure 2.9 The Brickworks quarry face with workers, c1920–30. (Source: NAA, A3650, 3315)



Figure 2.10 The Brickworks quarry and narrow gauge railway track, c1920–30. (Source: NAA, A3650, 3314)



Figure 2.11 View from Old Parliament House roof with the railway and carts that delivered the bricks in the top right. (Source: NAA, A3560, 1398)

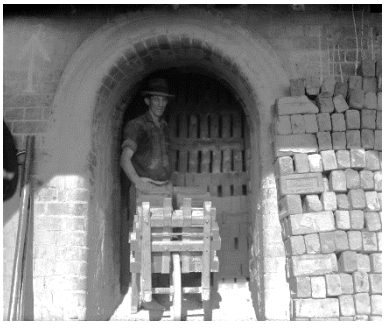


Figure 2.12 Man loading a kiln, c1926. (Source: NAA, A3560, 1973)



Figure 2.13 Canberra Brickworks, c1927. (Source: NAA, A3560, 2696)



Figure 2.14 Brick kilns and brick stacks, c1926. (Source: NAA, A3560, 167)



Figure 2.15 View to the kilns, c1928. (Source: NAA, A3560, 4557)



Figure 2.16 Stone crushing and screening plant. (Source: NAA, A3560)

chimney stack. The 1950s saw a change in the brick making process and a series of new crushers and hoppers was introduced, as well as an elevator and a series of conveyor belts. New brick press buildings and a workshop replaced the early machine shop adjacent the Staffordshire kiln. Despite extensive upgrades and works, a 1959 report on the operations, management, equipment, and economics of the Brickworks addressed concerns over low productivity at the site and the quality of bricks being produced.

In 1958, the two 1925 Downdraught kilns were demolished to allow for the construction of three new Downdraught kilns from 1960–1963. The new kilns had the capacity to hold 120,000 bricks and were reputed to be the longest in Australia. At this time, oil replaced coal as the fuel for firing the kilns.

By 1973, the Brickworks was considered in need of extensive modernisation and proposals were prepared by Commonwealth Brickworks Pty Ltd for upgrade works. These proposals were rejected by the National Capital Development Commission (NCDC) on environmental grounds and a new brickworks site was released at Mitchell in Canberra's north. The allocation of a new brickworks led to final closure of the Brickworks and the kilns were unloaded for the last time in August 1976.

2.3.5 Post Closure Phase, 1976–2017

In 1976, local developer and businessman Alan Marr (A R Marr Pty Ltd) put forward a proposal to develop the Brickworks as an integrated tourist, recreation, and retail centre with medium density housing to the east and north of the site. Marr succeeded in having the land rezoned to accommodate his vision and carried out maintenance and reconstruction works to the kilns. Landscaping of the quarry, involving land fill and the creation of the reflection lake, proceeded in 1978. The redeveloped Brickworks was opened to the public as a tourist attraction in July 1979. However, limited income opportunities and high capital costs forced Marr's business into provisional liquidation. In the early 1980s, Marr was seriously injured in a fall at the site and later died of complications. The Commonwealth accepted the surrender of Marr's company's lease in 1984 and management of the site was transferred to caretaker Bruce McDonald. While many of Marr's tenants remained at the Brickworks, concerns about the safety of some of the buildings and potential redevelopment of the site led to the tenants being asked to leave and the caretaker role being abolished. A timber recycling business, Thor's Hammer, was granted an extended period to relocate due to the considerable amount of its timber stock.

The 1988 *Canberra Brickworks South Canberra Policy Plan* suggested a range of potential uses for the site such as housing,

commercial accommodation, and office and retail space. The government adopted the plan, despite it being poorly received by the community. Hooker Projects submitted the preferred 'Expression Of Interest', which proposed a development that adapted the kilns and machine bays, and contained a sports precinct, museum, restaurant, hotel, and visitor attractions. A depressed economy led to Hookers being placed in provisional liquidation and by 1992 their proposal was defunct. It is around this time the Commonwealth handed the Brickworks site over to the ACT Government.

Further development proposals were investigated but none proceeded and during this phase the Brickworks continued to accommodate a range of tenants, including artists, designers, and manufacturers. In 2001 the Brickworks was included on the ACT Heritage Register as the 'Yarralumla Brickworks'. In 2013, the remnants of the former 1920s narrow-gauge railway were individually listed as the 'Yarralumla Brickworks Railway Remnants'.

In September 2013, the ACT Government's Land Development Agency (LDA) (now the Suburban Land Agency) released the *Canberra Brickworks and Environs Planning and Development Strategy*, which sought to promote the adaptive re-use of the site and its surrounds with respect to its heritage significance. Following revision of the strategy in 2015, the LDA called for development proposals to be submitted and in 2017 it was announced that the preferred tenderer was local Canberra developer Doma with its submission for a mixed-use residential, commercial, and retail development that utilised much of the historic Brickworks infrastructure.

2.4 The Brickmaking Process

The legibility of the brickmaking process can generally be traced across the site from east to west through key buildings and site elements; starting with the extraction of shale at the Quarry and moving west through the processing buildings, firing in the kilns and transport offsite. Later when the raw material was outsourced it was still delivered and stored at the Quarry, so the east to west movement of process was retained.[13] The process summarised below has been based on descriptions provided in newspaper reports, Lovell Chen Old Canberra Brickworks Conservation Management Plan (2010) and Lester Firth Associates, Old Canberra Brickworks: Conservation Plan (1986):

- **Quarrying:** The first operation of the brickmaking process was the quarry of raw materials (clay and shale) from the pit. In the early phase the shale was broken down from the face of the cliffs and transported in tip trucks on the small gauge rail to the crushing and grinding machines. As the surface clay was depleted, blasting was necessary to extract deeper veins of shale. Boreholes were drilled using a sledgehammer and chisel while men broke apart the exploded shafts of shale into smaller segments. This was dangerous work with risk of eye injury as shale flew under hammer blows. After the 1930s, due to inconsistent quality, raw material was sourced elsewhere.

- **Processing:** The Grinding attendant brought the shale to the jaw crusher which reduced the material to 75mm. It was then transported by buckets attached to elevator or belt to a storage bunker, then to the grinding mill hoppers. Further refinement followed with the fine powder passed through a 'screen made of steel piano wire which allows only the finest material to fall through.'[14] The high lime content meant a 'semi-plastic' pressing process was used. (Semi-plastic is ground clay, or shale, which is sufficiently damp to adhere under pressure). During the 1950s the expansion of the site saw the implementation of new crushers and pan rooms connected to a conveyor system. This included the Hazemag crusher installed in Small Crusher House (Element 21) and the White Pan Room (Element 19) also referred to as the Large Crusher House. The Primary Crusher House (Element 20) feature two hoppers, a Ross feeder and 'grissly feeder' with

rail bars to enable manual crushing. A Jacques swing jaw crusher was located under the Ross feeder.

During the 1930s there 'were six brick making units, three for each of the two large kilns, and each unit consisting of a 10ft grinding mill, a 'New Era' brick press, and pug mixer, driven by a 150hp electric motor. The output of each unit is approximately 1,500 bricks per hour.'[15] During the 1950s Anderson double re-press semi plastic presses were deployed to strengthen the brick.

- **Firing:** Green bricks, refined and pressed, were transported to the kilns for firing. The fired bricks were then sorted as they were unloaded, usually into "firsts", "seconds" and "clinkers." Clinkers were misshapen or bricks stuck fast to other bricks while baking. During 1926, the timing was described as follows: 'the period which elapses from the time the green brick enters the kiln and leaves a finished product is approximately three weeks, although the actual burning process is done in six days.'[16] The bricksetter would brick up to 70,000 bricks per day. Gaps between each brick in the stack allowed for hot air and flame to circulate during burning. Bricksetters would consume litres of water and salt tablets to counter the dehydration of the heat emanating from kilns (the 'Hoffman' type Hardy patent kiln was able to fire continuously at 1000 degrees Celsius).
- **Transport:** The bricks were transported from the Brickworks to Canberra city centre initially by traction engine. However, the machines were only able to complete two trips to brick loads across rough unmade roads. The construction of the light railway significantly expedited the process. The branch lines to key sites were removed before the opening of Provisional Parliament building in 1927. By the late 1920s, bricks were transported by lorry trucks.

Brickworks Products As technological advances progressed in the Brickworks machinery the diversity of products manufactured increased. To cope with the increased demand for building the National Capital, Downdraught kilns were installed to produce face and special bricks. Then the installation of the Staffordshire kiln (cutting edge technology for its time) enabled combinations of chambers to be used allowing the simultaneous production of a range of products, bricks, tiles and pipes. In 1927, the 'Hoffman' type Hardy patent kiln was installed with a potential annual output of six million bricks. A new down draft tile kiln was also operating with an annual output of 420,000 tiles and a new Roman tile machine with a daily output of 2,000 tiles.[17] By 1936 the Stock Sheet of the Department of Interior lists the range of products manufactured including:

> *3" common bricks, 3" Face bricks (red), 3" Black bricks common, 2" Paving bricks, 2" Face bricks (red), 3" semi-glazed Face Bricks, 3" Chocolate Face bricks, 3" Pavers, 2" Common bricks, Squints, Ovolo Double return bricks, Special Mould bricks, Ovolo Type 8, Ovolo Type 17, Splay on End 3", 3" Splay on End Flat double, Angle Bricks, Scotia, Cornice, 3" Bull Nose Bricks, Plinth single Return, Double Return, Bull nose stops – single and double, Vents, Louvres, Air Bricks, kerbs, Tiles – Marseilles, Roman, with apex, ridge, starters and stops, paving tiles, chimney pots, fluted bricks and facing tiles.*[18]

The 'Canberra Red' was the quintessential Brickworks product. This product came to house the provisional parliament house (Old Parliament House, 4 million bricks), the engine room powering the Capital (Kingston Powerhouse), the heart of the city (Civic), governance, postal and telegraph communications (Secretariat – East Block and West Block, 813,000 bricks); the new Canberra suburbs and the roofs over, not only politician's heads (Hotel Canberra, Hotel Kurrajong, 544,00 bricks), but the brickmakers (Yarralumla Brickworks Housing) and the public servants who lived in the Hotel Acton and other 'hostel' accommodation (Gorman House). The bricks themselves had unique frogged symbols: *C'WEALTH CANBERRA* or *CANBERRA C'WEALTH* (1920s), *CANBERRA* (1930s) and following Second World War simply *CB*.[19]Commentary in some of the building and design publications reported

the shift in taste away from the red, the *Building* magazine reporting: 'the brick made at Canberra is excellent, but unfortunately it is without variety.'[20]

White shale from the Attunga Point Quarry was used to make the Canberra Cream. This was reported as the 'result of a challenge thrown out by architects who maintained that the red brick did not tone with Canberra surroundings.'[21] The Canberra Times described the:

> *The development of new types of light-coloured bricks that have established favour with architects in Canberra is expected to lead to substantial orders for housing requirements, while experiments in tinted briquettes and glazed tiles have established further avenues for employment.*[22]

However, ultimately the Brickworks was unable to keep pace with the demand for bricks with supplementary bricks purchased from the Bowral works in New South Wales during 1939.[23] The last major output recorded the annual production of 7.25 million bricks in 1940. The subsequent 1959 report by HH Macey concluded that bricks were a 'little on the coarse side' and only moderate in quality.[24]

2.5 Chronology

The following table outlines the development phases and the construction dates of the remnant elements at the Canberra Brickworks Precinct.

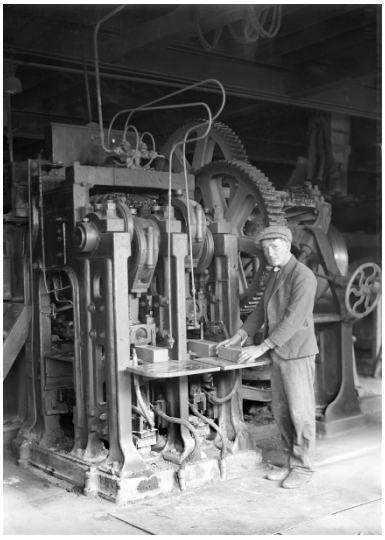


Figure 2.17 Brick pressing machine and operator, c1926. (Source: NAA, A3560, 1920)

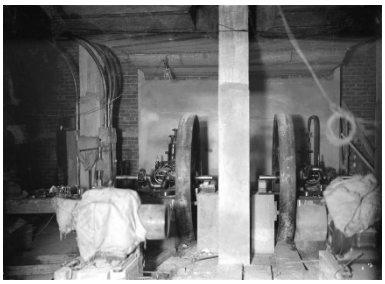


Figure 2.18 Brick pressing machinery being installed at the Brickworks, c1925. (Source: NAA, A3560, 1210)

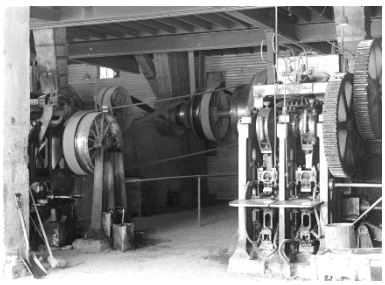


Figure 2.19 Brick presses for pressing clay bricks before firing, c1926. (Source: NAA, A3560, 159)

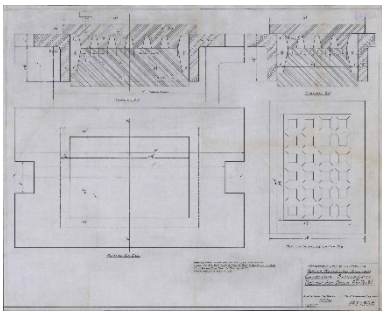


Figure 2.20 Dies for Air Brick, c1922. (Source: NAA, A2445, M2156B)

Table 2.1 Historic Development Phases of the Canberra Brickworks.

Number	Element	Date
Establishment Phase: 1911–1920		
11	Quarry	1913–1940
24	Concrete Retaining Wall	c1913
14	Power House	1915–16
1	Staffordshire Kiln	1914–15
2	Fan House for Staffordshire Kiln	1914–15
7	Chimney Stack for Staffordshire Kiln	1914–15
37	Original brickyard area between Staffordshire Kiln, Hardy Patent Kiln 1	c1915, c1926
Expansion Phase: 1921–1942		
1A	Railway Remnants—Narrow Gauge Railway	1923
13	Offices	c1925
3	Hardy Patent Kiln 1	c1926–27 (rebuilt 1955)
4	Fan House for Hardy Patent Kiln 1	c1927 (second structure c1955)
8	Chimney Stack for Hardy Patent Kiln 1	c1926–27
Post World War II Phase: 1944–1976		
24	Amenities Block	c1950, c1977
5	Hardy Patent Kiln 2	c1954
9	Chimney Stack for Hardy Patent Kiln 2	c1953, c2005
15	Machine Bay 1 for Staffordshire Kiln and Downdraught Kilns	c1955
16	Machine Bay 2 for Hardy Patent Kiln 1	c1955
17	Machine Bay 3 for Hardy Patent Kiln 2	c1955
18	Workshop	c1955
21	Small Crusher House (Crusher House I)	c1958
19	White Pan Room (Large Crusher House/Crusher House II)	c1955
20	Primary Crusher House (Crusher House III)	c1955
22	Elevator/Conveyor	c1955
6	Downdraught Kilns	c1960–63
26	Downdraught Kilns Control Room	c1961
10	Chimney Stack for Downdraught Kilns	c1961
27	Toilet Block	c1960s
28	Ancillary Storage Building	c1960s
29	Substation/Control Room	c1971

Number	Element	Date
30	Boiler House	c1971
31	Amenities Block 2	c1971
32	Extrusion Plant (Remnants)	c1971
33	Ancillary Storage Building 2	c1960s
34	Storage Shed	c1960s
38	Brickyard 2	c1954
Post Closure Phase: 1976–2017		
35	Model Railway Workshop	c1979
36	Model Railway Storage Shed	c1979



Figure 2.21 Frogged symbols for different types of Canberra Reds included: *CANBERRA C'WEALTH* c1920s and *CANBERRA* c1930s.



Figure 2.22 *'CB' frogged symbols were made* following World War II.

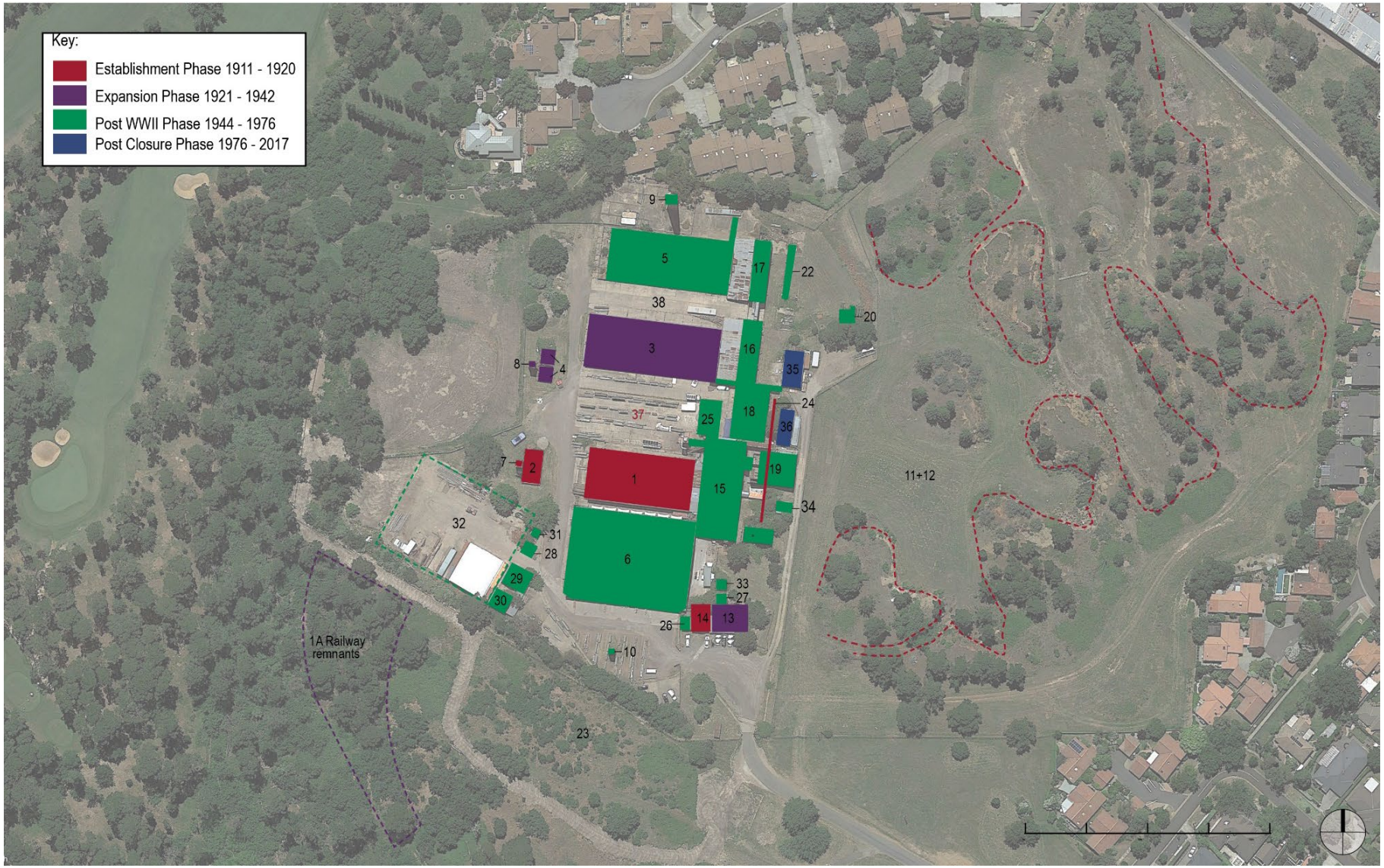


Figure 2.23 Site plan showing the location and development phase of individual elements within the Canberra Brickworks Precinct. (Source: Google Earth with GML overlay, 2017)

2.6 Comparative Analysis

2.6.1 Late Nineteenth and Twentieth Century Urban Brickworks in Australia

Brickworks were once a common feature of Australian urban landscapes. The introduction of continuous kilns from the 1870s marked a major shift in firing technology, enabling mechanised production on an industrial scale. This led to the replacement of small-scale enterprises with larger works, such as the Canberra Brickworks. The increased speed of the brickmaking process also encouraged the mechanisation of brick preparation, and improvements in related technologies and processes, including brick presses.

Brickyards with continuous Hoffman-type kilns proliferated from the late-nineteenth century to the interwar period. These yards closed progressively from the end of World War II, with further waves of closures in the mid-1960s and in the 1980s. The majority of these sites had been demolished by the 1990s.[25] Today, there are no Hoffman-type or 'patent' continuous kilns in operation as originally designed in Australia (other than a single example at Bowral, which has been modified to operate as a downdraught kiln).

The following section provides an overview of brickworks complexes in major Australian cities that include, or previously included, continuous kilns. The majority of these sites are either redundant, disused or have been adapted to an alternative use. Brickworks that have been demolished in their entirety and redeveloped are not included. This analysis was undertaken as part of the 2010 CMP and has not been added to as part of the CMP update.

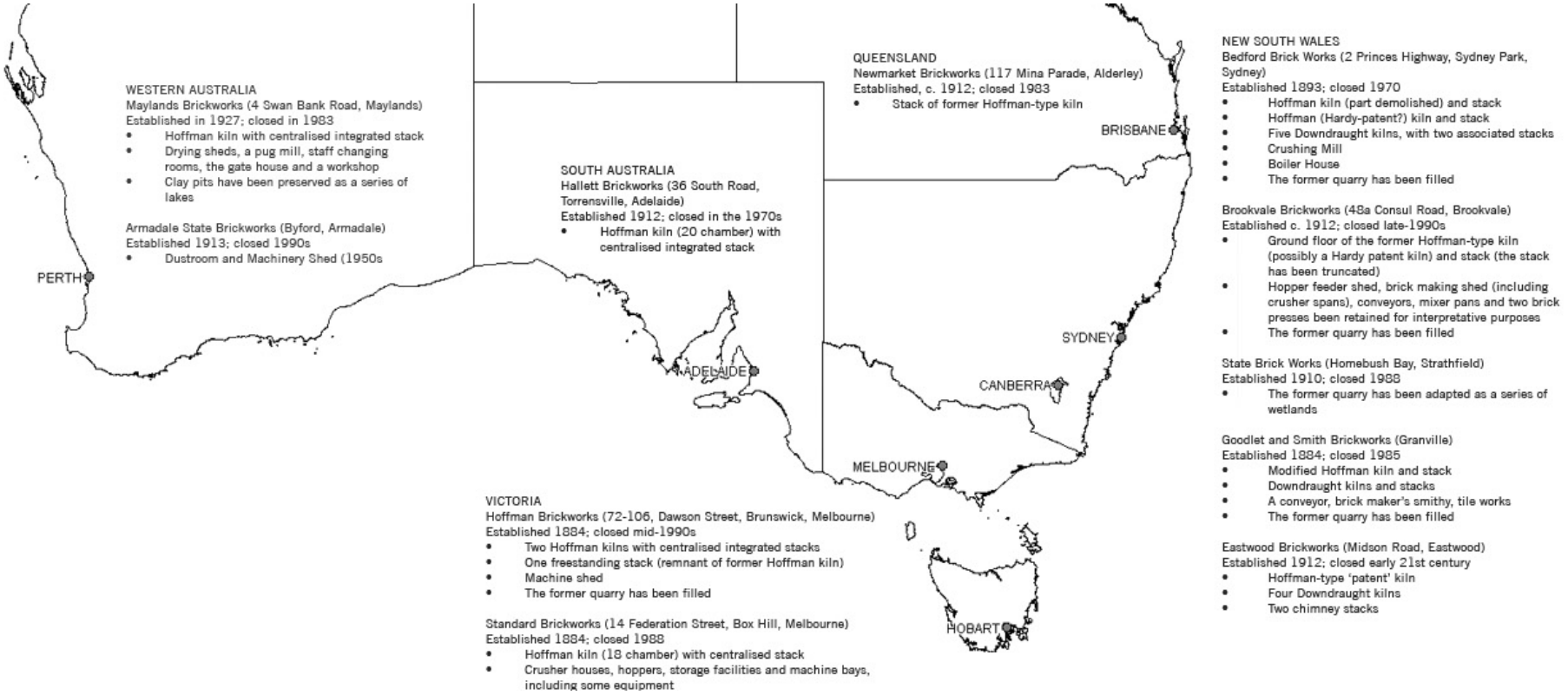


Figure 2.24 Surviving 'brickworks' in Australia with continuous kilns dating to the late 19th and early 20th century. Note: there are no sites in northern Western Australia, the Northern Territory, Tasmania and northern Queensland. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 177)

New South Wales

Goodlet and Smith Brickworks (fmr), Granville, Parramatta[26]

In 1884, hardware and building supplier Goodlet and Smith acquired the Junction Brick Company Ltd at Granville, west of Sydney. Production of building products, including bricks, finials, tiles and capping, and pottery, continued at the works until 1985.[27] Early development of the brickworks included a Hoffman kiln with a 45m high stack and associated technologies and support structures.[28] By the early twentieth century, the brickworks had evolved to become one of the largest in the Sydney region.

In 2002, infrastructure related to brick production at the site included the Hoffman kiln, by then truncated and adapted to two long downdraught kilns with an associated stack; two downdraught kilns; two stacks; a conveyor; brick maker's smithy; and ancillary buildings, including the old tile works.[29]

These elements have been retained and integrated into the 'Brickworks Square' interpretive component of the Holroyd Gardens residential development (Delfin Lend Lease). The former quarry has been filled.



Figure 2.25 The Holroyd Gardens redevelopment at the former Goodlet and Smith Brickworks, 2008. (Source: Flickr)



Figure 2.26 Interpretive signage and industrial relics at the former Goodlet and Smith Brickworks, 2008. (Source: Flickr)

Bedford Brick Works (fmr), St Peter's, Sydney

The Bedford Brick Works (also known as the Josiah Gentle Brickworks) was among the largest in the St Peter's district, which was the centre of Sydney's brickmaking industry from the 1840s. The complex was established in 1893 and taken over by the Austral Brick Company in 1933. It closed in 1970.[30] At its peak in the 1930s, the Bedford Brick Works included two Hoffman kilns, one with curved ends and a centralised stack, the other with a squared end and a stack attached at the south end. The later 'Hoffman' has been described as a Hardy patent kiln.[31] The site also included six Downdraught kilns in two clusters, brick sheds, a site office/entry building, and machine shed with a clay pit to the north (see Figure 2.25).

The site has been conserved within the public open space of Sydney Park. One of the Downdraught kilns and the west end of the Hoffman kiln with rounded ends has been demolished to accommodate a road widening scheme. The site office/entry has also been removed. The Hoffman (or Hardy patent) with squared ends, five downdraught kilns, a crushing mill and boiler house have been retained.[32]

The four surviving chimney stacks at the site have a strong presence in the local streetscape (see Figure 2.26). The site is included in the *Sydney Local Environmental Plan, 2010*.



Figure 2.27 Letterhead for Bedford Brick Works, St Peters, Sydney, 1929. (Source: Ron Ringer, *The Brickmasters*, 1788–2008, p 166)



Figure 2.28 Stacks at the former Bedford Brick Works, with Sydney Park in the foreground, 2008. (Source: Flickr)

Brookvale Brickworks (fmr), Brookvale

The Manly Brick and Tile Company built the Brookvale brickworks from 1910 to 1912. The company was taken over by Brickworks Ltd in 1936. Austral managed the plant from the end of World War II to the late 1990s.[33]

At its height, the Brookvale Brickworks included six Downdraught kilns located to the north and west of the site, and a large Hoffman-type kiln, with a square stack attached at one end (see Figure 2.27).[34] The arrangement of the Hoffman kiln is the same as the kiln at the Bedford Brickworks (fmr), which has been described as a Hardy patent kiln.

Following the closure of the brickworks in the late 1990s and preparation of a CMP by Pratten and Irving in 1996, consent was granted for the rezoning of the site[35] and its redevelopment as 71 townhouses and apartments. All the kilns have been demolished with the exception of the lower section of the Hoffman-

type kiln and the stack, whose height has been reduced by 11m from approximately 50m (see Figure 2.28).[36] In addition, a hopper feeder shed, brick making shed (including crusher spans), conveyors, mixer pans and two brick presses have been retained for interpretive purposes.

The site is included in the *Warringah Local Environmental Plan, 2011*.



Figure 2.29 Brookvale Brickworks prior to redevelopment (undated). (Source: Warringah Image Library)



Figure 2.30 The adapted/redeveloped kiln and truncated stack at Brookvale Brickworks. (Source: <www.marchesepartners.com.au>)

State Brickworks (fmr), Homebush Bay, Strathfield

In 1910, Arthur Griffith, NSW Minister for Public Works, proposed the establishment of a government brickworks that could produce cheap bricks and break the monopoly of private manufacturers. A 9.5ha site was purchased at Homebush Bay (also referred to as the Enfield Brickworks) and the site was operational by the end of the following year. Three Hoffman-type kilns were constructed in the first phase of development at the State Brickworks. The site was subsequently expanded around 1920 with the acquisition of 9.2ha, and construction of five further Hoffman kilns and six open kilns. Production continued intermittently at the State Brickworks until 1988.[37] Clay extraction at the site ceased in the 1960s, from which point the brick pits were used as a municipal waste depot.[38] The former brick pits were developed as a freshwater wetland during preparations for the Sydney 2000 Olympics.



Figure 2.31 Continuous kilns at State Brickworks, Strathfield, 1957. (Source: NSW Heritage Register)



Figure 2.32 Continuous kilns at State Brickworks, Strathfield, 1957. (Source: NSW Heritage Register)

Eastwood Brickworks (fmr), Parramatta

The Great Northern Brick Co Ltd established the former Eastwood Brickworks in 1912 to produce dry press bricks using locally available shale. A brickmaking shed and Downdraught kilns (possibly two) were built soon afterward. Expansion from the 1920s saw the addition of a 'patent' kiln, an additional Downdraught kiln, three grinding pans, and four Platt, one Clayton and two Whittaker presses. A 2002 description of the site referenced five Downdraught kilns, one Hoffman-type continuous 'patent' kiln and two chimney stacks.[39]

The Hoffman-type kiln at the former Eastwood works appears likely to have been the last operational kiln of its type in Australia, ceasing operations at the beginning of the twenty-first century (by then the site was commonly known as the Austral Brickworks).[40] The site has been developed for housing, including the filling of the former shale pit. The patent kiln and four of the Downdraught kilns have been stabilised and retained as interpretive elements. (See Figure 2.31.)

The site is included in the *Parramatta Local Environmental Plan 2011* as a Heritage item.



Figure 2.33 Aerial view of Eastwood Brickworks (fmr) c2007. (Source: Google Earth, c2007 in Lovell Chen, 2010, Canberra Brickworks CMP, p 183)



Figure 2.34 Aerial view of the former Eastwood Brickworks site, now residential development. Some elements were retained in what is called Brickyard Park. (Source: Google Earth, 2017)

Bowral Bricks, Bowral, Southern Highlands (operational)

Bowral Bricks was established in 1922,[41] and expanded into the major enterprise it is today (see Figure 2.33). A Hoffman-type kiln with a centralised integrated stack was constructed at the works (date unknown), and has subsequently been converted internally to two downdraught kilns. Externally, the kiln has 22 openings to chambers.[42]



Figure 2.35 Aerial view of Bowral Bricks. (Source: Google Earth, 2017)

Queensland

Newmarket Brickworks (fmr)

Around 1912, the Brisbane Brick and Builders Supply Co Ltd constructed a Hoffman kiln at the Newmarket brickworks, outside Brisbane. The kiln was built with a 50m high stack with a square plan, located approximately 15m from the kiln. This follows the model of the Hardy patent and Staffordshire kilns at the Canberra Brickworks.

The Newmarket Brickworks closed in the 1970s, and was redeveloped for alternative industrial uses from 1987. The stack was retained, but all other elements at the site demolished. The chimney stack is included in the Queensland Heritage Register (Place ID 601357).



Figure 2.36 Panorama of Newmarket, c1925, with brickworks chimney visible to the left. (Source: State Library of Queensland)



Figure 2.37 Hoffman stack at the former Newmarket Brickworks. (Source: Queensland Heritage Register)

South Australia

Hallett Brickworks (fmr), Torrensville, South Australia

The Hallett Brickworks was established by Hallett Brick Industries at Torrensville in 1912. A 20-chamber Hoffman kiln with rounded ends and a centralised circular stack was built at the site later that year. It is believed to have been the first of its kind in South Australia. The kiln operated until 1975.

Since 1983, the former brickworks operates as a market ('Brickworks Market'), which is open on Fridays, Saturdays, Sundays and public holidays. The kiln has been adapted to accommodate stalls and the like over two levels.[43] All machine sheds and ancillary buildings have been demolished.

Hallett Brickworks is included in the South Australian State Heritage Register.



Figure 2.38 Hallett Brickworks (undated). (Source: <www.brickworksmarket.com.au>)



Figure 2.39 Brickworks Market, 2010. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 187)



Figure 2.40 Brickworks Market, 2010. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 187)

Victoria

Hoffman Brickworks (fmr), Brunswick, Victoria

The Hoffman Patent Brick and Tile Company was established at premises in Albert Street, Brunswick, in 1870. The company held the patent rights to import the Hoffman kiln. In 1884 the company established premises at Dawson Street in Brunswick (the Albert Street premises were subsequently vacated). Production at the Dawson Street plant ceased in the mid-1990s.

From 1884 the Hoffman Patent Brick and Tile Company built the following at its Dawson Street works: three elliptical Hoffman kilns (16, 18 and 20 chambers) with integrated stacks and associated technologies, including clay grinding sheds, brick pressing sheds, stores, and warehouses. Pottery

works and related facilities, including small circular bottle pottery kilns (demolished), were located to the east of the site. A clay pit was located to the north of site.

Land to the north of the kilns at the Hoffman Brickworks has been adapted as a residential development. As part of the adaptive re-use of the site, the northernmost Hoffman kiln has been demolished; only its stack survives. The two surviving kilns, and the former engine house, brick pressing shed and grindings sheds to the west of the site have been retained and approval has been given for their conversion for residential use. The former Hoffman Brickworks is included in the Victorian Heritage Register (H0703).



Figure 2.41 Hoffman Brickworks, 1930s. (Source: State Library of Victoria, H5596)



Figure 2.42 Former Hoffman works at Brunswick, 2010. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 189)



Figure 2.43 Former Hoffman works at Brunswick, 2010. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 189)

Standard Brickworks (fmr), Box Hill, Victoria

The former Standard Brickworks at 14 Federation Street, Box Hill, Victoria operated from 1884, as the Haughton Park Brick Company, until its closure in 1988. From 1913 until 1938, the site was owned and operated by the Standard Brick and Tile Company and it was during this period that the majority of existing buildings and fabric were completed.

An 18-chamber Hoffman kiln with a centralised integrated circular stack was built in approximately 1913. Four brick presses were installed at the same time.[44] As existing, the site includes crusher houses, hoppers, storage facilities and bays, including some equipment. Despite a number of proposals for adaptive re-use/development, the site remains disused and the buildings are in poor condition, having been subject to extensive vandalism and graffiti. The ground level openings to the kiln have been boarded up.

The former Standard Brickworks site is included in the Victorian Heritage Register (VHR H0720).



Figure 2.44 Hoffman kiln at the former Standard Brickworks, 2010. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 190)



Figure 2.45 Former machinery sheds at the former Standard Brickworks, 2010. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 190)

Western Australia

Armadale State Brickworks (fmr), Byford, Armadale

The State Brickworks at Armadale was established in 1913, following the Government Trading Concerns Act of 1912. The site operated intermittently until the 1990s. The Brickworks had been in private ownership since 1961.[45]

A Hoffman kiln with integrated stack was built at the Armadale works in between 1913 and 1914. The next major phase of development was in the early post-World War II period when 'No. 2 Pressed Brickworks' and 'No. 3 Wire-Cut Brickworks' were constructed at the site. Two 'Zigzag' kilns, a form of transverse arch continuous kiln, were constructed at the site during the post-World War II period.[46] No. 2 Brickworks, which included a dustroom and machinery shed, replaced the earlier facility.

All kilns at the site have been demolished. Only the dustroom and machinery shed, built during the 1950s, survive. The machinery associated with these structures is also extant. The dustroom and Machinery Shed are included in the Heritage Council of Western Australian Register of Heritage Places (place ID 15829). The site was included in the National Trust of Australia (WA) list of endangered heritage sites for 2008.



Figure 2.46 Armadale Brickworks c1905. (Source: State Library of WA)

Maylands Brickworks (fmr), Maylands, Perth

The Maylands Brickworks was developed by Messrs Atkins and Law from 1927.

The first phase of development included a Hoffman kiln and drying sheds, pugmill and brick making extruder. The plant was expanded in 1936, with an additional Hoffman kiln, pugmill and drying sheds. As existing the site includes one Hoffman kiln with 18 chambers and centralised integrated stack (34m high). The second kiln was demolished following damage sustained during the 'Meckering' earthquake of 1968. Brick production ceased at the site in 1983.[47]

The kiln, stack and some ancillary buildings have been preserved. The site is included in the Heritage Council of Western Australian Register of Heritage Places (place ID 2410), in response to a public outcry against a proposal to develop them for residential use.[48]



Figure 2.47 Maylands Brickworks, 1950s. (Source: State Library of WA)



Figure 2.48 The Hoffman kiln and integrated stack at the former Maylands works. (Source: Flickr)

Midland Brick, Bassett Road, Middle Swan

Midland Brick is a major brick production company located at Middle Swan, north of Perth. It was established in 1946 by brothers Ric and Gerry New and has operated consistently since that time. The first kiln at the site was built in 1946. This may have been a Downdraught kiln, but this has not been established. The first of nine tunnel kilns at the site was constructed in 1962. The most recent (Kiln 11) was completed in 2006. The site covers an area of 100ha, and the company claims to produce approximately 60 per cent of WA's total brick output.[49]

2.6.2 Conclusion

Each of the surviving complexes identified above has particular qualities and characteristics, including kiln types, dates of construction and expansion, retention of plant and other attributes, and on this basis, it is difficult to draw direct comparisons between them.

Accepting this, it is evident that the brickworks at Canberra is now one of a relatively small number of surviving sites, which can demonstrate aspects of the operation of large-scale twentieth century urban brickworks. Compared with the majority of other sites reviewed, the Canberra site retains more evidence of the brick-making processes, site layout and principal building components typically found on such sites, albeit expressed through a range of buildings of vastly different dates of construction rather than a coherent complex of elements constructed in one or more key phases. Conversely, the ability of the site to meaningfully demonstrate some of these processes has been compromised by the removal of much of the manufacturing equipment itself (crushing and pressing). While through their form and construction, the kilns themselves (together with their related structures, fan houses and stacks) are evocative of the process that occurred within them, this is not the case for the simple steel-clad machinery bays, following the removal of the brick presses and other machinery and plant they accommodated. Only remnants of the conveying systems (conveyors and hoppers) remain in these buildings in a form that can be readily understood. The crusher houses similarly have had much of their infrastructure removed.

In considering the kiln types remaining on site, in summary, the continuous kilns (Staffordshire and Hardy patent) sit within what is now a relatively limited group of surviving kilns—predominantly of the early to mid-twentieth century, which are of the Hoffman continuous kiln or based on its typology. Within Australia there are approximately 12 surviving kilns of this type, including Hoffmans and Hardy patent. Within the typology of continuous kilns the Staffordshire kiln was a rare, if not unique, design in Australia and is the only surviving example of this design. On this basis, it is considered to be of additional interest.

Downdraught kilns of varying ages and design are found at a number of brickworks and related sites across Australia including three at the Sydney Park site and a number at the Bristile site in Perth. They are not rare as a building type.

2.7 Endnotes

1 Finlayson, D 2008, Landscapes Around Canberra, ACT Division, Geological Society of Australia, p 2.

2 Land Development Agency & Lovell Chen 2010, Canberra Brickworks, Denman Street, Yarralumla, Canberra : conservation management plan, Land Development Agency, Canberra, p199

3 Wright, WD 1923, *Canberra*, John Andrew & Co, Sydney, p 58.

4 CAB Consulting Pty Ltd, Context Pty Ltd, University of NSW and Rowell A, *Parliament House Vista Area Heritage Management Plan, Volume 1*, prepared for the National Capital Authority, 2010, p 47.

5 Gillespie, L 1984, *Aborigines of the Canberra Region*, L Gillespie, Campbell, ACT, p 29.

6 The National Capital Development Commission, *Tomorrow's Canberra: Planning for Growth and Change*, Australian National University Press, Canberra, 1970, pp 3–7; and Lovell Chen, *Nomination of Canberra to the National Heritage List: An examination of the merits*, prepared for the National Capital Authority, April 2008, pp 42–43.

7 Griffin, WB 1955 [1912], 'Original Report', reprinted with corrections in 'Parliament of the Commonwealth of Australia, Senate, Report from the Select Committee appointed to inquire into and report upon the development of Canberra, September 1955, Appendix B', cited in Marshall, D, Butler, G, Context Pty Ltd, Firth, D and Ross, M, Parkes Place and the National Rose Garden Heritage Management Plan, Volume 1, prepared for the National Capital Authority, 2011, p 52.

8 Rowe, DJ 1997, *Building a national image: the architecture of John Smith Murdoch, Australia's first Commonwealth Government architect*, Ph.D. (Arch) thesis, School of Architecture and Building, Deakin University, pp 139–140.

9 Rowe, DJ 1997, *Building a national image: the architecture of John Smith Murdoch, Australia's first Commonwealth Government architect*, Ph.D. (Arch) thesis, School of Architecture and Building, Deakin University, p 157.

10 National Archives of Australia, Series A110/FC 1913/1055, in Ian Carnell, 'Canberra's Cornerstone', *Canberra Historical Journal*, No. 5, March 1990, cited by Lester Firth Associates, 1986, Section 2.2.1.

11 ACT Heritage Council 2013, Yarralumla Brickworks Railway Remnants', pp 6–7.

12 ACT Heritage Council 2013, 'Yarralumla Brickworks Railway Remnants', viewed 4 July 2017 <http://www.environment.act.gov.au/__data/assets/pdf_file/0011/348680/249.pdf>, p 7.

13 Land Development Agency & Lovell Chen 2010, Canberra Brickworks, Denman Street, Yarralumla, Canberra : conservation management plan, Land Development Agency, Canberra, p201.

14 'Canberra Industries' Canberra Community News, 12 July 1926,p. 6. Accessed December 10, 2020, from http://nla.gov.au/nla.news-article66060249

15 Lester Firth and Associates (1986), Old Canberra Brickworks, 2.2.1

16 'Canberra Industries' Canberra Community News, 12 July 1926,p. 6. Accessed December 10, 2020, from http://nla.gov.au/nla.news-article66060249

17 Land Development Agency & Lovell Chen 2010, Canberra Brickworks, Denman Street, Yarralumla, Canberra : conservation management plan, Land Development Agency, Canberra, p 81.

18 Department of Interior, Stock Sheet, 1936, referenced in Lester Firth and Associates, 1986, Section 2.1.2.

19 Gugler, A, Hidden Canberra: History of Canberra – Brickyards Westridge, https://hiddencanberra.webs.com/historyofcanberra.htm, accessed on 10 December 2020.

20 'Queensland State Insurance Building Brisbane', 12 September 1925, *Building: the magazine for the architect, builder, owner and merchant*, Vol. 37 No. 217, p50.

21 'Busy Days Returning for the Brickworks: New Light Bricks Favoured by Architects', *Canberra Times,* Thursday 12 March 1936, p6.

22 'Busy Days Returning for the Brickworks: New Light Bricks Favoured by Architects', *Canberra Times,* Thursday 12 March 1936, p6.

23 Land Development Agency & Lovell Chen 2010, Canberra Brickworks, Denman Street, Yarralumla, Canberra : conservation management plan, Land Development Agency, Canberra, p 100.

24 As quoted in Land Development Agency & Lovell Chen 2010, Canberra Brickworks, Denman Street, Yarralumla, Canberra : conservation management plan, Land Development Agency, Canberra, p 100.

25 Pers comm, Stephen Wall, NSW Manufacturing Manager, Austral Brick Co Ltd, and Adam Mornement, Lovell Chen, 10 February 2010.

26 The former Goodlet and Smith Brickworks have also been known as Junction, Merrylands and Granville brickworks.

27 Ringer, R 2008, *The Brickmasters, 1788–2008*, Dry Press Publishing, Horsley Park, pp75–77.

28 Ringer, R 2008, *The Brickmasters, 1788–2008*, Dry Press Publishing, Horsley Park, p 77.

29 Eric Martin and Associates, 'Former Goodlet & Smith Brickworks as part of the Holroyd Gardens Development: Heritage Report & Statement of Heritage Impact for the Heritage Precinct Buildings', July 2002.

30 Whitaker, A 2008, 'Sydney Park', *Dictionary of Sydney*, viewed 15 January 2010 <www.dictionaryofsydney.org>.

31 Ringer, R 2008, 'Bricks', *Dictionary of Sydney*, viewed 9 February 2010 <www.dictionaryofsydney.org>. See also Figure 2.25.

32 Otto Cserhalmi & Partners Pty Ltd Architects, *Sydney Park, Brick Kiln & Chimney Precinct, Repairs & Remediation Study*, Stage 1 Return Brief, February 2007, p.3.

33 'The Kilns' development, 'History of the site', viewed 19 January 2010 <www.thekilns.com.au>.

34 'The Kilns' development, 'History of the site', viewed 19 January 2010 <www.thekilns.com.au>.

35 The area occupied by the former brickworks has been re-zoned Residential 2(e); the land surrounding the brickworks has been designated an Environment Protection 7(a) zone. Brookvale Brickworks and Surrounds — Draft Land Use Study, report to the Strategy Committee Meeting, Warringah Council, 27 May 1997. See <www.warringah.nsw.gov.au/council/documents/81270597.pdf>, viewed 19 January 2010.

36 Minutes of the Heritage Council Approvals Committee [NSW], 17 May 2001, item 7.1.

37 Ringer, R 2008, *The Brickmasters, 1788–2008*, Dry Press Publishing, Horsley Park, p 353.

[38] Sydney Olympic Park, 'State Brickworks: 1901–1988', viewed 19 January 2010 <www.sydneyolympicpark.com.au>.
[39] Eric Martin & Associates, 'Eastwood Brickworks Project: Heritage Report', 2002.
[40] Pers comm, Eric Martin of Eric Martin & Associates, and Adam Mornement, Lovell Chen, 4 February 2010.
[41] Bowral Brick, 'History', viewed 8 February 2010 <www.bowralbricks.com.au>.
[42] Pers comm, Stephen Wall, NSW Manufacturing Manager, Austral Brick Co Ltd, and Adam Mornement, Lovell Chen, 10 February 2010.
[43] Brickworks Market, 'History', viewed 18 January 2010 <www.brickworksmarkets.com.au>.
[44] Victorian Heritage Database, Former Standard Brickworks citation, VHR No. 0720.
[45] Heritage Council of Western Australia, Register of Heritage Places, Armadale State Brickworks Dustroom & Machinery Shed citation, place ID 15829.
[46] A 'Zigzgag' is a type of continuous kiln invented in Germany during the 1920s. It features a long fire zone advanced by suction fan. See Habla Zig-Zag Kilns International, viewed 3 February 2010 <www.hablakilns.com/industry.htm>.
[47] Heritage Council of Western Australia, Register of Heritage Places Assessment Documentation, place No. 2410 (Maylands Brickworks).
[48] Heritage Council of Western Australia, Register of Heritage Places Assessment Documentation, place No. 2410 (Maylands Brickworks).
[49] Midland Brick, 'About Midland Brick', viewed 3 February 2010 <www.midlandbrick.com.au>.

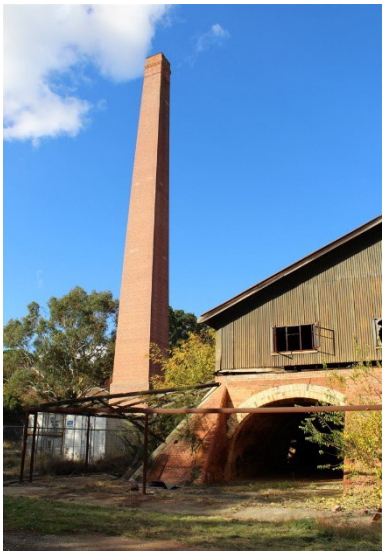
3.0 Understanding the Place—Physical Context











3.1 Introduction

This section provides a discussion of the built environment of the Canberra Brickworks Precinct, including a brief description and analysis of the elements of the site and its landscape setting, the different types of built structures, and historic archaeological potential.

The site comprises a range of built elements and industrial infrastructure constructed from various phases of the Brickworks' development and evolution. The site contains evidence from the four phases of development: establishment, expansion, postwar, and post closure, with each phase reflecting technical developments and building requirements.

The built structures at the site include kilns, chimney stacks, fan houses, workshops, crusher houses, machine bays, primary supporting buildings, and ancillary structures. Other historic features on the site include the adjacent quarry, and remnants of the former railway.

Following the closure of the site in 1976, the structures on the site have been used for ad hoc purposes and are in various states of repair.

Generally, the site's elements are in a poor to fair condition. Many of the elements retain their important features but all are in need of conservation action and maintenance due to lack of use, structural deterioration, water ingress, weather, vegetation overgrowth and vandalism.

A more detailed discussion of the individual elements including their physical condition is provided in the inventory sheets at Appendix A.

Much of the information relating to the physical context of the Brickworks has been drawn from the 2010 CMP, and revised and updated where necessary.

3.2 Landscape Context

3.2.1 Setting

Yarralumla, where the Canberra Brickworks Precinct is located, is an early suburb of Canberra to the southwest of Civic.

The site neighbours the Royal Canberra Golf Club and Westbourne Woods to the west, open parkland, and a reserve

to the south, and private residences along Lane Poole Place to the north. Bentham Street runs along the northeast of the site above the quarry.

Prior to the establishment of the Brickworks, the site was in a gently undulating landscape surrounded by grazing land and juvenile plantations of radiata pine. A gentle hill rose from the southeast sloping down to the northwest. While some sparse residential development occurred prior to the establishment of the Brickworks, the setting remained mostly unchanged until the interwar period. Most of Yarralumla's residential development took place in the latter half of the twentieth century. Because of its relatively sunken location, the Brickworks was a place concealed from view and seen only when approached over the hill that now overlooks the Brickworks quarry to the northeast of the site. From this position, the wooded areas of the Canberra Golf Course and Dunrossil Drive can be seen. As vegetation matured and development occurred, the Brickworks became an increasingly unseen place, only visible from afar by smoke from its chimney stacks, and after 1953, the landmark chimney stack of the Hardy Patent Kiln 2.

The visual setting of the area has changed over time and while the Brickworks site still exists with a treed and open grass backdrop to the west and south, expanding residential development to the north and east provides an altered context. The most distinctive aspect of the setting is that the Brickworks still retains a degree of concealment and a sense of detachment from the character of the residential city. The setting remains one of a degree of open, unkempt landscape, and wooded and plantation areas. Essentially, the Brickworks site still conveys a sense of the remoteness in which it was built.

3.2.2 Landscape Elements

The site has many trees scattered through and around the quarry, which appear to be mostly self-seeded conifers such as radiata pine. Photographs from the 1920s indicate that some tree specimens may have been consciously planted to the site's northeast. The remaining trees planted around the site are a mix of predominantly deciduous trees of varying ages. The site contains some weed infestation, such as blackberry.

The southern area of the Precinct is more densely populated with trees and plantings, presenting a more overgrown landscape.

Historically, while trees appear to have been deliberately planted, there is no evidence of a consciously designed landscape treatment implemented across the site. Trees are more likely to have been planted within the site for their amenity.

A Tree Assessment report, undertaken in 2015,[1] identified that the predominant species across the site is *Pinus radiata* (weed species), *Pinus ponderosa* and *Pinus sylvestris* and *Ulmus procera* and various tree and shrub weed species.

The report recommended that the site and surrounds would benefit from a landscape renewal plan to:

- identify the limited number of trees to be retained;
- manage removal of the poor quality and senescent trees;
- determine the replacement landscape; and
- develop an implementation and staging strategy to direct the replacement landscape installation.

3.2.3 Views

Canberra Brickworks is nestled in the Yarralumla landscape and does not offer any commanding views. However, the 1953 chimney stack (Element 9) for the Hardy Patent Kiln 2 is a landmark for the site from a distance and can be seen from several vantage points around Canberra. The Brickworks has a relatively understated presence in the surrounding area and views into the site from the surrounding suburb are incidental.

While some urban industrial complexes of comparable age were designed with a conscious and more formal presentation to one or more street frontages, this is not the case for the Brickworks. It is a site that is completely utilitarian in its physical and architectural conception.

There are interesting views within the site, included in Figure 3.0, toward historic elements, including to, and from within the quarry. There are views which are indicative of the aesthetic and industrial characteristics of the former industrial process and function of the site including the corrugated ironclad 'process' buildings along the eastern edge adjacent to the quarry, of the views to the dominant building forms of the kilns, the roofscape of the kilns, and the connecting open spaces between the kilns, brickyards, fan houses and chimney stacks.



Figure 3.1 Significant views within the site to elements of heritage significance on the site.

3.3 Historic Elements

Individual historic elements of the site are shown in Figure 1.4. A brief overview of the types of elements found on site is provided below, along with their location. The individual elements are described in more detail at Appendix A: Inventory of Historic Elements.

Kilns

There are six extant kilns located at the Brickworks comprising the Staffordshire Kiln (Element 1), Hardy Patent Kiln 1 and 2 (Elements 3 and 5), and the group of three Downdraught Kilns (Element 6).

The Staffordshire Kiln is identified through its transverse arches, detached chimney stack and complex system of flues and dampers. This enabled the use of combinations of chambers at the same time for simultaneous production of goods such as bricks, tiles, and pipes. It was the first permanent, continuous kiln at the Brickworks and was considered to have leading brick burning technology at the time of its construction in 1915.

The Hardy patent was another type of continuous kiln introduced to the Brickworks in 1926. While based on the 'Hoffman' type, the Hardy patent is distinguishable by its freestanding stacks as opposed to an integrated and central stack. It was fired continually in a clockwise cycle and produced up to 150,000 bricks a week. A second Hardy patent kiln was constructed in 1954 around the time that the earlier Hardy patent kiln was substantially rebuilt following partial collapse.

The group of Downdraught Kilns were built on the site of two demolished 'temporary' Downdraught kilns and were reputed to be the longest in Australia. Grouping the kilns together enabled consistent use through rotation. The kilns had the capacity to hold 120,000 bricks each and were used almost exclusively for the production of face and special bricks. The kilns were constructed of face brick with large fire brick faced metal doors at either end and fire feedholes lining the east and west sides. Initially coal-fired, they were later converted to oil-firing.

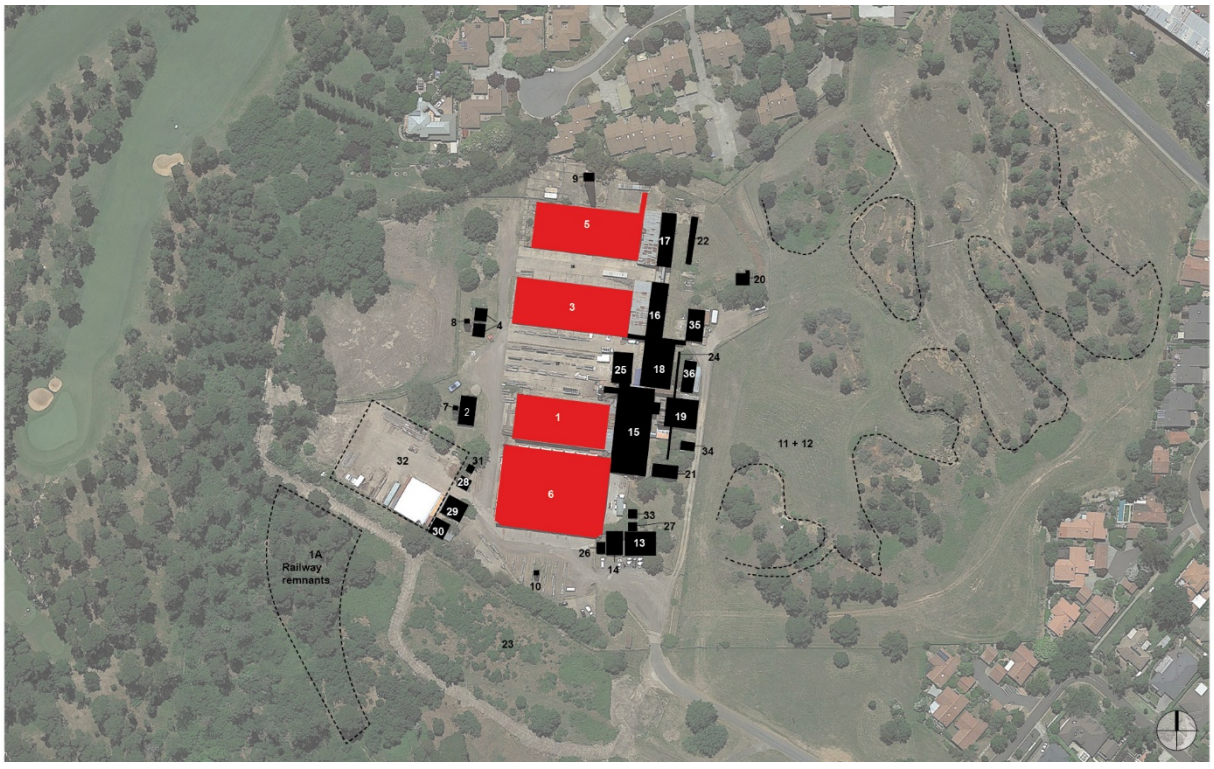


Figure 3.2 Location of the kilns at the site, shown in red. Element 6 is a single roof over three Downdraught Kilns, Element 1: the Staffordshire Kiln, Element 3: Hardy Patent Kiln 1 and Element 5: Hardy Patent Kiln 2. (Source: Google Earth with GML overlay, 2017)



Figure 3.3 Hardy Patent Kiln 1, Staffordshire Kiln and Downdraught Kilns (Elements 3, 1 and 6) (Source: GML, 2017)



Figure 3.4 Staffordshire Kiln (Element 1) (Source: GML, 2017)



Figure 3.5 Hardy patent kiln 1 (Element 3) (Source: GML, 2017)



Figure 3.6 Brickwork and verandah detailing of Hardy patent kiln 1 (Element 3) (Source: GML, 2017)



Figure 3.7 Hardy Patent Kiln 2 (Element 5) and Chimney Stack (Element 9). (Source: GML, 2017)



Figure 3.8 Upper firing floor of Hardy Patent Kiln 2 (Element 5). (Source: GML, 2017)



Figure 3.9 Downdraught Kilns (Element 6) beneath steel. Canopy. (Source: GML, 2017)



Figure 3.10 Door of a Downdraught Kiln. (Source: GML, 2017)

Chimney Stacks

There are four extant chimney stacks for each of the remaining kilns connected via an underground tunnel network. The brick chimney stacks are distinctive features of the site and important components of the former brick making process.

The Staffordshire and Hardy Patent Kiln 1 chimney stacks (Elements 7 and 8) are located about 30 metres west of their associated kilns. Though built 10 years apart, the stacks are similar in design. Both stacks are constructed of face brick and capped with several courses of corbelled brickwork, surmounted by nine rows of brickwork. The west-facing arched opening of the Staffordshire Kiln stack and the south-facing arched opening of the Hardy Patent Kiln 1 stack have been infilled. There is evidence of some rebuilding to the upper courses of the Staffordshire stack and a large crack is evident in the north elevation of Hardy Patent Kiln 1 stack, above the stepped courses.

The Hardy Patent Kiln 2 chimney stack (Element 9) is the tallest on site at 45 metres high, making it a landmark feature of the site. The stack is constructed of face brick and laid with Colonial bond courses. Two of the four entry hatches are in-filled and the east elevation entry is fitted with a wire mesh gate. Sections of the upper courses of brickwork have been re-laid with new mortar and the opening has been part-capped with steel roofing as a part of stabilisation works undertaken around 2005.

The Downdraught Kilns chimney stack (Element 10) is located at the south of the site and approximately 30 metres from its associated kilns. Constructed of red brick, the design of the stack is a simpler version of the Staffordshire Kiln and Hardy Patent Kiln stacks without the corbelled detailing. The brickwork shows signs of spalling, particularly to the north and west elevations. The large opening to the east elevation is likely to have accommodated a large duct from the fan house.



Figure 3.11 Location of the chimney stacks at the site, shown in red. (Source: Google Earth with GML overlay, 2017)

Fan Houses

The two extant fan houses remain for the Staffordshire Kiln and Hardy Patent Kiln 1. The fan houses draw the heat from the kilns via tunnels and out through the associated stacks.

Located about 20 metres from its kiln, the Staffordshire Kiln fan house (Element 2) is constructed of face red brick, laid in English bond with a Dutch gabled roof clad in corrugated steel. The fan house presents as a single-storey building but has an internal lower floor level.

The Hardy Patent Kiln 1 fan house (Element 4) is a more modest design made up of two timber framed sheds located side by side, with gabled roofs, clad and roofed in corrugated steel. One was constructed later than the other, in conjunction with the expansion of the Hardy Patent Kiln 1. Entry is from the east elevation and windows are located on the rear and side walls. There is an internal lower floor, similar to the Staffordshire fan house. The ducts connecting the fan house with the stack remain, and unlike the Staffordshire equivalent, these rise visibly out of the rear wall of the fan houses and connect to the east elevation of the stack at a height of approximately two metres.



Figure 3.12 Location of the remaining fan houses at the site, shown in red. (Source: Google Earth with GML overlay, 2017)



Figure 3.13 Fan Houses (Element 4) and Chimney Stack (Element 8) for Hardy Patent Kiln 1. (Source: GML, 2017)



Figure 3.14 Fan House (Element 2) and Chimney Stack (Element 7) for Staffordshire Kiln. (Source: GML, 2017)

Crusher Houses

Crusher houses refined raw brick making materials into manageable sizes before transferring to grinding mills and pugmills where the material was further refined, worked, and mixed. It was then fed into brick presses. The Brickworks retains the Small Crusher House (Element 21), the White Pan Room (Element 19), and the Primary Crusher House (Element 20) as processing facilities, dating from the 1950s. The buildings are steel framed and clad.

The Small Crusher House is flanked by low sloping walls of off-form concrete at the upper level, which frame the unloading bay. At the lower level, the structure presents as a two-storey building with some of the machinery platforms and framing including the hopper in place. The building was fitted with a single hopper and a 'Hazemag' rotary crusher, which ground and screened the raw material through a perforated plate. Material was then transferred by conveyor to the White Pan Room (also referred to as the Large Crusher House).

The White Pan Room has a distinctive skillion roofline in varying heights. White clay was directly unloaded into one of two hoppers at the building, which have since been removed. While the structure is retained, much of its internal machinery has been removed, exposing large holes in the concrete surrounding the former location of the hoppers. The conveyor connecting the crusher to the White Pan Room has been removed.

The Primary Crusher House is raised on steel posts with a concrete retaining wall to the east side. It processed raw material before it was transferred for further screening and grinding to the Red Pan building, which has since been demolished. The Primary Crusher House contained a 'Ross' feeder for raw shale with 32" and 18" Jaw Crusher and also a grizzly feeder. It was an integral element of the raw materials processing operations in the expansion of the Brickworks in the postwar period.



Figure 3.15 Location of the crusher houses at the site, shown in red. (Source: Google Earth with GML overlay, 2017)

Machine Bays and Workshop

The three extant Machine Bays (Elements 15, 16 and 17) and the Workshop (Element 18) were constructed in the 1950s to address postwar production increases. The material from the crushers was transferred to the lofts of the Machine Bays via a conveyor system, through the Workshop to hoppers and gravity fed through chutes into the brick presses below.

The Machine Bays are three storey steel-framed and clad structures containing a loft gallery with overhead conveyor, and hoppers and brick presses in the 'shop floor' below. The loft space has a concrete floor and the conveyor, housed within the roof space is accessed by steel ladder-form stairs from this level. There are several holes in the concrete floor where machinery and stairs have been removed. The brick making machinery has also been removed.

The Workshop was used for general workshop repairs and the maintenance of machinery and was built on the approximate site of the original machine shop, which was constructed in 1915 and demolished in the 1950s. The conveyor connecting the three machine bays travels through the gabled roof space within the north side of the building.



Figure 3.16 Location of the machine bays and workshop at the site, shown in red. (Source: Google Earth with GML overlay, 2017)

Elevator/Conveyor

Like the Machine Bays and Workshop, the Elevator/Conveyor (Element 22) was constructed during the postwar increase in production. The conveyor transported the crushed shale from the Primary Crusher House to the now demolished Red Pan Room to the east of Machine Bay 2 and 3. The Red Pan Room ground and screened the crushed shale, and the other section of the conveyor transported it to a distribution hopper adjoining Machine Bay 3. From this point the shale travelled vertically down to the table measures where it was then conveyed by elevator to the top of Machine Bay 3, joining the loft conveyors to be distributed to the brick presses.

The Elevator/Conveyor is a steel-framed structure, clad in corrugated galvanised steel supported on steel stanchions. Only part of the conveyor remains in situ. The section linking the demolished pan house to the distribution hopper is only partly intact and the section linking the pan house to the crusher has been demolished, leaving the entire structure isolated from its associated buildings.



Figure 3.17 Location of the elevator/conveyor (Element 22), shown in red. (Source: Google Earth with GML overlay, 2017)



Figure 3.18 Primary Crusher House (Element 20). (Source: GML, 2017)



Figure 3.19 White Pan Room (Element 19). (Source: GML, 2017)



Figure 3.20 Machine Bay 2/3 (Elements 16/17) with Elevator/ Conveyor (Element 22) in foreground. (Source: GML, 2017)



Figure 3.21 Elevator/Conveyor (Element 22). (Source: GML, 2017)

Ancillary Structures

Key Structures

The Power House and Offices provided critical support to the complex operation of the Brickworks. The Power House (Element 14) was constructed around 1915 of red face brick with a terracotta tiled gable roof. With the establishment of the Kingston Power House, the high voltage supply was broken down by transformers to lower voltages and distributed across the site. This was achieved by three overhead cables connected to the purpose-built Power House. The locations of the original entry points for the cables are visible on the south elevation. Some electrical equipment remains in situ within the building, including circuit breakers, ammeters, watt meters and distribution boards.

The Offices (Element 13) were constructed about 10 years after the Power House and extended in the 1950s and 1970s. The first extension doubled the size of the original two-room building, extending the structure to the south to provide a general office, office for the manager and costing clerk, and store room. Further works in the 1970s extended the building to the east, and further altered the south elevation. The Offices are of brick construction with a tiled gable roof, located immediately east of the Power House. During the 1970s a brick addition to the east and a new verandah partially enclosed the remainder of the south elevation, abutting the Power House.

Other Structures

Other temporary and permanent ancillary structures that provided support to the operation of the Brickworks and its modern-day function include sheds, stores, amenities blocks, and substations. These structures date from the 1960s or later and are primarily of brick construction.



Figure 3.22 Location of the ancillary structures at the site, shown in red. (Source: Google Earth with GML overlay, 2017)



Figure 3.23 Control Room (Element 26), Power House (Element 14), and Office (Element 13). (Source: GML, 2017)



Figure 3.24 Amenities Block (Element 25). (Source: GML, 2017)



Figure 3.25 Ancillary Storage Building (Element 28) and Amenities Building 2 (Element 31). (Source: GML, 2017)



Figure 3.26 Boiler House (Element 30) and Substation/Control Room (Element 29). (Source: GML, 2017)



Figure 3.27 Model Railway Workshop (Element 35). (Source: GML, 2017)



Figure 3.28 Substation/Control Room (Element 29). (Source: GML, 2017)

Other Site Features

Quarry

The geological formation of the quarry demonstrates the key characteristics of the Yarralumla Formation, which was formed from deep water sediments (mudstone and siltstone) of the early Silurian age (424–423 million years ago) and comprises a very fine-grained sedimentary rock known as shale. Within the quarry there are four specific locations (A, B, C and D), which demonstrate particular aspects of the site and the Yarralumla Formation. Of these, sites A and D show excellent examples of anticline in calcareous siltstone and Site B shows a typical tuffaceous mudstone and siltstone of the Yarralumla Formation. Site C shows abundant fossils of mainly brachiopods, trilobites and crinoids preserved in a bedding plane.

Following the testing of shale samples, the Brickworks site was selected for its potential to produce bricks of a good hardness and porosity. The raw material extracted from the new quarry came from a levelled knoll to the east of the site and was a hard, yellow shale. The shale varied greatly in quality and material from the various seams had to be mixed thoroughly to secure uniform colour in the bricks. The quarried material was transported to the Brickworks by a narrow-gauge tramway, which could be relocated as the quarry face advanced.

From the mid-1930s, raw materials were brought in from offsite. Quarrying at the Brickworks was reported to be a complex process, and costlier than average due to seams of unusable material such as limestone and sandstone. Levelled areas of the quarry were subsequently used to house Brickworks-related facilities, including an open-sided roofed enclosure for clay storage.

After the closure of the Brickworks, the site development proposal prepared by A R Marr Pty Ltd proposed the construction of a narrow-gauge railway and a 'reflection pool' in the former quarry. However, the pool failed to retain water and was frequently dry. Other than these works, and a concrete dividing wall capped with stone paving which is a remnant of Marr's pool, the quarry appears to be little altered since the closure of the Brickworks in 1976. The railway has been dismantled. There are areas of grass and the quarry and its edges are lightly treed, predominantly by self-seeded conifers.



Figure 3.29 Location of Element 11 + 12—the quarry and geological features at the site—shown in red with the Heritage Register numbers A, B, C, D included. Note: outlined locations are approximate and not to scale. (Source: Google Earth with GML overlay, 2017)

Concrete Retaining Wall

The Concrete Retaining Wall (Element 24) separates the quarry and the working areas and was constructed in the early years of the Brickworks. The wall extended to the north, approximately to the concrete base of the demolished pan room, where it returned to the east. The rear of the original 'Machine Shop' abutted the retaining wall.

The cast in situ off-form concrete wall is approximately three metres high and much of the original extent of the wall remains legible. The Crusher Houses (Elements 19 and 21) and the east and north brick walls of the Model Railway Workshop (Element 35) are built on top of the wall. It also carries the pedestrian bridge or 'catwalk' that provides access to the firing floor of Hardy Patent Kiln 1 (Element 3).



Figure 3.30 Location of the retaining wall at the site, shown in red. (Source: Google Earth with GML overlay, 2017)

Railway Remnants

The Railway Remnants reflect the early history of the Brickworks when a steam-powered narrow-gauge railway was introduced to expedite the mass transportation of bricks to construction sites around Canberra. In the clean-up and extensive landscaping works prior to the opening of Parliament House in May 1927, and possibly also because it had by that stage become more economical to transport the bricks by motor lorry, the railway was removed.

Remnants of the former Brickworks railway lines are evident closest to the southwest corner of the site, converging to form a single embankment. Close to the Brickworks two of the former lines are evident as earth terraces, which go through a short cutting to become distinctive earth mounds. The third line runs approximately parallel to the western boundary of the Brickworks and is evident as an earth terrace. Along some sections of the embankment there are mature pine trees within close proximity, with other trees and shrubs growing alongside and over the former rail line.



Figure 3.31 Location of the railway remnants at the site (Element 1A), shown in red. (Source: Google Earth with GML overlay, 2017)



Figure 3.32 View east toward the quarry (Element 11 + 12) showing geological formations. (Source: GML, 2017)



Figure 3.33 View in the quarry (Element 11 + 12) of the former 'reflection pool'. (Source: GML, 2017)



Figure 3.34 Concrete retaining wall (Element 24), showing later masonry wall constructed on top. (Source: GML, 2017)



Figure 3.35 Embankments and terracing of the Railway Remnants (Element 1A). (Source: GML, 2017)

Brickyards

The brickyard, the area between the Staffordshire Kiln (Element 1) and Hardy Patent Kiln 1 (Element 3), is part of the original development/early establishment phase of the Canberra Brickworks. The space was 'enclosed' following the construction of the Hardy Patent Kiln 1 (Element 3) in 1926 to the north of the Staffordshire Kiln, which had been constructed earlier in c1915.

A second brickyard (Element 38) formed with the construction of the Hardy Kiln 2 (Element 5) c1953, to the north of Hardy Patent Kiln 1.

The brickyards, the open space 'concourse' to the west of the kilns (north-south direction) from Element 2 to Element 4, and the open space between Fan Houses (Elements 2 and 4), are noted in the Heritage Register under 'Specific Requirements' for conservation policy consideration of the site, shown in red in Figure 3.35. The ground between the kilns is covered with concrete slabs, with deep concrete drainage pits in front of the kilns. A gravel roadway separates the kilns and fan houses.

The brickyards and open spaces are supporting elements of the site.

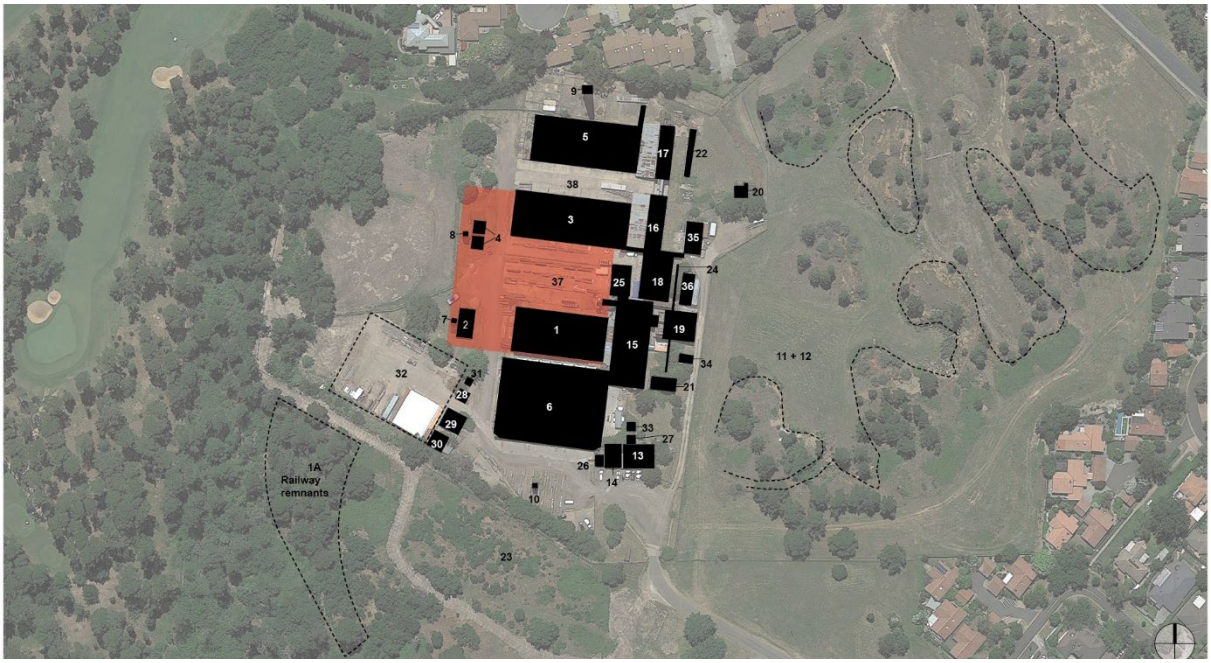


Figure 3.36 Location of the brickyards (Elements 37 and 38) and open spaces noted in the Heritage Register are shown in red. (Source: Google Earth with GML overlay, 2017)



Figure 3.37 View east over the first brickyard toward the Amenities Block (Element 25). (Source: GML, 2017)



Figure 3.38 First brickyard (Element 37), looking west. (Source: GML, 2017)

3.4 Condition of Individual Site Elements

The condition of the individual elements of the Brickworks and Railway Remnants, is based on visual inspections by GML, and Sellick Consultants Pty Ltd, Inspection Report of Canberra Brickworks, prepared in December 2019. The inspection report includes dilapidation assessments of each building of the site (the Canberra Brickworks heritage listed elements). The Railway Remnants are archaeological ruins, and a condition assessment is not provided.

Overall, the condition of the Brickworks is in poor condition as it has been unused and untenanted for several years. Individually, the structures vary in their condition, ranging from 'good', 'reasonable' to 'poor'. The lack of use or regular maintenance has led to continual degradation; generally including the brick and timber structures decaying, and roof and wall sheets becoming loose.

Table 3.1 provides a list of the Site Elements (some are features intrinsic to the heritage significance of the site), their condition as assessed in the Inspection Report, 2019. General conservation and/or 'remediation' requirements for each element are also provided in the table.

Table 3.1 Condition and conservation advice for the Individual Elements of the Site.

Site Element Number	Condition as @ 2019	General Remediation Works
Element 1—Staffordshire Kiln  	*External Condition:* Brick veneer and structure is in reasonable condition considering age, with some cracking. Original wall sheeting has severe deterioration in parts. Sheet fixings noted to be loose in some areas. Roof sheeting appears to have been replaced more recently. Roof and walls sheeting are generally not weather-proof. *Interior Lower level:* The majority of the entry archways to 20 brick kilns have loose bricks and voids in the brickwork bedding – resulting in displacement of some arches. The entry arches have displaced laterally in areas which is likely due to swelling of the bricks. The internal areas of the kilns are generally in sound structural condition, with some loose bricks. *Interior Upper Level:* Chimney vents across the floor are open. Steelwork bracing has buckles in some areas. There are areas of bracing missing and connections loose.	Retain and conserve the original form and external fabric. Restore the brickwork veneer and ensure it is weatherproof. Reinstate locally displaced bricks. Structural supports may be needed. Replace roof sheets and fixings as required. Replace badly weather damaged roof framing and upgrade as required to required modern standards. A structural engineer should assess the need for new bracing. . Retain and expose the roof trusses, where possible. Assess the steel roof structure further (by structural engineer) and fix where required. Retain the upper level firing floor with remnants of the equipment used to fire and feed the chambers. Retain an area of the firing floor, or a single chamber, as an intact, single volume, so the nature and operations of the firing floors can be understood. Chimney vents should be covered for safety in the short term, and ensure interpretation can be implemented for future adaptive reuse opportunities.

Site Element Number	Condition as @ 2019	General Remediation Works
	Timber floor structure is badly weathered, timber connections not adequate in some locations. Lean to roof sheets have deteriorated and sheet fixings are loose. Timber roof framing has weathered in some areas. Glazed louvre vents are broken and not weatherproof.	
Element 2—Fan House for Staffordshire Kiln 	*Condition of the Fan House* The form of the building and brick fabric are in reasonable condition. The roof, joinery and interior are in poor condition (due to water and vermin ingress). The tunnel connections with both the kiln itself and the associated chimney stack need to be investigated. Brickwork walls are in reasonable condition, with some cracking to lintels. Ceiling boards are in poor condition and partially collapsed. The open basement level contains debris and water. Handrails loose. Door and windows were broken and deteriorated.	Conserve and retain the original building form, fabric, openings, internal concrete platforms and 'fan' infrastructure. Closer inspection of tunnel connections with the kiln and the associated chimney stack is recommended.
Element 3—Hardy Patent Kiln I  	*External Condition* Roof is in reasonable condition, with the sheeting replaced more recently. Wall sheeting to exterior of structure in reasonable condition. Majority of windows are broken. The roof sheeting of the awnings is in reasonable condition. Although the timber rafters are in average condition, some of the rafters do exhibit weather damage. There is corrosion in areas of the steel fascia beam. Post connections are loose and some connections between steel fascia and posts has failed. *Interior Condition* The brickwork bedding of most of the entry archways has loose bricks and voids, causing a displacement of the arch.	*External* Replace any loose sheet fixings for both the wall cladding and roof. Ensure the roof is waterproof. Conserve and retain the Hardy Patent Kiln I, its original form and fabric, allowing for adaptive reuse options. Retain the verandah if possible. Retain/interpret the evidence of the former function of the firing floors of either this Kiln, or the Staffordshire Kiln. Retain and expose the roof trusses, where possible. Rafter-fascia connection of awnings needs to be upgraded and the timber rafters should be replaced where relevant. Steel post connection to correct as needed. *Interior* Reinstate loose brickwork areas. If this is not feasible, need to provide structural steelwork or other support, noting the prior use of mass concrete for this purpose.

Site Element Number	Condition as @ 2019	General Remediation Works
	Significant structural concrete augmentation has been installed to the east and west end connections between the main tunnels. Entry archways have significant cracking and displacement of the eastern and western ends. There are loose bricks within the internal kiln areas. *Interior Upper Level:* The steel trusses in the upper floor are in reasonable condition and the connections are overall, welded and in stable condition. Chimney holes are a trip hazard throughout within the floor. There are several battens loose where timber battens were installed to the underside of purlins that were potentially implemented to support ceiling lining.	*Interior Upper Level* Cover chimney holes and ensure the floor does not have any trip hazards. Timber battens can be removed if not needed. Should ceiling lining be installed, the battens will need to be appropriately secured. Retain the upper level firing floor with remnants of the equipment used to fire and feed the chambers. A structural engineer should further assess the steel roof structure and upgrade where relevant.
Element 4—Fan Houses for Hardy Patent Kiln 2 	*Condition of the Hardy patent kiln fan houses* Poor condition	The Fan House should be retained and stabilised in situ. Retain internal configuration as evidence of the original function of the building.
Element 5—Hardy Patent Kiln 2 	*External Condition* Wall sheeting is in poor condition and is loose in some areas. The windows and doors are in poor condition. Roof has loose sheets in certain areas, and it has deteriorated. It is in poor condition. The steel roof framing has weathered. There are areas of missing awnings. Some weathering of the timber rafters. Steel fascia beam has weathered significantly in certain areas. Post connections loose in areas.	*External* Wall sheeting needs to be replaced (or at minimum secured). Nailed fixings to be replaced using screw fixings. Replace and seal up windows where necessary. The timber rafters and fascia connection would be replaced as part of the awning renewal, adaptation and upgrade process. Steel posts to be remedied and reconnected to fascia. Structural steelwork to be re-purposed. *Interior* Locally displaced bricks should be reinstated.

Site Element Number	Condition as @ 2019	General Remediation Works
	Connections between timber fascia and posts has failed in certain areas. The steelwork, despite surface oxidation, is in reasonable condition for age. *Interior Condition* The brickwork bedding of most of the entry archways has loose bricks and voids, causing a displacement of the arch. Although loose bricks were noted throughout the internal kiln areas, displacement of the internal arches was less common. *Interior Upper Level* Although roof trusses are in reasonable condition, lateral bracing of the roof structure may require upgrading. A trip hazard is created by chimney ventsthroughout the floor.	Cover up chimney vents and ensure floor is free of trip hazards. A structural engineer should further assess the steel roof structure and upgrade where required. Excavation of the floor and replacement with concrete slab is possible, to allow the space to be used and the original proportions of the space to be retained. Retain the upper level firing floor with remnants of the equipment used to fire and feed the chambers.
Element 6—Downdraught kilns (three kilns)	Steel portal framed roof over the kilns is in reasonable condition. External condition of the Downdraught Kilns is poor and requires further structural assessment.	Conserve the original building form and fabric of each Downdraught kiln. The kilns require further structural assessment to inform conservation/remediation works. The steel framed roof could be restored or removed. Removal would require that restoration and waterproofing of the kilns occur as a high priority (and should be undertaken before removing the steel roof).
Element 7—Chimney Stack for Staffordshire Kiln 	*Condition of the chimney stack* Cracking to the base of the chimney; however, it appears stable. The top of the chimney has severe cracking and loose bricks. Note: observations were made from ground level.	Retain and conserve the chimney stack. Closer inspection of upper areas of chimney recommended. Additional structural support may be required. Secure/reinstate loose bricks at top of chimney.
Element 8—Chimney Stack for Hardy Patent Kiln 1	*Condition of the chimney stack* Good/reasonable condition	Conserve and restore the chimney stack. Closer inspection of upper areas of chimney recommended. Additional structural support may be required. Secure/reinstate loose bricks at top of chimney.

Site Element Number	Condition as @ 2019	General Remediation Works
		
Element 9—Chimney Stack for Hardy Patent Kiln 2 	Good condition. The top of the chimney did have more severe cracking and loose bricks. Although chimney appears to be stable overall, some observations of cracking were made at the base. (Note: observations made from ground level).	Conserve and restore the chimney stack. Secure and reinstate loose bricks at the top of chimney. Additional structural support may be required.
Element 10—Chimney Stack for Downdraught Kilns	The Chimney Stack is in reasonable condition and appears to be stable. No significant cracking was observed (from ground level), but the upper section is in poorer condition, with loose and deteriorated bricks. There is evidence of brickwork spalling, particularly to the west and north faces.	Conserve the form and fabric of the structure.
Element 11 + 12—Quarry 	*Condition of the Quarry:* Reasonable condition Unused Eroding Quarry face Public safety concern	Retain, protect and make safe the Quarry form—the identified geological features (rock outcrops). Implement landscape and interpretation opportunities that reflect the Quarry form and presentation of its origins as an excavated brick pit.
Element 13—Office	*External condition of the office building* Reasonable condition. Windows and doors are boarded up.	Remove intrusive ad-hoc additions. Reinstate the original form and fabric of the office building in association with the Power House if possible.

Site Element Number	Condition as @ 2019	General Remediation Works
		
Element 14—Power House 	*External Condition:* General external condition is good. Brickwork is in reasonable condition Windows and doors are boarded up Timber fascia weathered in areas. Roof tiles in sound condition. Roof sheets appeared to be in reasonable condition. No internal access by Sellick Consultant	Conserve and retain the original building form and fabric. Re-open and repair original windows and doorways. Remove intrusive external elements/structures. Consider retention of interior equipment as part of a new fitout/adaptive reuse.
Element 15—Machine Bay 1 for Staffordshire Kiln and Downdraught Kilns	Poor condition. The loose roof sheets are a safety hazard.	Foot traffic is not recommended on roof and public access should be restricted. The structure is to be made safe for construction workers and would not be accessible for general public access in the short term.
Element 16—Machine Bay 2 for Hardy Patent Kiln 1	Poor Condition. The loose roof sheets are a safety hazard.	Foot traffic is not recommended on roof and public access should be restricted. The structure is to be made safe for construction workers and would not be accessible for general public access in the short term.
Element 17—Machine Bay 3 for Hardy Patent Kiln 1	Poor condition.	Moderate rectification works
Element 18—Workshop	*Lower Level* In some areas the wall sheeting was damaged, and some windows were broken. Roof sheeting and structural steel was generally in reasonable condition. *Upper Level* The timber structure has significant weathering.	Where damaged, the windows and wall sheeting are to be replaced. A structural assessment is advised, and public access should be restricted.

Site Element Number	Condition as @ 2019	General Remediation Works
Element 19—Large Crusher House (White Pan Room /Crusher House II)	*External Condition* There are some bracing members missing. Rectification of some steelwork connections. Weathering of sheeting by in serviceable condition. Some loose sheets present. *Interior Condition* Collapsed area of suspended slab on grade. There is debris scattered throughout ground floor.	Additional structural support may be required. A detailed structural assessment is required and any loose sheeting to be secured. Clean up debris and reinstate slab if required. Restrict public access until stabilised.
Element 20—Primary Crusher Room (Crusher House III)	Poor condition	A structural assessment is required, and any loose sheeting should be secured.
Element 21—Small Crusher House (Crusher House I)	The steelwork is in reasonable condition. Deterioration of timber floor structure and a section of the roof has been removed. (Note: access was from the ground level only).	The roof/wall sheeting to be secured. Where required, reinstate the roof framing. The building should be made safe and is being treated as a partial ruin. Restrict public access until stabilised.
Element 22—Elevator/Conveyor	Poor condition	A structural assessment is required, and loose sheeting should be secured.
Element 24—Concrete Retaining Wall 	*Condition of the Concrete Retaining Wall:* Reasonable condition Brickwork retaining wall appears to be sliding off the concrete retaining wall. Note: This element is not an intrinsic feature of the heritage significance (Refer to ACT Heritage Register citation, Appendix B).	The brick retaining wall should be stabilised as required.
Element 25—Amenities Block 	*External Condition* The external brickwork in reasonable condition. Roof sheets are weathered with loose fixings. Inspection of roof framing not possible due to limited access. Weathering of fascia boards. Broken glass of windows and frames weathered. *Interior Condition*	The structure could be adaptively reused, or demolished and replaced. Secure sheeting by replacing the sheet fixings. Recommendation to inspect internal structure before providing public access, if required.

Site Element Number	Condition as @ 2019	General Remediation Works
	Restricted access to the internal area, so from the external inspection the internal structure appears in sound condition.	
Element 26—Downdraught Kilns Control Room	This element is not an intrinsic feature of the heritage significance (Refer to ACT Heritage Register citation, Appendix B).	—
Element 27—Toilet Block	Poor condition. This element is not an intrinsic feature of the heritage significance.	—
Element 28—Ancillary Storage Building	Poor condition. This element is not an intrinsic feature of the heritage significance.	—
Element 29—Substation/Control Room	Reasonable condition. This element is not an intrinsic feature of the heritage significance.	—
Element 30—Boiler House	Good condition. This element is not an intrinsic feature of the heritage significance.	—
Element 31—Amenities Block 2	Poor condition. This element is not an intrinsic feature of the heritage significance.	—
Element 32—Brick Extrusion Plant (Remnant Slab only)	Poor condition. This element is not an intrinsic feature of the heritage significance.	—
Element 33—Ancillary Storage Building 2	Poor condition. This element is not an intrinsic feature of the heritage significance.	—
Element 34—Storage Shed	Reasonable condition. This element is not an intrinsic feature of the heritage significance.	—
Element 35—Model Railway Workshop	Reasonable condition. This element is not an intrinsic feature of the heritage significance.	—
Element 36—Model Railway Storage Shed	Reasonable condition. his element is not an intrinsic feature of the heritage significance.	—
Element 37—Brickyard	Reasonable condition Cracked paving	Remove trip hazards.
Element 38—Brickyard	Reasonable condition Cracked paving	Remove trip hazards.

Site Element Number	Condition as @ 2019	General Remediation Works
Element 1A—Railway Remnants Narrow-gauge railway (remnants)	Poor condition of the area due to weed growth and self-sown mature trees. Uneven ground levels – safety concern	Clearing and removal of weed infestation—taking care not to disturb archaeological ruins and potential archaeological evidence Regular weed management and maintenance needed prior to, and during the redevelopment.

3.5 Historic Archaeological Analysis

The history of the site (provided in more detail in Appendix C) indicates that a number of structures have been demolished as part of the evolution and development of the place. These structures may well remain represented on the site by subsurface archaeological features. The predicted archaeological resources of the site have been outlined and assessed in an Archaeological Assessment report prepared for the site in 2016 by Navin Officer (refer Appendix F).[2] This report identified 12 areas of archaeological potential.

Known areas of archaeological potential include:

- possible building platform and concrete features (BRW1) remains located to the south of the existing access road and gate;
- the Brickworks 'Accommodation Village' area (Element 23) located to the south of the Brickworks main operation area—the former Accommodation Village included the Brickworks Hostel, Married Quarters (Element 23/BRW2), an area of postholes and other remains (BRW3) and the former Single Men's Quarters area (BRW4);
- clay features and rubble mounds (BRW5 and BRW6) located to the west of the Brickworks kilns. The material is known to be contaminated with asbestos. These features include depressions with brick and concrete rubble in them and are interpreted as relating to a now-demolished rectangular structure located in the area;
- the quarry (Elements 11 and 12/BRW7) on the eastern side of the site;
- the old kiln and dormitories (BRW8) located to the southeast of the Brickworks main operation area. This was likely demolished by the mid-1920s;
- the cottage, stables and coal store (BRW9) located to the east of the Brickworks main operation area, and to the west of the quarry (BRW7). These structures were built in 1913 and demolished by 1947;
- the railway remnants (BRW10) and railway siding (BRW11) located to the southwest of the Brickworks main operation area. Most remnants of the track were removed in the 1920s; and
- the insitu underground flues and workings (BRW12) which connect the kilns to associated fan stacks.

These areas were identified as having varying levels of archaeological potential as follows:

- High archaeological potential:
  - the remains of the Brickworks Accommodation Village area archaeological features comprising the former location of the Brickworks Hostel, Married Quarters (Element 23/BRW2) and the associated area of postholes and other remains (BRW3);
  - the quarry (Elements 11 and 12/BRW7); and
  - the flues and subsurface workings (BRW12).
- Moderate archaeological potential:
  - possible building platform and concrete features (BRW1) remains located to the south of the existing access road and gate; and

  - the railway remnants (BRW10) and railway siding (BRW11).

- Low archaeological potential:
  - the former Single Men's Quarters area (BRW4);
  - clay features and rubble mounds (BRW5 and BRW6) located to the west of the Brickworks kilns. The material is known to be contaminated with asbestos. These features include depressions with brick and concrete rubble in them and are interpreted as relating to a now-demolished rectangular structure located in the area;
  - the old kiln and dormitories (BRW8); and
  - the cottages, stables and coal store (BRW9) located to the east of the main kiln area.

The varying levels of archaeological potential at the site are shown in Figure 3.38 below.



Figure 3.39 Areas of archaeological potential at the site. (Source: Figure 44 in the 2016 draft Archaeological Assessment, Navin Officer, Appendix F)[3]

3.6 Endnotes

1 dsb Landscape Architects, Yarralumla Brickworks Precinct Tree Assessment, Tree Management Report, 25 November 2015 pp1–2.

2 Navin Officer Heritage Consultants, Archaeological Assessment Canberra Brickworks and Environs, report prepared for the Land Development Agency, September 2016.

3 Navin Officer Heritage Consultants, Archaeological Assessment Canberra Brickworks and Environs, report prepared for the Land Development Agency, September 2016, p47.

4.0 Heritage Significance of the Site

4.1 Introduction

The heritage significance presented in this section is for the Heritage Places:

- Yarralumla Brickworks', referred to as Canberra Brickworks or the Brickworks; and
- Yarralumla Brickworks Railway Remnants, referred to as the Railway Remnants.

The ACT Heritage Register citations for the Brickworks and Railway Remnants are at Appendix B, noting that the official listings do not include assessments against criteria, only a 'statement of heritage significance' and a list of 'features intrinsic to the heritage significance of the place' are included, in addition to a description and history.

Based on the citations and the 2010 CMP, a heritage assessment for the Brickworks and Railway Remnants against the adopted ACT Heritage HERCON criteria is provided at Section 4.3, Table 4.1.

An assessment of the historical archaeological significance was undertaken by Navin Officer in 2016 and has been integrated with the assessment in Section 4.3. The draft 'Archaeological Assessment of the Canberra Brickworks and Environs' is provided at Appendix F.

4.2 Identified Heritage Significance of the Canberra Brickworks

4.2.1 Statutory Framework—ACT Heritage Act 2004

The ACT heritage legislation (*Heritage Act 2004* [the ACT Heritage Act] and the *Heritage Legislation Amendment Bill 2013*) aims to represent and protect the rich natural and cultural heritage of the ACT. The legislation establishes a system for the recognition, registration and conservation of natural and cultural heritage places and objects, including Aboriginal places and objects. Amendments made to the ACT Heritage Act, passed on 25 September 2014, formally adopted the HERCON (Heritage Convention) criteria for assessing heritage significance. Table 4.1 provides a comparison of the two sets of criteria.

Table 4.1 Comparison between the 2014 Adopted HERCON Criteria and the Previous ACT Heritage Criteria (used in the 2010 CMP).

HERCON Criteria[1]	ACT Heritage Criteria (previous/now redundant)
a) Importance to the course or pattern of the ACT's cultural or natural history	c) it is important as evidence of a distinctive way of life, taste, tradition, religion, land use, custom, process, design or function that is no longer practised, is in danger of being lost or is of exceptional interest h) it has strong or special associations with a person, group, event, development or cultural phase in local or national history i) it is significant for understanding the evolution of natural landscapes, including significant geological features, landforms, biota or natural processes k) for a place—it exhibits unusual richness, diversity or significant transitions of flora, fauna or natural landscapes and their elements l) for a place—it is a significant ecological community, habitat or locality for any of the following: (i) the life cycle of native species; (ii) rare, threatened or uncommon species; (iii) species at the limits of their natural range;

HERCON Criteria [1]	ACT Heritage Criteria (previous/now redundant)
	(iv) distinct occurrences of species
b) Uncommon, rare or endangered aspects of the ACT's cultural or natural history	f) it is a rare or unique example of its kind, or is rare or unique in its comparative intactness c) it is important as evidence of a distinctive way of life, taste, tradition, religion, land use, custom, process, design or function that is no longer practised, is in danger of being lost or is of exceptional interest
c) Potential to yield important information that will contribute to an understanding of the ACT's cultural or natural history	j) it has provided, or is likely to provide, information that will contribute significantly to a wider understanding of the natural or cultural history of the ACT because of its use or potential use as a research site or object, teaching site or object, type locality or benchmark site
d) Importance in demonstrating the principal characteristics of a class of cultural or natural places or environments	g) it is a notable example of a kind of place or object and demonstrates the main characteristics of that kind
e) Importance in exhibiting particular aesthetic characteristics valued by the ACT community or a cultural group in the ACT	b) it exhibits outstanding design or aesthetic qualities valued by the community or a cultural group
f) Importance in demonstrating a high degree of creative or technical achievement for a particular period	a) it demonstrates a high degree of technical or creative achievement (or both), by showing qualities of innovation, discovery, invention or an exceptionally fine level of application of existing techniques or approaches
g) Strong or special association with the ACT community or a cultural group within the ACT for social, cultural or spiritual reasons. This includes the significance of a place to Indigenous peoples as part of the continuing and developing cultural traditions	b) it exhibits outstanding design or aesthetic qualities valued by the community or a cultural group d) it is highly valued by the community or a cultural group for reasons of strong or special religious, spiritual, cultural, educational or social associations e) it is significant to the ACT because of its importance as part of local Aboriginal tradition
h) Special association with the life or works of a person, or people, important to the history of the ACT	h) it has strong or special associations with a person, group, event, development or cultural phase in local or national history

4.3 Heritage Assessment of the Brickworks and Railway Remnants

4.3.1 Assessment against the HERCON Criteria

This CMP provides an assessment of the two ACT Heritage Register places of the site, and is based on the 2010 CMP, and the HERCON criteria. It is important to note the Heritage Act provisions apply only to the registered heritage boundaries and features intrinsic to their heritage significance.

Table 4.2 Assessment against ACT Heritage HERCON Significance Criteria.

Heritage Significance Criteria	Assessment Against Criteria
a) Importance to the course or pattern of the ACT's cultural or natural history	**Canberra Brickworks** The Canberra Brickworks is important to the course of the ACT's history as the first industrial manufacturing facility commissioned for and constructed in the Territory, developed specifically to facilitate the construction of the new Federal Capital. The Brickworks provides tangible evidence of the early establishment of the city, following the Commonwealth decision to construct a national capital in the Yass-Canberra district in October 1908. The Brickworks is of historic significance for its role in the history and early development of the national capital. Bricks manufactured at the site were used to construct many residential and public buildings in Canberra, including Provisional Parliament House, the Kingston

Heritage Significance Criteria	Assessment Against Criteria
	Powerhouse, and Hotel Canberra. Subsequent phases in the development of the Brickworks, until its closure, reflect the broader political context that determined the fluctuation of construction of the Federal Capital, with major phases of the development in the 1920s and post-World War II period. The Brickworks site is of scientific (geological) significance as the type locality for the Yarralumla Formation, a major sedimentary sequence dating from the Silurian Period, 424–423 million years ago. The rock units at the site provide the reference section for comparison of other outcrops within the Yarralumla Formation and, in this context, are of research and educative value. Archaeological resources at the Brickworks provide evidence of the industrial components of the operations (eg BRW7, BRW8, BRW10, and BRW11) and may provide further information into the brickwork operations and history. ***The Canberra Brickworks meets this criterion.*** **Railway Remnants** The remnants of the former Canberra Brickworks railway are important in the development of Canberra, particularly for the initial period between 1923–1927. Bricks (including those referred to colloquially as 'Canberra Reds') were loaded onto timber tip wagons and transported via a narrow-gauge rail line to major developments across the city including Provisional Parliament House, the Kingston Powerhouse, Hotel Canberra, buildings in Civic as well as Federal Capital Commission houses for the growing population. The railway enabled faster transport of the bricks than the previous use of steam traction engines that hauled heavy iron wheeled trailers on mostly unmade roads. The railway transported up to six million bricks per annum. The remnants of the embankment, cuttings and terraces (BRW10 and BRW11) are important as evidence of the process by which bricks used in the construction and development of the new city were transported. ***The Railway Remnants meets this criterion.***
	Features intrinsic to the significance: • Canberra Brickworks—the remnants and physical evidence of the Brickworks which demonstrate aspects of the operation of, and working life at the site—the quarry, kilns, fan houses, chimney stacks, and other associated structures from the establishment of the Brickworks until its closure in 1976, the spatial layout demonstrating the former process of brick production, and the geological features in the quarry. • Railway Remnants—the remnants of the original earthen railway embankment, cutting and terraces.
b) Uncommon, rare or endangered aspects of the ACT's cultural or natural history	**Canberra Brickworks** The Canberra Brickworks is an unusually complete example of a complex demonstrating aspects of the operation of twentieth-century large-scale urban brickworks. The Staffordshire and Hardy patent kilns are part of a relatively small group of surviving continuous kilns in a national context. The Staffordshire Kiln is the only known remaining example in Australia of this particular type of continuous kiln. It is of interest for its design which through a relatively complex system of dampers and flues offered more control and flexibility than earlier types. The archaeological remains at the Brickworks provide evidence of the historical functional context of the Brickworks. ***The Canberra Brickworks meets this criterion.*** **Railway Remnants** The railway remnants are a rare example of the once extensive rail network in Canberra associated with the building of the national capital. The Brickworks railway remnants were fundamental for the transportation of bricks for the construction of early Canberra, and form an example of a significant industrial heritage site in the ACT. ***The Railway Remnants meets this criterion.***

Heritage Significance Criteria	Assessment Against Criteria
	Features intrinsic to the significance: • Canberra Brickworks—the remnants and physical evidence which demonstrate aspects of the operation and working life at the site—the quarry, kilns, fan houses, chimney stacks and other associated structures from the establishment of the Brickworks until its closure in 1976, the spatial layout demonstrating the former process of brick production, and the individual Staffordshire and Hardy patent kilns. • Railway Remnants—the remnants of the original earthen railway embankment, cutting and terraces.
c) Potential to yield important information that will contribute to an understanding of the ACT's cultural or natural history	**Canberra Brickworks** Canberra Brickworks has research potential to further the understanding of past technology and industrial processes related to brickmaking in the ACT. Elements of the Brickworks have potential to yield information that may contribute to a greater understanding of the detailed operations of the site. The archaeological potential refers to subsurface features (eg BRW1, BRW5, and BRW9), quarry (BRW7) and former accommodation village area (Element 23/BRW2, BRW3, BRW4, and BRW8). It may yield information that would contribute to an understanding of the history and changing use over time of the Brickworks. ***Canberra Brickworks meets this criterion.*** **Railway Remnants** The archaeological remnants of the railway have potential to yield information about the construction, nature, and configuration of the railway, and meets this criterion. (The ACT Heritage Register for the Railway Remnants does not indicate the place meets this criterion)
	Features intrinsic to the significance: • Canberra Brickworks—the remnants and physical evidence which have the potential to further demonstrate aspects of the operation, history and changing use over time of the site. • Railway Remnants—the archaeological remnants of the railway have potential to yield information about the construction, nature, and configuration of the railway.
d) Importance in demonstrating the principal characteristics of a class of cultural or natural places or environments	**Canberra Brickworks** Canberra Brickworks is an exceptional representative example of a large-scale, twentieth century urban brickworks. The extant buildings, structures, layout of the site and archaeological remnants demonstrate aspects of the processes and operations common to large scale, industrial brick production. Archaeological remnants at the site may demonstrate the evolution of a range of industrial processes associated with brickmaking in the twentieth century (eg BRW7, BRW10, BRW11, and BRW12). Canberra Brickworks retains a good range of production and ancillary buildings which also contribute to the understanding of the function of the site. The geological features of the former quarry are significant as a type locality for the Yarralumla Formation, a major sedimentary sequence dating from the Silurian Period, 424–423 million years ago. The rock units of the quarry provide useful reference for comparison with other outcrops of the Yarralumla Formation. ***Canberra Brickworks meets this criterion.*** **Railway Remnants** The remnants do not demonstrate the principal characteristics of a railway and do not meet this criterion.
	Features intrinsic to the significance: • Canberra Brickworks—Intrinsic features in the ACT Heritage Register citation specifically including: — historic evidence of the Brickworks which demonstrate aspects of the operation and working life at the site;

Heritage Significance Criteria	Assessment Against Criteria
	— the quarry, kilns, fan houses, chimney stacks, remains of early workers camps and accommodations and other associated structures from the establishment of the brickworks until its closure in 1976; and — the spatial layout demonstrating the former process of brick production, and the geological features in the quarry.
e) Importance in exhibiting particular aesthetic characteristics valued by the ACT community or a cultural group in the ACT	**Canberra Brickworks** The extant building forms, structures and larger elements of equipment of the Canberra Brickworks have aesthetic significance for their industrial characteristics and, combined with the visual qualities of the quarry, contribute to a distinctive industrial landscape character. The aesthetic qualities are experienced from within the site, which is set low in the landscape, so as not to intrude on the Federal Capital, and the original kilns had low, fan-forced chimneys. The 1953 brick chimney stack (approximately 45 metres tall) is a prominent feature in the landscape and an iconic local landmark. The scale, location and idiosyncratic forms of the kilns and chimneys as well as dominance of red brick and corrugated iron across the site contributes to the aesthetic character of the site. Other characteristics include the brick forms and tall pitched iron clad roofs which create interesting and dramatic external massing and internal spaces, and contrast with the dark interiors of the kilns. The quarry has a particular aesthetic quality, comprising a combination of open space and the exposed rock outcrops. The aesthetic characteristics of the Brickworks as an industrial cultural landscape is evident and valued by the community. The local production of bricks; colloquially know as 'Canberra Reds', were used to build much of Canberra's civic, institutional, and residential fabric of the National Capital. Canberra Reds, and the places associated with historical development of Canberra, continue to hold significant aesthetic value by the ACT community. ***Canberra Brickworks meets this criterion.*** **Railway Remnants** The remnants are not aesthetically distinctive and do not meet this criterion.
	Features intrinsic to the significance: • Canberra Brickworks—Intrinsic features in the ACT Heritage Register citation specifically including: — the distinctive industrial cultural landscape character (scale, form, location and materials of the structures); — the low setting of the site in the landscape, with the open spaces and rock face of the quarry; and — the structures and physical evidence of the former Brickworks including the kilns, fan houses, chimney stacks (particularly the tallest 1953 stack).
f) Importance in demonstrating a high degree of creative or technical achievement for a particular period	**Canberra Brickworks** The process of brick production and the individual kilns at the Canberra Brickworks is important for the achievement of building the national capital with locally produced building material. Potential archaeological deposits may provide further information on the technical aspects of the Brickworks operations, brick production, how this changed over time and the reactivation of the facility in the 1920s (eg BRW7, BRW10, BRW11, and BRW12). However, the production process itself is not considered innovative or of a high degree of technical achievement at the time of construction, and does not meet this criterion. **Railway Remnants** The remnants do not display a high degree of technical achievement and do not meet this criterion.
g) Strong or special association with the ACT community or a cultural group within the ACT	**Canberra Brickworks** Canberra Brickworks holds strong associations with the local Yarralumla community as well as the ACT community more generally.

Heritage Significance Criteria	Assessment Against Criteria
for social, cultural or spiritual reasons	There is value and attachment by the ACT community, associated with Canberra Reds as they are sought after in contemporary design and residential builds. ***Canberra Brickworks meets this criterion.*** **Railway Remnants** The remnants do not hold a special association within the ACT community and do not (individually) meet this criterion.
	Features intrinsic to the significance: • Canberra Brickworks as included in the Features Intrinsic in the ACT Heritage Register citation (Appendix B1).
h) Special association with the life or works of a person, or people, important to the history of the ACT	**Canberra Brickworks** Canberra Brickworks is associated with many locally employed workers during its operation, and with many arts, theatre, artisan and industrial users and groups since its closure. The associations are not considered notable at a Territory level, and does not meet this criterion. **Railway Remnants** The remnants do not hold a special association with significant people and do not meet this criterion.

4.3.2 Summary Statement of Heritage Significance

The assessment against the ACT Heritage HERCON criteria confirms that:

- Canberra Brickworks is a place with heritage significance, against six of the eight criteria: a), b), c), d), e) and g); and
- the Railway Remnants is a place with heritage significance, against two of the eight criteria: a) and b).

4.3.3 Summary Statements of Significance

Canberra Brickworks

Canberra Brickworks is significant as the first industrial manufacturing facility commissioned for and constructed in the Territory, developed specifically to facilitate the construction of the new Federal Capital. It provides tangible evidence of the early establishment of the city, following the Commonwealth decision to construct a national capital in the Yass-Canberra district in October 1908.

Bricks, colloquially known as ‘Canberra Reds’, manufactured at the site were used to construct many residential and public buildings in Canberra, including Provisional (Old) Parliament House, the Kingston Powerhouse, and Hotel Canberra. Subsequent phases in the development of the Brickworks, until its closure, reflect the broader political context that determined the fluctuation of construction of the Federal Capital, with major phases of the development in the 1920s and post-World War II period.

The Brickworks site is of scientific (geological) significance as the type locality for the Yarralumla Formation, a major sedimentary sequence dating from the Silurian Period, 424–423 million years ago. The rock units at the site provide the reference section for comparison of other outcrops within the Yarralumla Formation and in this context are of research and educative value.

The Brickworks is an unusually complete example of a complex demonstrating aspects of the operation of twentieth-century large-scale urban brickworks, with the extant buildings, structures and layout of the site demonstrating aspects of the processes and operations common to industrial brick production. The

Railway Remnants, and industrial production and ancillary buildings contribute to the understanding and sequence of the historic function of the Brickworks.

The Staffordshire Kiln (Element 1) is the only known remaining example in Australia of this particular type of continuous kiln.

The site has research potential to further the understanding of past technology and industrial processes related to brickmaking in the ACT. Elements of the Brickworks, and the Railway Remnants (Element 1A), have potential to yield information that may contribute to a greater understanding of the detailed operations of the site. The historical archaeological potential of the subsurface features and quarry may yield information that would contribute to an understanding of the history and changing use over time of the Brickworks.

The extant building forms and structures of the Canberra Brickworks have industrial aesthetic characteristics in the built form and, combined with the visual qualities of the quarry, a distinctive industrial landscape character. The aesthetic qualities are experienced from within the site, which is set low in the landscape, so as not to intrude on the Federal Capital, and the original kilns had low, fan-forced chimneys. The 1953 brick chimney stack (Element 9) is approximately 45 metres tall and a prominent feature in the landscape and an iconic local landmark. The scale, location and idiosyncratic forms of the kilns and chimneys as well as dominance of red brick and corrugated iron across the site contributes to the aesthetic character of the site. Other characteristics include the brick forms and tall pitched iron clad roofs which create interesting and dramatic external massing and internal spaces, and contrast with the dark interiors of the kilns. The quarry has a particular aesthetic quality, comprising a combination of open space and the exposed rock outcrops.

The Canberra Brickworks, and Canberra Reds, holds strong associations with the local Yarralumla community as well as the ACT community more generally.

Railway Remnants

The Railway Remnants are an important example of the once extensive rail network associated with the development of Canberra, initially between 1923–1927. Bricks manufactured at the Brickworks were loaded onto timber tip wagons and transported via a narrow-gauge rail line to major developments across the city such as the Provisional Parliament House, the Kingston Powerhouse, Hotel Canberra, buildings in Civic as well as homes for the growing population.

The railway enabled faster transport of the bricks than the previous use of steam traction engines that hauled heavy iron wheeled trailers on mostly unmade roads. The railway transported up to six million bricks per annum.

The remnants of the embankment, cuttings and terraces are important as evidence of the process by which bricks used in the construction and development of the new city were transported. They are rare aspects of Canberra's industrial heritage — evidence of the infrastructure that was used to build the national capital.

4.3.4 Features Intrinsic to the Heritage Significance

The features intrinsic (elements) of the Canberra Brickworks and the Railway Remnants which are intrinsic to the heritage significance, and included in the ACT Heritage Register, are provided in this section.

Canberra Brickworks

The features intrinsic to the heritage significance of the Canberra Brickworks contribute to the heritage significance of the site, to varying degrees based on their role in the history, operation and development of the place.

A distinction of the varying contribution to the heritage significance is identified in the ACT Heritage Register citation as either Schedule 1 – Elements of Exceptional Significance or Schedule 2 – Elements of Moderate Significance. The 2010 CMP categorises Schedule 1 as 'Core', Schedule 2 as 'Supporting' and other non-listed elements as 'Incidental', with these outlined below. The significance of individual elements, both listed and unlisted, are included in the inventory sheets at Appendix A.

Core Elements (Schedule 1 'Features of Exceptional Significance')

Core elements make an exceptional contribution to the heritage significance of the Canberra Brickworks.

Core elements include surviving fabric associated with the establishment and expansion phases of development on the site. These elements are central to an understanding and appreciation of the operation and history of the site in this early period including its relationship with the early history and development of Canberra. The tall chimney stack (Element 9), though constructed from a later development phase, is significant for its aesthetic values as prominent landmark.

Table 4.3 Core Elements that make an Exceptional Contribution to the Heritage Significance of Canberra Brickworks.

ACT Heritage Register Citations: Core Elements Number, Name and Date		
CMP Number	**Individual Historic Element Number and Name**	**Date of Construction**
Establishment Phase: 1911–1920		
11	Quarry	1913–1940
12	Geological features A, B, C, D	
24	Concrete Retaining Wall	c1913
14	Power House	1915–16
1	Staffordshire Kiln	1914–15
2	Fan House for Staffordshire Kiln	1914–15
7	Chimney Stack for Staffordshire Kiln	1914–15
37	Original brickyard area between Staffordshire Kiln, Hardy Patent Kiln 1, and Fan Houses	c1915, c1926
Expansion Phase: 1921–1942		
1A	Narrow-gauge railway (remnants)	1923
3	Hardy Patent Kiln 1	c1926–27 (rebuilt 1955)
4	Fan House for Hardy Patent Kiln 1	c1927 (second structure c1955)
8	Chimney Stack for Hardy Patent Kiln 1	c1926–27
Post World War II Phase: 1944–1976		
9	Chimney Stack for Hardy Patent Kiln 2	c1953, c2005

Supporting Elements (Schedule 2 'Features of Moderate Significance')

Supporting elements make a moderate contribution to the heritage significance of the Canberra Brickworks.

Supporting elements include the key structures associated with the expansion of the manufacturing facility in the post-World War II period, which demonstrate the pattern of this expansion, the arrangement of various elements of the process across the site, and aspects of the brickmaking process. Minor non-specific processes or ancillary buildings are not included. The heavily modified earlier office building of c1925 has also been included in this group.

Table 4.4 Schedule 2 Supporting Elements—Elements of Moderate Significance.

ACT Heritage Register Citations: Supporting Elements Number, Name, Date		
CMP Number	**Individual Historic Element Number and Name**	**Date of Construction**
Expansion Phase: 1921–1942		
07	Office	c1925 (c1953 and c1970s extensions are 'Incidental', refer to Table 4.5)
23	Remains of the Brickworks Accommodation Village	c1920s (ruin)
Post World War II Phase: 1944–1976		
5	Hardy Patent Kiln 2	c1954
38	Brickyard 2	c1954
15	Machine Bay 1 for Staffordshire Kiln and Downdraught Kilns	c1955
16	Machine Bay 2 for Hardy Patent Kiln 1	c1955
17	Machine Bay 3 for Hardy Patent Kiln 2	c1955
18	Workshop	c1955
21	Small Crusher House (Crusher House I)	c1958
19	Large Crusher House/Crusher House II (White Pan Room)	c1955
20	Primary Crusher House (Crusher House III)	c1955
22	Elevator/Conveyor	c1955
6	Downdraught Kilns (under a single roof)	c1960–63
26	Downdraught Kilns Control Room	c1961
10	Chimney Stack for Downdraught Kilns	c1961

Incidental Elements

Incidental elements comprise the structures from the post-World War II period which, while related to the expansion of the complex, were originally minor in nature, reflect ancillary uses rather than key manufacturing processes and/or have been considerably altered. In addition, this group includes a small number of buildings that were constructed at the site following its closure in 1976.

Table 4.5 Incidental Elements that are Neutral to the heritage significance of the Canberra Brickworks, not specifically mentioned in the ACT Heritage Register citation.

Incidental Elements Numbers, Names and Date		
CMP Number	**Individual Historic Element Number and Name**	**Date of Construction**
Post World War II Phase: 1944–1976		
25	Amenities Block	c1950, c1977
27	Toilet Block	c1960s
28	Ancillary Storage Building	c1971
29	Substation/Control Room	c1971
30	Boiler House	c1971
31	Amenities Block 2	c1960s
32	Extrusion Plant (Remnants)	c1971
33	Ancillary Storage Building 2	c1960s
34	Storage Shed	c1960s
Post Closure Phase: 1976–2017		
35	Model Railway Workshop	c1979
36	Model Railway Storage Shed	c1979

Railway Remnants

There is little surviving physical evidence of the narrow-gauge railway which transported bricks from the site to construct buildings throughout Canberra. It is historically significant and, as a ruin/archaeological evidence, it is an element of the site's landscape.

Table 4.6 Features Intrinsic to the Heritage Significance of the Railway Remnants.

ACT Heritage Register Citations: Incidental Elements Numbers, Names and Date		
CMP Number	**Individual Historic Element Number and Name**	**Date of Construction**
1A	Remnants of the original earthen railway embankment, cutting and terraces.[2]	c1923

4.4 Summary Commentary on the ACT Heritage Register citations

A review of the ACT Heritage Register citations and the 2010 CMP heritage assessment identifies that the heritage significance and intrinsic features of the Canberra Brickworks and the Railway Remnants are largely correct. They are significant places recognised in their listing on the ACT Heritage Register.

Additional detail has been required in some of the 'assessment statements' against the criteria, and due to the changes to the criteria, some of the statements should be combined.

The 2010 CMP assessed the Brickworks for potential National Heritage values; however, the site was found not to meet the threshold for listing at that time, nor in 2020, and has not been included in this CMP.

4.5 Endnotes

1 ACT Heritage Council, Heritage Assessment Policy, February 2015.
2 Yarralumla Brickworks Railway Remnants, ACT Heritage Register Listing, 7 November 2013.

5.0 Conservation Policies

5.1 Introduction

5.1.1 Constraints and Opportunities

The development of conservation policies is underpinned by the consideration of a range of constraints and opportunities affecting the future conservation, management and interpretation of the place.

The key management constraints and opportunities for the Canberra Brickworks Precinct, which derive from a combination of the site's significance, its condition, development constraints and future opportunities, are specifically:

- ensuring best practice heritage management (Section 5.2);
- the identified heritage significance which is embodied in its elements and attributes (Section 5.3);
- the physical condition of the place and requirements for conservation works and maintenance (Section 5.4);
- the responsibilities and requirements of the site managers and users, including operational considerations (Section 5.5);
- development challenges and opportunities (Section 5.6);
- requirements imposed by external factors including statutory authorities and the legal framework within which any change or development must take place (Section 5.7); and
- opportunities for interpretation initiatives (Section 5.8).

These factors—constraints and opportunities—are discussed in the text which precedes the conservation policy in Section 5.2 and provides the focus and direction for the conservation policies. The policies address the heritage significance of the place and its setting, as well as the individual elements of the Canberra Brickworks and the Railway Remnants. The policies support strategic decision making for the future of the site, legislative compliance, and the conservation of the site's heritage significance.

5.1.2 Principles of the Conservation Policy

Conservation policy is based on the need for redevelopment of the site, to allow for the conservation of the site, and the principles embodied in the Burra Charter. The Burra Charter is a set of principles and processes for best practice in heritage conservation developed by Australia ICOMOS (International Council of Monuments and Sites). The Burra Charter is the national standard for conservation planning and work by practitioners and all Australian government heritage bodies. The 2013 update of the Burra Charter includes many Practice Notes providing relevant and useful guidelines.[1] The Burra Charter is attached at Appendix D.

The following principles form the basis for the conservation policies in this section, including:

- retention, conservation, management and interpretation of the heritage significance, which is embodied in the attributes and elements of the site;

- identification of where and how change, adaptation (including identifying new appropriate uses) and new development can be undertaken on the site, that is compatible with the heritage significance and can provide for the conservation of significant elements;
- seeking professional heritage conservation advice for proposed works and redevelopment opportunities – architectural, archaeological, landscape and interpretation advice; and
- exploring opportunities to understand historical background, interpret and present the heritage significance, and maintaining records in relation to proposed and/or implemented changes to the place.

The policies are numbered sequentially and accompanied by explanatory text—the constraints and opportunities as a precursor to the policies. A summary of the policies and an implementation schedule is provided in Section 6.0 and includes timing, priorities and responsibilities.

Detailed conservation guidelines for the individual elements that contribute to the site's heritage significance are provided at Appendix A: Inventory of Individual Historic Elements.

5.2 Conservation Policies

5.2.1 General Heritage Management Processes

CMP as the Guiding Document

CMPs are developed as a best practice tool for the ongoing management of heritage places and assist managers in decision making when planning for new development or change. This CMP provides a useful framework for the management of the Canberra Brickworks Precinct – Canberra Brickworks and the Railway Remnants – and is the primary guide for the future management of the site.

Policy 1—Adopt the CMP and its conservation policies.

1.1 This CMP must be adopted as the principal guiding document for the future management of the heritage significance of the site—Canberra Brickworks and the Railway Remnants.

1.2 Refer to this CMP for all matters relating to the heritage significance, conservation and management of the site (including Appendix A for recommendations and identified issues for individual heritage elements at the site).

1.3 Implement the policies and actions set out in this CMP, in line with the identified priority and timing guidelines (refer to Section 6).

1.4 Arrange for the CMP to be approved by the ACT Heritage Council (refer also to Policy 31).

1.5 Ensure all site managers, staff and contractors have access to the information in this CMP (hard copy and electronically) and have suitable induction and training activities to understand its importance and intent to ensure best heritage practice.

Review and Monitoring of the CMP

This CMP has been prepared to revise the 2010 CMP for the site to address changes to the ACT Heritage legislation for assessing significance, to include the associated Railway Remnants heritage place, to provide an update of the condition of the site and its elements, and to understand the site in the context of proposed redevelopment.

Regular review and updates of the CMP ensure that the heritage significance of the site is understood and is being managed appropriately. Updates of the CMP are essential following major changes to a heritage place to ensure it remains accurate and relevant.

Policy 2—Regularly review the CMP and its policies.

2.1 Review and update the CMP following major changes in circumstances, including conservation works, or new development/construction.

2.2 Amend specific policies in light of new circumstances, such as a change in use.

2.3 Monitor the condition of the heritage significance and include the re-evaluation as part of a review of the CMP (noting that an update to the CMP may not be warranted).

Burra Charter Principles and Processes

The principles and process of the Burra Charter, and its Practice Notes, should be used to guide the ongoing management of the site and all future conservation works.

Policy 3—Refer to the Burra Charter and its Practice Notes.

3.1 Refer to the Burra Charter to guide the ongoing management of the site and all future conservation works (refer to Appendix D).

Engaging Appropriate Expertise

It is important that appropriately qualified personnel with the relevant expertise are engaged to guide the management and conservation of the heritage significance of the site.

Heritage management: Professional heritage consultants – architects, archaeologists, interpretation specialists – should be engaged to provide advice regarding heritage significance assessments, interpretation, impact assessments, and when planning or undertaking adaptation, interpretation or conservation works.

Heritage conservation: Where necessary and reasonably available, tradespeople and contractors, with skills and experience in traditional construction techniques should be engaged to ensure appropriate materials and methods are employed when carrying out physical conservation works.

Policy 4—Engage appropriately qualified personnel.

4.1 Ensure appropriate heritage expertise is engaged for management, assessments and conservation works, and that all involved are aware of Burra Charter principles for conservation, traditional construction techniques and developments.

4.2 Seek expert advice from heritage professionals for:

- heritage significance assessment against the HERCON criteria;
- undertaking conservation works/actions;
- heritage management and interpretation planning advice;
- impact assessments for proposed works and development; and
- conservation works for the preparation of a Statement of Heritage Effects (SHE). Note: Statement of Heritage Effects (SHE) applications are made directly to the ACT Heritage Council under Section 61G of the Heritage Act and are made independently of development applications.

5.3 Understanding the Heritage Significance

5.3.1 Assessment of Heritage Significance

Section 4 provides a review and reassessment of the heritage significance of the two ACT Heritage Register places and confirms that they are significant places that meet the threshold for inclusion in the ACT Heritage Register.

Policy 5—Note the assessment against criteria in this CMP.

5.1 Acknowledge the assessment of heritage significance against the HERCON criteria in this CMP. This provides information which is consistent with the ACT Heritage Register citations for the 'Yarralumla Brickworks' and the 'Yarralumla Brickworks Railway Remnants' .

5.3.2 Management of the Heritage Significance

The heritage significance of the Canberra Brickworks Precinct – the site – gives rise to a range of management obligations and requirements, the most fundamental of which is to ensure that the intrinsic features of heritage significance are sustained and conserved for present and future generations. This will depend on how well the heritage significance, the physical fabric, the ability to interpret the historic operation and function of the site and its contribution to building the national capital, through to 1976, can be integrated with future development decisions, and how the adaptation of individual buildings, interpretation, and other legislative processes for the site are managed.

Managing the site's heritage significance will require consistent integration of heritage and development objectives as part of the redevelopment proposal. The right balance will come from a shared understanding of the heritage significance of the site being factored into development proposals early in the decision-making process.

The key obligations arising from the heritage significance of the site are to:

- conserve and protect the heritage significance of the two ACT Heritage Register places in accordance with the Heritage Act provisions;
- retain and conserve the elements which embody, and are intrinsic to, the heritage significance of the site, while also identifying future changes or new development compatible with its values;
- identify appropriate and compatible future uses for the whole site and its individual heritage elements to ensure longevity of the place for future generations to appreciate;
- ensure future development and planning for the site optimises the site's heritage significance through conservation, adaptation, interpretation and good design; and
- continue to manage the site and its heritage significance to avoid, mitigate or minimise any adverse impacts from change and development.

Policy 6—Conserve the heritage significance of the place in accordance with its assessed significance.

6.1 Conserve and manage the Canberra Brickworks and Railway Remnants in accordance with the heritage significance included in the ACT Heritage Register citation and the Heritage Act.

5.3.3 Conservation of the Features Intrinsic to the Heritage Significance

Precinct—Whole of Site Approach

Canberra Brickworks and the Railway Remnants are recognised for their heritage significance to the ACT. Together, and with the individual heritage elements of the site, they provide the physical evidence which contributes to and conveys the heritage significance of the overall site. Individually, and as a collection of elements of the place, is the physical demonstration of the former operation/historic function of the Brickworks.

. Policy 7—Conserve the site: the whole of the Canberra Brickworks Precinct and its intrinsic features.
7.1 Conserve the heritage significance of the site whole, as a cohesive complex of elements with an industrial historic character.
7.2 Conserve the features/elements that are intrinsic to the heritage significance of the site, as identified in Section 4 and the ACT Heritage Register.

Individual Elements of the Site

The Heritage Register citations identify elements/features intrinsic to the heritage significance of the site (the Canberra Brickworks and Railway Remnants). The citation provides a ranking of relative significance of heritage elements to guide management decisions.

The policy objectives in this CMP provide an approach to conserving the intrinsic features and fabric of the site—these are referred to as 'Schedule 1: Core Elements' and 'Schedule 2: Supporting Elements'—and ensure that works to the place are consistent with Burra Charter principles and processes. In accordance with the Heritage Act, Heritage Council approval must be obtained where removal of significant heritage elements and intrinsic features are proposed.

The policy for the conservation and management of heritage elements is outlined below. Appendix A of this CMP must be referenced for further guidance on identified heritage elements.

Policy 8—Retain and conserve elements of the site in accordance with their heritage significance.
8.1 Conserve the elements in accordance with their heritage significance, following Burra Charter principles, and processes, and further guidance in this CMP, including Appendix A.
8.2 Schedule 1: 'Core elements' must be retained and conserved.
8.3 Schedule 2: 'Supporting elements' are to be retained and conserved.
8.4 'Incidental elements' are neutral to the site's heritage significance and can be retained, altered or removed.

Plant, Machinery and Ephemera

Original brick-making plant and machinery from the Brickworks has largely been removed, including original brick presses and crushers. Remnant machinery is limited and includes conveyors and hoppers from the post-World War II period in the Machine Bays (Elements 15–17), equipment in the Power House (Element 14), and a gantry crane in the Workshop (Element 18). These items are not considered individually significant and do not relate to the process of brick making.

The Fan Houses (Elements 2 and 4) also contain some remnant ducting and the underground workings, including flue systems and connections to their corresponding kilns and chimney stacks. These must be conserved and retained, where possible, as part of understanding the former operation of the site.

The Staffordshire and Hardy patent kilns (Elements 1, 3 and 5) retain their upper level firing floors with remnants of the equipment used to fire and feed the chambers on the levels below. A representative area of the firing floor of one of the kilns must be retained to demonstrate the former function of the kilns.

Policy 9—Record, investigate and conserve remnant equipment where it relates to the former operation of the site.

9.1 Record and investigate remnant items of historic machinery, relic equipment and ephemera on site, and prepare an inventory of items.

9.2 Retain plant and equipment that contributes to the significance and/or understanding of the operation of the Brickworks for future interpretive purposes. Record the objects in situ prior to removal, if not retained (refer to Policy 29).

9.3 Retain all underground workings related to the kiln operations, including flue systems and connections to the fan houses and stacks, if possible.

9.4 Retain evidence of at least one of the firing floors to demonstrate the function of the Staffordshire and Hardy patent kilns.

9.5 Retain and interpret brick-making ephemera (ie etched kiln numbers).

9.6 Approval by the ACT Heritage Council must be obtained if removal of significant fabric – associated with historic machinery, relic equipment or ephemera — is proposed.

5.4 Physical Condition and Maintenance

5.4.1 Condition and Maintenance

The condition of the individual elements at the site varies from poor to fair. The site generally suffers from a lack of regular maintenance, given its lack of use and continued function, and is subject to vandalism. The lack of regular maintenance leads to deterioration over time, therefore finding a use for the site and its individual elements is important to ensure its longevity (refer to Section 5.6.2).

The 2013 Northrop report (validated by Sellick Consultants in 2017 and 2021) provides recommendations for remediation of the individual elements in the short term, including options depending on whether the element would require public access or not. Building adaptation and conservation works would need to be planned and undertaken as part of any future development proposal for the site, taking into consideration the heritage significance of the elements.

An ongoing cyclical inspection and maintenance program must be developed and implemented to ensure that the significant fabric for safety and maintaining water tightness and good structural condition. Regular structural and condition assessments must be undertaken by qualified professionals to ensure the buildings are stabilised and safe for access. As part of regular condition assessments, ensure vegetation growth is maintained to avoid structural damage.

Policy 10—Develop and implement a condition and maintenance program to conserve core and supporting heritage elements on site.

10.1 Undertake regular structural condition inspections by qualified professionals to review the physical condition of the elements. This would be undertaken in detail when documenting the conservation and remediation works for the redevelopment project.

10.2 Undertake conservation and remediation works as a priority to ensure the elements are stabilised and safe for access prior to works associated with the conservation, redevelopment and adaptive reuse of the site. Noting that any works not defined in this CMP may require further Council advice and approval prior to their commencement, as they will not be authorised by the CMP approval.

10.3 Respect the heritage significance and retain significant fabric when undertaking conservation works and maintenance for the redevelopment project, and following completion of the project.

10.4 Undertake maintenance in accordance with the Burra Charter and the heritage significance of the site, and the individual elements.

10.5 Implement an ongoing cyclical maintenance program following completion of the conservation works and redevelopment. The regularity of inspections by a structural engineer, would be determined by a certifying engineer.

10.6 Update and implement maintenance requirements following any major changes to the site, or to individual elements.

5.5 Site Management and Operational Requirements

5.5.1 Current Ownership and Management

At the time of preparing this CMP, the site is owned by the ACT Government, and managed by ACT Property Group. Given the current land management context, maintenance of the site and its heritage significance is the responsibility of the current landowner.

The property developers, Doma, have not been provided legal title over the site, and as such are not able to undertake any conservation or management works until they take possession of the site. At that time, Doma Group may undertake conservation works concurrently with approved redevelopment works.

If ACT Heritage Council considers that certain works are urgently required to stabilise elements on site to ensure their conservation before the legal transfer of the title, it could independently issue advice or a Heritage Direction to the ACT Property Group, as the current land manager relating to those works.

5.5.2 Future Management Responsibilities

As the future land owners Doma will have primary responsibility for implementing the conservation policies, adopting the heritage management processes and decision-making procedures of the CMP as part of the redevelopment project as it progresses.

Responsibilities include ensuring the heritage significance is retained, conserved and considered as part of strategic decisions about future development (for sustainable economic, social and cultural benefits and return) to allow the heritage significance to be conserved and maintained into the future.

In addition, future site users (tenants, managers, individuals and groups who use and occupy the various buildings or parts of the site) also have responsibility to act in accordance with the Heritage Act, identified heritage significance and policies in this CMP.

Proposed redevelopment of the site may result in changes to the management structure and responsibilities into smaller areas and elements. The heritage management of these areas should be reviewed as necessary. Where multiple parties are responsible for managing the site's heritage significance, it should be undertaken in a cohesive manner.

Policy 11—Ensure responsibility for managing the heritage significance is appropriately assigned and understood.

11.1 Ensure a cohesive approach to the management of the heritage significance of the site and all its elements.

11.2 Review management and responsibilities following any changes to ownership and/or management of individual areas or elements of the site.

11.3 Ensure ACT Heritage Council provides specific Heritage Directions to the current site manager, if there are urgent conservation or maintenance works required to stabilise elements on site to ensure their conservation, before the legal transfer of the title.

5.5.3 Operational and Planning Issues

Use and Public Access

The Brickworks has not operated for the manufacture of bricks since its closure in 1976. Its heritage significance is not dependent on the ongoing use of the site for manufacturing bricks or a related industrial purpose.

The heritage significance – its history, scale and the location of the Brickworks – is of interest to the local community, particularly regarding its potential future development. However, the site does not have a strong visible presence due to its relatively concealed setting, except for the 1950s chimney stack. The site is currently vacant and is fenced and locked, and not currently accessible to the public.

The southern area of the site is open and accessible and includes the Railway Remnants which are not easily accessible and are overgrown with vegetation.

Policy 12—Encourage public access to the site.

12.1 Encourage public access in the future redevelopment of the site, where appropriate (refer to Policy 15).

Circulation and Roads

Documentary evidence suggests that historically the principal road access to the site has been from the south and southwest (though not necessarily exactly following the current alignment). There is also a strong tradition of connecting roadways along the west of the kilns and, in the post-1940 period, between the processing buildings and the quarry (reflecting the delivery of raw materials onto the site following the closure of the quarry).

A 1976 aerial photograph (refer to Appendix C) shows a more complex arrangement of roads within and around the site, including routes through and around the quarry reflecting the complex nature of truck movements in and out of the site in this later phase of operations.

Policy 13—Respect the historic circulation and road layout at the Precinct.

13.1 Maintain the historic approach, to the Brickworks site from the south. Additional access routes could be introduced if required.

13.2 Reference the historic circulation and road layout of the site in any future site development, ie the roadway along the western side of the kilns.

Risks

The current risks to the site include fire and vandalism, both of which have the potential to adversely impact the heritage significance of the individual heritage elements. These issues stem from unauthorised access, although the site is locked at all times and a site security service is in place. Unauthorised access also poses a public safety risk, as many of the buildings are not structurally secure nor meet code compliance.

Following redevelopment of the Brickworks, authorisation for site access to the site will likely change and the security/vandalism risk should be reviewed at that time.

There are also site contamination issues which require management and removal (ie asbestos and hazardous waste) to make it safe for public access.

Policy 14—Identify and manage potential risks to the heritage significance of the site.
14.1 Undertake a comprehensive risk audit and prepare a strategy to manage risks to the heritage significance.
14.2 Review potential risks when redevelopment of the site commences and authorisation to the site changes.

5.6 Development Policies

5.6.1 General Approach to Site Development

Cultural, social and economic benefits are integral for sustaining the heritage significance of the site for future generations.

This will require a carefully planned approach to finding suitable new use/s, adaptation of historic structures for new uses and infill development. Planning for redevelopment should provide a wholistic sustainable approach, where the benefits for the integration of meaningful and creative interpretation of the site's heritage significance of built forms and the spaces in between contribute to the sustained economic viability for the continued conservation works.

In general, a redevelopment approach which explores the revitalisation of the site, including conservation of the heritage elements and introduction of interpretation and encourages public use would be a positive outcome.

This CMP includes overarching and detailed conservation policies to guide future development at the site. This includes conservation policies and adaptive re-use guidelines for individual elements, and demolition guidelines.

The site should continue to be managed with a clearly identified approach to the conservation of the significant elements, and a cautious approach to any new work to ensure that the significance is sustained.

Policy 15—Ensure redevelopment planning for a sustainable future of the site.
15.1 Ensure a cohesive approach to redevelopment at the site, with consideration of adaptation and the conservation and interpretation of the heritage elements.
15.2 Explore opportunities to revitalise the site through conservation, interpretation, and public access, where appropriate.
15.3 Refer to the CMP and its policies when planning redevelopment of the site.

5.6.2 Future Use

When considering redevelopment of the Brickworks, it is important to identify a compatible use to ensure the sustainable future for the whole site. A compatible use means a 'use which respects the cultural significance of a place … such a use involves no, or minimal, impact on cultural significance'.[2]

While the Brickworks has significance from its historic association as a brick-making facility, it has not been in operation since 1976 and much of its original machinery has been removed from the site. Therefore, a future use for the site should not be strictly limited to a similar industrial or manufacturing facility, instead focusing on a proposed use that conserves, interprets and celebrates the heritage significance of the site.

Finding a compatible use for the Brickworks and its individual structures will require careful consideration of their heritage significance and ensuring the uses are complementary and provide opportunities for visitor engagement and interpretation.

Proposed future uses for the site must be assessed, as part of any proposal, for their feasibility and the potential impact on the identified heritage significance and significant fabric of the individual elements.

Potential future uses must be considered as part of an integrated approach to overall development of the Brickworks, which includes adaptation, new development, and interpretation.

A future use across the whole site and for individual elements which encourages public access where appropriate would assist in conveying the heritage significance of the site and offer opportunities for interpretation.

Policy 16—Explore potential compatible uses for the site.
16.2 Consider new uses, which would work well as part of overall redevelopment of the Brickworks, adaptation, new development, and interpretation.
16.3 Consider uses which allows public access to all or part of the site.

5.6.3 Adaptation—Adaptive Reuse

The approach to adaptation of the site must maintain an understanding of the historical evolution of the Brickworks and its operation, to inform the introduction of feasible new uses that will support the conservation and interpretation of the heritage significance of the place in the long term.

When planning for adaptation, reference should be made to the *New Uses for Heritage Places: Guidelines for the Adaptation of Historic Buildings and Sites* prepared by the Heritage Office, NSW Department of Planning, and the Royal Australian Institute of Architects NSW Chapter, which provides valuable guidance. It describes adaptation as follows:

> *Adaptation may involve the introduction of new services, or a new use, or changes to safeguard a heritage item. A good adaptation is one that is sympathetic to the existing building and its historic context, and inserts new work, or makes changes that enhance and complement the heritage values of the heritage item.*[3]

The comparative analysis (refer to Section 2.4) identifies a number of examples of former brickworks and industrial sites which have been adapted for new uses, some of which have been done sympathetically, retaining the character of the site and evidence of significant fabric.

Adaptation, alterations or proposed change in use at the Brickworks should follow best practice guidelines. Considerations for adaptation or adaptive re-use of buildings on the site, and the site itself, should be guided by Article 21 of the Burra Charter, and associated Practice Note:

- *21.1 Adaptation is acceptable only where the adaptation has minimal impact on the cultural significance of the place.*
- *21.2 Adaptation should involve minimal change to significant fabric, achieved only after considering alternatives.*

Adaptation should be carefully considered as part of proposed redevelopment of the site as a whole. Specific elements pose challenges for adaptive re-use, including the chimney stacks, fan houses and some of the process buildings where remnant plant and infrastructure exists; however, many of the elements can tolerate change and are able to be adapted to suit new uses. The process of adaptation of some elements to suit an appropriate new use may result in considerable changes, such that the structure is fundamentally altered, and the heritage significance is impacted.

Therefore, to ensure a balance across the site, it is recommended that any proposals for adaptation be undertaken as an integrated approach across the site as a whole, rather than by element. This approach would ensure that key aspects of the history and operation of the site are represented, rather than focusing on any one particular element.

Proposals for adaptation of buildings at the Brickworks must ensure an appropriate balance is achieved between retention and conservation of fabric and delivery of a long-term sustainable use. A key objective is to ensure historic function of brickmaking at the site can be readily understood in the retained and reused fabric without being reliant upon complex added interpretation.

Any proposed changes should be undertaken with regard to the heritage significance of the element, the policies in this CMP, and the specific management guidelines for each element in the inventories at Appendix A.

Any proposals for adaptation of individual structures should be assessed for potential heritage impacts on the individual element (as an intrinsic feature) and on the overall site's heritage significance (and follow ACT Heritage requirements of preparing a SHE).

Policy 17—Explore opportunities for adaptation which respect the significance of the element and the Precinct as a whole.

17.1 Consider the site as a whole and ensure an appropriate balance between retention and conservation of fabric and delivery of a long term sustainable use with economic, social and cultural benefits.

17.2 Ensure that the operation of the place as a brickworks can be readily understood in the retained and reused fabric without relying on added interpretation.

17.3 Refer to the *New Uses for Heritage Places: Guidelines for the Adaptation of Historic Buildings and Sites* (the Heritage Office, NSW Department of Planning and the Royal Australian Institute of Architects NSW Chapter, 2008).

17.4 Prepare all adaptive reuse projects/adaptation proposals in accordance with best practice guidelines, the Heritage Act and policies in this CMP. Heritage Council advice and endorsement must be obtained for all development works to features of intrinsic significance to the site and registered heritage places.

17.5 Refer to the conservation policies and adaptation guidelines in Appendix A for specific advice on the individual heritage elements.

17.6 Assess all proposals for adaptation for potential impacts on the heritage significance of the site and individual elements (refer to Policy 33).

5.6.4 New Development

Ensure new development provides an overall approach to revitalising the site, with a whole-of-site appreciation for the heritage significance of the site, the core and supporting intrinsic features of the Brickworks, Railway Remnants and areas of archaeological potential.

A redevelopment project should include the conservation, adaptation, landscape development, archaeological investigations and interpretation.

New development beyond the alteration and adaptation of existing elements should complement the reading of the Brickworks as a historic, industrial 'landscape' comprising a complex of elements and distinct open space character.

Policy 18—Respect the heritage significance of the site when planning to introduce new development.

18.1 Ensure new development is based on a whole-of-site appreciation for the heritage significance of the site, the core and supporting intrinsic features of the Brickworks, Railway Remnants and areas of archaeological potential.

18.2 Respect the heritage significance of the Brickworks as a whole complex of elements in a historic industrial landscape setting with the quarry, railway remnants and areas of archaeological potential when introducing new development.

Infill Development

The publication *Design in Context: guidelines for infill development in the historic environment* produced by the Heritage Office and the RAIA (now AIA) provides detailed information on infill design and should be referred to when planning new buildings as part of the redevelopment.

To achieve successful infill development, design considerations such as character, scale, form, siting, materials and detailing, must be factored early into the planning stage. Redevelopment of the site shall be consistent with the Specific Requirements of the Heritage Register citation.

New buildings or structures should allow appropriate setbacks, building heights and landscape arrangements in the context of the original Brickworks structures.

Policy 19—Refer to the *Design in Context* guidelines when planning infill development.

19.1 Refer to the *Design in context: guidelines for infill development in the historic environment* (the Heritage Office and the Royal Australian Institute of Architects, NSW Chapter, 2005).

19.2 Infill, new structures or buildings shall be consistent with the Heritage Register citations, to consider appropriate character, scale, form, siting, materials and detailing of new buildings and their complementary relationship to the intrinsic features of the site.

19.3 Carefully plan infill development on the site to be complementary and appropriately set backs from the heritage elements, with appropriate screening and building heights.

Industrial Character

The Brickworks has a distinctive historic, industrial character, with the kilns, fan houses, chimney stacks, machine bays, and the associated quarry and railway remnants all contributing to its aesthetic qualities and understanding of its former operation. In planning for any new development or proposed re-use, there is a need to consider the presentation of the place as a whole, with reference to its industrial aesthetic character. This should be considered in the retention of elements that contribute to this character, to the design of any new buildings, and the adaptation of existing buildings.

Policy 20—Retain the historic industrial character of the site when planning new development.

20.1 Retain elements and significant fabric that contribute to, and demonstrates, the industrial character of the site.

20.2 Respect the industrial character of the site when designing new buildings, and adapting existing buildings.

Landscape Context

The site, including the Brickworks and Railway Remnants, has a degree of isolation from the surrounding suburban development and city, and its location still conveys a sense of its original remoteness.

New development at the Brickworks should consider the historic context — its landscape setting surrounding the site and the complex of the functional arrangement of elements and spaces that served the brick-making process.

Redevelopment of the landscape should respect the quality of the immediate surrounds of the site, including for any urban design/landscape planning undertaken for the site. The existing plantings on the site are not identified as significant; however, a coordinated landscape approach for any redevelopment of the site should be implemented to regain a cohesive aesthetic and improved quality and connections between the buildings and structures.

The quarry contains significant geological features which must be conserved, retained, protected and interpreted as part of the redevelopment of the site in accordance with the Heritage Register citations and the Heritage Act.

Policy 21—Conserve and retain the historic industrial character when redeveloping the landscape.

21.1 Conserve and retain the historic industrial character when planning the landscape for the redevelopment of the site (multiple elements: Core and Supporting).

21.2 Conserve and retain the identified rock outcrops in the quarry (Element 11 + 12) as significant geological features .

21.3 Conserve and retain the Railway Remnants (Element 1A).

Views

Views within the site: New buildings should be sited and designed to allow for significant visual connections to be maintained between the existing elements with important connections (ie between the kilns and fan houses and stacks). Refer to the 'views' diagram in Section 3.0.

The Heritage Act provisions apply only to the heritage registered place and intrinsic features.

Policy 22—Respect views within, to and from the site when planning new development.

22.1 Allow and enhance visual connections between, and to, key elements of the intrinsic features of significance of the brickworks.

22.2 Retain views to the 1950s chimney stack (Element 9) from within the site.

Spatial Layout

New development should respect the visual, physical and spatial relationships between the key heritage elements including the infrastructure between the kilns and their fan houses and chimney stacks, and the relationship between the main complex and the quarry.

There is an established history of connections and links between elements at the site, both below ground, at ground and elevated (ie underground flues and catwalks). There is an opportunity to continue patterns of connection and multiple levels of activity in future development, including scope for new buildings to link with existing buildings at varying levels to facilitate access and circulation.

New development within the historic core area of the Brickworks should generally be avoided, to retain the legibility of the historic layout and its industrial character. Any new buildings required within this area to facilitate a new use for the site should be appropriate in scale and of a complementary design and nature to the existing built forms. They should consider the surrounding elements in their massing, scale and form and respect the orthogonal layout of the existing built elements, and follow the same arrangement. The introduction of multiple domestic-scaled building forms (individual houses) should generally be avoided.

Policy 23—Respect the spatial qualities of the Precinct and the relationship between elements.

23.1 Respect the legibility of the site as a complex of built and landscape elements and its inherent spatial qualities.

23.2 Respect the existing layout and relationship between the elements, including the underground links between the kilns, fan houses and chimney stacks.

23.3 Explore opportunities to introduce connections between new development and existing elements at multiple levels.

23.4 Avoid development within the historic core area of the Brickworks that is inconsistent with the industrial character.

23.5 Small scale new development within this area to support new site uses would be acceptable, provided it follows best practice 'infill design guidelines' for heritage places.

23.6 Respect the massing, scale, form, and orthogonal layout of the existing heritage elements when planning new buildings in the vicinity of the Brickworks.

5.6.5 Conservation of Heritage Elements

Individual Heritage Elements

While the multiple values ascribed to individual elements at the Precinct allow for the consideration of different approaches to its conservation and adaptation, it is important that any conservation or adaptation works undertaken are in accordance with these Burra Charter principles.

Demolition of core elements is generally not supported (refer to 'Demolition' in this Section for further guidance); however, if adaptation is proposed, then the works must have regard for the identified heritage significance and be guided by the specific policies and recommendations included in this CMP (refer also to Appendix A).

Generally, retention of supporting elements is preferred, however these elements provide greater flexibility than core elements with regard to change and alteration, particularly internally. Where adaptation is proposed, this must be guided by the specific policies and recommendations included in this CMP (refer also to Appendix A).

Incidental elements can be retained, altered or removed; however, specific works or proposals relating to these elements, including replacement or adaptation, must also have regard for the policies and recommendations included in this CMP.

Any alterations must respect, and be undertaken in the context of, the identified heritage significance for the individual element and the Precinct as a whole.

Policy 24—Respect the heritage significance of individual elements and their context within the site.

24.1 Respect the heritage significance of the core and supporting elements and their context in the site when planning adaptation.

24.2 Refer to the detailed guidance at Appendix A when planning adaptation of individual elements.

Incremental Change

The Brickworks incrementally evolved as industrial processes changed over time. This evolution is evidenced by both core and supporting elements ranging in their construction dates between 1913 and the 1960s. Many elements of the site have been modified, including in many cases extensively, as the site evolved and expanded, reflecting changes in work practices and processes on the site. Many original

or early openings have been altered, including enlargement of openings and, in some cases, the infilling of earlier openings. There are also elements which have undergone significant rebuilding including inaccurate or conjectural reconstruction works (eg: the Staffordshire and 1927 Hardy patent kilns).

The intrinsic features of the site demonstrate the industrial process of brick making, including major changes in work practices (such as the widening of the entries to the kiln chambers to allow for the use of forklifts). However, some alterations have been made on an ad hoc basis and detract from the integrity, presentation and legibility of particular elements.

Future changes, through proposed development of the site – including internal and external works to the intrinsic features – should be considered in the context of potential impacts on the heritage significance of the site as a whole, its original fabric and features.

Policy 25—Plan for appropriate change to avoid a loss of integrity.
25.1 Avoid undertaking incremental changes which result in a loss of original fabric and intrinsic features of the site as a whole.
25.2 Ensure any proposed changes to the individual elements form part of an overall cohesive approach to the conservation and redevelopment of the site as a whole.

Restoration and Reconstruction

Restoration means returning a place to a known earlier state by removing accretions or by reassembling existing elements without the introduction of new material, whereas reconstruction means returning a place to a known earlier state, and is distinguished from restoration by the introduction of new material.[4]

Best practice guidelines including Articles 18–20 of the Burra Charter should be followed:

- *18. Restoration and reconstruction should reveal culturally significant aspects of the place.*
- *19. Restoration is appropriate only if there is sufficient evidence of an earlier state of the fabric.*
- *20.1 Reconstruction is appropriate only where a place is incomplete through damage or alteration, and only where there is sufficient evidence to reproduce an earlier state of the fabric. In some cases, reconstruction may also be appropriate as part of a use or practice that retains the cultural significance of the place.*
- *20.2 Reconstruction should be identifiable on close inspection or through additional interpretation.*

Restoration and reconstruction of individual elements at the Brickworks is possible, noting that the end use is no longer a brick-making function.

Restoration and reconstruction of fabric would be combined with adaptation for new uses. Any proposed reconstruction works involving reinstatement of original fabric must be assessed against the specific recommendations for individual elements and as part of a broader approach to adaptation at the site, and in line with a strategy for site interpretation and presentation.

For individual elements, there may be cases where unsympathetic alterations or additions could be removed to improve the presentation and legibility of the heritage significance of the element and the whole site.

The relocation of particular structures within the site would obscure an understanding of the historic layout and processes on the site and is not supported, excluding those elements that have already been moved from their historic location (e.g. Supporting Element 22 – Elevator/Conveyor). Conservation of all elements of heritage significance requires retention in historic, existing locations, and relocation would

diminish heritage significance of the site. In addition, the majority of supporting elements on the site have heritage significance to the complex as a whole.

Policy 26—Undertake restoration and reconstruction of elements in accordance with best practice in heritage conservation.

26.1 Assess proposed restoration or reconstruction works for individual elements in this CMP (refer to Appendix A) and as part of a broader approach to adaptation at the site.

26.2 Avoid relocating existing elements which would result in a loss of context and ability to interpret the heritage significance and historic function of the site.

Demolition

The removal of heritage elements and features has the potential to impact the heritage significance of the site, through the loss of evidence of the historic operation of the Canberra Brickworks.

A Statement of Heritage Effects (SHE) must be undertaken for potential impacts on the heritage significance of the element, its relationship to other elements in its setting, and the site. A SHE must be submitted under Section 61H of the Heritage Act, and approved by the ACT Heritage Council

Demolition of intrinsic features of heritage significance—both Schedule 1 and Schedule 2 elements—would only be permitted by the ACT Heritage Council under exceptional circumstances, and where it is demonstrated with professional assessments that elements are structurally unsound as to be beyond economic repair and/or where conditions pose significant health or safety risks that are beyond economic repair.

- Demolition of the Schedule 1 **Core Elements** is generally not supported. However, demolition could be considered on the grounds of safety, i.e., where the building poses an imminent and demonstrable risk to health and safety. Demolition is not permitted unless it can be demonstrated that there is no prudent and feasible alternative.
- Demolition of the Schedule 2 **Supporting Elements**, which generally date from the mid-to-late twentieth century, would further diminish the ability of the complex to demonstrate the manufacturing processes that occurred on this site in the later phase of its history.
- **Incidental elements** are not considered to have heritage significance and can be demolished as required, without further assessment.

Conservation of all elements of heritage significance is best achieved through their retention in historic locations. Relocation has the potential to diminish heritage significance, noting that the Specific Requirements in the Heritage Register citation do allow for some elements to be relocated if certain conditions are met. The Specific Requirements also permit minor equipment to be relocated within the site for interpretative purposes and/or for protection.

Policy 27—Avoid demolition of core and supporting elements which contribute to the heritage significance of the site.

27.1 Explore alternatives, including adaptive re-use, prior to planning to demolish core or supporting elements.

27.2 Assess proposals for demolition of core or supporting elements for potential heritage impacts (refer to Policy 33).

27.3 Prepare a SHE in accordance with Section 61H of the Heritage Act should demolition of demolition of core or supporting elements be proposed and obtain approval from the ACT Heritage Council.

27.4 Undertake an archival recording prior to demolition in accordance with the *NSW Heritage Office Guidelines for Archival Recording* (refer to Policy 29).

27.5 Unless permitted by the Specific Requirements in the Heritage Register citation, retain all elements of heritage significance in their historic location.

5.6.6 Historic Archaeology

The potential impacts of new and future development proposals on the archaeological features of the site should be assessed against the identified archaeological values and sensitivities outlined in this CMP. When planning for development (ie excavation/earthworks) to areas identified as having high or moderate archaeological sensitivity, undertake appropriate archaeological investigation during the early planning stage, and follow any recommended mitigation measures. Any archaeological investigations conducted at the site must be in accordance with an Excavation Permit approved under Section 61F of the Heritage Act.

An Unanticipated Finds Protocol should be in place for all excavation work on the site.

Policy 28—Assess for impacts from development on areas of archaeological potential.

28.1 Refer to the historic archaeological analysis at Section 3.4 to understand areas of archaeological potential.

28.2 Assess potential development impacts based on the historic archaeological analysis at Section 3.4 of this CMP.

28.3 Seek an Excavation Permit under Section 61F of the Heritage Act if undertaking an archaeological excavation at the site.

28.4 When undertaking excavation work on the site, follow the Unanticipated Finds Protocol included in Appendix E.

5.6.7 Site Recording

The Burra Charter highlights the importance of having a record of significant places prior to any changes occurring, which includes redevelopment. Prior to undertaking any changes, including conservation works or new development, the Brickworks should be documented, and records maintained in a central location, for future use and access by the site owner/manager.

Adequate records (ie as a photographic record accompanied by a detailed description) of the existing fabric and condition of the elements, including an understanding of the layout and broader context of the overall Precinct, should be prepared. Recording of the site should be undertaken in accordance with the NSW Heritage Office Guidelines '*How to Prepared Archival Records of Heritage Items'*, and '*Photographic Recording of Heritage Items Using Film or Digital Capture*' or equivalent standards. A copy of the record should be lodged with the ACT Heritage Library and could inform future interpretation opportunities.

Existing information about the Canberra Brickworks Precinct, including heritage reports, historic records, photographs and architectural drawings, are all valuable resources which should be collated and stored, to offer a comprehensive suite of documentation relating to the design, construction and history of the site. In addition to the recording of the site prior to undertaking changes, this information would serve as a useful reference tool, particularly for potential future interpretation opportunities.

Alternative methods of recording aspects of the site could also be explored, such as preparing oral histories by former workers, residents, visitors and users of the Brickworks, or digitally recording the site through video or 3D modelling. These methods are also important interpretation initiatives (refer to Section 5.8).

Policy 29—Keep adequate and accurate records.
29.1 Keep and maintain records of conservation and maintenance works, particularly in relation to changes made to features intrinsic to the place.
29.2 Undertake archival recording of the site prior to commencement of any major works/new development in accordance with the NSW Heritage Office Guidelines (or equivalent)
29.3 Submit archival records/reports to ACT Heritage Council for their records and provide a copy to the ACT Heritage Library.
29.4 Collect and conserve documents relating to the design, construction and history of the Brickworks for potential interpretative use (refer to Policy 36).

5.6.8 Development Proposal 2017-2021

The development proposal for the site by Doma includes plans for a mixed-use residential, commercial, and retail development that retains the core of the historic Brickworks, with residential apartment blocks, townhouses, and houses in the broader site setting.

The proposed 'Master Plan and Development Design Strategy', 2016 seeks to develop the entire Brickworks complex including the quarry and railway remnants, with a cohesive approach to 'whole of site' conservation, heritage management and interpretation of the site's heritage significance associated with its former function. The redevelopment proposal was assessed for its potential heritage impacts in a SHE undertaken in January 2017, which would be updated when a concept design is developed for the site in early 2021. The SHE determines the redevelopment proposal would have an overall positive impact, and that heritage advice should continue to be sought throughout the development process to ensure the heritage significance is conserved and interpreted.

Policy 30—Ensure proposed redevelopment is compliant with the CMP, Heritage Act and Burra Charter.
30.1 Ensure proposed redevelopment of the site is compliant with provisions of the Heritage Act including requirements set out in the two ACT Heritage Register citations, the policies and guidance outlined in this CMP and the Burra Charter principles.
30.2 Assess all proposals for redevelopment of the site for potential heritage impacts (refer to Policy 33), by undertaking a SHE, to be submitted under Section 61H of the Heritage Act, and approved by the ACT Heritage Council.

5.7 Legislative and Management Framework

5.7.1 ACT Legislative Requirements

The statutory obligations and legislation that govern the place are principally the Heritage Act and *Planning and Development Act 2007* (ACT) (the Planning and Development Act).

ACT Heritage Act 2004

The Canberra Brickworks and the Railway Remnants are listed on the ACT Heritage Register, established under Section 20 of the Heritage Act. Listing in the ACT Heritage Register means that a place or object:

- is of heritage significance to the people of the ACT and enriches understanding of the ACT's history and identity;
- is legally protected under the Heritage Act, including the application of heritage guidelines; and

- requires advice by the ACT Heritage Council on development issues to improve conservation outcomes.

In accordance with the Heritage Act, the CMP should be approved by the ACT Heritage Council.

Canberra Brickworks

The ACT Heritage Register citation for the Canberra Brickworks includes 'Specific Requirements', which are guidelines for addressing a range of activities and adaptation/development actions. Some of these are as follows:

> *The identified heritage values and intrinsic features of the place shall be conserved whilst allowing for the integrated and sympathetic redevelopment of the place as a single entity, consistent with contemporary practices for the adaptive reuse of industrial and commercial heritage places. In conserving and developing the place its significant historical use as an industrial site for the production of bricks and clay products shall continue to be evident and accessible to the public.*[5]

The Specific Requirements are arranged under the following headings and are relatively detailed:

- Landscape Setting;
- Built Structures – including alterations and additions;
- Industrial Equipment; and
- Demolition.

Railway Remnants

Heritage guidelines applicable to the conservation of the Railway Remnants provided in the ACT Heritage Register citation state that:

> *The guiding conservation objective is that the Yarralumla Brickworks Railway Remnants shall be conserved and appropriately managed in a manner respecting their heritage significance and the features intrinsic to that heritage significance, and consistent with a sympathetic and viable use or uses. Any works that have a potential impact on significant fabric shall be guided by a professionally documented assessment and conservation policy relevant to that area or component (i.e. a Statement of Heritage Effects—SHE).*[6]

Policy 31—Manage the site in accordance with the *ACT Heritage Act 2004* (the Heritage Act).
31.1 Manage and implement actions at the site in accordance with the relevant legislation, regulations and codes, including the *Heritage Act*.

Planning and Development Act and the ACT Territory Plan

The Planning and Development Act provides a planning and land development framework for the ACT. It stipulates and regulates the functions of the Planning and Land Authority in the Environment, Planning and Sustainable Development Directorate.

The Planning and Land Authority is the primary authority for planning and development in the ACT, with statutory roles performed under the Planning and Development Act and the *Territory Plan 2008* (the Territory Plan). The Planning and Land Authority advises the ACT Government on land, planning and building policy. Listed heritage places and objects in the ACT, which may be impacted by planning developments, the Planning and Land Authority seeks advice from the ACT Heritage Council under the provisions of the ACT Heritage Act. It also gives development approval.

The Territory Plan is the key statutory planning document in the ACT, providing the policy framework for the administration of planning in the ACT. The purpose of the Territory Plan is to manage land use, change and development in a manner consistent with strategic directions set by the ACT Government, legislative assembly and the community.

The Territory Plan is currently being reviewed to ensure it remains a contemporary best practice document outlining planning requirements in the ACT.[7] The area in which the Canberra Brickworks is located is zoned in the Territory Plan as CZ6 – Leisure and Accommodation, and additionally as Residential Use in the Yarralumla Precinct Code.

Any proposed changes to the use of the site would have to comply with the current zoning and rules stated in the Territory Plan. However, this does not reflect the historic function of the site, nor does it allow for all potential compatible uses. Amendments to the Territory Plan could be considered to allow for an appropriate adaptive re-use and development on the site.

Policy 32—Manage the site in accordance with the Territory Plan.

32.1 Explore options to amend the Territory Plan to allow for consideration of a range of alternative compatible uses at the site.

Approvals Process

Changes to the site (including internal and external works to individual buildings and new building work) must consider the potential impacts on the heritage significance including from the loss of original fabric/features. Intentions to further develop the site should consider building heights and locations, form, fabric, and screening so that potential impacts are reduced, or mitigated, and the heritage significance of the site are retained.

A SHE is required under Section 61H of the Heritage Act for any proposed activity that is likely to diminish the heritage significance of a place. It is required by the ACT Heritage Council in its consideration of relevant information when assessing a development application. Potential impacts from future development would be assessed and mitigation measures addressed through the preparation of a SHE. Measures would be identified to mitigate any adverse impacts and ensure protection of heritage significance.

Policy 33—Follow the works approval process for proposed works at the site.

33.1 Seek necessary approvals for all proposed works from the relevant authorities including the ACT Government and the ACT Heritage Council for new development at the site in accordance with all planning requirements and the Heritage Act.

33.2 Assess all actions, including conservation works, for potential impacts on the heritage significance of the site.

33.3 Prepare a Statement of Heritage Effects (SHE) for any proposal or action with potential to adversely impact the heritage significance of the site. SHE applications are made to the Council in accordance with Heritage Act provisions.

33.4 Obtain professional advice to prepare a SHE, to assess potential heritage impacts, proposed actions, and provide guidance on avoiding impacts and/or recommend alternatives.

Community Consultation

The future of the Brickworks is important to the ACT Community, as demonstrated by representations from the Yarralumla Residents Association and attendance at community consultation sessions regarding potential future uses and development proposals. Recognising the strong community

attachment to the heritage significance of the site, regular liaison should continue to be undertaken on proposals affecting the future use and development of the place.

Information should also be provided to the broader community on the history and significance of the site and its status as a heritage listed place (ie through active interpretation) as part of any future redevelopment.

Policy 34—Undertake consultation with the Canberra community regarding the future of the site.
34.1 Keep the community informed of progress of any future development.

5.7.2 Other Statutory and Safety Requirements

National Construction Code

The National Construction Code (NCC) provides the minimum necessary requirements for safety, health, amenity and sustainability in the design and construction of new buildings (and new building work in existing buildings) throughout Australia.

With specific reference to the heritage implications of achieving code compliance in the individual heritage elements at the Brickworks, advice should be sought from heritage professionals.

Disability Discrimination Act 1992

The Commonwealth *Disability and Discrimination Act 1992* (the DDA Act) provides for equity in access for elderly people or people with a disability to sites and facilities.

The DDA Act makes it illegal to discriminate against a person on the basis of their disability. It is not specifically about buildings, however where a building's design and construction prevents access by people with a disability, the owners of those buildings are deemed to be discriminating against people on the basis of a disability.

The 'access to buildings component' of the DDA Act is applied only to buildings that are available for the general public to enter and use, as employees, patrons, customers or the general public.

Depending on the nature of any proposed future use or redevelopment at the Brickworks, DDA Act compliance is likely to be an issue.

Work Health and Safety Act 2011

The *Work Health and Safety Act 2011* (ACT) (the WHS Act) requires that the owners of the site take action to protect visitors and site users from hazards while working, including any conservation works being undertaking at the Brickworks.

Advice should be sought from heritage professionals as necessary when achieving compliance at the Brickworks.

Policy 35—Comply with the relevant legislative requirements for construction, access and safety.
35.1 Ensure any redevelopment or conservation works undertaken at the site are compliant with the relevant legislative requirements for the National Construction Code, the DDA Act and the WHS Act.
35.2 Consider the heritage significance and original fabric of the individual heritage elements when planning upgrades to meet legislative requirements (ie NCC and DDA Act compliance).
35.3 Seek advice from heritage professionals when planning redevelopment.

5.8 Opportunities for Interpretation

5.8.1 Understanding Interpretation

Interpretation is an essential part of the conservation process as defined by the Burra Charter.[8] The term interpretation means 'all the ways of presenting the cultural significance of a place'. This includes the treatment of heritage fabric through maintenance, restoration, etc, as well as the use of a place and the introduction of explanatory material, events and activities.[9] Successful interpretation encourages personal appreciation and enjoyment of the experience of a place; it can also be an engaging educational tool, inspiring or deepening connections between people and places.[10]

The active interpretation of heritage places supports community recognition, enjoyment and understanding of the site's heritage significance. Interpretation can also be a useful tool in explaining the layers of change at a heritage place.[11] Importantly, the maintenance and retention of the heritage fabric and elements at the Brickworks fulfils an interpretive role in itself.

5.8.2 Objectives for Future Interpretation

There is currently limited interpretation at the Precinct, partly due to the nature of the site as a former manufacturing facility and its more recent operation as a recycled timber wholesaler limiting public access.

Implementing interpretation initiatives is an essential component of heritage management and would increase public awareness of the heritage significance of the site.

Potential opportunities for interpretation should be undertaken early in any development proposal, to ensure an integrated approach to conservation, interpretation and new development.

An Interpretation Strategy is a precursor to implementing interpretations initiatives, which are included in a more detailed Interpretation Plan.

Interpretation Strategy

The development of an Interpretation Strategy would provide a clear approach to the interpretation initiatives appropriate for the site. An Interpretation Strategy could include:

- Identification of key interpretation themes and messages for the site – the interpretation messages should closely echo the heritage significance and stories of the site and the policies employed to conserve the significance.
- Determination and tailoring of interpretation to the potential audiences appropriate to the site – the key audience for interpretation at the Brickworks are the site users, visitors and the local community more broadly.
- Exploration of options for a variety of interpretative initiatives and media, not limited to signage, but also art/sculptural elements, oral histories, interactive media and off-site possibilities including online websites, digital applications and other contemporary methods.

Consistent with the ACAT Orders representing the agreement between the Heritage Council and the ACT Government regarding the Dunrossil Estate (attached at Appendix I), the alignment of the railway remnants within the Dunrossil Estate will be visually interpreted through the following elements:

- Differentiated paving and ground treatments; and

- Illustrative and/or educational signage.

Policy 36—Develop an Interpretation Strategy.
36.1 Prepare an Interpretation Strategy as a high priority, for the redevelopment of the site, as a means of integrating, showcasing and celebrating the heritage significance of the Brickworks for future users of the site.
36.2 Identify key themes and messages, potential audiences, and options for interpretive media in the Interpretation Strategy to guide future development of interpretive content.
36.3 Ensure interpretation is considered as part of a whole-of-site approach to revitalising the Brickworks, including conservation and new development.
36.4 Explore opportunities to integrate interpretation initiatives early in any future development proposal.

5.9 Conclusion

The identification of a range of constraints and opportunities gives rise to considerations for the management and redevelopment of the site. The conservation policies in this section provide the guidance and direction for conserving, managing, and interpreting the heritage significance of Canberra Brickworks and the Railway Remnants.

It is important that a cohesive approach to managing the site is employed, including when planning for conservation, interpretation and development.

The implementation of the policies in this CMP, are summarised in Section 6.0, to ensure the heritage significance of the place is conserved.

5.10 Endnotes

1 The practice notes can be viewed at the following link: <http://www.icomos.org/australia/charter.html>.
2 Australia ICOMOS Inc, *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance 2013*, Australia ICOMOS Inc, Burwood, VIC, 2000, Article 1.11.
3 Heritage Office, NSW Department of Planning and the Royal Australian Institute of Architects NSW Chapter, *New Uses for Heritage Places: Guidelines for the Adaptation of Historic Buildings and Sites*, 2008.
4 Australia ICOMOS Inc, *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance 2013*, Australia ICOMOS Inc, Burwood, VIC, 2000, Articles 1.7 and 1.8.
5 Yarralumla Brickworks, ACT Heritage Register Listing.
6 Yarralumla Brickworks Railway Remnants, ACT Heritage Register Listing, 7 November 2013.
7 ACT Government Environment, Planning and Sustainable Development Directorate—Planning, Territory Plan, viewed 19 February 2020 <http://www.planning.act.gov.au/tools_resources/legislation_plans_registers/plans/territory_plan>.
8 Australia ICOMOS Inc, *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance 2013*, Australia ICOMOS Inc, Burwood, VIC, 2000, Article 14.
9 Australia ICOMOS Inc, *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance 2013*, Australia ICOMOS Inc, Burwood, VIC, 2000, Article 1.17.
10 Australia ICOMOS Inc, *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance 2013*, Australia ICOMOS Inc, Burwood, VIC, 2000, Article 8.
11 Australia ICOMOS Inc, *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance 2013*, Australia ICOMOS Inc, Burwood, VIC, 2000, Article 15.

6.0 Conservation Policy: Implementation Schedule

6.1 Introduction

The two ACT Heritage register places in the Canberra Brickworks Precinct are recognised as places of significance to the ACT and should be conserved and managed in accordance with the Heritage Act and the conservation policies outlined in this CMP.

The policies for the conservation (described in more detail in Section 5.0) define how the conservation of the site's heritage significance should be achieved. The implementation of the management, conservation and maintenance of the site's heritage significant elements and methods for understanding of its significance through documentation and interpretation, is set out in this section.

The implementation schedule outlines the policies and actions, and the priorities and timing for their implementation.

6.2 Implementation of the Conservation Policies and Actions

6.2.1 Priorities

The priorities for action are listed in three categories, each responding to a different level of risk to the heritage values:

- **High**: Actions which are essential to mitigate key risks to the heritage significance. These actions are an essential component of the CMP and without them the site's heritage significance may suffer adverse impacts.
- **Medium**: Actions that should be planned for in order to conserve the heritage significance of the site. Resources should be planned to enable implementation of these actions and ensure conservation of the heritage significance.
- **Low**: Actions that are important to the future conservation of the heritage significance, yet respond to less immediate risks. Resources should be planned in advance of the implementation of these actions.

6.2.2 Timing

Timing parameters have been established for the implementation of policies and actions in line with their priority. Note that the timing of these may be impacted by the timing of the transfer of custodianship of the land from government ownership to private ownership. Implementation should be completed:

- upon adoption of the CMP (within 12 months);
- within 24–36 months;
- within 5–10 years;
- annually;
- as required; or
- on an ongoing basis.

6.3 Responsibility

The key responsibility for implementation, review and monitoring of the CMP currently lies with Doma, nominated as the preferred tenderers for the site. Doma has primary responsibility for implementation of conservation policies, adopting the heritage management processes and decision-making procedures of the CMP. Their responsibilities include understanding the heritage significance and ensuring this significance is retained in any strategic decisions about future development.

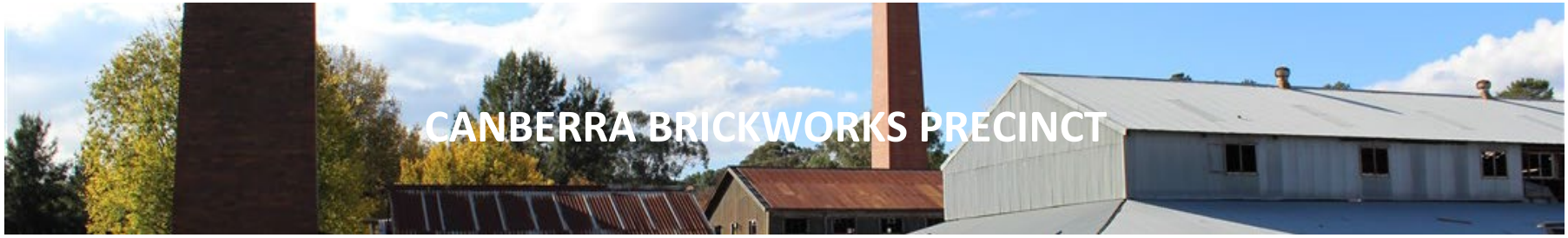
Proposed redevelopment of the site may result in changes to the management structure and responsibilities into smaller areas and elements, and therefore the heritage management should be reviewed as necessary. Where multiple parties are responsible for managing the site's heritage significance, it is important that it is undertaken in a cohesive manner.

Future site users, who may be individuals and groups who manage or occupy the various buildings, would also have responsibilities for the ongoing heritage management at the site. Their role in the day-to-day operation of the site and undertaking regular maintenance means that they should act in accordance with the identified heritage significance and policies in this CMP, including any future updates.

6.4 Conservation Policy: Implementation Schedule



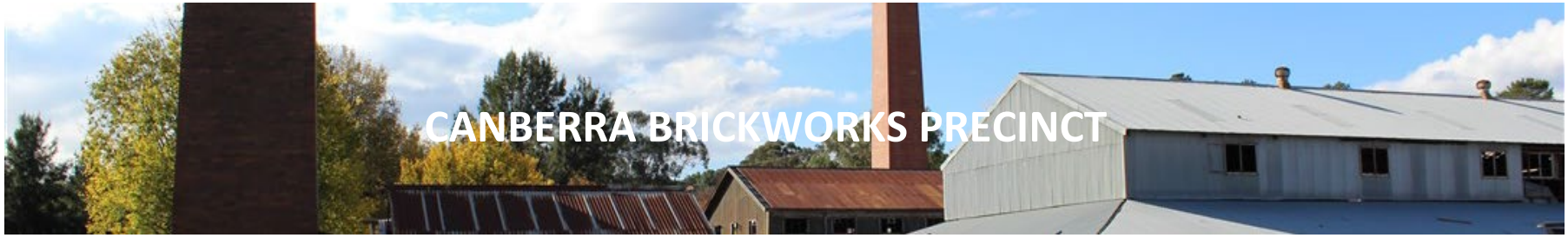
Policies	Actions	Implementation	
		Priority	Timing
General Heritage Management Processes (Refer to Section 5.2.1)			
1.0 Adopt the CMP and its conservation policies	1.1 This CMP must be adopted as the principal guiding document for the future management of the heritage significance of the site—Canberra Brickworks and the Railway Remnants.	High	Immediately and Ongoing
	1.2 Refer to this CMP for all matters relating to the heritage significance, conservation and management of the site (including Appendix A for recommendations and identified issues for individual heritage elements at the site).	High	Ongoing
	1.3 Implement the policies and actions set out in this CMP, in line with the identified priority and timing guidelines.	High	Ongoing
	1.4 Arrange for the CMP to be approved by the ACT Heritage Council.	High	Immediately
	1.5 Ensure all site managers, staff and contractors have access to the information in this CMP (hard copy and electronically) and have suitable induction and training activities to understand its importance and intent to ensure best heritage practice.	High	Ongoing
2.0 Regularly review the CMP and its policies	2.1 Review and update the CMP following major changes in circumstances, including conservation works, or new development/construction.	Medium	As required
	2.2 Amend specific policies in light of new circumstances, such as a change in use.	Medium	As required
	2.3 Monitor the condition of the heritage significance and include the re-evaluation as part of a review of the CMP (noting that an update to the CMP may not be warranted).	Medium	As required



Policies	Actions	Implementation	
		Priority	Timing
3.0 Refer to the Burra Charter and its Practice Notes	3.1 Refer to the Burra Charter to guide the ongoing management of the site and all future conservation works (refer to Appendix D).	High	Ongoing
4.0 Engage appropriately qualified personnel	4.1 Ensure appropriate heritage expertise is engaged for management, assessments and conservation works, and that all involved are aware of Burra Charter principles for conservation, traditional construction techniques and developments.	High	As required
	4.2 Seek expert advice from heritage professionals for: - heritage significance assessment against the HERCON criteria; - undertaking conservation works/actions; - heritage management and interpretation planning advice; - impact assessments for proposed works and development; and - conservation works for the preparation of a Statement of Heritage Effects (SHE) to accompany documentation for Development Applications. Note: Statement of Heritage Effects (SHE) applications are made directly to the ACT Heritage Council under Section 61G of the Heritage Act and are made independently of development applications.	High	As required
Understanding the Heritage Significance (Refer to Section 5.3)			
5.0 Note the assessment against criteria in this CMP	5.1 Acknowledge the assessment of heritage significance against the HERCON criteria in this CMP. This provides information which is consistent with the ACT Heritage Register citations for the 'Yarralumla Brickworks' and the 'Yarralumla Brickworks Railway Remnants'.	High	Immediately



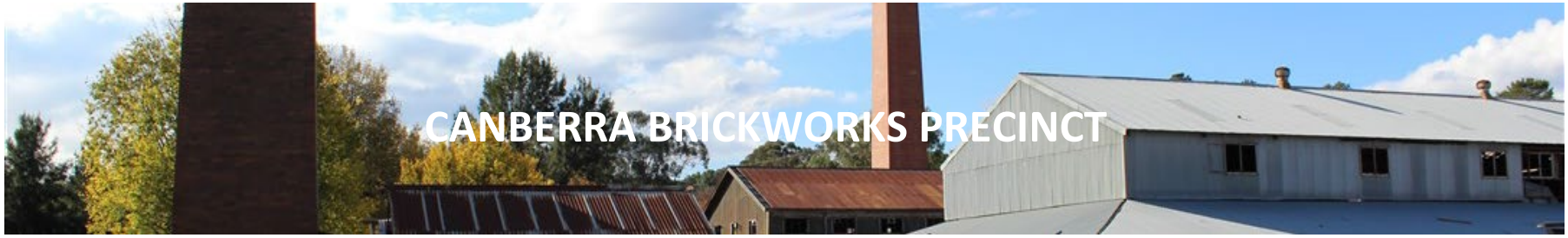
Policies	Actions	Implementation	
		Priority	Timing
6.0 Conserve the heritage values of the place in accordance with its assessed significance	6.1 Conserve and manage the Canberra Brickworks and Railway Remnants in accordance with the heritage significance included in the ACT Heritage Register citation and the Heritage Act.	High	Immediately and Ongoing
7.0 Conserve the site; the whole of the Canberra Brickworks Precinct and its intrinsic features	7.1 Conserve the heritage significance of the whole site, as a cohesive complex of elements with a historic industrial character.	High	Ongoing
	7.2 Conserve the features/elements that are intrinsic to the heritage significance of the site, as identified in Section 4.0 and the ACT Heritage Register citations.	High	Ongoing
8.0 Retain and conserve elements of the site in accordance with their heritage significance	8.1 Conserve the elements in accordance with their heritage significance, following Burra Charter principles, and processes, and further guidance in this CMP, Appendix A.	High	Ongoing
	8.2 Schedule 1: 'Core elements' must be retained and conserved.	High	Ongoing
	8.3 Schedule 2: 'Supporting elements' must be preferably be retained and conserved.	High	Ongoing
	8.4 'Incidental elements' are neutral to the site's significance, and can be retained, altered or removed.	High	Ongoing
9.0 Record, investigate and conserve remnant equipment where it relates to the former operation of the site.	9.1 Record and investigate remnant items of historic machinery, relic equipment and ephemera on site, and prepare an inventory of items.	Medium	Within 24-36 months
	9.2 Retain plant and equipment that contributes to the significance and/or understanding of the operation of the Brickworks for future interpretive purposes. Record the objects in situ prior to removal, if not retained (refer to Policy 29).	Medium	Within 24-36 months
	9.3 Retain all underground workings related to the kiln operations, including flue systems and connections to the fan houses and stacks, if possible.	High	Ongoing
	9.4 Retain evidence of at least one of the firing floors to demonstrate the function of the Staffordshire and Hardy patent kilns.	High	Ongoing



Policies	Actions	Implementation	
		Priority	Timing
	9.5 Retain and interpret brick-making ephemera (ie etched kiln numbers).	High	Ongoing
	9.6 Approval by the ACT Heritage Council must be sought if removal of significant fabric – associated with historic machinery, relic equipment or ephemera – is proposed.	Medium	As required
Understanding the Physical Condition (Refer to Section 5.4)			
10. Develop and implement a condition and maintenance program to conserve the core and supporting heritage elements on site.	10.1 Undertake structural condition inspections as required by qualified professionals to review the physical condition of the elements. This would be undertaken in detail when documenting the conservation and remediation works for the redevelopment project.	High	Ongoing
	10.2 Undertake conservation and remediation works as a priority to ensure the elements are stabilised and safe for access. Noting that any works not defined in this CMP may require further Council advice and approval prior to their commencement, as they will not be authorised by the CMP approval.	High	As required.
	10.3 Respect the heritage significance and retain significant fabric when undertaking conservation works and maintenance for the redevelopment project and following completion of the project.	High	Ongoing
	10.4 Undertake maintenance in accordance with the Burra Charter and the heritage significance of the site and the individual elements.	High	Ongoing
	10.5 Implement an ongoing cyclical maintenance program following completion of the conservation works t conservation works and redevelopment. The regularity of inspections by a structural engineer, would be determined by a certifying engineer.	Medium	Immediately and Ongoing
	10.6 Update and implement maintenance requirements following any major changes to the site, or to individual elements.	Medium	As required
Site Management and Operational Requirements (Refer to Section 5.5)			
	11.1 Ensure a cohesive approach to the management of the heritage significance of the site and all its elements.	High	Ongoing



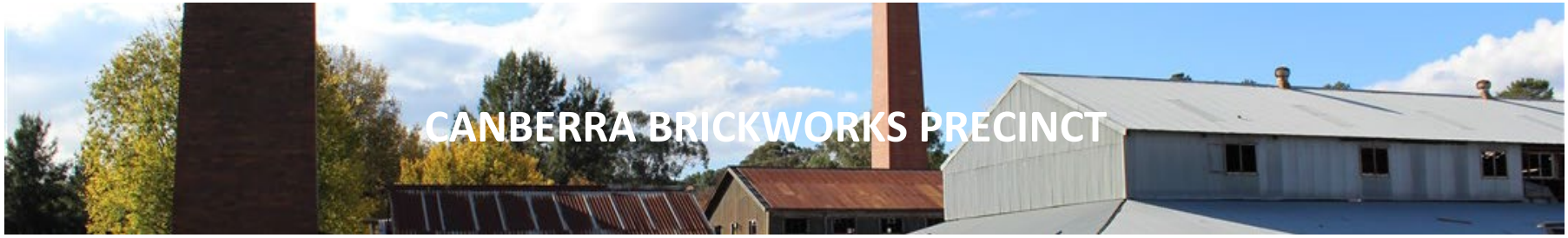
Policies	Actions	Implementation	
		Priority	Timing
11. Ensure responsibility for managing the heritage significance is appropriately assigned and understood	11.2 Review management and responsibilities following any changes to ownership and/or management of individual areas or elements of the site.	Medium	As required
12. Encourage public access to the site	12.1 Encourage public access in the future redevelopment of the site, where appropriate (refer to Policy 15).	Medium	As required
13. Respect the historic circulation and road layout at the Precinct	13.1 Maintain the historic approach to the Brickworks site from the south. Additional access routes could be introduced if required.	High	Ongoing
	13.2 Reference the historic circulation and road layout of the site in any future site development, ie the roadway along the western side of the kilns.	High	As required
14. Identify and manage potential risks to the heritage significance of the site	14.1 Undertake a comprehensive risk audit and prepare a strategy to manage risks to the heritage significance.	Medium	Within 24-36 months
	14.2 Review potential risks when redevelopment of the site commences and authorisation to the site changes.	Medium	As required
Development Challenges and Opportunities (Refer to Section 5.6)			
15. Ensure redevelopment planning for a sustainable future of the site	15.1 Ensure a cohesive approach to redevelopment at the site, with consideration of adaptation and the conservation and interpretation of the heritage elements.	High	Immediately and as required
	15.2 Explore opportunities to revitalise the site through conservation, interpretation and public access, where appropriate.	High	Immediately
	15.3 Refer to the CMP and its policies when planning redevelopment of the site.	High	Ongoing



Policies	Actions	Implementation	
		Priority	Timing
16. Explore potential compatible future uses for the Precinct and its individual elements	16.1 Consider new uses, which would work well as part of overall redevelopment of the Brickworks, adaptation, new development, and interpretation.	High	Immediately
	16.2 Consider uses which allows public access to all or part of the site.	High	Immediately
17. Explore opportunities for adaptation which respect the significance of the element and the Precinct as a whole	17.1 Consider the site as a whole and ensure an appropriate balance between retention and conservation of fabric and delivery of a long term sustainable use with economic, social and cultural benefits.	High	Immediately
	17.2 Ensure that the operation of the place as a brickworks can be readily understood in the retained and reused fabric without relying on added interpretation.	High	Ongoing
	17.3 Refer to the *New Uses for Heritage Places: Guidelines for the Adaptation of Historic Buildings and Sites* (the Heritage Office, NSW Department of Planning and the Royal Australian Institute of Architects NSW Chapter, 2008).	High	Ongoing
	17.4 Prepare all adaptation proposals in accordance with best practice guidelines, the Heritage Act and the policies in this CMP. Early advice from the Heritage Council is encouraged for adaptation proposals.	High	Ongoing
	17.5 Refer to the conservation policies and adaptation guidelines in Appendix A for specific advice on the individual heritage elements.	High	Ongoing
	17.6 Assess all proposals for adaptation for potential impacts on the heritage significance of the site and individual elements (refer to Policy 33)	High	As required
18. Respect the heritage significance of the site when planning to introduce new development	18.1 Ensure new development is based on a whole-of-site appreciation for the heritage significance of the site, the core and supporting intrinsic features of the Brickworks, Railway Remnants and areas of archaeological potential.	High	Ongoing
	18.2 Respect the heritage significance of the Brickworks as a whole complex of elements in a landscape setting; with the quarry, railway remnants and areas of archaeological potential when introducing new development.	High	Ongoing



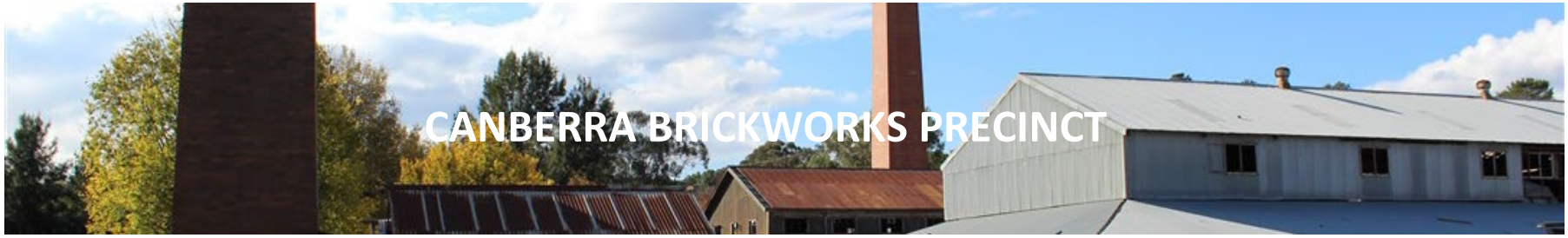
Policies	Actions	Implementation	
		Priority	Timing
19. Refer to the Design in Context guidelines when planning infill development	19.1 Refer to the *Design in context: guidelines for infill development in the historic environment* (the Heritage Office and the Royal Australian Institute of Architects NSW Chapter, 2005).	High	As required
	19.2 Infill, new structures or buildings shall be consistent with the Heritage Register citations, to consider appropriate character, scale, form, siting, materials and detailing of new buildings and their complementary relationship to the intrinsic features of the site.	High	Ongoing
	19.3 Carefully plan for infill development on the site, to be complementary and appropriately set back from the heritage elements, with appropriate screening and building heights.	High	Ongoing
20. Retain the historic industrial character of the site when planning new development	20.1 Retain elements and significant fabric that contribute to, and demonstrate, the industrial character of the site	High	Ongoing
	20.2 Respect the industrial character of the site when designing new buildings, and adapting existing buildings	High	Ongoing
21. Conserve and retain the historic industrial character when redeveloping the landscape	21.1 Conserve and retain the historical industrial character when planning the landscape for the redevelopment of the site (multiple elements: Core and Supporting).	High	Ongoing
	21.2 Conserve and retain the identified rock outcrops in the quarry (Element 11 + 12) as significant geological features.	High	Ongoing
	21.3 Conserve and retain the Railway Remnants (Element 1A).	High	Ongoing
22. Respect views within, to and from, the site when planning new development	22.1 Allow and enhance visual connections between, and to, key elements of the intrinsic features of significance of the brickworks.	High	Ongoing
	22.2 Retain views to the 1950s chimney stack (Element 9) from within and into the site.	High	Ongoing
	23.1 Respect the legibility of the site as a complex of built and landscape elements and its inherent spatial qualities.	High	Ongoing



Policies	Actions	Implementation	
		Priority	Timing
23. Respect the spatial qualities of the Precinct and the relationship between elements	23.2 Respect the existing layout and relationship between the elements, including the underground links between the kilns, fan houses and chimney stacks.	High	Ongoing
	23.3 Explore opportunities to introduce connections between new development and existing elements at multiple levels.	High	Ongoing
	23.4 Avoid development within the historic core area of the Brickworks that is inconsistent with the industrial character.	High	Ongoing
	23.5 Small scale new development within this area to support new site uses would be acceptable, provided it follows best practice 'infill design guidelines' for heritage places.	High	As required
	23.6 Respect the massing, scale, form, and orthogonal layout of the existing heritage elements when planning new buildings in the vicinity of the Brickworks.	High	Ongoing
24. Respect the heritage significance of individual elements and their context within the site	24.1 Respect the heritage significance of the core and supporting elements and their context in the site when planning adaptation.	High	Ongoing
	24.2 Refer to the detailed guidance at Appendix A when planning adaptation of individual elements.	High	Ongoing
25. Plan for appropriate change to avoid a loss of integrity	25.1 Avoid undertaking incremental changes which result in a loss of original fabric and intrinsic features of the site.	High	Ongoing
	25.2 Ensure any proposed changes to the individual elements form part of an overall cohesive approach to the conservation and redevelopment of the site.	High	Ongoing
26. Undertake restoration and reconstruction of elements in accordance with best practice in heritage conservation	26.1 Assess proposed restoration and reconstruction of elements works for individual elements in this CMP (refer Appendix A) and as part of a broader approach to adaptation at the site.	High	Ongoing and as required
	26.2 Avoid relocating existing elements and adding new fill development which would result in a loss of context and ability to interpret the heritage significance and historic function of the site.	High	Ongoing



Policies	Actions	Implementation	
		Priority	Timing
27. Avoid demolition of core and supporting elements which contribute to the heritage significance of the site.	27.1 Explore alternatives, including adaptive reuse, prior to planning to demolish core or supporting elements.	High	As required
	27.2 Assess proposals for demolition of core or supporting elements for potential heritage impacts (refer to Policy 33).	High	As required
	27.3 Undertake a SHE under Section 61H of the Heritage Act, should proposed demolition of demolition of core or supporting elements be required.	High	As required
	27.4 Undertake an archival recording prior to demolition in accordance with the NSW Heritage Office Guidelines for Archival Recording (refer to Policy 29).	High	As required
28. Assess for impacts from development on areas of archaeological potential	28.1 Refer to the historic archaeological analysis for the site at Section 3.4 of this CMP to understand areas of archaeological potential.	High	Immediately and ongoing
	28.2 Assess potential development impacts based on the historic archaeological analysis provided at Section 3.4 of this CMP.	High	As required
	28.3 Seek an Excavation Permit under Section 61F of the Heritage Act if undertaking an archaeological excavation at the site.	High	As required
	28.4 When undertaking excavation work on the site, follow the Unanticipated Finds Protocol included in Appendix E.	High	As required
29. Keep adequate and accurate records	29.1 Keep and maintain records of conservation and maintenance works, particularly in relation to changes made to features intrinsic to the place.	Medium	As required
	29.2 Undertake archival recording of the site prior to commencement of any major works/new development, in accordance with the NSW Heritage Office Guidelines (or equivalent)	High	As required
	29.3 Submit archival records/reports to ACT Heritage Council for their records and provide a copy to the ACT Heritage Library.	Medium	As required
	29.4 Collect and conserve documents relating to the design, construction and history of the Brickworks for potential interpretative use (refer to Policy 36).	Medium	Within 24-36 months.



Policies	Actions	Implementation	
		Priority	Timing
30. Ensure proposed redevelopment is compliant with the CMP, Heritage Act and Burra Charter	30.1 Ensure proposed redevelopment of the site is compliant with provisions of the Heritage Act including requirements set out in the two ACT Heritage Register citations, the policies and guidance outlined in this CMP and the Burra Charter principles.	High	Ongoing
	30.2 Assess all proposals for redevelopment of the site for potential heritage impacts (refer to Policy 33), by undertaking a SHE, to be submitted under Section 61H of the Heritage Act and approved by the ACT Heritage Council.	High	As required
Legislative and Management Framework (Refer to Section 5.7)			
31. Manage the site in accordance with the *ACT Heritage Act 2004* (the Heritage Act)	31.1 Manage and implement actions at the site in accordance with the relevant legislation, regulations and codes, including the *Heritage Act*.	High	As required
32. Manage the site in accordance with the Territory Plan	32.1 Explore options to amend the Territory Plan to allow for consideration of a range of alternative compatible uses at the site.	Low	As required
33. Follow the works approval process for proposed works at the site.	33.1 Seek necessary approvals for all proposed works from the ACT Heritage Council for new development at the site.	High	As required
	33.2 Assess all actions, including conservation works, for potential impacts on the heritage significance of the site.	High	As required
	33.3 Prepare a Statement of Heritage Effects (SHE) in accordance with the any proposal or action with potential to adversely impact the heritage significance of the site. SHE applications are made to the Council in accordance with Heritage Act provisions.	High	As required
	33.4 Obtain professional advice to prepare a SHE, to assess potential heritage impacts, proposed actions, and provide guidance on avoiding impacts and/or recommend alternatives.	High	As required



Policies	Actions	Implementation	
		Priority	Timing
34. Undertake consultation with the Canberra community regarding the future of the site.	34.1 Keep the community informed of progress of any future development.	Medium	As required
35. Comply with the relevant legislative requirements for construction, access and safety.	35.1 Ensure any redevelopment or conservation works undertaken at the site is compliant with the relevant legislative requirements for the National Construction Code, the DDA and the WHS Act.	High	As required
	35.2 Consider the heritage significance and original fabric of the individual heritage elements when planning upgrades to meet legislative requirements (ie NCC and DDA compliance).	High	As required
	35.3 Seek advice from heritage professionals when planning redevelopment.	High	As required
Opportunities for Interpretation (Refer to Section 5.8)			
36. Develop an Interpretation Strategy	36.1 Prepare an Interpretation Strategy as a high priority, for the redevelopment of the site as a means of integrating, showcasing and celebrating the heritage significance of the Brickworks	Medium	Immediately
	36.2 Identify key themes and messages, potential audiences, and options for interpretive media in the Interpretation Strategy to guide future development of interpretive content.	Medium	As required
	36.3 Ensure interpretation is considered as part of a whole-of-site approach to revitalising the Brickworks, including conservation and new development.	High	As required
	36.4 Explore opportunities to integrate interpretation initiatives early in any future development proposal.	High	As required

Canberra Brickworks Precinct

Conservation Management Plan

Volume Two—Appendices

Report prepared for Doma Group

August 2021



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Report Register

The following report register documents the development and issue of the report entitled Canberra Brickworks—Conservation Management Plan, undertaken by GML Heritage Pty Ltd in accordance with its quality management system.

Job No.	Issue No.	Notes/Description	Issue Date
17-0170	1	Draft Report	18 July 2017
17-0170	2	Second Draft Report	31 August 2017
19-0443	3	Final Draft Report	11 December 2019
19-0443	4	Final Draft Report—issued to ACT Heritage	19 February 2020
19-0443	5	Final Draft Report—Volume 1 and 2 (addressing ACT Heritage October 2020 comments)—for client review	23 December 2020
19-0443	6	Final Draft Report—Volume 1 and 2 (addressing ACT Heritage, October 2020 comments)	13 January 2021
19-0443	7	Final Report—ACT Heritage Council Approval	12 August 2021

Quality Assurance

GML Heritage Pty Ltd operates under a quality management system which has been certified as complying with the Australian/New Zealand Standard for quality management systems AS/NZS ISO 9001:2008.

The report has been reviewed and approved for issue in accordance with the GML quality assurance policy and procedures.

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Cover Image: Canberra Brickworks, December 2020. (Source: GML Heritage)

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Appendix A—Inventory of Individual Historic Elements

Purpose of the Inventory

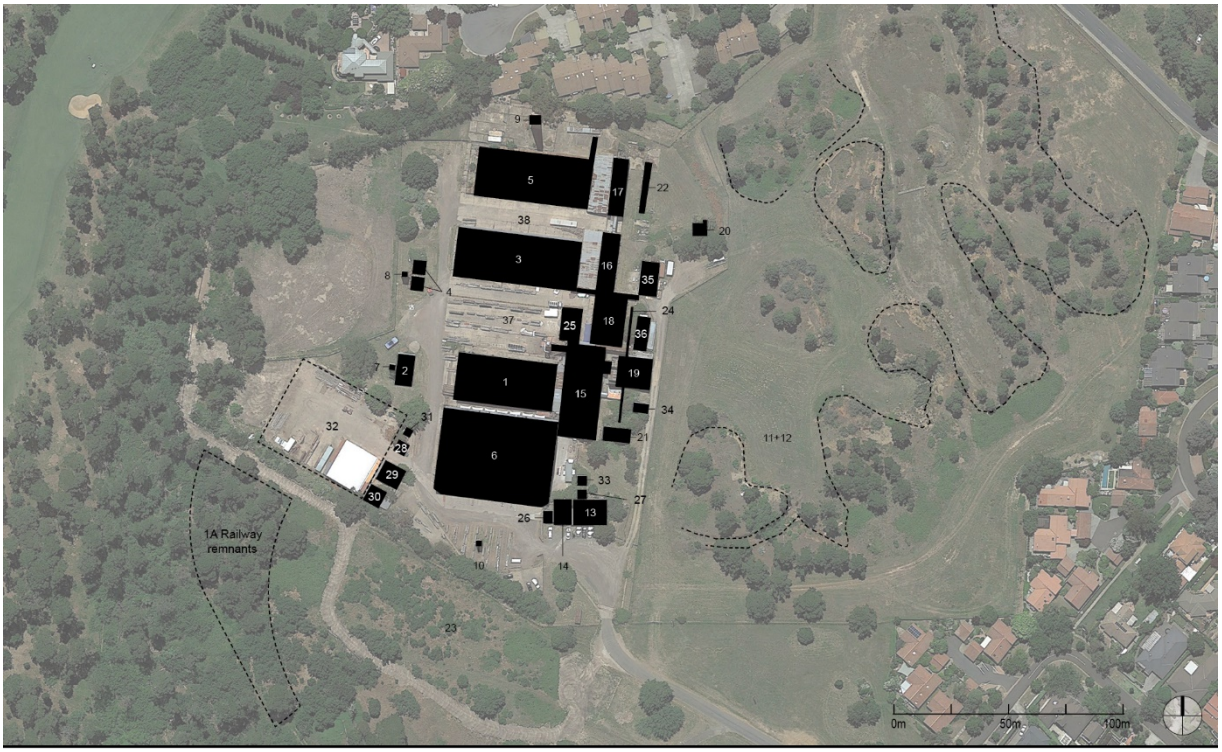
This appendix provides an inventory of the individual historic elements on the site, numbered according to Figure 1. Each inventory 'sheet' includes a history, physical description, heritage significance, and conservation policies relevant to the historic elements at the Canberra Brickworks Precinct.

The histories and descriptions have been drawn predominantly from the 2010 CMP and reviewed and updated where necessary. Information on the physical and structural condition is drawn from the 2013 Northrop structural audit report and updated by Sellick Consultants Pty Ltd in 2019 and 2021, and attached in full at Appendix G– Sellick Consultants Inspection Report/Condition Assessment Report, 2021.

The policies should be read with an understanding of the overarching conservation policies in Section 5.0 of the CMP to ensure consistency across the site. Conservation works would need to be undertaken as part of any future development proposal for the site and should take into consideration the heritage significance of the elements. Should works be required to historic elements that are intrinsic features of the Brickworks site, a Statement of Heritage Effects (SHE) must be prepared in accordance with the Heritage Act, and Council approval obtained for works.

The 2021 Inspection Report on the structural condition, prepared by Sellick Consultants applies a ranking of remediation (also referred to as reinstatement or rectification) works. The remediation ranking is as follows:

- **immediate rectification** works for Element 1 Staffordshire Kiln (Core) and Elements 16 and 17– Machine Bays (Supporting);
- **reinstatement required** for safe public access as part of the construction works; and
- of **no structural concern** and therefore no immediate works required.



Legend:

1	Staffordshire Kiln (1915)	9	Chimney Stack for Hardy Patent Kiln 2 (1953)	17	Machine Bay 3 for Hardy Patent Kiln 2 (1955)	24	Concrete retaining wall	33	Ancillary Storage Building 2
2	Fan House for Staffordshire Kiln (1915)	10	Chimney Stack for Downdraught Kilns (1963)	18	Workshop (1955)	25	Amenities Block	34	Storage Shed
3	Hardy Patent Kiln 1 (1927)	11	Quarry	19	White Pan Room (Large Crusher House/Crusher House II) (1955)	26	Downdraught Kilns Control Room	35	Model Railway Workshop
4	Fan house for Hardy Patent Kiln 1 (1953)	12	Geological features	20	Primary Crusher House (Crusher House III) (1955)	27	Toilet Block	36	Model Railway Storage Shed
5	Hardy Patent Kiln 2 (1953)	13	Offices (1916)	21	Small Crusher House (Crusher House I)	28	Ancillary Storage Building	37	Original Brickyard
6	Downdraught Kilns (1963)	14	Power House (1915)	22	Elevator/Conveyor	29	Substation/Control Room	38	Brickyard 2
7	Chimney Stack for Staffordshire Kiln (1915)	15	Machine Bay 1 for Staffordshire Kiln and Downdraught Kilns (1955)	23	Remains of the Brickworks Accommodation Village	30	Boiler House	1A	Railway remnants registration area
8	Chimney stack for Hardy Patent Kiln 1 (1927)	16	Machine Bay 2 for Hardy Patent Kiln 1 (1955)			31	Amenities Block 2	Refer also to figure 3.38 Areas of Archaeological Potential	
						32	Extrusion Plant (Remnants)		

Figure 1 The Site: Numbering and Location of Historic Elements of the Canberra Brickworks Precinct and Railway Remnants.

Canberra Brickworks: Inventory of Individual Historic Elements

Element 1—Staffordshire Kiln

Name of Element	Staffordshire Kiln	**CMP No. | ACT No.**	Element 1
Historical Phase	Establishment 1911–1920	**Date**	c1916
Construction	Brick with corrugated steel roof		





Historical Background

The Staffordshire Kiln was the first permanent kiln structure to be constructed at the Brickworks and the only example of its type to survive in Australia today.

Plans for the kiln were purchased in early 1914 from Robert E Odd, the Australian holder of the patent for the 'Staffordshire' and 'Manchester' continuous brick kilns. The Staffordshire kiln, a variation on the Hoffman model, had been patented by Dean and Hetherington of Accrington, Lancashire, England, in 1904. The continuous tunnel of the Hoffman kiln was replaced by a series of separate side-by-side chambers. This allowed a single chamber to give special treatment to its contents such as terracotta tiles or pipes, which could therefore be produced alongside brick firing. Previously, separate kilns were required.

Construction of the kiln began in November 1914 and was operational by early 1916. However, the Brickworks closed within a year due to a reduced works program in Canberra during World War I, and the 1916 coal strike.

The internal fire bricks were imported from England, with some apparently numbered to show construction sequence. Truss work in the loft was also imported with steel beams stamped 'Frodingham England' (Appleby-Frodingham Steel Co.). A single level verandah supported on timber posts enclosed the north and south elevations. By the mid-1920s, this had been removed and a more robust structure enclosed the north, south and west walls at first floor level with a timber enclosed verandah structure, thought to have been open to the firing floor internally (ie the brick walls having been demolished There is some evidence that this expanded upper level to the Staffordshire Kiln may have been used for drying tiles, presumably those produced in the tile-making plant added to the site in this period. A 1925 plan showing proposed alterations at the site indicates two 'tile lifts' adjacent to the Staffordshire Kiln. The first floor level to the verandah was demolished in the AR Marr period and the brick walls at first floor level were rebuilt in their original position at this time, but without the openings as in the original.

Significant rebuilding works took place in the mid-1950s when the Hardy Patent Kiln 1 was upgraded and extended, and the Hardy Patent Kiln 2 was constructed. At this time, the kiln chamber entrances were enlarged to permit forklift access.

Description and Condition

The Staffordshire Kiln is a 20-chamber two storey structure with a brick base, brick upper walls and a galvanised steel roof. There is a firing floor above enclosed by non-original brick side walls and original brick end walls, with a gable roof form clad in corrugated steel. The gable to the west end is infilled with corrugated steel and timber louvres, which are thought to be the original treatment. A 1917 photograph shows that the same scheme was in place at the east end, now obscured by the skillion roof structure that later enclosed the yard area between the machine bays and the kiln (see Figure 4). The first floor has been partially updated with an external brick veneer. The individual kiln numbers, originally painted above the centre of each of the arched entrances, are today incised in a rendered 'pad' to the right side of each of the openings. To the south elevation, one of the kilns at the eastern end has been infilled with brickwork and a single door opening installed, enabling the space to be secured for storage. The first-floor level of the verandah has been demolished and the supporting verandah is only extant in areas to the east, and is in an advanced state of deterioration. The timber floor is badly weathered in the interior upper floor, and the timber connections are not adequate in some locations. The timber roof framing has also weathered in some areas.

Internally, there are a number of 'trace-holes' which could be closed by dampers and were raised and lowered from the firing floor above. Within the kiln arches the feedholes and hot air off-takes are still apparent. Some kilns have been paved internally with cement tiles, a modification which occurred after the closure of the plant. The majority of the entry archways have loose bricks and voids in the brickwork bedding, resulting in displacement of some arches. The entry arches have displaced laterally in areas, which

Canberra Brickworks: Inventory of Individual Historic Elements

is likely due to swelling of the bricks. The internal areas of the kilns are generally in sound structural condition, with some loose bricks.

The upper floor and verandah of the Staffordshire Kiln has also been modified a number of times including the enclosing of the verandah with corrugated iron, bringing the line of the upper floor out to the edge of the original verandah. This modification was later reversed by A R Marr Pty Ltd when new brick walls were constructed on the line of the original building wall, with the intention of refitting the space as a commercial facility. The roofing was also replaced at this time. The glazed louvre vents are also broken and not weatherproof.

The inspection report for the building identified that the brick veneer is in reasonable condition for its age, however there is some cracking and loose brickwork throughout the arches of the kilns, and the entries to some have deteriorated. The wall sheeting has severe deterioration in places and the timber lean-to is significantly weathered. The sheet fixings are noted to be loose in some areas. The steel trussed roof is in a reasonable condition and roof sheeting appears to have been replaced more recently. The steel brace at the south elevation has buckled. There are 'chimney' holes from the kilns below throughout the floor.

Significance	Core Element

The Staffordshire Kiln, and its associated structures and underground infrastructure, is an element of core significance. It was the first permanent kiln structure on the site and is a key surviving element from the earliest phase of development. This choice of relatively elaborate kiln type with capacity to fire multiple types of products simultaneously reflected the requirements of the Brickworks as the sole provider to the new national capital. While extensively modified and rebuilt in some areas, this kiln is the only example of a Staffordshire kiln remaining in Australia.

The Fan House and Chimney Stack were both integral to the operation of the Staffordshire Kiln. While only remnants of dismantled equipment remain in the Fan House, the arrangement of the interior demonstrates the function of the building and its relationship to the kiln and the associated chimney.

Structural Advice as at 2021	Immediate rectification works required, with access to some floor areas to be restricted—refer to Appendix G for detail.

Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved

- The Staffordshire Kiln must be retained and conserved.
- The brickwork veneer should be restored and ensured that it is weatherproof.
- External fabric of the building should generally be retained, noting that non-original brickwork on the upper level could be removed/replaced.
- Locally displaced bricks should be reinstated.
- An area of the firing floor of either this kiln or one of the Hardy patent kilns should be retained intact as a single volume, allowing the nature and operations of the firing floors to be clearly understood.
- Minor changes to the exterior, such as new openings, would be acceptable.
- A limited number of roof lights would be acceptable to improve light and amenity to the upper floor.
- Installing solar panels on the roof and exploring other ESD opportunities would be acceptable.
- The remnant verandah could be removed and replaced. Any new structure (ie verandah and/or upper level walkway) should reference the industrial character.
- The current form of the entries to the kiln chambers should be retained. Chambers could be enclosed with recessed doors if needed.
- Retain kiln chambers as open space where possible in an adaptive reuse project, to provide a representative example of a kiln space for the interpretation of the historical use, rather than subdividing all of them.
- The building could be adapted internally for new use or uses, including subdivision and new fitout, provided an area of firing floor is retained for this kiln or one of the Hardy patent kilns. The kiln chambers could be linked (ie north-south or east-west connections) to extend the space, if necessary to support a new use.
- Within the interior upper level, the existing dirt floor can be excavated and replaced with a new floor, covering up the firing holes and ensuring the floor is free of trip hazards. This will lower the floor level and permit a sufficient truss clearance to allow an adaptive reuse of the space.
- Window fenestration to the upper floor should mimic the rhythm of historic openings but allow for appropriate daylight and ventilation access for an adaptive reuse.
- Restore all or part of a chamber, including the vents to show the original kiln operation, and the corresponding upper floor space sufficient so that the method of firing and controlling the kilns can be seen in future adaptative reuse.
- Bracing of the upper level should be further assessed by a structural engineer.
- Steel roof structure needs to be further assessed by a structural engineer and fixed where required.

Canberra Brickworks: Inventory of Individual Historic Elements

- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.



Figure 1 The Staffordshire Kiln, Fan House and Chimney Stack, photographed in 1917 by Harry Connell. Note that in this view the kiln verandah does not extend to the west elevation. (Source: National Library of Australia)



Figure 2 West elevation of the Staffordshire Kiln in 2010 showing the remains of the verandah. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 3 West elevation of the Staffordshire Kiln. (Source: GML, October 2016)

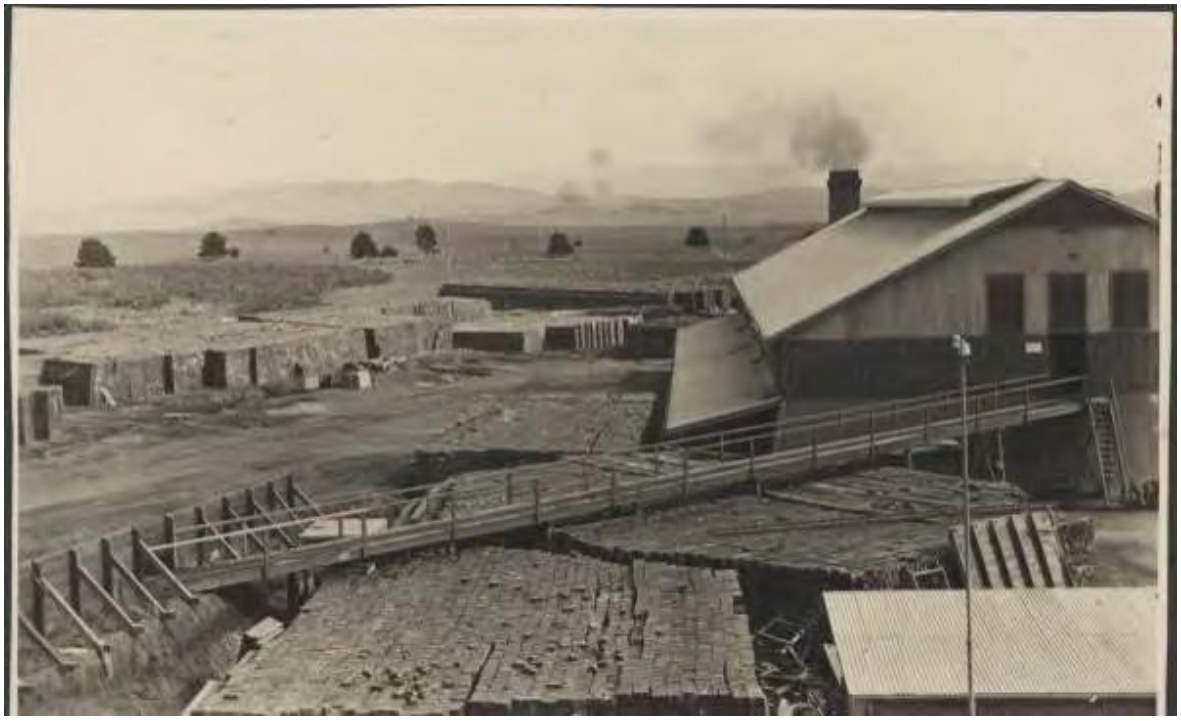


Figure 4 East elevation photographed by Harry Connell in 1917. (Source: National Library of Australia)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 5 North elevation photographed prior to the rebuilding of the verandah to support a first-floor enclosed verandah structure. (Source: National Archives of Australia)



Figure 6 View of the west elevation from the 1920s showing the later two-level verandah structure. (Source: National Archives of Australia)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 7 North elevation showing modified kiln entrances. (Source: GML, 2017)



Figure 8 Interior of kiln at north elevation. (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements

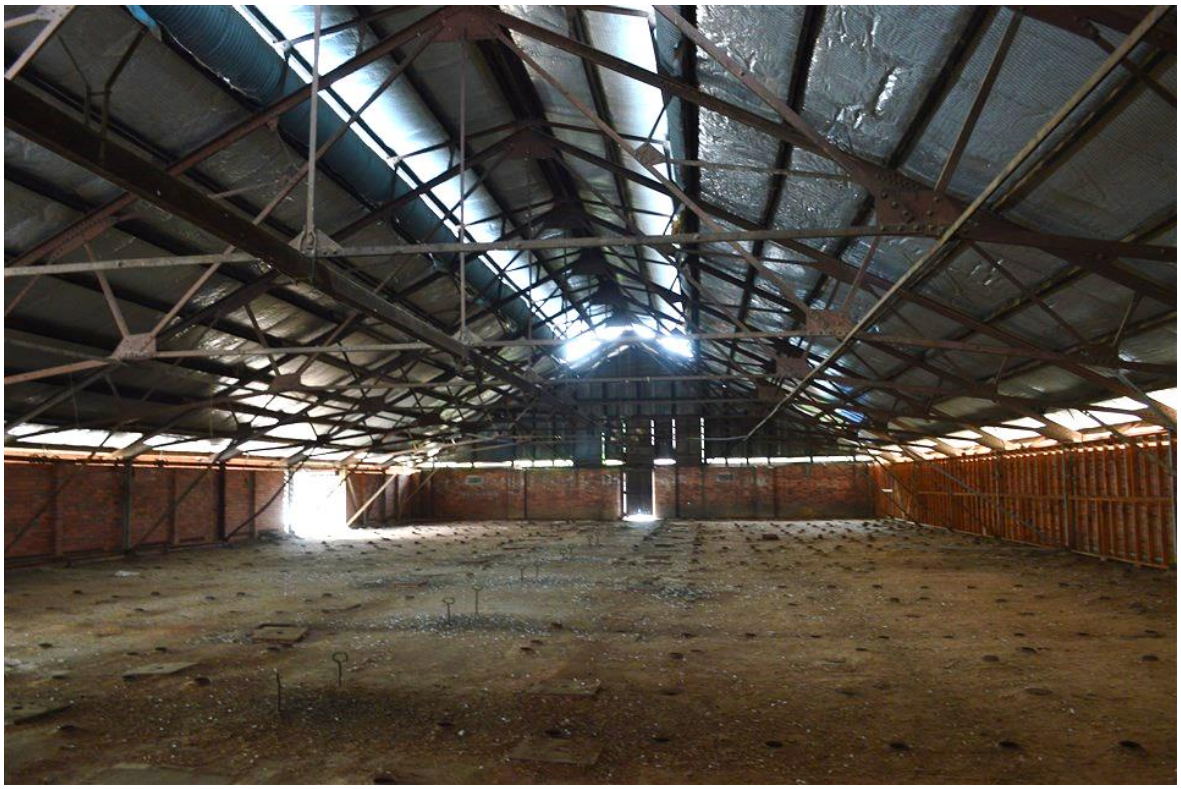


Figure 9 Interior of upper level. (Source: GML, 2016)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 1A—Railway Remnants

Name of Element	Railway Remnants	**CMP No. | ACT No.**	Element 1A | Yarralumla Brickworks Railway Remnants
Historical Phase	Establishment and Expansion 1911– c1940	**Date**	1923





Historical Background

In 1923, a 3-feet 6-inch (1067 mm) gauge steam-hauled railway was constructed to transport bricks from the Brickworks to construction sites around the fledgling Federal Capital such as Provisional Parliament House (1927), Hotel Canberra (now the Hyatt, 1927) and other public buildings and offices including Telopea Park School (1923), East Block (1927), Albert Hall (1928) and Hotel Kurrajong (1926). The southern terminus was at the Power House, where the line connected with a small engine shed.

Rail proved a more effective means of transport as the bricks were originally moved by steam traction engines that hauled heavy iron-wheeled trailers on mostly unmade roads. This proved unsatisfactory and time consuming as the traction engines only achieved two round trips a day between the Brickworks and the Parliament House.

After the failure of the standard gauge railway to Civic Centre following collapse of the causeway bridge in the floods of 1922, the Brickworks railway was extended to Civic, crossing the Molonglo River on a small timber bridge near the Scott's Crossing Road. It is understood that in the city area the abandoned standard gauge track was used by moving one rail a distance of 14.5 inches across on the existing sleepers to form the narrower gauge. It is believed the Brickworks tramway terminated about 40 feet beyond the Civic Centre platform.

In the clean-up and extensive landscaping works prior to the opening of Parliament House on 9 May 1927, and possibly also because it had by that stage become more economical to transport the bricks by motor lorry, the railway was removed.

Description and Condition

Remnants of the three lines of the former Brickworks railway are evident closest to the southwest corner of the Brickworks site, converging to form a single embankment. Close to the Brickworks, two of the former lines are evident as earth terraces, which go through a short cutting to become distinctive earth mounds. The third line runs approximately parallel to the western boundary of the Brickworks and is evident as an earth terrace. Along some sections of the embankment there are mature pine trees within close proximity, with other trees and shrubs growing alongside and over the former rail line. The setting of the Remnants within the pines creates an attractive vista.

The following provides a description of the railway from 1967:

> *The track at the Brickworks was set out in three parallel lines, one on either side of the Staffordshire kilns and the remaining one ran to the coal dump. Immediately after leaving the proximity of the kilns, these tracks swung around rather sharply to the left, the points that gave access to the sidings being at an angle of 53 degrees to the straight part along the kilns…After converging to a single track, the line ran straight for about 200 yards, then, after crossing Uriarra Road swung again to the left in a curve on an embankment and straightened out with a slight down grade for ¾ mile where a reserve curve brought it alongside Adelaide Avenue. It continued beside this road to the State Circle where it followed the left contour of the Circle for about one third of its circumference until it met Commonwealth Avenue which it crossed at an angle…*[1]

Canberra Brickworks: Inventory of Individual Historic Elements

Significance	Core Element and individually listed on the ACT Heritage Register

The Remnants of the former Yarralumla Brickworks Railway is significant for its association with the early construction of the Federal Capital from 1923 until 1927. This was a critical period in the development of Canberra and included major construction works in the lead-up to Parliament relocating to Canberra. The railway transported bricks for many prominent, as well as ordinary, buildings from this period. Major examples include the Provisional Parliament House, Hotel Canberra, East Block and the Hotel Kurrajong.

The Remnants highlight one of the many challenges of building a city within a short timeframe, in a relatively undeveloped area and with constraints on transport and technology.

The Brickworks railway, of which the Remnants is a remaining portion, transported up to six million bricks per annum. The Remnants provide tangible evidence that can assist in understanding the circumstances surrounding aspects of Canberra's construction.

The Remnants are also considered to have moderate archaeological potential for their ability to enhance our understanding of the railway and its operation.

Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved

- The Railway Remnants must be retained as a landscape element that through the form of the embankments and earth terraces reflects its origins.
- Any adaptation of this element should ensure its legibility as a former railway is retained.
- Potential impacts to the archaeological elements of this feature from development should be assessed against the sensitivity zoning outlined in the historic archaeological analysis and heritage significance assessments in this CMP.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

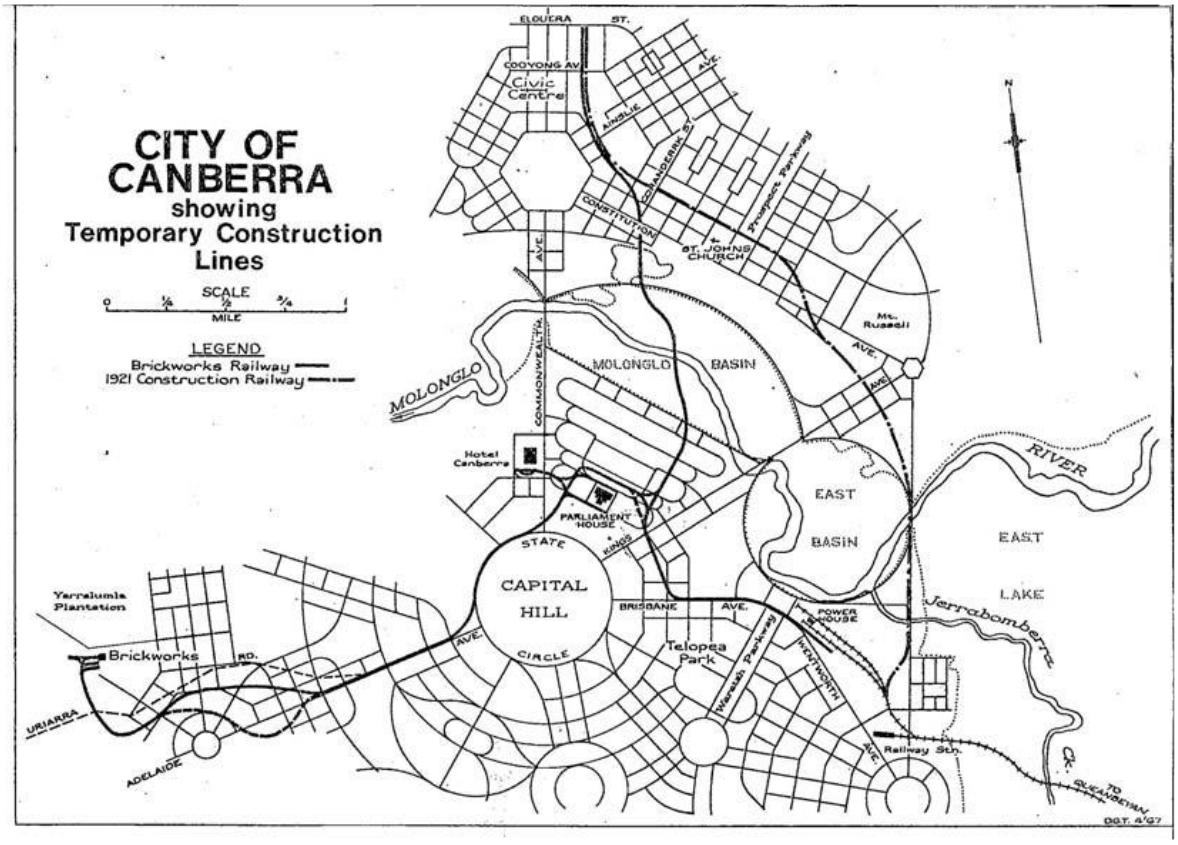


Figure 1 Map of Canberra showing the line of the Brickworks Railway. (Source: Australian Railway Historical Society Bulletin No. 355, May 1967)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 2 View toward the Canberra Brickworks, showing the Railway Remnant terracing and embankments. (Source: GML, 2017)

Endnotes

1 Australian Railway Historical Society Bulletin No. 355, May 1967.

Canberra Brickworks: Inventory of Individual Historic Elements

Element 2—Fan House for Staffordshire Kiln

Name of Element	Fan House for Staffordshire Kiln	**CMP No. | ACT No.**	Element 2
Historical Phase	Establishment 1911–1920	**Date**	c1916
Construction	Brick with corrugated steel roof		





Historical Background

An unusual feature of the design of the Staffordshire Kiln was the use of fans to help dissipate heat and burnt fuel. The use of fans compensated for the greater draw or suction a taller chimney would have provided, and allowed for the use of a lower brickstack. Accommodated in a separate building (the Fan House), fans are used to draw the heat through the kiln tunnel to be dispersed through a short brick stack, rather than a high chimney. It is possible that this aspect of the design of Brickworks Staffordshire Kiln was pursued to avoid the visual impact of a higher stack in the Canberra area.

The fan house is located approximately 20 metres west of the Staffordshire Kiln. It was constructed in conjunction with the kiln in c1915–16 and housed the machinery to induce the drafts required to disperse heat and burnt fuel through the stack.

The small brick kiln behind the Fan House is not shown in a 1917 photograph of the Brickworks but is clearly visible in a photograph taken in c1926. This indicates that it is an early site element (Figure 2).

Description and Condition

The Fan House is a single storey building with concrete basement level constructed of face red brick laid in English bond with a Dutch gabled timber frame roof clad in replaced corrugated steel. There is a central double door opening in the east (front) elevation, flanked by tripartite timber-framed casement windows with awning toplights, set on sloping sills of bullnose bricks. Additional windows are centrally placed in the north and south end walls. The west wall has windows placed directly opposite the windows that flank the entrance. Internally the ceiling is lined in beaded, painted timber boards. Within the building there is a diamond-shaped concrete apron to the entry with metal ladder-form stairs to a lower floor level to either side of the apron. There is a metal guardrail around the apron. The apron sits over the entry to the kiln draught tunnel and the tunnel to the stack. One of two fan motors remain within the basement area and the concrete engine mounts are also intact. The fan housings are partly intact with the dampers in situ and one of the tangential fans hanging on the rear wall. The ductwork which carries the exhaust to the stack is carried below ground. The bulk of the plant equipment appears to have been removed. Remnants remain of the tangential fans, as well as partially dismantled motor housing, and components of one of the electric motors remain. The dampers to the kiln tunnel are also extant. The tunnel connections with both the kiln itself and the associated chimney stack need to be further investigated.

The inspection report for the building identified that the ceiling boards are in poor condition and partially collapsed and the concrete basement is filled with debris. The front doors have been removed, the windows are broken and the glass panes are missing. The internal brickwork is graffitied and heavily stained by soot. The handrails do not fully extend around the ground floor platform, with one handrail loose. There is moderate cracking of the brick lintels above the windows. The remaining fan motor is in a dilapidated state. Sinkholes have been observed around the building due to settlement of basement backfill. The brick ‘oven’ structure next to the chimney stack is severely cracked. Little to no mortar remains in the joints, leaving bricks loose and unstable. The rainwater goods, soffits and fascias to the roof have all been removed. The condition of the roof, joinery and interior is poor. Brickwalls are in reasonable condition, with some cracking to lintels.

There is significant water ingress into the basement of the building, and presumably the tunnel connections, which needs to be further investigated.

Canberra Brickworks: Inventory of Individual Historic Elements

Significance	Core Element

The Staffordshire Kiln, its associated structures and underground infrastructure, is an element of core significance. It was the first permanent kiln structure on the site and is a key surviving element from the earliest phase of development. This choice of relatively elaborate kiln type with capacity to fire multiple types of products simultaneously reflected the requirements of the Brickworks as the sole provider to the new national capital. While extensively modified and rebuilt in some areas, this kiln is the only example of a Staffordshire kiln remaining in Australia.

The Fan House and Chimney Stack were both integral to the operation of the Staffordshire Kiln. While only remnants of dismantled equipment remain in the Fan House, the arrangement of the interior demonstrates the function of the building and its relationship to the kiln and the associated chimney.

Structural Advice as at 2021	Reinstatement required for safe public access during construction works. No structural concerns—refer to Appendix G for detail.

Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved

- The Fan House must be retained and conserved including original building form, openings, fabric, internal concrete platforms. And, if possible the 'fan' infrastructure could be reused or interpreted as part of future adaptation.
- Externally, no new openings should be introduced.
- The internal adaptation of the building is possible and alternatives for its reuse should be explored.
- The internal configuration (including lowered floor level and the tunnel connections with the kiln and chimney stack) should be retained as evidence of the original function of the building. New removable flooring could be introduced to allow for accessible movement through the building.
- Any replacement required of fabric (ie deteriorated timber window joinery) should match or be complementary to existing materials.
- Water ingress to the basement needs to be further investigated and addressed.
- Investigate the retention of the original 'fan' function and elements in an adaptive reuse scheme. Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.



Figure 1 East elevation of Fan House with Chimney Stack behind. (Source: GML, 2017)

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Figure 2 Southwest corner of Fan House next to small brick 'kiln'. (Source: GML, 2017)



Figure 3 Interior of the Fan House from entrance across ground level platform. Tangential fan mounted on rear wall. (Source: GML, 2017)

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Figure 4 Interior of the Fan House, showing poor condition ceiling boards. (Source: GML, 2017)

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Element 3—Hardy Patent Kiln 1

Name of Element	Hardy Patent Kiln 1	**CMP No. | ACT No.**	Element 3
Historical Phase	Expansion 1921–1942	**Date**	1926–27, substantially rebuilt c1955
Construction	Brick, upper floor and roof of corrugated galvanised steel		





Historical Background

The Hardy Patent Kiln 1 was built in 1926 and became operational in 1927. It was a critical component of the drive to double the output of the Brickworks in the build-up to the relocation of the Parliament to Canberra and the transfer of public servants. Other components of the expansion of the Brickworks during the mid-1920s were two 'temporary' Downdraught kilns, which were located close to the site of the present Downdraught Kilns, and a Scotch kiln (undated and demolished) located to the north of the Staffordshire Kiln. The Hardy patent kiln fired continually in a clockwise cycle and was able to produce up to 150,000 bricks per week, though in January 1927 the *Canberra Times* estimated annual output for the kiln as up to six million bricks. A firing cycle lasted 14 days.

In the mid-1950s the partially collapsed kiln was extensively rebuilt. It was also extended from 18 to 20 bays. Further works are understood to have been undertaken in the 1970s.

Description and Condition

Hardy Patent Kiln 1 is a two-storey structure of full brick masonry construction with a light-weight upper level clad in steel trussed corrugated galvanised steel. The ground floor comprises 20 arched brick openings or 'wickets', which provide access to the two kiln chambers oriented east–west. In the late 1960s each alternate wicket was widened to permit egress of forklifts. Other wickets have been infilled with brickwork. The outer walls of the kiln are battered at approximately 60 degrees. Wicket numbers are painted onto the brickwork next to each opening. A single-storey timber verandah roofed in corrugated galvanised steel extends around all sides of the building. The verandah is supported on timber props that extend at 45 degrees from the brickwork, as well as by a series of painted steel posts. To the east, the verandah abuts the skillion roofed section of the corrugated steel Machine Bay 2 to its east.

The first-floor area (the firing floor) is of steel-framed construction, clad and roofed in corrugated sheet steel. As built, the walls to the north and south were interrupted at regular intervals by openings infilled with timber louvres, providing ventilation to the space. There are a number of metal framed casement windows to the north and south walls. The position of these is unrelated to the original configuration of louvred openings and is thought to date from the rebuilding of much of the kiln structure in the 1950s. The floor retains a number of the firing holes and handles for opening and closing the flues. A portion of the floor area has been excavated and the form of the firing holes can be seen.

Originally, access to the west end of the firing floor was via a timber stair, which rose through the verandah (see Figure 1). However, the re-cladding of the end wall and the verandah form has removed evidence of this access point. The east end has been modified with a walkway at first floor level extending from the south elevation and connecting the firing floor with the adjoining machine bay behind (the latter dating to the mid-1950s). Access to the firing floor is through a single leaf ledged and braced timber door in the east wall. The interiors of the kilns have been part floored in cement pavers, and divided by a non-original brick wall. These works were undertaken as part of the AR Marr post-closure development proposal.

The existing roof, first floor cladding and verandah roofing are thought to date from the early 1970s, when fire damaged the structure.

The inspection report for the building identified that the timber lean-to awning around the north and south elevations is in a reasonable condition with some weather damage to the rafters. The wall sheeting to exterior of structure is also in reasonable condition. Brickwork is loose throughout the wickets and some entry archways have been displaced from loose bricks and voids,

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causing a displacement of the arch. The internal kiln area has loose bricks. Mass concrete has been used to augment some of the collapsed arches.

The east and west archways between kiln halls and the northeast entry have severe cracking and displacement. Both western entries are badly damaged and have suffered from structural movement. Ceiling battens line the underside of purlins on the first floor, several of which were loose. Windows throughout the first floor have been removed or damaged. The upper floor steel trusses are in reasonable condition. Within the interior upper floor, the chimney holes are a trip hazard. There are several battens loose where timber battens were installed to the underside of purlins that were potentially implemented to support ceiling lining. The roof sheeting appears to have been replaced more recently and is in reasonable condition.

The timber rafters of the awning—external ground floor—are in average condition, some of the rafters exhibit weather damage. There is corrosion in areas of the steel fascia beam. Post connections are loose and some connections between steel fascia and posts has failed.

Significance	Core Element

Hardy Patent Kiln 1, together with its Fan House and Chimney Stack, demonstrates the expansion of the Brickworks in the 1920s in response to the increased demand for building materials for the development of the national capital. The kiln was commissioned prior to the relocation of Parliament to Canberra in 1927. The kiln has been extensively modified and extended but still provides an important link to this phase in the history of the site.

Hardy Patent Kiln 1 is also of interest as an example of an Australian patent kiln design thought to date from the late nineteenth century, one of a large number of variations of the Hoffman kiln typology developed in this period.

The associated Fan House and Chimney Stack are integral to the operation of the kiln, including in its expanded form post-World War II.

Structural Advice as at 2021	Reinstatement required as part of the construction works—refer to Appendix G for detail.

Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved

- Hardy Patent Kiln 1 must be retained and conserved (original form and fabric), allowing for adaptive reuse options.
- External fabric of the building should generally be retained.
- Reconstruction or reinstatement of former internal industrial equipment and features is not required.
- Wall sheeting and roof sheets needs to be replaced (or at minimum secured). Ensure that the roof is waterproof.
- Nail fixings to be replaced using screw fixings.
- Where possible, retain and expose the roof trusses.
- Retain/interpret the evidence of the former function of the firing floors of this kiln or the Staffordshire Kiln.
- Interpretation of the sequence of alterations to the kiln is highly desirable.
- External modifications can include new openings on the first floor and in the roof.
- Two options are proposed for the loose bricks in different conditions. Where bricks are locally loose but exhibit no overall displacement, reinstate locally displaced bricks in order to match existing ones. Where areas of brickwork are loose with significant displacement, reinstate loose brickwork areas where feasible, but if this is not feasible, structural steelwork support (or other structural support) needs to be provided.
- Timber rafters should be replaced where required.
- Steel post connection to correct as needed.
- Recessed doors in the existing openings on the ground floor can be added if required, and brick infilled openings on the ground floor can be re-opened if required. Additional openings could be inserted on the ground floor at the western end of the kiln if necessary to improve solar access to support a new use, and could reference the openings at the western end of Hardy Patent Kiln 2.
- Installing solar panels on the roof and exploring other ESD opportunities would be acceptable.
- The verandah should be retained, if possible, or reinterpreted as part of an adaptive reuse. Any new structure (ie verandah and/or upper level walkway) should reference the industrial character.
- The building could be adapted internally for new use, including subdivision of the kiln chambers and first floor, provided an area of firing floor is retained for this, the other Hardy Patent Kiln or the Staffordshire Kiln. Carefully designed openings between the north and south kiln chambers could be introduced, if necessary, to support a new use.
- Replacement of floor with concrete slab is possible, to allow the space to be used and the original proportions of the space to be retained.
- Within the interior upper level, the existing dirt floor could be excavated and replaced with a new floor, covering up the firing holes and ensuring the floor is free of trip hazards. This will lower the floor level and permit a sufficient truss clearance to allow an adaptive reuse of the space.

- Window fenestration to the upper floor should mimic the rhythm of historic openings but allow for appropriate daylight and ventilation access for an adaptive reuse.
- Timber batterns could be removed if not required, however should ceiling lining be installed, the battens should be appropriately secured.
- A structural engineer should assess the steel roof structure and upgrade where required.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.



Figure 1 Hardy Patent Kiln 1 in foreground and the Staffordshire Kiln in 1928. (Source: National Archives of Australia)



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Figure 2 South elevation of Hardy Patent Kiln 1. Fan House and associated Chimney Stack in background. (Source: GML, 2017)



Figure 3 North and west elevation of Hardy Patent Kiln 1. (Source: GML, 2017)



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Figure 4 Interior of Hardy Patent Kiln 1. The kiln is divided in two by a non-original brick wall. (Source: Lovell Chen, 2010)



Figure 5 Southwest 'wicket' to Hardy Patent Kiln 1. (Source: GML, 2017)



Figure 6 First floor of Hardy Patent Kiln 1 with firing holes visible to the floor. (Source: GML, 2017)

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Element 4—Fan House for Hardy Patent Kiln 1

Name of Element	Fan House for Hardy Patent Kiln 1	**CMP No. | ACT No.**	Element 4
Historical Phase	Expansion 1921–1942	**Date**	c1926, 1955
Construction	Timber frame, corrugated steel cladding		





Historical Background

The first stage of the Hardy Patent Kiln 1 Fan House was constructed c1926 and was a considerably more modest structure than the Staffordshire Kiln Fan House. It is located approximately 20 metres west of Hardy Patent Kiln 1.

In 1955, plans were prepared to provide additional exhaust capacity and the Fan House was augmented by a near identical structure constructed to its immediate south. This structure was set approximately 30 centimetres above the floor level of the earlier building. The need for additional capacity may have related to the rebuilding and extension works to Hardy Patent Kiln 1, which was expanded from 18 to 20 chambers c1955.

Description and Condition

The Fan House comprises two timber-framed sheds with gabled roofs, clad in corrugated steel, and a concrete basement level. There is an entry to the east elevation and windows in the rear and outer walls.

Internally, the Fan House is similar to the Staffordshire Kiln Fan House. The floor is below ground level and there is an entry apron with metal handrails. Evidence remains of the now removed fan machinery, the location of which is discernible by the pedestal mount of the fan machinery. The ducts connecting the Fan House with the stack are in-situ, and unlike the Staffordshire Kiln Fan House, these are visible rising out of the rear walls and connecting to the east elevation of the stack at approximately two metres in height (Figure 4).

The inspection report for the building identified that of the two structures, the northern-most is in worse condition. Roof and wall cladding was highly weathered and missing in places, and that the concrete basement level is filled with debris. Doors have been removed, windows are broken and all the glazing is missing or broken. The handrails do not extend completely around the ground floor platform. Sinkholes were observed around the building due to settlement of basement backfill. There is vegetative overgrowth to the north side. The condition is poor.

Significance	Core Element

Hardy Patent Kiln 1, together with its Fan House and Chimney Stack, demonstrates the expansion of the Brickworks in the 1920s in response to the increased demand for building materials for the development of the national capital. The kiln was commissioned prior to the relocation of Parliament to Canberra in 1927. The kiln has been extensively modified and extended but still provides an important link to this phase in the history of the site.

Hardy Patent Kiln 1 is also of interest as an example of an Australian patent kiln design thought to date from the late nineteenth century, one of a large number of variations of the Hoffman kiln typology developed in this period.

The associated Fan House and Chimney Stack are integral to the operation of the kiln, including in its expanded form post-World War II.

Structural Advice as at 2021	Rectification works and further inspection required as part of the construction works—refer to Appendix G for detail.

Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved

- The Fan House must be retained and stabilised in situ.

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- The internal configuration (including lowered floor level and the tunnel connections with the kiln and chimney stack) should be retained, where possible, as evidence of the original function of the building.
- The remnant substantially dismantled plant could be retained for interpretive purposes or removed as required. If removed, it should be fully recorded.
- Externally, no new openings should be introduced.
- The building could be adapted internally.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

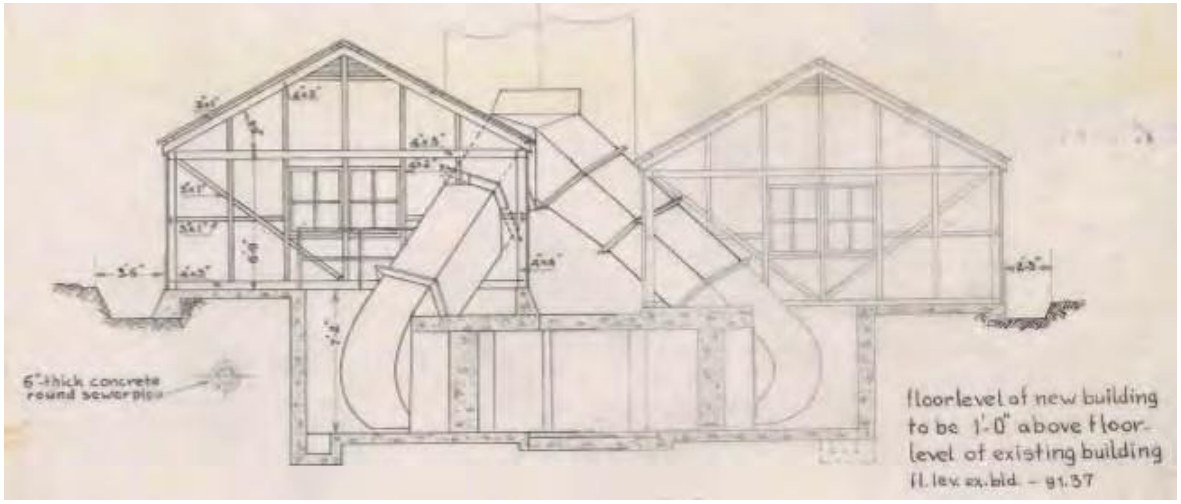


Figure 1 Section through the second stage of the Fan House for Hardy Patent Kiln 1 constructed in 1955. (Source: National Archives of Australia)

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Figure 2 View of the Hardy Patent Kiln 1 Fan House and Chimney Stack looking southwest. (Source: GML, 2017)



Figure 3 Interior of the c1955 structure showing the duct leading to the chimney stack. (Source: GML, 2017)

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Figure 4 Interior of the c1926 structure. (Source: GML, 2017)

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Figure 5 View from corner of Hardy Patent Kiln 1 looking west. (Source: GML, 2017)



Figure 6 Rear (west) elevation of the c1955 structure and base of chimney stack. Roof of Hardy Patent Kiln 1 in the background. (Source: GML, 2017

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Element 5—Hardy Patent Kiln 2

Name of Element	Hardy Patent Kiln 2	**CMP No. | ACT No.**	Element 5
Historical Phase	Postwar 1944–1976	**Date**	c1954
Construction	Brick, corrugated steel and corrugated fibro cement sheet		





Historical Background

After the decision to abort construction of the Tunnel kiln in 1952, plans were prepared and tenders called to authorise the construction of a new 20-chamber Hardy patent kiln with a 50-metre stack, kiln loft and awning to meet Canberra's post-World War II needs. The new Hardy Patent Kiln 2 was constructed on the foundations of the Tunnel kiln.

The decision not to adopt the fan-induced model of the Staffordshire Kiln and Hardy Patent Kiln 1, and instead build a taller chimney stack, did not result in the expected superior drawing power, and fans had to be installed to augment the draw shortly after completion. Plans indicate that the wicket openings were originally only a metre wide (see Figure 1). A number of these openings were widened for forklift use during the 1960s, including the west end kiln.

Description and Condition

Hardy Patent Kiln 2 is a two-storey structure with full masonry brick walls to the ground floor, which contains two large kiln halls. The first floor is open space with 'firing' holes to floor and light weight sheet walls. The roof is timber trussed with corrugated sheeting. The ground floor comprises 20 arched brick openings or 'wickets', which provide access to the two east–west kiln chambers.

Since construction, each alternate wicket has been modified to enlarge the openings for forklift access. The outer walls are battered at approximately 60 degrees and the wicket numbers are painted directly onto the brickwork surrounding each opening. A verandah roofed in corrugated steel extends around three sides of the building. The west side only has metal posts and support framing intact. The removal of the verandah cladding may have occurred prior to the part removal of the brick end wall, where the two kilns are revealed in cross-section (see Figure 2). To the east, the verandah abuts the skillion roof that bridges the space between the corrugated steel Machine Bay 3 to its east and is made of steel, extended at 45 degrees from the brickwork, supported on steel props, as well as by a series of painted steel posts. There are a number of metal-framed casement windows to the two long north and south walls and the west end wall. The removal of the verandah flashing to the north elevation and the verandah to the west elevation have exposed the wall studs.

The inspection report for the building identified that the wall sheeting is in poor condition, with sheets loose in areas. Weather damage to the rafters and roof sheeting has deteriorated. Some fascia beams have weathered and weathering is significant in certain areas. The brickwork throughout the kiln arches and masonry arch entries is loose. The brickwork bedding of most of the entry archways has loose bricks and voids, causing a displacement of the arch. The southwest corner entrance has moved substantially with differential movement between the brickwork. Fire damage is evident to the first floor and has particularly affected one of the large roof trusses. Although roof trusses are in reasonable condition, lateral bracing of the roof structure may require upgrading. A trip hazard is also created by chimney holes throughout the dirt floor. Doors and windows are in poor condition or have been removed or damaged and there are some holes throughout the roof and wall sheeting. The timber ladder on the northeast corner of the building is severely weathered. Post connections loose in areas and connections between timber fascia and posts has failed in certain areas. There is severe weathering in the timber framed flooring and is thus not suitable for use. Mass concrete has been used to augment some of the collapsed arches.

Significance	Core Element

Hardy Patent Kiln 2, together with its underground infrastructure and associated chimney stack, are key elements of a major expansion and upgrade of the Brickworks during the 1950s, along with the new crusher houses, grinding facilities, automatic conveyors, new brick presses and machine bays. The construction of this kiln greatly expanded the production capacity of the

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works. The kiln is relatively intact, including when compared with Hardy Patent Kiln 1, and is a good representative example of this typology of continuous kilns.

Structural Advice as at 2021	Reinstatement required as part of the construction works—refer to Appendix G for detail.
Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved.

- Hardy Patent Kiln 2 must be retained and conserved.
- An area of the firing floor of either the Staffordshire Kiln or one of the Hardy Patent Kilns should be retained intact as a single volume, allowing the nature and operations of the firing floors to be clearly understood.
- No significant changes should be made to the exterior of the ground floor, as an intact example (noting modifications to wickets to allow forklift access and alterations at the west end).
- Entries to the kiln chambers should generally be retained in their current modified form.
- Brick infilled openings on the ground floor can be re-opened if required.
- Installing solar panels on the roof and exploring other ESD opportunities would be acceptable.
- A walkway or upper level connection (similar to the existing walkways on the other kiln buildings) would be acceptable, to provide improved access and accessibility, and facilitate a new use.
- The building could be adapted internally for a new use, including subdivision of the kiln chambers and first floor, provided an area of firing floor is retained for this, the other Hardy Patent Kiln or the Staffordshire Kiln. Carefully designed openings between the north and south kiln chambers could be introduced, if necessary to support a new use.
- Within the interior upper level, the existing dirt floor can be excavated and replaced with a new floor, covering up the firing holes and ensuring the floor is free of trip hazards. This will also lower the floor level and permit a sufficient truss clearance to allow an adaptive reuse of the space.
- Window fenestration to the upper floor should mimic the rhythm of historic openings but allow for appropriate daylight and ventilation access for an adaptive reuse.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

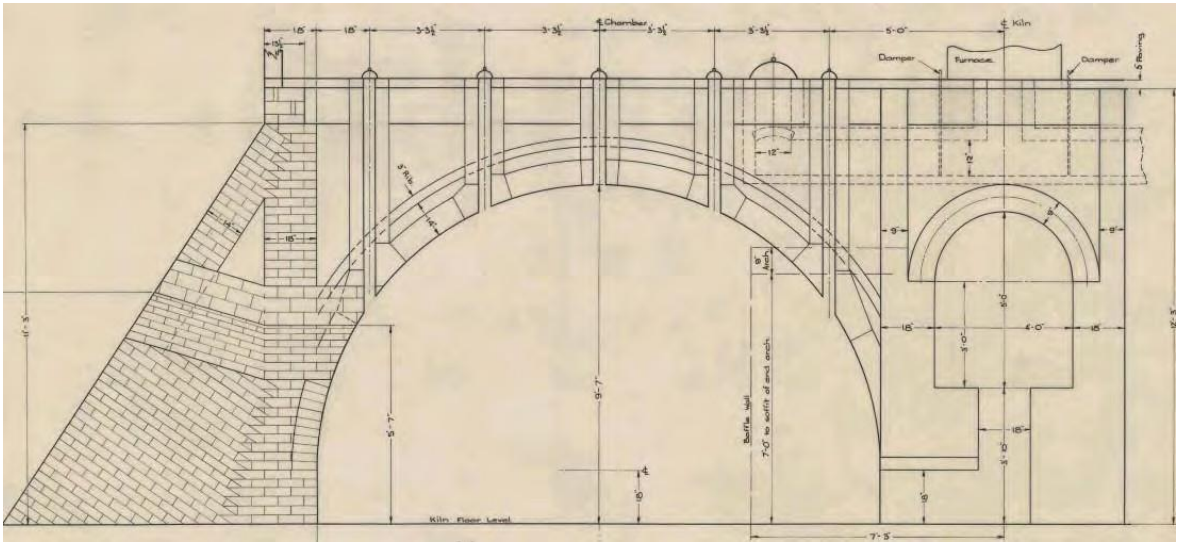


Figure 1 Section through wicket chamber and flue of the second Hardy Patent Kiln, 1953. (Source: National Archives of Australia)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 2 Front (west) elevation of Hardy Patent Kiln 2. Verandah framing evident. (Source: GML, 2017)



Figure 3 West and south elevation of Hardy Patent Kiln 2 from the gravel road. (Source: GML, 2017)

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Figure 4 Southeast kiln entrance. (Source: GML, 2017)



Figure 5 Kiln chamber looking east. (Source: GML, 2017)

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Figure 6 View of first floor from the rear (east) of the building. Firing' holes evident in the floor. (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 6—Downdraught Kilns

Name of Element	Downdraught Kilns (three kilns and roofed enclosure)	**CMP No. | ACT No.**	Element 6
Historical Phase	Postwar 1944–1976	**Date**	c1960–61
Construction	Brick (kilns) with corrugated steel roof enclosure (shed)		





Historical Background

In the 1960s, a series of three Downdraught kilns were built. Initially coal-fired, they were subsequently converted to oil-firing. The kilns were used almost exclusively for the production of face and special bricks.

The kilns were constructed close to the site of two 'temporary' Downdraught kilns with a brick stack (see Figure 2), which had been built in 1925 to cope with the increasing demands for the growth of the national capital after the end of World War I. The temporary kilns were demolished around c1958.

The three kilns have each been altered internally to serve as antique market stalls or storage areas in the period immediately following on from the closure and relocation of the brickworks in 1976. Works typically involved the paving of the interior floors with brick, the installation of electric wiring and lighting—generally in the form of spotlights which have reused the hot air off-takes, or suspended fluorescent fittings.

Description and Integrity

The three kilns are oriented north–south and are constructed of face brick laid in an English bond and fitted with large fire brick faced metal doors to either end. There are feedholes along both the east and west sides for the ingress of coal, and later oil, each of which is topped with a segmented brick arch and infilled with brickwork. Each kiln is enclosed by steel framing that extends above each of the kilns and is reinforced by a system of tensioned tie rods. The kilns have a stepped profile, with the domed roof surface enclosed to the east and west sides by a traversable brick pier. The kilns are numbered 1 through 3 from east to west, with 1 being closest to the Power House.

Internally, the kilns are designed to be accessed via the metal doors to either end. None of the three kilns are currently accessible from the north. Apart from Kiln 1, the doors to the south end comprise metal cladding to the exterior face and a wall of firebricks, held in place to the surface of the metal door by a heavy-duty metal mesh. The doors to Kiln 1 are metal without the firebrick lining. The doors are fitted with easy clean hinges, enabling them to be folded fully back flat against the kiln wall to permit access to the interior. Internally the north doors are either bricked over or, as for Kiln 1, a false stud wall with plaster has been installed.

Between the three kilns, racks have been installed by the current site tenant for the storage of salvaged timber. A secure display space has been created to the east of Kiln 1, within the form of the open-sided corrugated steel roof structure. It is a metal-framed corrugated steel enclosure with corrugated laserlite let into the east wall. The whole kiln structure is enclosed by an open-sided metal framed corrugated steel canopy. The date of construction of this has not been confirmed although the structure appears on the 1976 aerial photograph (see Figure 1). The roof cladding has been replaced.

The kilns are in poor condition braced with steel posts and cables, which appear be in reasonable condition. Internally, the brickwork is in a reasonable condition with isolated loose bricks.

The steel roof sheeting has been replaced more recently and is damaged in some areas. Removal would require that restoration and waterproofing of the kilns as a high priority (and should be undertaken before removing the steel roof).

Significance	Core Element

The Downdraught Kilns, and their associated underground infrastructure, Control Room and Chimney Stack, are part of the evolved Brickworks complex and date from one of the last phases of expansion on this site. They contribute to an understanding of the

Canberra Brickworks: Inventory of Individual Historic Elements

operation of such complexes; in this case the choice of Downdraught kilns appears likely to have been made on the basis of their suitability for specialist lines.

Structural Advice as at 2021	Reinstatement required for safe public access during construction works. Kilns require stabilisation and water proofing—refer to Appendix G for detail.
Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved.

- The Downdraught Kilns should be retained and conserved.
- The kilns require further structural assessment to inform remediation works. While thought to be broadly contemporary with the kilns, the enclosing shed roof structure could be retained or demolished as required.
- The internal adaptation is possible and alternatives for reuse should be explored. The kiln chambers could be subdivided if required.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

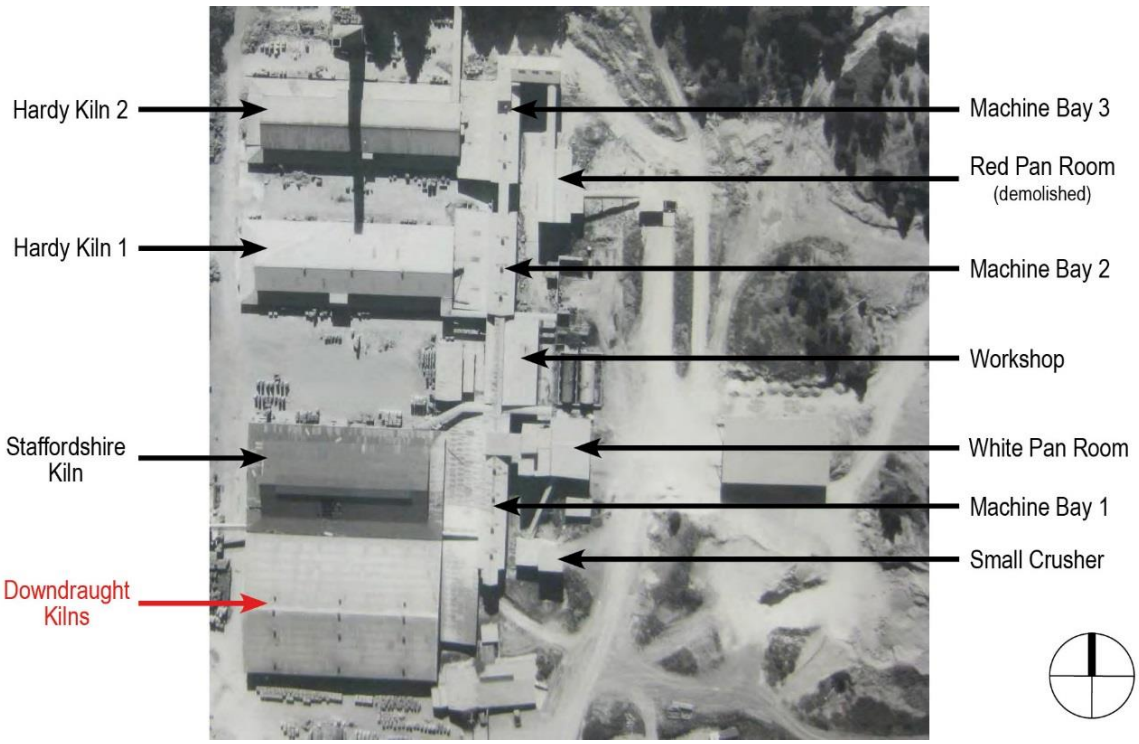


Figure 1 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. The Downdraught Kilns are indicated in red. (Source: ACT Heritage Library with GML overlay)

Canberra Brickworks: Inventory of Individual Historic Elements

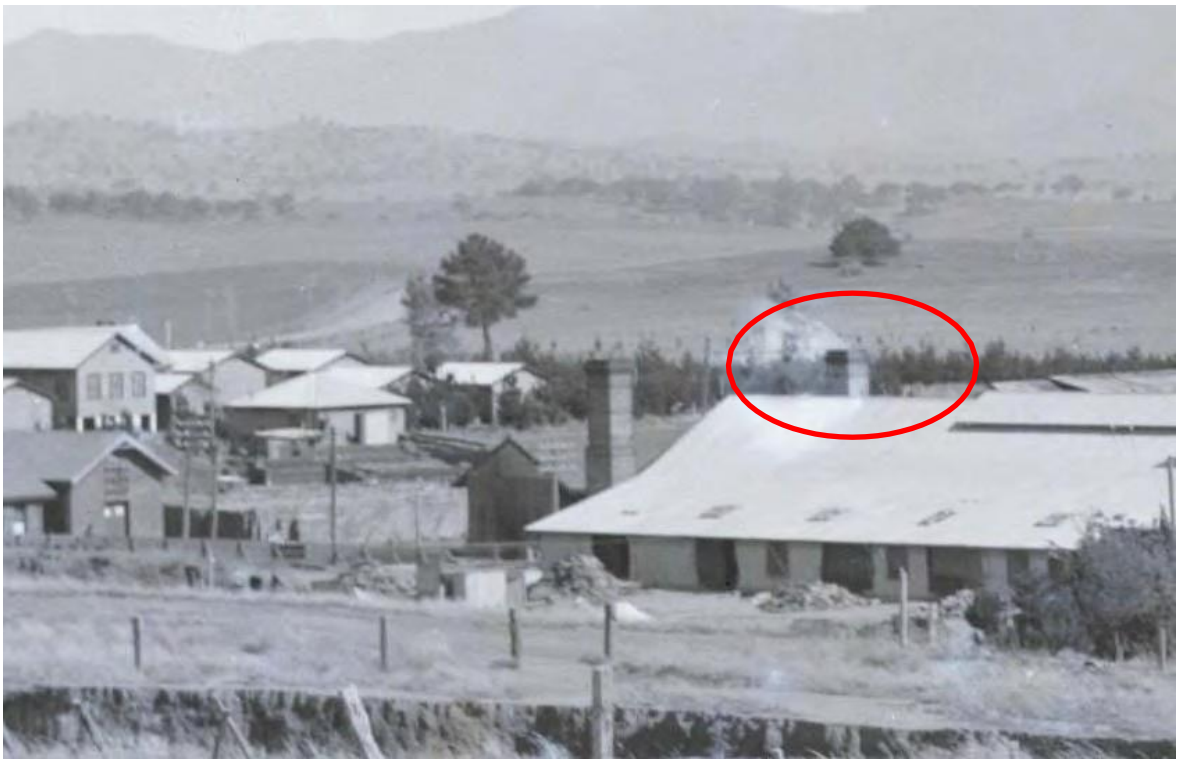


Figure 2 Detail from a 1929 photograph of the Brickworks, with the chimney of the temporary downdraught kilns highlighted. (Source: National Archives of Australia, with Lovell Chen overlay)



Figure 3 Interior of enclosure showing the north elevation of two of the three kilns, under the large steel roof, a later addition. (Source: Lovell Chen, 2010)

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Figure 4 Kiln roof with brick walkway to sides. (Source: Lovell Chen, 2010)



Figure 5 Kiln entry showing stepped side wall. (Source: Lovell Chen, 2010)

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Figure 6 Side elevation showing steel framing and fire holes. (Source: Lovell Chen, 2010)



Figure 7 Interior of kiln showing entry and deteriorating fire bricks. (Source: Lovell Chen, 2010)

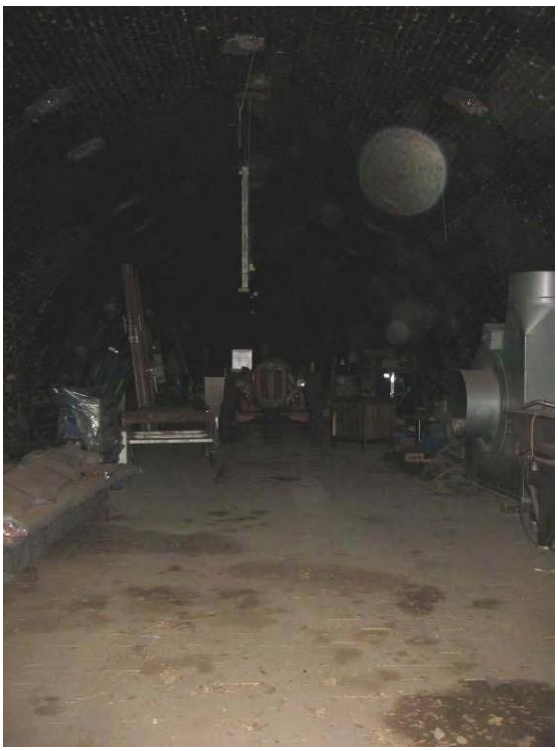


Figure 8 Interior of kiln showing later cement paving. (Source: Lovell Chen, 2010)

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Element 7—Chimney Stack for Staffordshire Kiln

Name of Element	Chimney Stack for Staffordshire Kiln	**CMP No. | ACT No.**	Element 7
Historical Phase	Establishment 1911–1920	**Date**	c1916
Construction	Brick		





Historical Background

Fans were installed to draw the heat and burnt fuel from the Staffordshire Kiln through the subterranean duct and out through the stack. The use of fans allowed for the construction of a shorter brick stack.

The small brick kiln next to the stack is not shown in a 1917 photograph of the Brickworks but is clearly visible in a photograph taken in c1926. This indicates that it is an early site element (Figure 2).

Description and Condition

The chimney stack is located approximately 30 metres west of the Staffordshire Kiln separated by a gravel road and is adjacent to the Fan House. It is constructed of red face brick, capped with several courses of corbelled brickwork and surmounted by nine rows of brickwork. Metal bracing to the corners of the section above the stepped brickwork is partly intact. There is evidence of rebuilding to some of the upper courses. A lightning conductor is a recent installation. An arched opening in the west face of the stack has been infilled with brickwork. Within the stack, iron rungs have been installed on a diagonal to provide internal access.

A small brick 'experimental' kiln abuts the stack and has arched openings to both its west and south faces.

The inspection report for the building identified that the stack has cracking at the base, however it appears to be stable. Bricks are loose at the top and some have fallen. There is also some visible cracking at the top. The brick kiln is in a partially ruinous state. It is severely cracked with little to no mortar remaining in the joints, leaving the bricks loose and unstable. There is vegetative overgrowth impacting the structure.

Significance	Core Element

The Staffordshire Kiln, its associated structures and underground infrastructure, is an element of core significance. It was the first permanent kiln structure on the site and is a key surviving element from the earliest phase of development. This choice of relatively elaborate kiln type with capacity to fire multiple types of products simultaneously reflected the requirements of the Brickworks as the sole provider to the new national capital. While extensively modified and rebuilt in some areas, this kiln is the only example of a Staffordshire kiln remaining in Australia.

The Fan House and Chimney Stack were both integral to the operation of the Staffordshire Kiln. While only remnants of dismantled equipment remain in the Fan House, the arrangement of the interior demonstrates the function of the building and its relationship to the kiln and the associated chimney.

Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved

- The Chimney Stack and attached kiln must be retained and conserved.
- Closer inspection of upper areas of chimney recommended.
- Additional structural support may be required. The loose bricks at top of chimney should be secured/reinstated. Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

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Figure 1 The full extent of the stack with a smaller, near-contemporary kiln adjoining to the right. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 68)

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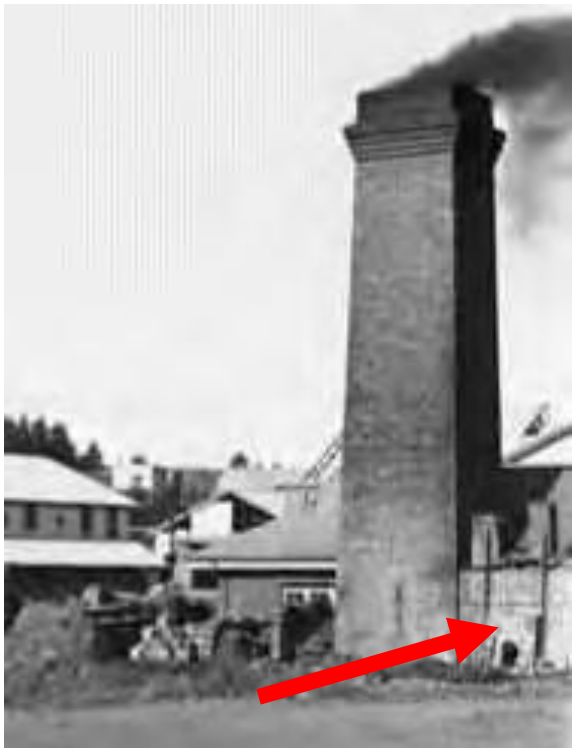


Figure 2 Detail of a photograph of c1926. The kiln abutting the stack is indicated by the arrow. (Source: National Archives of Australia)

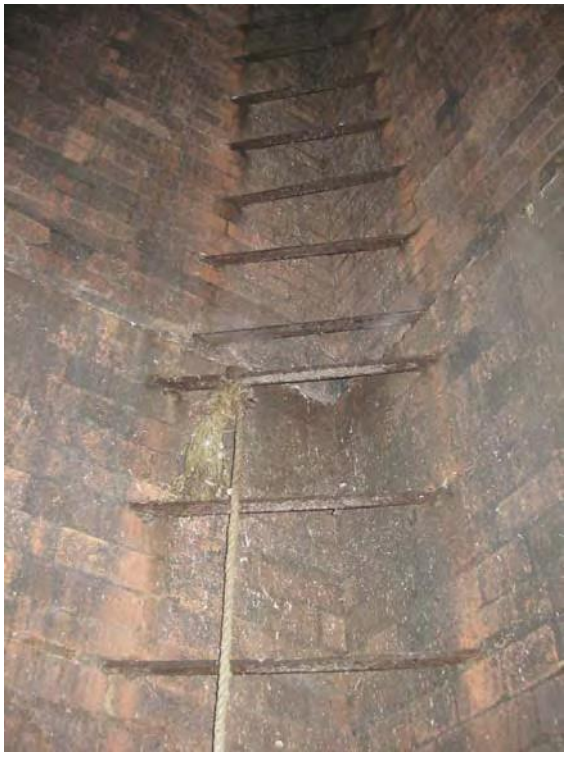


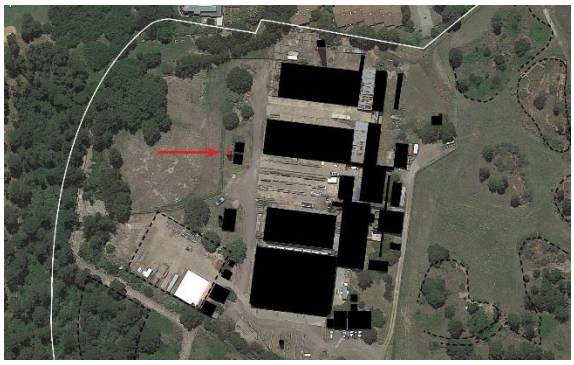
Figure 3 Interior of the chimney stack. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 69)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 8—Chimney Stack for Hardy Patent Kiln 1

Name of Element	Chimney Stack for Hardy Patent Kiln 1	**CMP No. | ACT No.**	Element 8
Historical Phase	Expansion 1921–1942	**Date**	c1926–27
Construction	Brick		





Historical Background

The brick chimney stack was built to service the 1927 Hardy Patent Kiln 1. While the stack is virtually identical to the Chimney Stack for the Staffordshire Kiln, the ductwork linking to the Fan House is not placed below ground and adjoins it through an opening in the east elevation, approximately two metres above ground.

Description and Condition

The Chimney Stack is adjacent to the Fan House, located approximately 30 metres west of the kiln building. A gravelled roadway separates the kiln from the stack and fan house. Constructed of red face brick, the stack is capped with several courses of corbelled brickwork and surmounted by nine rows of brickwork.

The inspection report identified cracking at the base of the chimney but overall appears stable. More severe cracking was observed at the top of the stack and bricks are loose and some have fallen. The arched opening in the south face of the stack is infilled with brickwork. The condition is good —reasonable.

Significance	Core Element

Hardy Patent Kiln 1, together with its Fan Houses and Chimney Stack, demonstrates the expansion of the Brickworks in the 1920s in response to the increased demand for building materials for the development of the national capital. The kiln was commissioned prior to the relocation of Parliament in 1927. The kiln has been extensively modified and extended but still provides an important link to this phase in the history of the site.

Hardy Patent Kiln 1 is also of interest as an example of an Australian patent kiln design thought to date from the late nineteenth century, one of a large number of variations of the Hoffman kiln typology developed in this period.

The associated Fan House and Chimney Stack are integral to the operation of the kiln, including in its expanded form post-World War II.

Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved

- The Chimney Stack must be retained and conserved.
- Closer inspection of upper areas of chimney recommended. Additional structural support may be required. The loose bricks at top of chimney should be secured/ reinstated.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 1 Chimney Stack north elevation. (Source: GML, 2017)



Figure 2 Hardy Patent Kiln 1 Fan House and Chimney Stack. (Source: GML, 2017)

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Figure 3 Infilled archway at south elevation. (Source: GML, 2017)

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Element 9—Chimney Stack for Hardy Patent Kiln 2

Name of Element	Chimney Stack for Hardy Patent Kiln 2	**CMP No. | ACT No.**	Element 9
Historical Phase	Postwar 1944–1976	**Date**	c1953, c2005
Construction	Brick, steel cladding		





Historical Background

A tall stack for superior drawing power was specified as part of the new Hardy patent kiln in 1952. This represented a break with tradition at the Brickworks, as the two existing continuous kilns were fan induced requiring only short stacks. However, the tall stack was not a success, and fans were installed to augment the draw shortly after completion.

The stack may have been designed by architect Eric Nicholls (1902–1966). However, this has not been confirmed. Nicholls had designed the much earlier and architecturally distinctive Canberra Incinerator (for the Reverberatory Incinerator and Engineering Company) in 1938–39.

The opening has been part-capped with steel roofing as a part of a series of works undertaken c2005. An internal steel frame and timber work platforms were installed as part of those building works, which stabilised the structure and repaired significant cracking and damage to the top.

Description and Condition

The chimney stack comprises a brick plinth, a shaft, and a 'crown' or capital of corbelled brickwork. It is constructed of red face brick laid in Colonial bond courses and is approximately 45 metres high. It is located north of Hardy Patent Kiln 1, and is surrounded by a large concrete slab. There is an arched brick entry hatch at ground level to all four elevations with the entry to the east elevation fitted with a secured wire mesh gate. The west and north openings are infilled with brick and to the south a concrete tunnel rises from underground indicating the location of the kiln tunnel. To the west elevation there is a large rectangular opening approximately 3.5 metres above the ground, secured by a metal grille. This may have been the location of ducts that linked the stack to a now demolished fan house facility. The chimney steps inwards, rising from a brick plinth, capped with brickwork laid on a 45-degree angle. A lightning conductor has been fixed to its south elevation. Sections of the upper courses of brickwork have been re-laid with new mortar visible. Internally the tunnel connection to the kiln is visible and there is a steel frame and timber work platforms installed within the stack.

The inspection report notes the base is in good condition for its age, and the upper areas appeared to be in reasonable condition.

The top of the chimney has more severe cracking and loose bricks. Although the chimney appears to be stable overall, some observations of cracking were made at the base.

Significance	Core Element

Hardy Patent Kiln 2, together with its underground infrastructure and associated Chimney Stack, are key elements of a major expansion and upgrade of the Brickworks during the 1950s, along with the new crusher houses, grinding facilities, automatic conveyors, new brick presses and machine bays. The construction of this kiln greatly expanded the production capacity of the works. The kiln is relatively intact, including when compared with Hardy Patent Kiln 1, and is a good representative example of this typology of continuous kilns.

In addition to its role as a key element in the post-World War II expansion of the Brickworks, the Chimney Stack for Hardy Patent Kiln 2 is also of aesthetic significance as a prominent element in the immediate vicinity and a marker for the site. It is also visible from more distant views at the north shore of Lake Burley Griffin and from Black Mountain.

Canberra Brickworks: Inventory of Individual Historic Elements

Structural Advice as at 2021	No structural concern, as viewed from ground level. Closer inspection of the upper chimney required. Rectification may be required as part of the construction works—refer to Appendix G for detail.
Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved

- The Chimney Stack must be retained and conserved.
- Loose bricks should be reinstated and secured at the top of the chimney.
- Additional structural support may be required.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.



Figure 1 View of the chimney stack from the east. (Source: Lovell Chen, 2010)



Figure 2 West elevation, base of the chimney stack. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 3 Chimney stack and the first floor of Hardy Patent Kiln 2 to the right. (Source: GML, 2017)

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Element 10—Chimney Stack for Downdraught Kilns

Name of Element	Chimney Stack for Downdraught Kilns	**CMP No. | ACT No.**	Element 10
Historical Phase	Postwar 1944–1976	**Date**	c1961
Construction	Brick		





Historical Background

The brick chimney stack located northwest of the three Downdraught Kilns was linked by underground tunnels to a now-demolished fan house. The large opening in the east face of the stack is thought to be for a duct from the fan house, which has since been removed. The method of operation is thought to have been similar to that of the fan house and stack associated with Hardy Patent Kiln 1. There is no obvious evidence of the fan house remaining.

Description and Condition

The Chimney Stack is located approximately 30 metres south of the Downdraught Kilns. The stack is surrounded by a gravelled carparking area with timber stored at its base. The design of the stack is a simpler version of the Staffordshire and Hardy patent kiln stacks, without the corbelled brickwork. In recent years, the stack has been used by the site's tenants as an incinerator.

There is a large oblong opening approximately three metres above the ground in the north face, indicating where a duct channelled spent fuel and heat to the stack for dispersal. There is an opening at low level in the south face, set within a steel door surround. The door is missing.

The Chimney Stack is in reasonable condition and appears to be stable. No significant cracking was observed (from ground level), but the upper section is in poorer condition, with loose and deteriorated bricks. There is evidence of brickwork spalling, particularly to the west and north faces.

Significance	Core Element

The Chimney Stack for the Downdraught Kilns (Element 10) and the associated underground infrastructure is part of the evolved Brickworks complex and date from one of the last phases of expansion on this site.

The Chimney Stack and association with the Downdraught Kilns is a core element of the heritage significance of the site.

Structural Advice as at 2021	Reinstatement may be required as part of the construction works—refer to Appendix G for detail.
Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved

Canberra Brickworks: Inventory of Individual Historic Elements

- The Chimney Stack for Downdraught Kilns must be retained and conserved.
- A structural assessment is required, and structural reinforcement may be needed.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 1 East and north elevation of the Chimney Stack for the Downdraught Kilns. (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 2 Opening at base of southern facade. (Source: GML, 2017)

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Element 11 + 12—Quarry and Geological Features

Name of Element	Quarry (also known as the 'brick pit') and geological features	**CMP No. | ACT No.**	Element 11 and 12 A, B, C, D
Historical Phase	Establishment and Expansion (1911–c1940)	**Date**	Shale extraction from 1913





Historical Background

The underlying geology of Canberra is made up of sedimentary and volcanic rock types formed when the landscapes were positioned on the margins of the supercontinent, Gondwana.[1] The quarry reflects an integral part of Canberra's geology, which consists of a range of sedimentary and volcanic rock types. The main rock types are:

- deep water sediments of late Ordovician and early Silurian age;
- shallow water sediments of middle to late Silurian age; and
- volcanic rocks of middle Silurian to early Devonian age.

The Brickworks site lies on the early Silurian age (424–423 million years ago) Yarralumla Formation. The Formation was created 425 million years ago by sedimentary mudstone or siltstone deposited in a shallow sea. Evidence of fossils including brachiopods, trilobites, corals, bivalves, bryozoans and crinoids remain as evidence of this ancient landscape.[2]

The geological composition also included shale, a fine-grained sedimentary rock, ideal for brickmaking as it was both hard and porous. However, the shale varied greatly in quality and limestone and sandstone intrusions into seams of the rock made processing more expensive and some material unusable.

Land on Frederick Campbell's 'Yarralumla' property was selected for the new Commonwealth Brickworks site following tests on shale samples, which were considered capable of producing bricks of good hardness and porosity. The quality proved not to hold over time.

The raw material quarried for the 'temporary' Brickworks from 1913 was a hard yellow shale, obtained by levelling a knoll to the east of the site. The shale varied greatly in quality and material from the various seams had to be mixed thoroughly to secure a uniform colour in the bricks, which led to increased production costs. Raw materials were transported from the quarry to the Brickworks by a narrow gauge tramway, which was constructed so that tram trucks ran downhill and empty trucks returned to the quarry area using manpower. The tram lines could be relocated as the quarry face advanced.

Quarrying at the site was reported to be a complex process, and costlier than comparable brickworks due to seams of unusable material such as limestone and sandstone. From the mid-1930s, raw materials were brought in from outside the Brickworks.

Levelled areas of the quarry floor were subsequently used to house Brickworks-related facilities, including an open-sided roofed enclosure for clay storage, which has since been removed. It is shown in an aerial photograph of the site taken in 1976 (see Figures 2 and 7). Another smaller structure, located farther east, is also shown although its purpose is not known.

After the closure of the Brickworks, AR Marr Pty Ltd proposed the construction of a narrow-gauge railway and a 'reflection pool' in the former quarry (see Figures 3 and 5). However, the pool failed to retain water and was frequently dry.

Description and Condition

The quarry comprises sections of grass and its edges are lightly treed with predominantly self-seeded conifers. It has been fenced off due to safety concerns regarding the eroding quarry face. A concrete dividing wall capped with stone paving is a remnant of the walkway proposed by AR Marr to cross the 'reflection pool'. The railway has been dismantled.

Canberra Brickworks: Inventory of Individual Historic Elements

There are four specific locations at the quarry that demonstrate particular aspects of the site and the Yarralumla Formation:

- Location 12: A and D show excellent examples of anticline in calcareous siltstone. The siltstone can be seen to grade to sandstone from the inner strata to the outer.[3]
- Location 12: B shows a typical tuffaceous mudstone and siltstone of the Yarralumla Formation. The tuff is poorly cemented and consists of a fine-grained white clay matrix containing large fragments of siltstone.[4]
- Location 12: C shows abundant fossils of mainly brachiopods, trilobites and crinoids preserved in a bedding plane. The quarry is one of the only locations in which the fossil contents of the Yarralumla Formation can be closely observed.[5]

Other than for the works undertaken by Marr, the quarry appears to be little altered since the closure of the Brickworks in 1976. It retains a series of rock outcrops that possibly contained unsuitable material, with quarrying continuing around them. It is not clear the extent to which sections of the quarry floor may have been modified and filled since the 1970s.

As of 2019, the quarry is in a partially maintained state with clear walking routes. The rest of the quarry is overgrown and unmaintained. There is a gravelled path running along the west bank of the remains of the 'reflection pool'. Some trees have fallen over. There is no water in the 'reflection pool'. Condition; generally reasonable. It is unused and holds public safety concern.

Significance	Core Element

The quarry dates from the establishment of the Brickworks and demonstrates a key aspect of the original brick making operation and as it existed up until c1940.

The quarry is also considered to be of scientific significance as the type locality for the geological Yarralumla Formation, a major sedimentary sequence dating from the Silurian Period, 424–423 million years ago. The rock units at the site provide the reference section for comparison with other outcrops within the Yarralumla Formation and, in this context, are of both research and educational value.

The quarry was assessed as having high archaeological potential[6] based on its ability to yield further information about the history and operation of the Brickworks over time.

Conservation Policy and Adaptation Guidelines	Core elements must be retained and conserved

- The quarry should be retained as a landscape element that through form and presentation reflects the quarry form and its origins as an excavated brick pit.
- The identified rock outcrops of the quarry must be retained, protected and made safe as geological features.
- New development within the quarry should be confined to the area to the north, east and south, along the ridgeline and away from the historic core of the brickworks.
- New development should be appropriately sited and of a scale, and form that supports the presentation and interpretation of the retained section of the quarry.
- The western section of the quarry closest to the Brickworks buildings, including all four of the identified geological sites of significance, should be retained as an open landscape feature. While at least two small process-related buildings (clay storage shed and another, specific use unknown) are known to have been built on the levelled floor of this part of the quarry, the preference is for no new permanent buildings to be constructed in this area.
- New development including any levelling, infilling or earthworks required to support new development should be assessed for impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) and in reference to the sensitivity zoning outlined in the historic archaeological analysis of the site provided at Section 3.5 of this CMP.

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 1 View of the quarry showing the narrow-gauge tramway used to transport shale to the crusher, 1921. (Source: National Archives of Australia)



Figure 2 Detail of a 1976 aerial photograph showing the clay storage shed and an unknown smaller structure to the right (both demolished). (Source: ACT Heritage Library with Lovell Chen overlay)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 3 Detail of site landscaping plan prepared by A R Marr Pty Ltd showing the reflection pond and the location of the model railway, c1977. (Source: ACT Heritage Library)



Figure 4 View from northwest corner of the quarry looking south across the elevator/conveyor and Machine Bays 1, 2 and 3. The Primary Crusher House is to the left. (Source: GML, 2017)



Figure 5 View looking southwest to the Brickworks from main access route to the quarry. (Source: GML, 2017)





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Figure 6 View of the northwest corner of the Quarry. Lane Poole residences to the left, Bentham Street above on the right. (Source: GML, 2017)



Figure 7 View looking south across the quarry. (Source: GML, 2017)



Figure 8 A R Marr's walkway designed to cross the 'reflection pool'. (Source: GML, 2017)



Figure 9 View looking east across walkway. Bentham Street is located beyond the ridgeline of the quarry. (Source: GML, 2017)

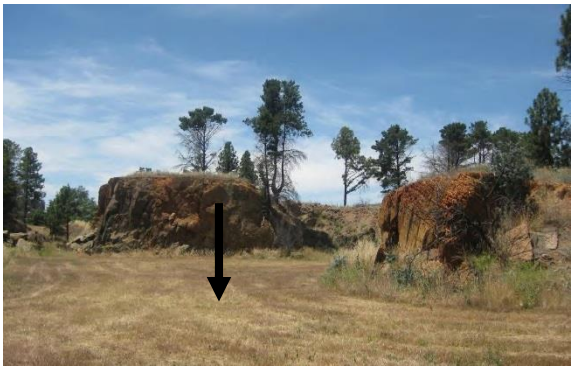


Figure 10 Quarry looking north towards Bentham Street. (Source: Lovell Chen, 2010)

Figure 11 The approximate site of the clay storage shed, demolished after the closure of the works, is indicated by the arrow. (Source: Lovell Chen, 2010)

Endnotes

[1] Finlayson, D 2008, Landscapes Around Canberra, ACT Division, Geological Society of Australia, p 2.

[2] Land Development Agency & Lovell Chen 2010, Canberra Brickworks, Denman Street, Yarralumla, Canberra—Conservation Management Plan, Land Development Agency, Canberra, p 199.

[3] SMEC Australia Pty Ltd 2013, Preliminary Geotechnical Site Investigation for the Canberra Brickworks, Land Development Agency, Canberra, p 15.

[4] SMEC Australia Pty Ltd 2013, Preliminary Geotechnical Site Investigation for the Canberra Brickworks, Land Development Agency, Canberra, p 17.

[5] SMEC Australia Pty Ltd 2013, Preliminary Geotechnical Site Investigation for the Canberra Brickworks, Land Development Agency, Canberra, p 16.

[6] Navin Officer Heritage Consultants, Archaeological Assessment Canberra Brickworks and Environs, report prepared for the Land Development Agency, September 2016.

Canberra Brickworks: Inventory of Individual Historic Elements

Element 13—Office

Name of Element	Office	**CMP No. | ACT No.**	Element 13
Historical Phase	Expansion 1921–1942	**Date**	c1925, extended c1953 and 1970s
Construction	Brick with terracotta tiled roof, brick additions, steel sheet roof		





Historical Background

The 1916 Survey Plan indicates a galvanised iron 'Office' located approximately 40 metres north of the present office building (see Figure 1). This was subsequently removed and the site developed for the original machine shed. The date of construction for the original portion of the present offices, comprising two rooms, has not been established (an office is shown in the same location in the 1916 plan; however, this is not confirmed to be the present building). It is not indicated on a site plan dated September 1921, but is represented in outline on a site plan of April 1926 (see Figure 2). It also appears in a 1929 photograph (see Figure 3).

The offices have been extended in at least two phases: 1953 and during the 1970s. The 1953 works doubled the size of the original building, extending the structure to the south to provide a General Office, office for the Manager and for a Costing Clerk, as well as a store room. A lavatory and washroom were located between the office and the Power House (see Figure 4). The extension had a skillion roof of corrugated iron. A later extension, thought to have been built during the 1970s, extended the building to the east and further altered the south elevation.

Description and Integrity

The original structure comprises red face brick with a terracotta tiled gable roof located adjacent to the Power House to the east. A number of extensions have been made to the original building, with extant drawings prepared in both 1953 and 1958 for alterations and extensions to the original two-roomed structure. The 1958 works appear not to have gone ahead. During the 1970s a brick addition to the east and a new verandah partially enclosed the remainder of the south elevation, abutting the Power House. In addition, a small brick extension was added to the rear (north) of the building, and small skillion roofed outbuildings were constructed to the east and north. The subsequent alterations have diminished the integrity and obscured the presentation of the building. Windows and doors are boarded up and the external condition of the office building appears to be reasonable.

Significance	Supporting Element (c1953 and 1970s extensions are 'incidental')

While the original section of the office building is associated with an early phase of development at the Brickworks, the building has been extensively modified and overbuilt, the result being that the original form is substantially obscured.

Conservation Policy and Adaptation Guidelines	Supporting elements preferably should be retained and conserved

- The Offices (original form and fabric) should preferably be retained and conserved, noting that the Heritage Register citation allows for its relocation subject to the relocation process being fully documented and full reconstruction of the building taking place within a specified period.
- The 1950s/1970s later extensions are not significant and could be removed.
- The building could be adapted internally for a new use.
- Remove intrusive ad-hoc additions.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

Canberra Brickworks: Inventory of Individual Historic Elements

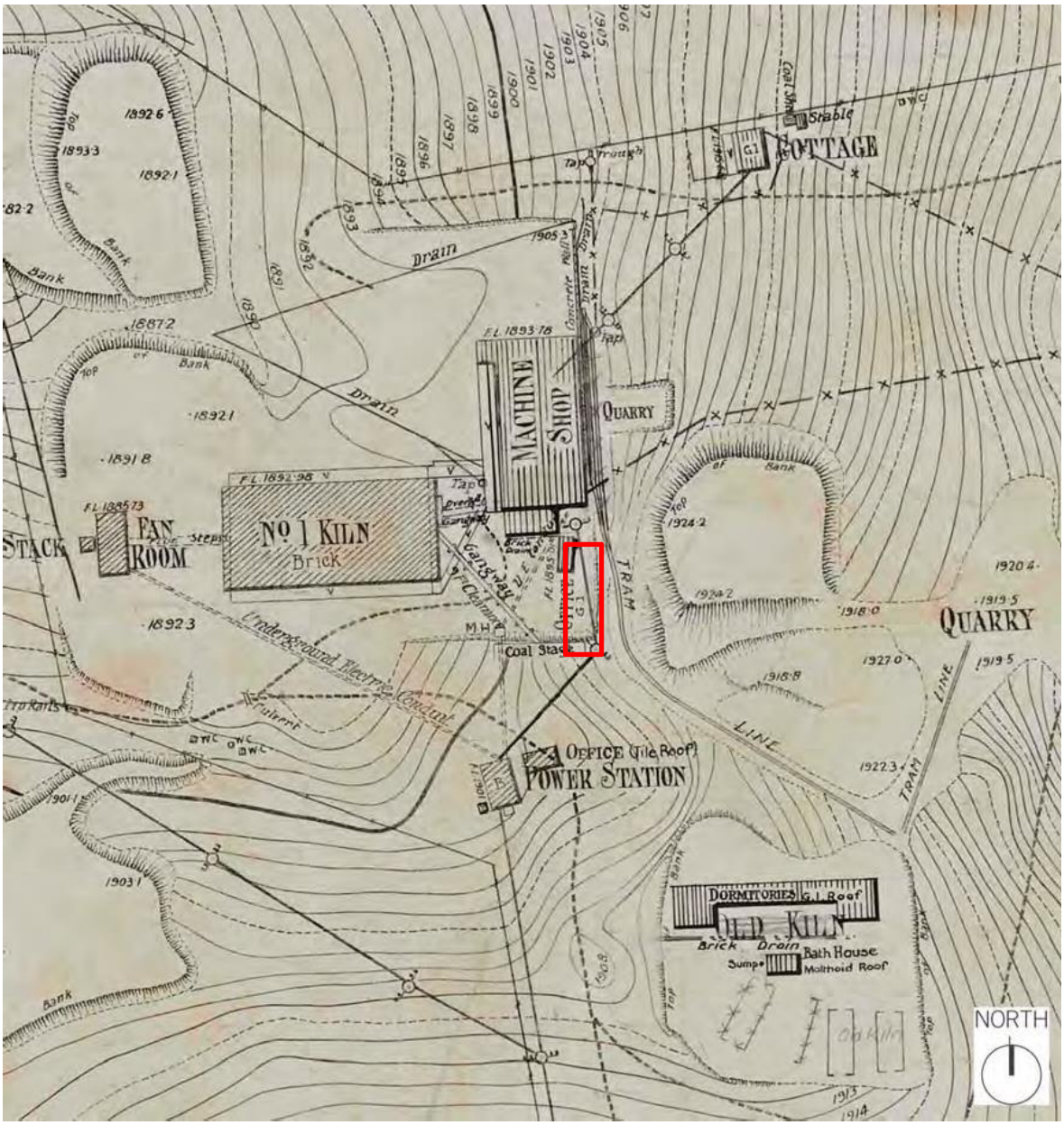


Figure 1 Detail of Contour and Detail Survey, Canberra Brick Yards, 20 December 1916, with the subsequently removed office south of the machine shop outlined in red. (Source: NAA: A6664, L165A, 1916 with GML overlay)

Canberra Brickworks: Inventory of Individual Historic Elements

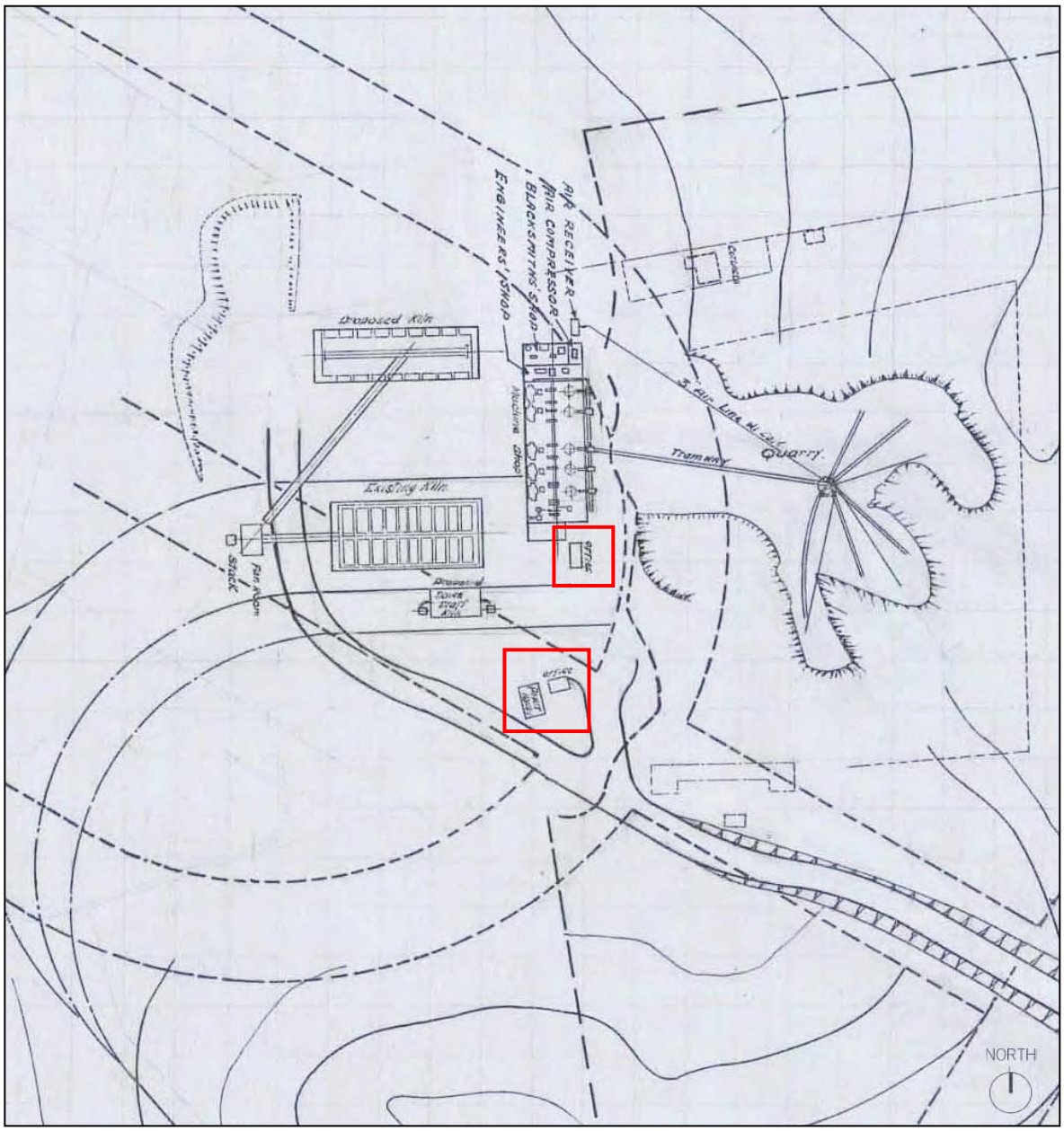


Figure 2 Detail from the Canberra Brickworks site plan, April 1926. The present office building (below), subsequently extended, and the original office (above), later demolished, are outlined. (Source: National Archives of Australia with GML overlay)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 3 Detail of a photograph of the Brickworks site in 1929 taken from the quarry area, showing the original form of the office building to the east of the Power House (foreground). Note that at this date the main entrance to the Power House is from the north. The married quarters camp is in the background. (Source: National Archives of Australia)

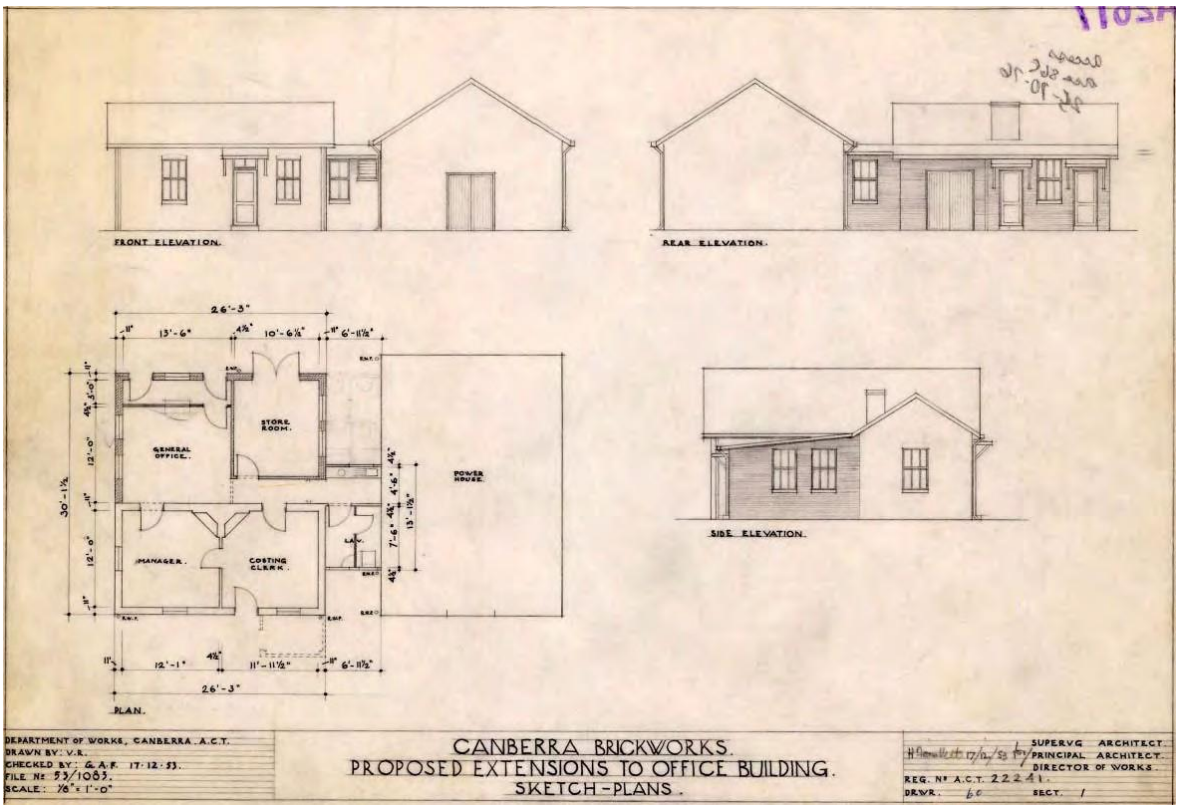


Figure 4 Office extension consisting of a two roomed addition to the south and a lavatory/washroom infilling the space between the original structure and the Power House, 1953. (Source: National Archives of Australia)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 5 East and north elevations, showing the extent of the 1950s/1970s additions. The only portion of the original two-roomed structure, not enclosed by additions, is indicated by the arrow. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 14—Power House

Name of Element	Power House	**CMP No. | ACT No.**	Element 14
Historical Phase	Establishment 1911–1920	**Date**	c1915–16
Construction	Brick with terracotta tiled roof		





Historical Background

Prior to the commissioning of the Central Generating Station (Kingston Power House) in 1915, the Brickworks was powered by a steam driven donkey engine. When the Kingston Power House came on line in July 1915, the high voltage supply was broken down by transformers to lower voltages and distributed across the Brickworks. This was achieved by three overhead cables connected to the purpose-built Power House, described as the 'Power Station' on the 1916 Survey plan (see Figure 1). The locations of the original entry points for the cables are visible on the south elevation.

It is possible that the openings in the south elevation have undergone alteration.[1]

Description and Condition

The Power House is a single storey face red brick building, with a gable roof clad in terracotta tiles and timber vents within the gable at both the south and north end. Access is via paired, ledged and braced timber doors to the south and north ends of the building. Highlight windows on the east wall and three access points for transmission cables in the south wall are bricked up and there are two non-original multi-paned metal-framed windows in the west wall.

Internally, the Power House has half a concrete floor and half dirt floor and the ceiling is lined with a narrow profile painted corrugated iron. Some early electrical equipment is in situ within the building, including circuit breakers, ammeters, watt meters and distribution boards. Other early high voltage switchgear and transformers are thought to have been removed. The original connection high up in the south wall has been discontinued and power is now relayed underground from a power pole in close proximity to the structure.

The inspection report for the building identified that the roof tiles are in a sound condition, the roof sheets and brickwork in general are in a reasonable condition, and the doors and windows are damaged but are boarded up. The timber fascia is weathered in some areas. The extension of the adjoining office block to the east and the siting of the small service building to the immediate west are intrusive elements to the Power House building. Comparing photographs from 2010, it appears some works have been undertaken to the roof, gable and brickwork.

No internal observations of the condition could be made by Sellick Consultant as they did not have access on the date of their inspection.

Significance	Supporting Element

The Power House is associated with the earliest phase of the permanent brickworks and was a key element in the development of the site, providing power to the site after the Kingston Power House came on line in 1915.

The provision of continuous power supply was fundamental to the operation of the plant.

Structural Advice as at 2021	Reinstatement required for safe public access during construction works—refer to Appendix G for detail.
Conservation Policy and Adaptation Guidelines	Supporting elements should preferably be retained and conserved

Canberra Brickworks: Inventory of Individual Historic Elements

- The Power House should preferably be retained and conserved to the extent of the external fabric (ie brickworks, tile roof, timber soffits etc) to retain original building form, noting that the Heritage Register citation allows for its relocation subject to the relocation process being fully documented and full reconstruction of the building taking place within a specified period.
- Consideration could be given to the reinstatement of infilled openings to the exterior. Original windows and doorways could be re-opened and repaired.
- The remnant equipment could be retained as part of a new fitout, or removed as required.
- The building could be adapted internally for a new use.
- Remove intrusive external elements/structures.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

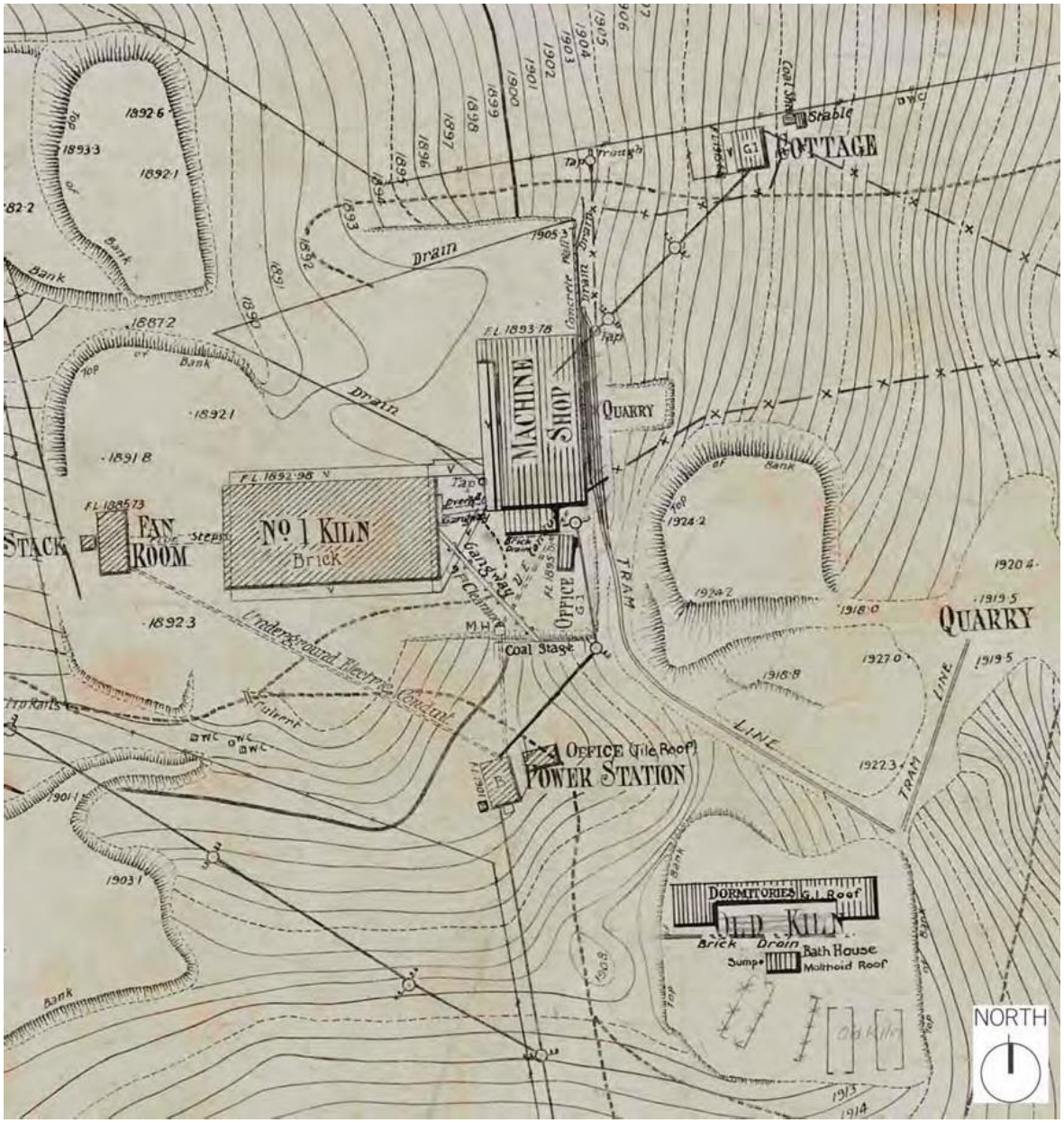


Figure 1 Detail of Contour and Detail Survey, Canberra Brick Yards, 20 December 1916. The Power House is referred to as the 'Power Station'. (Source: NAA: A6664, L165A, 1916)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 2 The Power House is the tile roofed building in the centre of the image. The Office building (Element 13) adjoins it to the right and the small cream brick structure to the left is the Downdraught kiln control room (Element 26). (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 55)



Figure 3 South elevation and entry, showing bricked up openings. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 56)



Figure 4 Interior showing retained plant. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 56)

Endnotes

[1] A drawing dated 17 December 1953 (ref. Canberra Brickworks Proposed extension to Office Building Sketch-plans, National Archives of Australia) detailing additions to the adjoining office refers to the north elevation of the Power House as the 'front' and the south elevation as the 'rear'. The drawing details the doors to the north elevation but does not detail any openings to the south, possibly implying that the openings to the south are not original. No original drawings of the Power House have been located to confirm or refute this evidence, but a visual inspection of the fabric suggests that the door opening and the cable access points are original details or alterations of long standing, predating the 1953 drawing.

Canberra Brickworks: Inventory of Individual Historic Elements

Element 15—Machine Bay 1 for Staffordshire Kiln and Downdraught Kilns

Name of Element	Machine Bay 1 for Staffordshire Kiln and Downdraught Kilns	**CMP No. | ACT No.**	Element 15
Historical Phase	Postwar 1944–1976	**Date**	c1955
Construction	Corrugated galvanised steel, over steel frame		





Historical Background

Also known as Brick Press No. 1, Machine Bay 1 is partly located on the site of the earlier 1915 machine bay and tile making plant. The present machine bay was constructed in 1955 as part of the upgrading of the Brickworks to meet post-World War II production requirements. After grinding and processing through the crusher houses and pan rooms, raw materials were fed along the top-level conveyor system housed within the loft areas of the three machine bays and passed through the upper roof area of the Workshop to hoppers. It was then gravity fed via chutes to the brick presses below. After pressing, the bricks were transported by forklift to the adjoining kiln for firing. Machine Bay 1, which serviced the Staffordshire Kiln, also received white clay material refined in the adjoining White Pan Room (also known as the Large Crusher House) immediately to the east. The machine bay was extended by two additional bays to service the 1960s Downdraught Kilns. This addition was subsequently demolished.

Description and Condition

Machine Bay 1 is a three-level, steel-framed and corrugated galvanised steel-clad structure. It comprises the loft gallery containing the overhead conveyor, which extends through the loft space of all three machine bays and the Workshop. It also contains hoppers, which would feed the brick presses located on the 'shop floor' below. The loft space has a concrete floor and the conveyor in the roof space, which is accessed by steel ladder-form stairs. There is a timber conveyor level walkway 'catwalk'. There is a row of windows previously fitted with glass louvres to the east and west sides of the loft space, and a row of windows to the rear (east) wall of the shop floor below. The shop floor is raised on a concrete slab and the space between the end (west) wall of the kiln and the machine bay has a skillion roof clad in corrugated steel over a series of warren trusses. Several skylights punctuate the roof. This roof form is thought to be original (see Figure 2).

The brick making machinery (brick presses and the like) has been removed and the southern extension to service the Downdraught Kilns has been demolished.

The inspection report for the building identified the steel roof and wall sheeting is weathered and some sheets are loose and missing. The steel columns appear in sound condition and the steel trusses of the lean-to roof are in reasonable condition. The raised 'catwalk' appears in a reasonable condition, though the timber flooring is severely weathered and missing. The south end of the upper floors is also open.

Significance	Supporting Element

Replacing earlier structures on the site between the kilns and the quarry, the machine bays present as a series of utilitarian steel-framed and clad process buildings constructed as part of the post-World War II expansion and modernisation of the Brickworks. The form and location of these related structures, and the conveyor that connects them, demonstrate important aspects of the historical pattern and layout of the complex. Despite the removal of most of the equipment including the brick presses, the machine bays assist in the understanding of the brick making process post-World War II.

Structural Advice as at 2021	Reinstatement and rectification may be required as part of the construction works. Loose roof and wall sheeting should be fixed to prevent a safety risk—refer to Appendix G for detail.

Canberra Brickworks: Inventory of Individual Historic Elements

Conservation Policy and Adaptation Guidelines	Supporting elements preferably should be retained and conserved

- Machine Bay 1 should preferably be retained and conserved to interpret the historical use of the place or adopted to suite a new use for the place.,.
- The conveyors, hoppers and walkways at the upper level could be retained, or may be replaced with new development that is generally consistent with the scale, form, external materials and industrial character of the place. .
- Externally, there is scope for modifications to be made while retaining the industrial character and presentation of the building.
- Windows and other openings should be allowed for appropriate access, daylight and ventilation for an adaptive reuse purpose.
- Internal adaptation is possible and alternatives for its reuse could be explored. .
- The loose roof sheets are a safety hazard and foot traffic are not recommended on the roof. Rectification works should take place.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

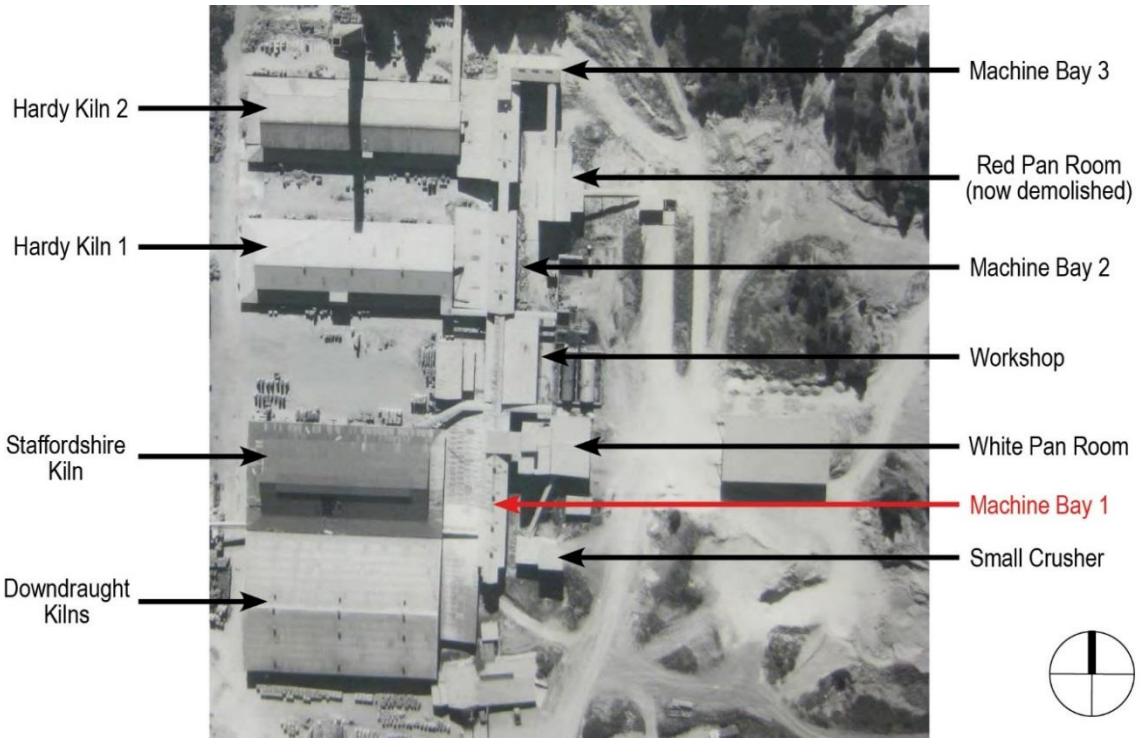


Figure 1 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. Machine Bay 1 is indicated in red. (Source: ACT Heritage Library with GML overlay)

Canberra Brickworks: Inventory of Individual Historic Elements

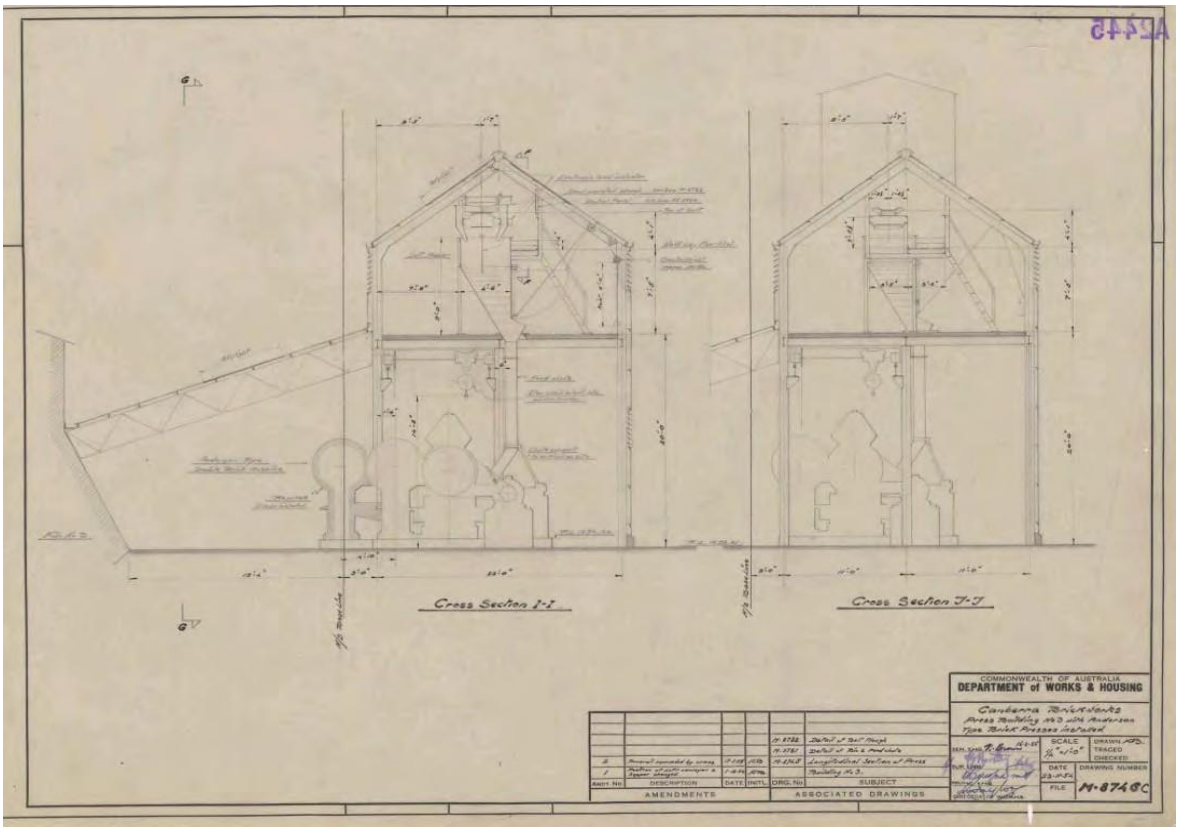


Figure 2 Canberra Brickworks Press Building III, 23 November 1954. Cross-sections showing internal structure and machinery installation, Machine Bay 3. (Source: National Archives of Australia)



Figure 3 The truncated south end of Machine Bay 1, showing location of former headgear housing. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 4 Interior of the Machine Bay shop floor, previously used by a timber recycling business. (Source: GML, 2016)



Figure 5 West side of Machine Bay 1 from the Staffordshire Kiln. (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 16—Machine Bay 2 for Hardy Patent Kiln 1

Name of Element	Machine Bay 2 for Hardy Patent Kiln 1	**CMP No. | ACT No.**	Element 16
Historical Phase	Postwar 1944–1976	**Date**	c1955
Construction	Corrugated galvanised steel, over steel frame		





Historical Background

Machine Bay 2 was built in 1955 as part of the upgrade of the Brickworks to meet post-World War II production requirements. It is interlinked with Machine Bays 1 and 3, and the Workshop. After grinding and processing through the crusher houses and pan rooms, raw materials were fed along the top-level conveyor system housed within the lofts of the three machine bays and passed through the upper roof area of the Workshop to hoppers. It was then gravity fed via chutes to the brick presses below. After pressing, the bricks were transported by forklift to Hardy Patent Kiln I for firing. Machine Bay 2 received raw materials transported via conveyor from Machine Bay 3, which was fed from the 400-ton hopper (now demolished) that adjoined the west end of Machine Bay 3.

Description and Condition

Machine Bay 2 is a three-level steel-framed and corrugated galvanised steel-clad structure. The structure comprises the loft gallery containing the overhead conveyor, which extends through the loft space of all three machine bays and the Workshop, and hoppers, which fed the brick presses housed on the 'shop floor' below. The loft space has a concrete floor and the conveyor, housed within the peak of the roof space, is accessed by steel ladder-form stairs from this level. There is a timber conveyor level walkway 'catwalk', and an open walkway at the height of the concrete floor level, which interconnects this building with Machine Bay 3, to the north. There is a row of windows, previously fitted with glass louvres to the east and west sides of the loft space and a row of windows to the east (rear) of the shop floor. The shop floor is raised on a concrete slab and the space between the end (west) wall of the kiln and the machine bay is roofed by a skillion roof, clad in corrugated steel over a series of warren trusses. Several skylights punctuate the roof. This roof form is thought to be original—refer to the section drawing for Machine Bay 3 (see Figure 2).

The brick making machinery has been removed.

The inspection report for the building identified that the suspended concrete slabs to the upper floor appear to be in a reasonable condition with some minor spalling to the underside near a drilled penetration, which has exposed reinforcement. The raised timber deck walkway is weather damaged. Windows are weathered and have been broken or removed throughout the upper floors exposing the building's interior to weather and some roof sheeting has also been removed, which has caused rot to the timber purlins. Some steel truss bottom chords to the walkway extending from the machine bays to Hardy Patent Kiln 1 and the Staffordshire Kiln are significantly distorted.

Significance	Supporting Element

Replacing earlier structures on the site between the kilns and the quarry, the machine bays present as a series of utilitarian steel-framed and clad process buildings constructed as part of the post-World War II expansion and modernisation of the Brickworks. The form and location of these related structures and the conveyor that connects them demonstrate important aspects of the historical pattern and layout of the complex. Despite the removal of most of the equipment including the brick presses, the machine bays assist in the understanding of the brick making process post-World War II.

Structural Advice as at 2021	Immediate rectification works required. Loose roof sheets are a hazard, with access to some areas to be restricted—refer to Appendix G for detail.

Canberra Brickworks: Inventory of Individual Historic Elements

Conservation Policy and Adaptation Guidelines	Supporting elements should preferably be retained and conserved

- Machine Bay 2 should preferably be retained and conserved to interpret the historical use of the place or adopted to suite a new use for the place.
- Externally, there is scope for modifications to be made while retaining the industrial character and presentation of the building, that is generally consistent with the scale, form, external materials and industrial character of the place.
- Windows and other openings should be allowed for appropriate access, daylight and ventilation for an adaptive reuse purpose.
- The loose roof sheets are a safety hazard and foot traffic are not recommended on the roof. Rectification works should take place.
- The internal adaptation is possible and alternatives for its reuse could be explored.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

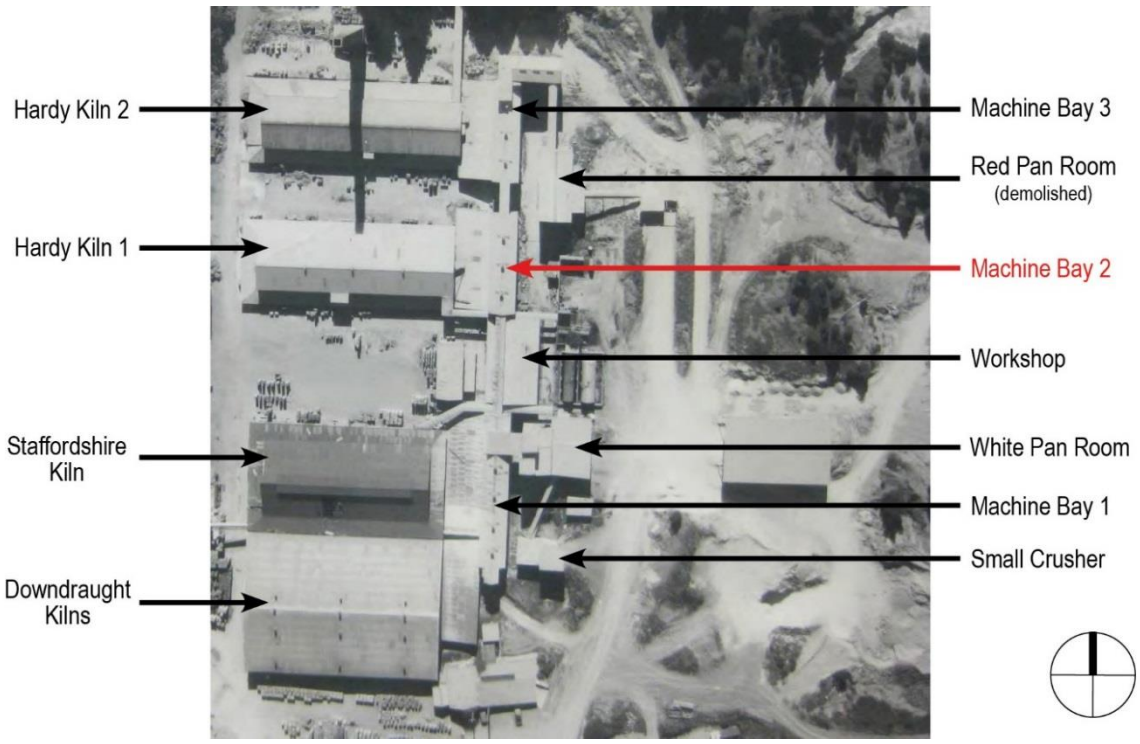


Figure 1 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. Machine Bay 2 is indicated in red. (Source: ACT Heritage Library with GML overlay)

Canberra Brickworks: Inventory of Individual Historic Elements

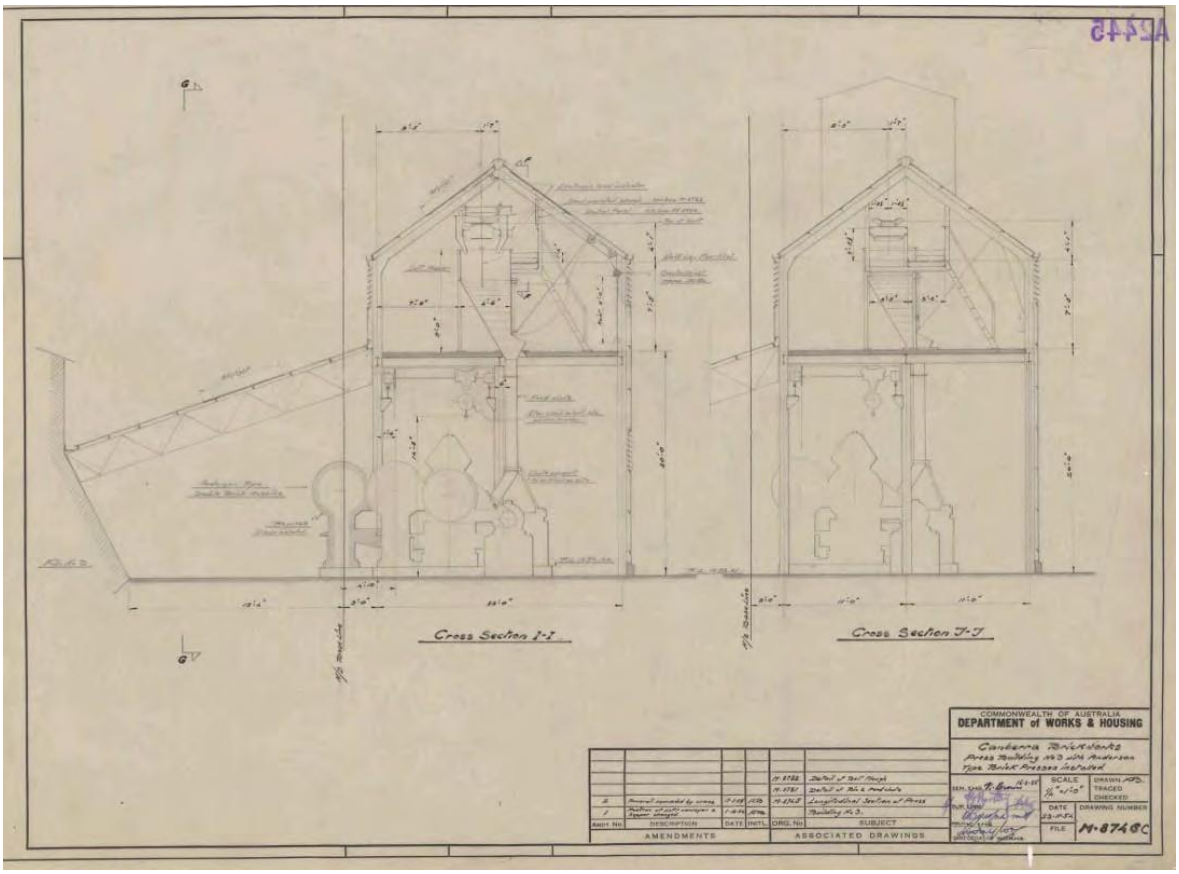


Figure 2 Canberra Brickworks Press Building III, 23 November 1954. Cross-sections showing internal structure and machinery installation, Machine Bay 3. (Source: National Archives of Australia)



Figure 3 The rear (east) elevation of Machine Bay 2. (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 4 Interior of the Machine Bay 2 shop floor with Hardy Patent Kiln 1 in the background. (Source: GML, 2017)



Figure 5 Shop floor of Machine Bay 2. (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 6 Conveyor bridge connecting Machine Bay 2 (left) to Machine Bay 3 (right). (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 17—Machine Bay 3 for Hardy Patent Kiln 2

Name of Element	Machine Bay 3 for Hardy Patent Kiln 2 (Brick Press Building)	**CMP No. | ACT No.**	Element 17
Historical Phase	Postwar 1944–1976	**Date**	c1955
Construction	Corrugated galvanised steel, over steel frame		





Historical Background

Machine Bay 3 was built in 1955 as part of the upgrade of the Brickworks to meet post-World War II production requirements. It is interlinked with Machine Bays 1 and 2, and the Workshop. After grinding and processing through the crusher houses and pan rooms, raw materials were fed along the top-level conveyor system housed within the lofts of the three machine bays and passed through the upper roof area of the Workshop to hoppers. It was then gravity fed via chutes to the brick presses below. After pressing, the bricks were transported by forklift to Hardy Patent Kiln 2 for firing. Machine Bay 3 received raw materials directly from the 400-ton hopper (now demolished) that adjoined the north end of the structure.

Description and Condition

Machine Bay 3 is a three-level steel-framed and corrugated galvanised steel-clad structure. The structure comprises the loft gallery containing the overhead conveyor, which extends through the loft space of all three machine bays and the Workshop, and hoppers, which fed the brick presses housed on the 'shop floor' below. The loft space has a concrete floor and the conveyor, housed within the peak of the roof space, is accessed by steel ladder-form stairs from this level. The northernmost section is blocked off as it approaches the site of the part-demolished headgear housing and site of the removed hopper. There is an open walkway at the height of the concrete floor level which interconnects this building with Machine Bay 2, to the south. There is a row of windows, previously fitted with glass louvers to the east and west sides of the loft space, and a row of windows to the east (rear) wall of the shop floor below. The shop floor is raised on a concrete slab, and the space between the end (west) wall of the kiln and the machine bay is roofed by a skillion roof, clad in corrugated steel over a series of warren trusses. Several skylights punctuate the roof. This roof form is thought to be original (see Figure 2).

Some elements of the dismantled brick making machinery have been relocated to this building and are located in its northeast corner. The hopper and part of the headgear for the loft conveyors has also been removed.

The inspection report for the building identified that the suspended concrete slabs to the upper floor appear to be in a reasonable condition with some minor spalling to the underside near a drilled penetration, which has exposed reinforcement. The raised timber deck walkway is weather damaged. Windows are weathered and have been broken or removed throughout the upper floors exposing the building's interior to weather and some roof sheeting has also been removed, which has caused rot to the timber purlins. Some steel truss bottom chords to the walkway extending from the machine bays to Hardy Patent Kiln 1 and the Staffordshire Kiln are significantly distorted.

Poor condition: This structure is in worse condition than Machine Bay 2 to its south, with the upper level missing most of the cladding.

Significance	Supporting Element

Replacing earlier structures on the site between the kilns and the quarry, the machine bays present as a series of utilitarian steel-framed and clad process buildings constructed as part of the post-World War II expansion and modernisation of the Brickworks. The form and location of these related structures, and the conveyor that connects them, demonstrate important aspects of the historical pattern and layout of the complex. Despite the removal of most of the equipment including the brick presses, the machine bays assist in the understanding of the brick making process post-World War II.

Canberra Brickworks: Inventory of Individual Historic Elements

Structural Advice as at 2021	Immediate rectification works required. Loose roof sheets are a hazard, with access to some areas to be restricted—refer to Appendix G for detail.

Conservation Policy and Adaptation Guidelines	Supporting elements should preferably be retained and conserved

- Machine Bay 3 should preferably be retained and conserved, including the skillion form connection to Hardy Patent Kiln 2 and the elevated conveyor 'bridge' that connects to Machine Bay 2.
- The conveyors, hoppers and walkways at the upper level could be retained, or may be replaced with new development that is generally consistent with the scale, form, external materials and industrial character of the place. Windows and other openings should be allowed for appropriate access, daylight and ventilation for an adaptive reuse purpose.
- Externally, there is scope for modifications to be made while still retaining the industrial character and presentation of the building.
- The internal adaptation is possible and alternatives for its reuse could be explored.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

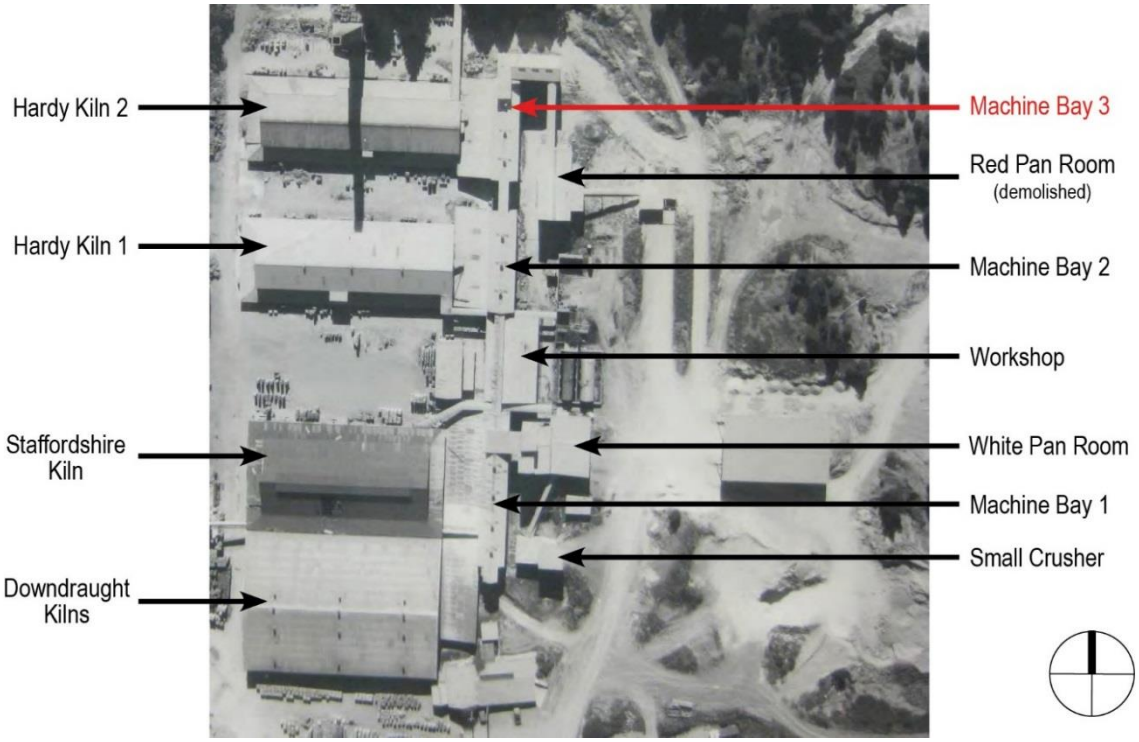


Figure 1 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. Machine Bay 3 is indicated in red. (Source: ACT Heritage Library with GML overlay)

Canberra Brickworks: Inventory of Individual Historic Elements

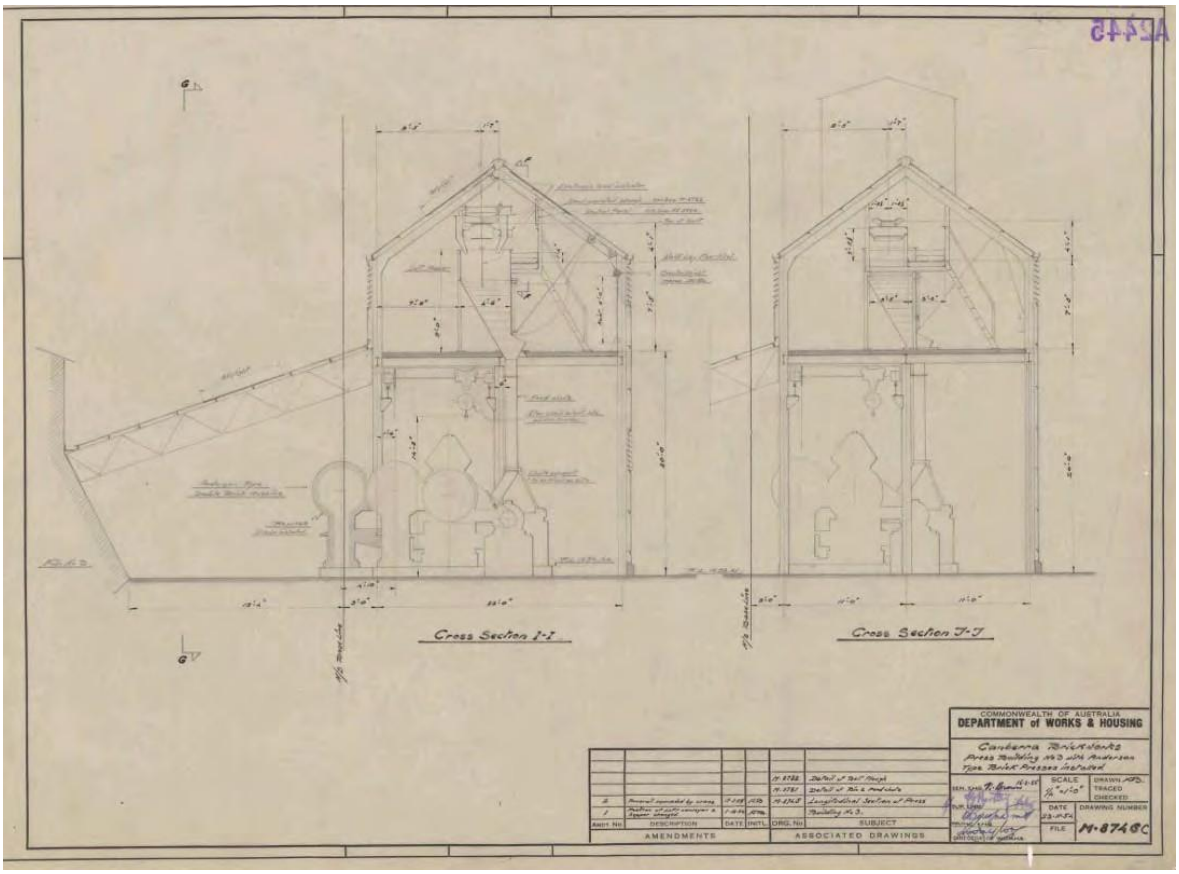


Figure 2 Canberra Brickworks Press Building III, 23 November 1954. Cross-sections showing internal structure and machinery installation, Machine Bay 3. (Source: National Archives of Australia)

Canberra Brickworks: Inventory of Individual Historic Elements

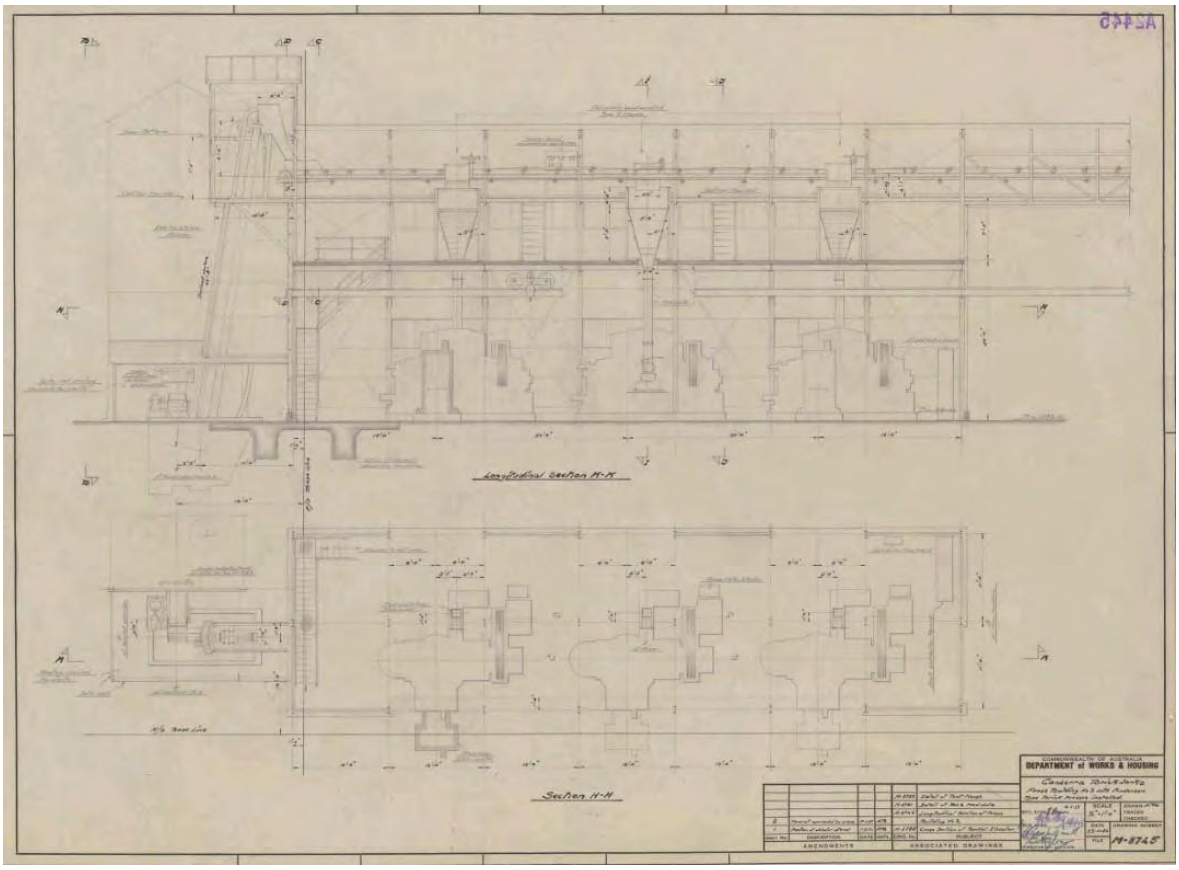


Figure 3 Canberra Brickworks Press Building III, 23 November 1954. Longitudinal sections showing internal structure and machinery installation, Machine Bay 3. (Source: National Archives of Australia)



Figure 4 Machine Bay 3 behind the Elevator/Conveyor. Chimney Stack for Hardy Patent Kiln 2 to the right. (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 5 Machine Bay 2 (left) and Machine Bay 3 (right), looking west, showing the conveyor 'bridge' and open walkway between the two structures. (Source: Lovell Chen, 2010)



Figure 6 North end of Machine Bay 3 showing remains of headgear housing for the loft conveyor. (Source: Lovell Chen, 2010)



Figure 7 Interior with remnants of the Anderson brick machinery at the north end. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 8 Interior of the Machine Bay 3 shop floor, looking north. (Source: Lovell Chen, 2010)



Figure 9 Interior of Machine Bay 3 shop floor looking north. (Source: GML, 2017)

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Element 18—Workshop

Name of Element	Workshop	**CMP No. | ACT No.**	Element 18
Historical Phase	Postwar 1944–1976	**Date**	1955
Construction	Corrugated galvanised steel over steel frame		





Historical Background

The Workshop was constructed in 1955 and was used for general workshop repairs and the maintenance of machinery. It runs north–south across the Brickworks complex and was built on the approximate site of the original machine shop, which was constructed in 1915 and demolished in the 1950s.

Description and Condition

The Workshop is a two-storey steel framed building clad in corrugated steel over a brick base with a concrete slab floor. There is a sliding corrugated steel door in the west elevation and another entry to the north elevation. Due to vandalism, the original louvred glazing to both the west and east elevation has partly been replaced by corrugated fibreglass sheeting. The window openings as shown on the original plan differ from those shown today. To the north and south the building is partly enclosed at the upper level by walkways that connect the conveyor gallery with the higher ground to the east. The conveyor connecting the three machine bays extends through the gabled roof space to the north of the Workshop where the overhead gantry crane remains.

Internally the building has a concrete floor and the walls are unlined.

The inspection report identified that the building is generally in a reasonable condition, with wall sheeting damaged in some areas. The windows throughout the ground floor are broken and the timber walkway above the building is badly weathered. Roof sheeting and structural steel is in reasonable condition. Windows have been removed from the walkway resulting in weather damage to the timber elements. The timber structure has significant weathering.

Significance	Supporting Element

Replacing earlier structures on the site between the kilns and the Quarry, the Workshop is one of a series of utilitarian steel-framed buildings constructed as part of the post-World War II expansion and modernisation of the Brickworks. The form and location of these related structures and the conveyor that connects them, demonstrate important aspects of the historical pattern and layout of the complex. The Workshop performed a key function in the operation of the complex but was not directly involved in brickmaking processes.

Structural Advice as at 2021	Reinstatement required as part of the construction works, with upper areas requiring inspection—refer to Appendix G for detail.

Conservation Policy and Adaptation Guidelines	Supporting elements should preferably be retained and conserved

- The Workshop, including the conveyor that connects this building to the machine bays could be retained in situ, and may be conserved to interpret the historical use of the place or adopted to suite a new use for the place.
- The gantry crane and other remnant equipment unrelated to the brickmaking process can be retained, or removed if required.
- Windows and other openings should be allowed for appropriate access, daylight and ventilation for an adaptive reuse purpose.
- External modifications could be made.
- Internal adaptation is possible and alternatives for its reuse could be explored.

Canberra Brickworks: Inventory of Individual Historic Elements

- A structural assessment is advised for the upper level, and public access should be restricted.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

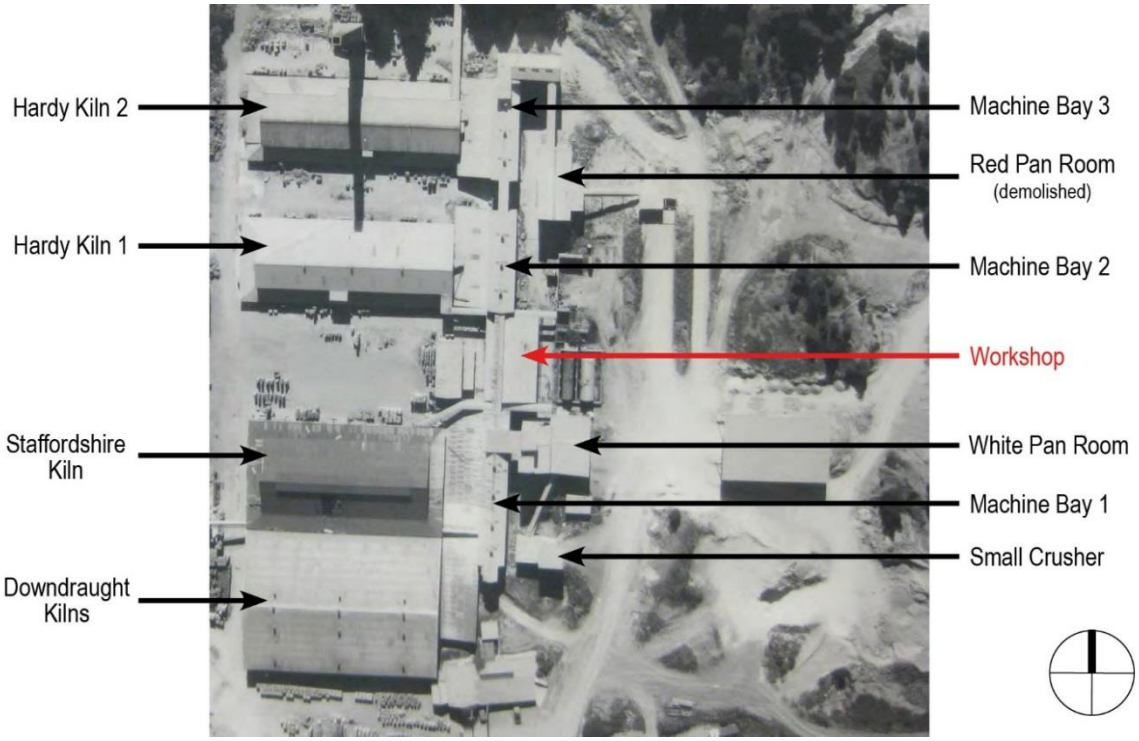


Figure 1 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. The Workshop is indicated in red. (Source: ACT Heritage Library, Woden, ACT, with GML additions)

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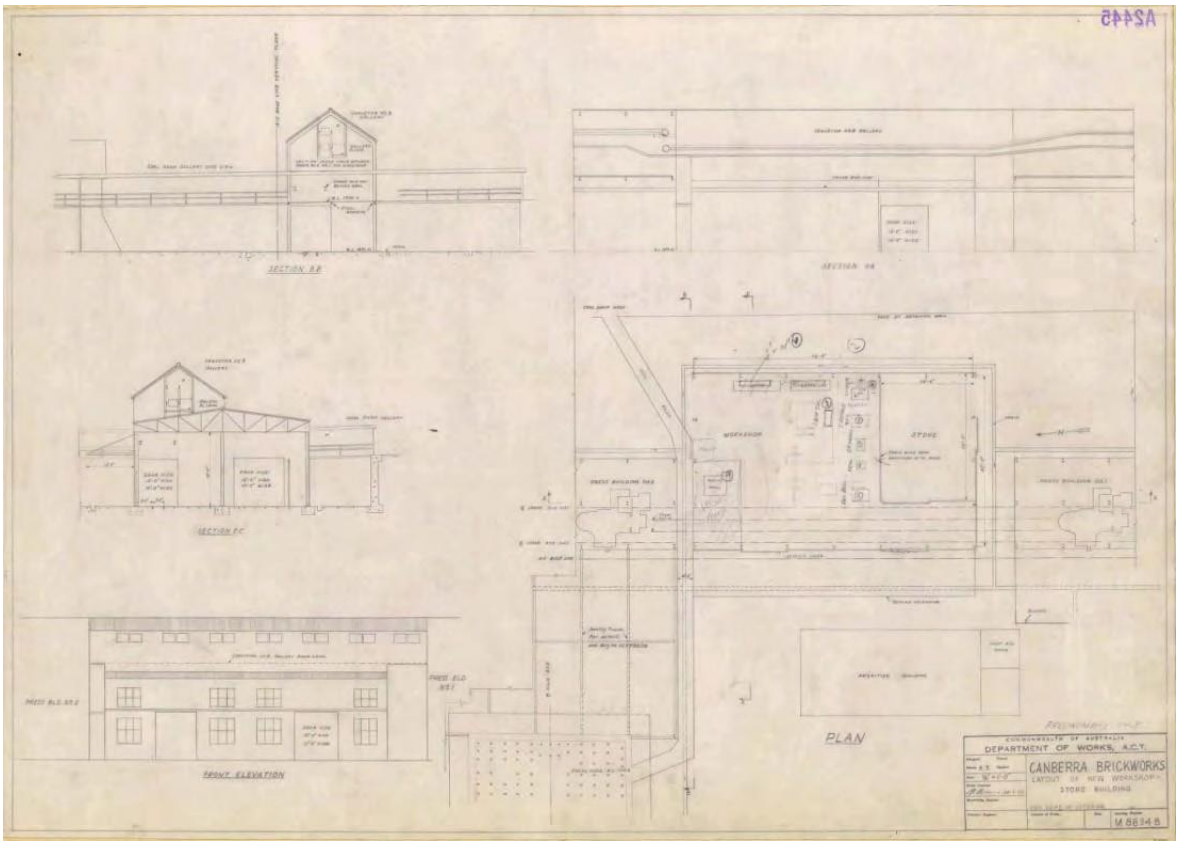


Figure 2 Canberra Brickworks—layout of new Workshop—Store Building, 1955. (Source: National Archives of Australia)



Figure 3 Interior of Workshop. (Source: Lovell Chen, 2010)

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Figure 4 West elevation showing entry. (Source: Lovell Chen, 2010)

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Element 19—Large Crusher House

Name of Element	Large Crusher House (White Pan Room)	**CMP No. | ACT No.**	Element 19
Historical Phase	Postwar 1944–1976	**Date**	c1955
Construction	Corrugated galvanised steel over steel frame		





Historical Background

The Large Crusher House (White Pan Room) is thought to have been constructed in c1955 as part of the expansion and modernisation of the Brickworks. Along with the now demolished 'Red Pan Room' located further north, the Large Crusher House refined raw materials including shale and white clay prior to processing and feeding into the brick presses housed in the machine bays.

Located to the east of Machine Bay 1 (Element 15), this facility was solely used for the crushing and refining of white clay. The clay was brought to the crusher house/pan house by truck where it was placed in the two hoppers ready to be fed into grinding pans. The grinding pans comprised a rotating perforated metal disc or pan over which large rollers crushed the clay. After grinding, the raw material was elevated and screened. Where material was still too coarse it was returned to the grinding pans and then elevated to the top of the adjoining machine bay to be fed into the brick presses.

The building was later connected to the Small Crusher House (Element 21) by a conveyor, which transported crushed raw materials for further refining in the Large Crusher House. This increased the processing capacity of the complex. The relationship between the Small Crusher House and Large Crusher House generally mirrored that of the Primary Crusher House (Element 20) and the Red Pan Room. However, unlike the Red Pan Room, the White Pan Room also had a hopper for directly loading raw materials.

Description and Condition

The Large Crusher House is a steel-framed, corrugated steel-clad machinery house with a distinctive roofline of skillion forms in varying heights. Like the Small Crusher House, there is an unloading bay at a higher level where white clay material was directly unloaded into one of two hoppers, which have both been removed. The structure is framed by off-form concrete walls and the interior has been gutted with most of the machinery removed. This has exposed large holes in the concrete surrounding the former location of the hoppers.

The inspection report for the building identified that several bracing members have been removed from the structure and that the wall sheeting is weathered and loose in some areas. There is debris scattered throughout the building and areas of the suspended slab have collapsed.

Significance	Supporting Element

Along with the machine bays, the three related crusher houses were new process buildings constructed as part of the post-World War II expansion and modernisation of the Brickworks. The form and location of these related structures demonstrate important aspects of the historical pattern and layout of the complex. Despite the removal of most of the equipment, the form of the buildings, the remnant hopper, and other elements internally reflect aspects of the brickmaking process post-World War II.

The Large Crusher House is a particularly prominent site element with its collection of skillion roofed forms rising above the machine bays.

Structural Advice as at 2021	Reinstatement and rectification may be required as part of the construction works. Loose roof and wall sheeting should be fixed to prevent a safety risk—refer to Appendix G for detail.

Canberra Brickworks: Inventory of Individual Historic Elements

Conservation Policy and Adaptation Guidelines	Supporting elements should preferably be retained and conserved

- The Large Crusher House should preferably be retained and conserved. However, it is recognised that this may be difficult to achieve given the current condition.
- The structure could be adapted for a new use, retained as an interpretative feature, or replaced with a new sympathetic façade would likely need to be added to the eastern elevation, which is generally consistent with the scale, form, external materials and industrial character of the place.
- While not essential, consideration could be given to the retention of the remnant platforms and hopper.
- Additional structural support maybe be required. A detailed structural assessment is required and any loose sheeting to be secured.
- Clean up debris and reinstate slab if required.
- Restrict public access unless the building is made safe.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

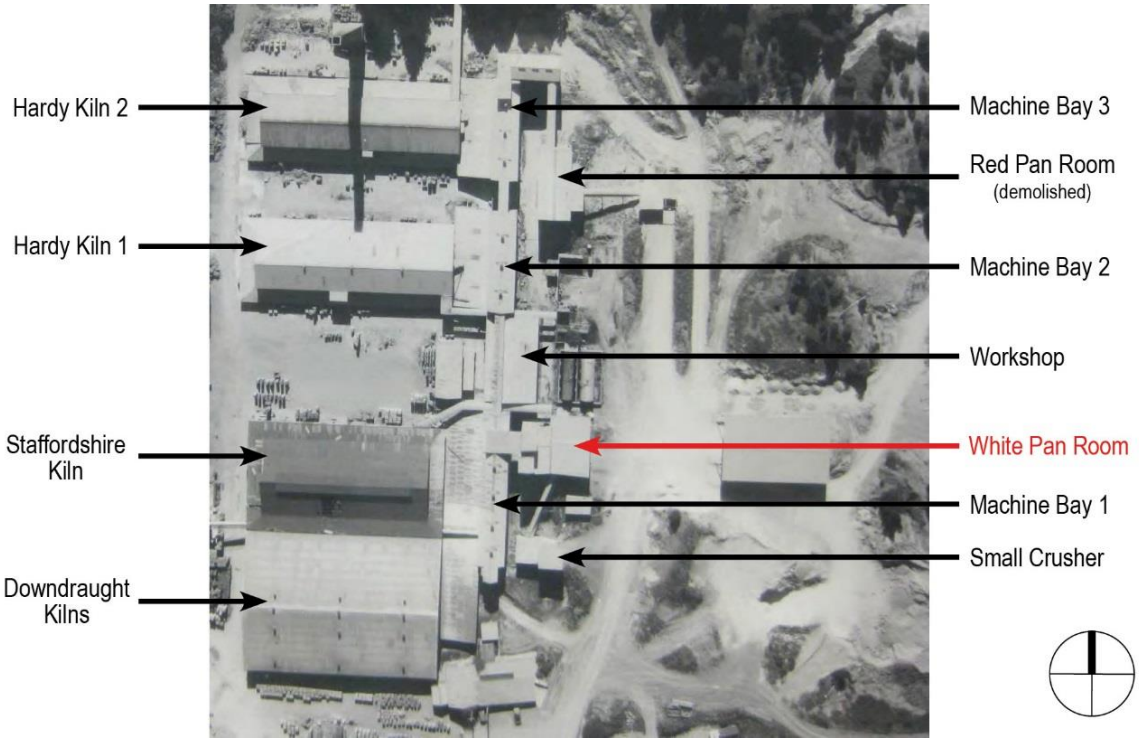


Figure 1 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. Large Crusher House/White Pan Room is indicated in red. (Source: ACT Heritage Library with GML overlay)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 2 The Large Crusher House viewed from the east. The shed in the foreground is Element 36—Model Railway Storage Shed. (Source: Lovell Chen, 2010)



Figure 3 Interior of the Large Crusher House looking west. The site of the now-removed hoppers is in the foreground. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 4 South elevation showing the 'high-level' connection to Machine Bay 1, which is shown at left. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 21—Small Crusher House

Name of Element	Small Crusher House	**CMP No. | ACT No.**	Element 21
Historical Phase	Postwar 1944–1976	**Date**	Unknown, mid to late 1950s
Construction	Corrugated galvanised steel cladding over steel frame		





Historical Background

Though its construction date is unknown, the Small Crusher House appears to have been constructed as part of the 1950s expansion works. Its later construction date may suggest the requirement to augment the operations of the newly completed White Pan Room and Primary Crusher House at comparatively short notice.

The Small Crusher House was fitted with a 'Hazemag' brand crusher and a single hopper. Raw materials could be unloaded directly from the truck bay at the higher level into the hopper and then into the crusher. The 'Hazemag' crusher was a rotary crusher that ground and screened the raw material through a perforated plate. Material was then transported by conveyor to the White Pan Room, which solely processed white clay for further refining. Here materials would be further ground and screened. Crushed clay would then be conveyed by elevator to the three machine bays adjoining the crusher houses to the west.

Description and Condition

The Small Crusher House is a steel-framed, corrugated, galvanised steel-clad machinery house. The building at the upper level is flanked by low sloping walls of off-form concrete, which frame the unloading bay. At the lower level, the structure presents as a two-storey building with some of the machinery platforms and framing, including the hopper, in place. The conveyor connecting the crusher to the White Pan Room has been removed. Part of the roof cladding and lower sections of the wall cladding and the internal flooring have been removed.

The building is in a reasonable condition.

Significance	Supporting element

Along with the machine bays, the three related crusher houses were new process buildings constructed as part of the post-World War II expansion and modernisation of the Brickworks. The form and location of these related structures demonstrate important aspects of the historical pattern and layout of the complex. Despite the removal of most of the equipment, the form of this building, the remnant hopper, and other elements internally reflect aspects of the brickmaking process post-World War II.

Conservation Policy and Adaptation Guidelines	Supporting elements should preferably be retained and conserved

- The remnant platforms and hopper could be retained, adapted for a new use or retained as an interpretative feature. Or may be replaced with new development that is generally consistent with the scale, form, external materials and industrial character of the place. .Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

Canberra Brickworks: Inventory of Individual Historic Elements

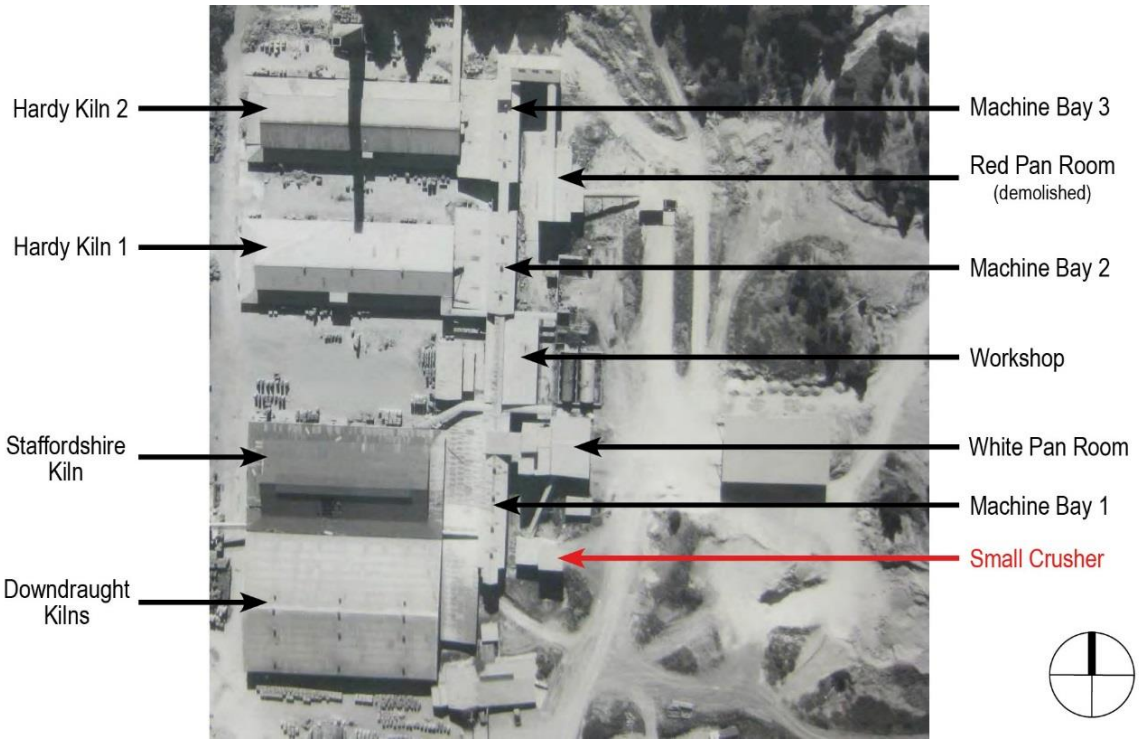


Figure 1 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. Small Crusher House is indicated in red. (Source: ACT Heritage Library with GML overlay)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 2 Small Crusher House viewed from the north. (Source: Lovell Chen, 2010)

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Element 22—Elevator/Conveyor

Name of Element	Elevator/Conveyor	**CMP No. | ACT No.**	Element 22
Historical Phase	Postwar 1944–1976	**Date**	c1955
Construction	Corrugated galvanised steel cladding over steel frame, partially dismantled		





Historical Background

The Elevator/Conveyor was constructed c1955 as part of the postwar expansion and modernisation of the Brickworks. In two parts, the conveyor transported the crushed shale from the Primary Crusher House to the now demolished Red Pan Room located to the rear (east) of Machine Bay 2 and Machine Bay 3. The Red Pan Room ground and screened the crushed shale, and the other section of the conveyor transported it to a distribution hopper which adjoined Machine Bay 3. From this point the shale travelled vertically down to the table measures where it was then conveyed by elevator to the top of Machine Bay 3, joining the loft conveyors to be distributed to the brick presses. The presses were housed within the machine bays, which serviced each of kilns.

Description and Condition

The Elevator/Conveyor is a steel-framed structure clad in corrugated galvanised steel supported on steel stanchions. Part of the conveyor remains in situ. Footings of the demolished structures are present, including sections of the dismantled gangway that led from the firing floor of Hardy Patent Kiln 2 to an oil storage depot, the current site of the houses in Lane Poole Place.

The structure is in poor condition. The section linking the Red Pan Room (demolished) to the distribution hopper is only partly intact and the section linking to the crusher has been demolished. The adjoining distribution hopper structure has also been demolished.

Significance	Supporting Element

The Conveyor was an integral element in the transport and refining of raw material from the Primary Crusher House to the brick kilns. While much of the structure's fabric is missing, the remaining portion demonstrates aspects of the layout and sequence of processes on the site.

Structural Advice as at 2021	Rectification works required as part of the construction works—refer to Appendix G for detail.
Conservation Policy and Adaptation Guidelines	The ACT Heritage Register citation requires this element to be conserved, although it can be relocated

- The Elevator/Conveyor should preferably be retained and conserved, noting that the Heritage Register citation—Specific Requirements—allows for its relocation subject to the relocation process being fully documented and full reconstruction of the building taking place within a specified period.
- A structural assessment is required, and loose sheeting should be secured.
- The structure could be adapted for a new use, or retained as an interpretative feature.
- Integral equipment and machinery may be retained and conserved for their ability to demonstrate the historic industrial processes and aesthetic, industrial character.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

Canberra Brickworks: Inventory of Individual Historic Elements

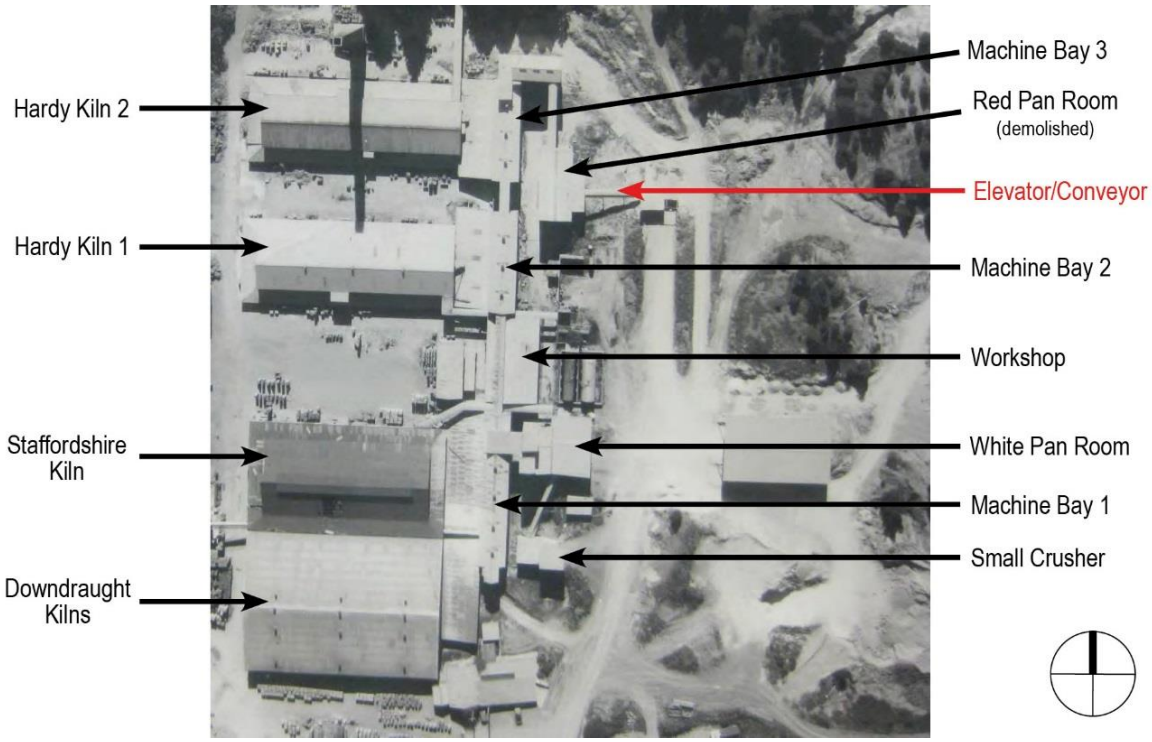


Figure 1 1976 aerial photograph with major site elements in the vicinity of the machine bays labelled. (Source: ACT Heritage Library with GML overlay)



Figure 2 East side of the Elevator/Conveyor with Machine Bay 3 in the background. (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 3 Front of the Elevator/Conveyor. (Source: GML, 2017)



Figure 4 View of the Elevator/Coveyor and Machine Bay 3 west of the quarry. (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 24—Concrete Retaining Wall

Name of Element	Concrete Retaining Wall	**CMP No. | ACT No.**	Element 24 | n/a
Historical Phase	Establishment 1911–1920	**Date**	c1913–16
Construction	Off-form concrete cast in situ		





Historical Background

A concrete retaining wall separating the quarry and the working area is shown on the 1916 Survey Plan. It is likely that it was constructed as part of the permanent works during 1915 to 1916. At its southern end, the wall returned to form the 'Coal Stage', also shown on the 1916 Survey Plan. The wall extended to the north, approximately to the concrete base of the demolished Pan Room, where it returned to the east (see Figure 3). The rear of the original 'Machine Shop' abutted the retaining wall (see Figure 1).

Description and Condition

The cast in situ off-form concrete wall is approximately four metres high. Its depth has not been established. The original extent of the wall remains legible, although the former Coal Stage has been demolished. The crusher houses and the east and north brick walls of the Model Railway Workshop (Element 35) are built on top of the wall. It also carries the pedestrian bridge that provides access to the firing floor of Hardy Patent Kiln 1 (see Figure 3).

The inspection report notes that the brickwork part of the retaining wall appears to be sliding off the concrete retaining wall, and the wall has partially collapsed with loose bricks. There is also a large tree that has become unstable due to the collapse of the wall. The condition is reasonable.

Significance	Element is not identified to be of heritage significance

The concrete retaining wall is an early feature of the site but does not have a heritage significance.

Conservation Policies	Element can be retained or demolished as required

- The retaining wall continues to operate to mediate the levels between the quarry and the brickworks. Although it is not required to be retained, it is likely to be largely retained as it interacts with many supporting heritage elements. Where retained, it should be stabilised as required.
- The Model Railway Workshop (Element 35), and non-original brickwork atop the wall could be retained or demolished as required.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines.

Canberra Brickworks: Inventory of Individual Historic Elements

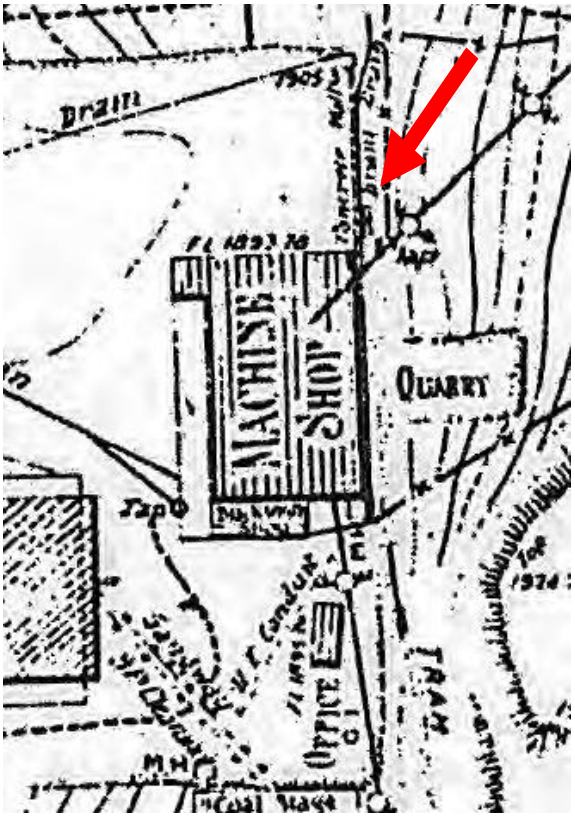


Figure 1 Detail from 1916 Survey Plan with the concrete retaining wall identified. (Source: NAA: A6664, L165A, 1916)



Figure 2 Retaining wall to the rear of the Workshop. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 3 The north end of the concrete / brick retaining wall. (Source: Lovell Chen, 2010)

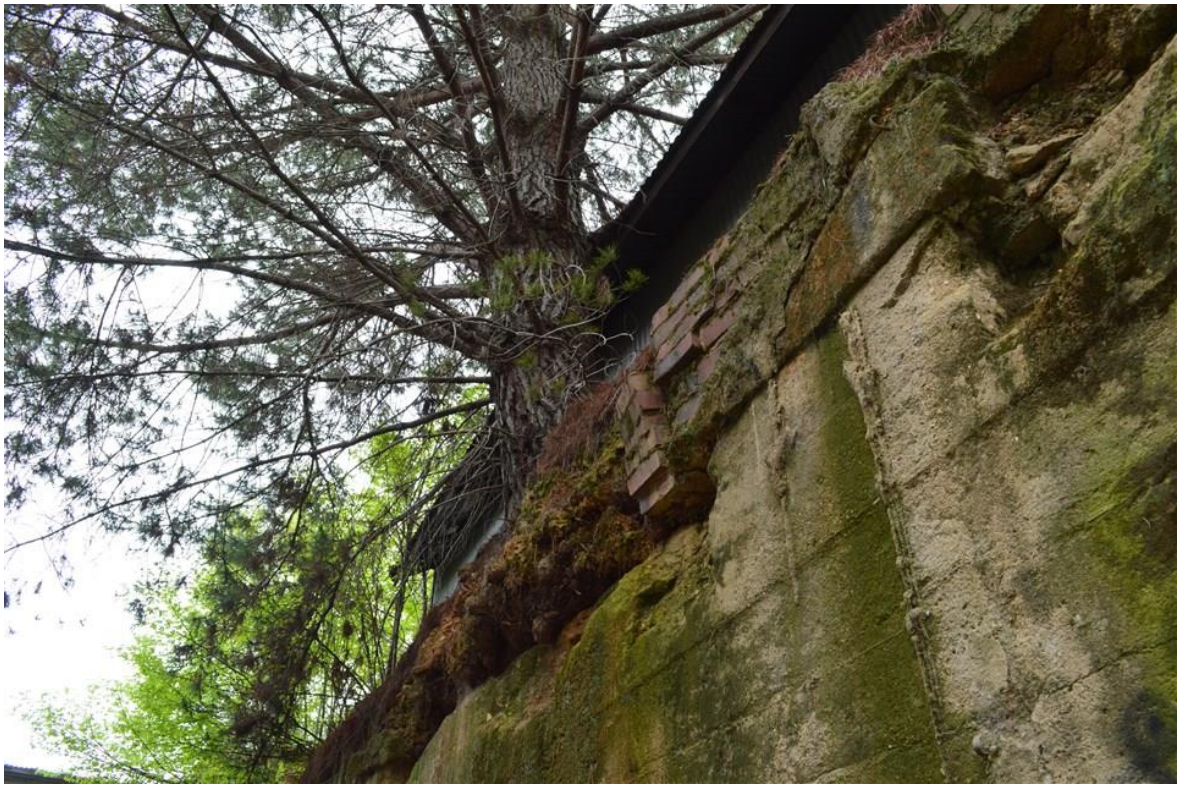


Figure 4 Top of retaining wall showing unstable tree. (Source: GML, 2016)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 5 Concrete top and upper masonry work to the retaining wall partially collapsed. (Source: GML, 2016)

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Element 25—Amenities Block

Name of Element	Amenities Block	**CMP No. | ACT No.**	Element 25 | n/a
Historical Phase	Postwar 1944–1976	**Date**	c1950, c1977
Construction	Brick reinforced concrete, galvanised steel		





Historical Background

The provision of a purpose-built amenities building, consolidating toilet, changing and lunch room facilities, was one of the first actions of the Brickworks administration in the years following World War II. It heralded an era of significant expansion and modernisation and saw the provision of a modern, up-to-date facility that centralised workers' amenities.

The first floor originally accommodated a lunch room with access from a concrete staircase to both the north and south ends of the east (front) elevation. Toilet and changing facilities including showers, a drying room and a locker room were located on the ground floor. The present entrances to the ground floor toilets were originally windows and the ground floor spaces were originally accessed from the stairwells. However, the date of these works has not been established. The building previously had a covered breezeway protecting the entry. A single-storey first aid room was appended to the south end of the building after the A R Marr lease period.

Description and Condition

The Amenities Block is a two-storey building of red face brick, with a gable roof clad in corrugated galvanised steel. There is ramp access to both toilets. The white painted area to the ground floor facade indicates the scale of the breezeway enclosure since removal.

Internally the former locker room, showers and drying room have been reconfigured. A wall has been constructed dividing the ground floor in half on an east–west axis to provide male and female washrooms and toilet facilities. These alterations were undertaken by A R Marr Pty Ltd as part of the conversion of the site to a tourist precinct in the late 1970s. The finishes are typical of the period—ceramic tile, modular basins, laminate partitions and mosaic tiled floors.

The inspection report for the building identified that the brickwork is in a reasonable condition, with the roof sheets, fascia boards and window frames weathered. There are signs of vandalism including graffiti, broken glass, and debris on the floor. As there was restricted access to the interior, from the external inspection the internal structure appears in sound condition.

Significance	Element is not identified to be of heritage significance

The Amenities Block was constructed as part of a major consolidation and expansion of the Brickworks in the 1950s and reflects the need to provide improved facilities for workers on site.

Structural Advice as at 2021	No structural concern—refer to Appendix G for detail.
Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- The Amenities building can be retained or demolished as required. While retention is preferred as part of the larger group of 1950s buildings reflecting the operation of the complex in the post-World War II period, the Amenities Block is an incidental building unrelated to process.
- The building could be adapted internally or demolished and replaced.

Canberra Brickworks: Inventory of Individual Historic Elements

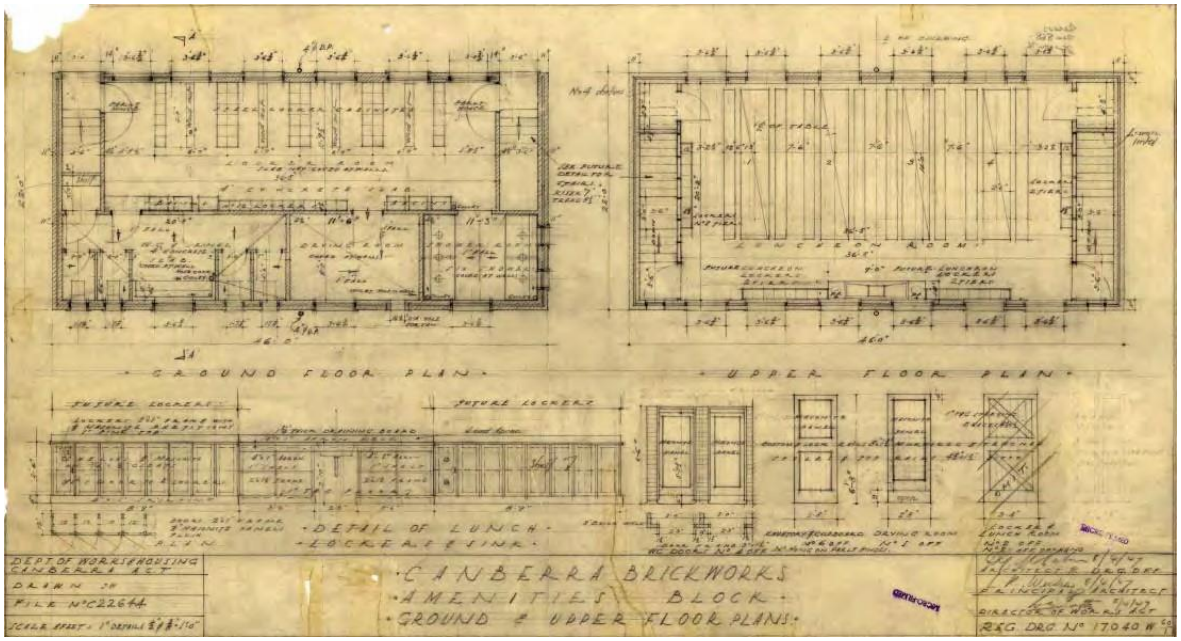


Figure 1 Amenities Block floor plans, 1947. (Source: National Archives of Australia.)



Figure 2 The Amenities Block. The Chimney Stack for the Staffordshire Kiln is visible in the background. (Source: GML, 2017)

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Element 26—Downdraught Kiln Control Room

Name of Element	Downdraught Kiln Control Room	**CMP No. | ACT No.**	Element 26 | n/a
Historical Phase	Postwar 1944–1976	**Date**	c1961
Construction	Brick with corrugated steel roof		





Historical Background

The Control Room was constructed during the early 1960s to coincide with the construction of the three Downdraught Kilns. The windows were timber framed louvres to the south and west elevations, which were broken prior to being boarded over with plywood. The ceiling was originally corrugated asbestos cement sheet but has recently been replaced.

Description and Integrity

The Control Room is constructed of orange and cream brick with a gable roof of corrugated asbestos cement. There is a brick stair with concrete treads to the west elevation leading to the entry in the north elevation.

The inspection report for the structure notes the external brickwork is in a generally reasonable condition. The roof and gable ends have been updated and repainted. The windows and doors have been boarded up and are damaged in places.

Significance	Element is not identified to be of heritage significance

The Control Room to the Downdraught Kilns is an incidental element of neutral significance to the site.

Structural Advice as at 2021	Minor rectification works, but not of structural concern—refer to Appendix G for detail.
Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- The building can be removed or demolished as required.

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Figure 1 The Downdraught Kiln Control Room is the cream brick building adjoining the Power House (Element 14). (Source: Lovell Chen, 2010)



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Figure 2 South elevation of the Control Room. (Source: GML, 2017)



Figure 3 North and partial west facade of the Control Room. (Source: GML, 2017)

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Element 27—Toilet Block

Name of Element	Toilet Block	**CMP No. | ACT No.**	Element 27 | n/a
Historical Phase	Postwar 1944–1976	**Date**	c1960s
Construction	Brick, steel roof decking		





Historical Background

A small brick toilet adjoins the rear of the Office (Element 13) and is located adjacent to the Ancillary Storage Building 2 (Element 33). It is similar in size and materials to the Amenities Block 2 (Element 31), which adjoined the brick extrusion plant at the other side of the Brickworks. It contained a toilet cubicle. Its construction of various coloured brickwork, suggests it was built from materials at hand.

Description and Condition

The toilet is constructed of coloured brickwork and has a skillion roof of metal roof decking. There is a window in the north wall and a boarded-up door to the east elevation.

The building is in poor condition.

Significance	Element is not identified to be of heritage significance

The Toilet Block is one of a series of relatively minor ancillary and service buildings at the Brickworks from the postwar phase. A number of these buildings are typical of the support functions found on any industrial site and do not inform the process or contribute to its significance.

Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- The Toilet Block could be retained or demolished as required.



Figure 1 The toilet block is indicated by the arrow. (Source: Lovell Chen, 2010)

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Element 28—Ancillary Storage Building

Name of Element	Ancillary Storage Building	**CMP No. | ACT No.**	Element 28 | n/a
Historical Phase	Postwar 1944–1976	**Date**	c1971
Construction	Brick, corrugated galvanised steel		





Historical Background

The Ancillary Storage Building is a small structure located on the edge of the brick extrusion plant site to the west of the Brickworks complex. Its construction date is possibly c1971, the time when the extrusion plan was constructed. Its original function is not known. The building has been used by the site tenants as an artist's studio space.

Description and Condition

The building is constructed of tan wire-cut brick with a skillion roof of metal roof decking. Internally, it has a concrete floor, partly brick walls painted white with some areas of painted lining panels, and window openings to both the south and east elevations. There is a doorway in the east elevation. The glazing and window framing as well as the door have been removed. The ceiling is also lined and painted.

The building is vacant and in poor condition.

Significance	Element is not identified to be of heritage significance

The Ancillary Storage Building is one of a group of buildings/elements at the Brickworks associated with the extrusion plant that was constructed c1971 in the postwar phase and has since been demolished. A number of these buildings and remnants are typical of the support functions found on any industrial site and do not inform the process or contribute to its significance.

Structural Advice as at 2021	No structural concerns—refer to Appendix G for detail.
Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- The Ancillary Storage Building could be retained or demolished as required.

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Figure 1 The rear (west) elevation of the Ancillary Storage Building. The Downdraught Kilns storage shed is in the background. (Source: GML, 2017)



Figure 2 South elevation of the Ancillary Storage Building. (Source: GML, 2017)

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Element 29—Substation/Control Room

Name of Element	Substation/Control Room	**CMP No. | ACT No.**	Element 29 | n/a
Historical Phase	Postwar 1944–1976	**Date**	c1971
Construction	Brick, corrugated galvanised steel		





Historical Background

The Substation/Control Building was constructed in 1971, to house the new extrusion brick making plant as well as a series of brick drying kilns. The extrusion plant was connected to the machine shed complex at the east side of the site by an overhead conveyor, which passed between the Staffordshire and Downdraught kilns. In August 1972, the *Canberra Times* reported that the $500,000.00 extrusion machine raised the total production capacity of the Brickworks from around 20 million bricks per year to more than 40 million.

To service the new plant, the Substation/Control Room and adjoining Boiler House were erected. After the closure of the plant, both buildings were refitted to serve as stalls as part of a larger antique market, which operated from the late 1970s to the early 1980s.

Description and Condition

The former Substation/Control Room is located to the north of the Boiler House. It is constructed of brick and has a gabled roof clad in corrugated steel. The gable is infilled with corrugated steel to the front and rear. There is a single door entry in the north elevation and a window, with metal bars fixed to its outside face. The door is a painted timber ledged door set within a timber frame. There is a steel roller door to the east elevation with a crude corrugated steel canopy above supported on timber posts with angled brackets. A verandah extends further south than the extent of the building, almost abutting the verandah of the adjoining Boiler House. This last element is thought to date from the use of the building as an antique stall. A painted timber sign fixed to the building's facade adjoining the louvre window by the roller door reads 'Nicky's Antiques'. A metal cable tray that previously extended from the rear (west) wall into the extrusion plant proper has been crushed against the wall.

Internally, the brickwork is painted and there is a concrete floor and painted concrete ceiling. The space is largely stripped out.

The building is in a reasonable condition. It has been impacted by minor vandalism, including broken windows, graffiti and smoke damage. The corrugated galvanised steel roofing appears recent and is in very good condition. The verandah and sign date from the post-closure phase and are related to its subsequent use as an antique stall.

Significance	Element is not identified to be of heritage significance

The Substation/Control Room is one of a group of buildings/elements at the Brickworks associated with the extrusion plant that was constructed c1971 in the postwar phase and has since been demolished. A number of these buildings and remnants are typical of the support functions found on any industrial site and do not inform the process or contribute to its significance.

Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- The Substation/Control Room could be retained or demolished, as required.

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 1 Front of Substation/Control Room with the Boiler House (Element 30) to the left. (Source; GML, 2017)



Figure 2 The Substation/Control Room (left) and Boiler House photographed from the location of the former extrusion plant. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 30—Boiler House

Name of Element	Boiler House	**CMP No. | ACT No.**	Element 30 | n/a
Historical Phase	Postwar 1944–1976	**Date**	c1971
Construction	Brick, corrugated galvanised steel		





Historical Background

The Boiler House was constructed in 1971 to house the extrusion brick making plant as well as a series of brick drying kilns. The extrusion plant was connected to the machine shed complex at the east side of the site by an overhead conveyor which passed between the Staffordshire and Downdraught kilns. In August 1972, the *Canberra Times* reported that the $500,000.00 extrusion machine raised the total production capacity of the Brickworks from around 20 million bricks per year to more than 40 million.

To service the new plant, the Boiler House and adjoining Substation/Control Room were erected. After the closure of the plant, both buildings were refitted to serve as stalls as part of a larger antique market, which operated from the late 1970s to the early 1980s.

Description and Condition

The Boiler House is a double-height structure constructed of brick with a gabled roof clad in corrugated steel. The gable is infilled with corrugated steel to both the front and rear. Access is through a steel roller door. There is a crude corrugated steel canopy above the roller door entry in the east elevation, supported on timber posts. This last element is thought to date from the use of the building as an antique stall. There is a crudely laid brick and concrete paver apron to the entry.

Internally, the brickwork is painted and there is a concrete floor and painted ceiling lining boards with a narrow bead. There are two fixed pane windows to the east and west walls, approximately 2.5 metres above the internal floor level. No machinery or equipment relating to its original use remains.

The building is in good condition apart from the impacts of minor vandalism, including the broken windows.

The verandah is thought to date from the post-closure phase and related to its subsequent use as an antique stall.

Significance	Element is not identified to be of heritage significance

The Boiler House is one of a group of buildings/elements at the Brickworks associated with the extrusion plant that was constructed c1971 in the postwar phase and has since been demolished. A number of these buildings and remnants are typical of the support functions found on any industrial site and do not inform the process or contribute to its significance.

Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- The Boiler House could be retained or demolished, as required.

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 1 Former boiler house building showing east entry and later verandah addition. (Source: Lovell Chen, 2010)



Figure 2 The Boiler House (right) and Substation/Control Room photographed from the site of the former extrusion plant. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 3 Detail of entry through sliding door at east elevation. (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 31—Amenities Block 2

Name of Element	Amenities Block 2	**CMP No. | ACT No.**	Element 31 | n/a
Historical Phase	Postwar 1944–1976	**Date**	c1960s
Construction	Brick, metal roof decking		





Historical Background

This small brick Amenities Block 2 is located to the eastern edge of the brick extrusion plant (Element 32). It adjoins and predates a small tan brick Ancillary Storage building (Element 28). It is similar in size and is constructed of similar materials to the storage shed (Element 34) on the southern edge of the quarry, behind the White Pan Room and Toilet Block (Element 27). It contained a toilet cubicle and shower recess and may also have functioned as a laundry post-closure of the Brickworks.

Its construction of vari-coloured brickwork suggests it was built from materials at hand.

Description and Condition

Amenities Block 2 is of vari-coloured brickwork and has a skillion roof of metal roof decking. Internally, it has a concrete floor and there are window openings to the north, east and south. Entry is from the south. The interior has been heavily vandalised with all fittings and finishes in poor condition.

Significance	Element is not identified to be of heritage significance

Amenities Block 2 is one of a series of relatively minor ancillary and service buildings at the Brickworks from the postwar phase. A number of these buildings are typical of the support functions found on any industrial site and do not inform the process or contribute to its significance.

Structural Advice as at 2021	No structural concerns—refer to Appendix G for detail.
Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- Amenities Block 2 could be retained or demolished as required.

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 1 East and north elevation of the Amenities Block. (Source: GML, 2017)



Figure 2 Amenities Block 2 to the left with the Downdraught Kilns opposite and the Staffordshire Kiln and Hardy Patent Kiln 1 in the background. (Source: GML, 2017)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 32—Brick Extrusion Plant

Name of Element	Brick Extrusion Plant (Remnant Slab for Brick)	**CMP No. | ACT No.**	Element 32 | n/a
Historical Phase	Postwar 1944–1976	**Date**	c1971
Construction	Concrete slab		





Historical Background

An extrusion brick making plant was constructed in 1971, as well as a series of brick drying kilns. The brick extrusion plant was connected to the machine shed complex at the east side of the site by an overhead conveyor, which passed between the Staffordshire and Downdraught kilns. This is shown in an aerial photograph of the Brickworks site taken in May 1976 (see to Figure 1). The *Canberra Times* reported in August 1972 that the $500,000 extrusion machine raised the total production capacity of the plant from approximately 20 million bricks per year to over 40 million per year.

After the closure of the Brickworks, the shed building that enclosed the drying kilns and brick making machinery was relocated to the Canberra Showgrounds and the conveyor was dismantled. The drying kilns have also been demolished. The slab is now used as a timber store.

Description and Condition

The brick extrusion plant has been demolished, and the slab for the brick extrusion plant and only the slab remains. . The Substation/Control Room and Boiler House adjacent to the element were constructed to service the extrusion plant.

The concrete slab is in poor condition.

Significance	Element is not identified to be of heritage significance

The slab for the brick extrusion plant is one of a group of buildings/elements at the Brickworks associated with the extrusion plant, which was constructed c1971 in the postwar phase and has since been demolished. A number of these buildings and remnants are typical of the support functions found on any industrial site and do not inform the process or contribute to its significance.

Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- The concrete slab could be retained or demolished as required.

Canberra Brickworks: Inventory of Individual Historic Elements

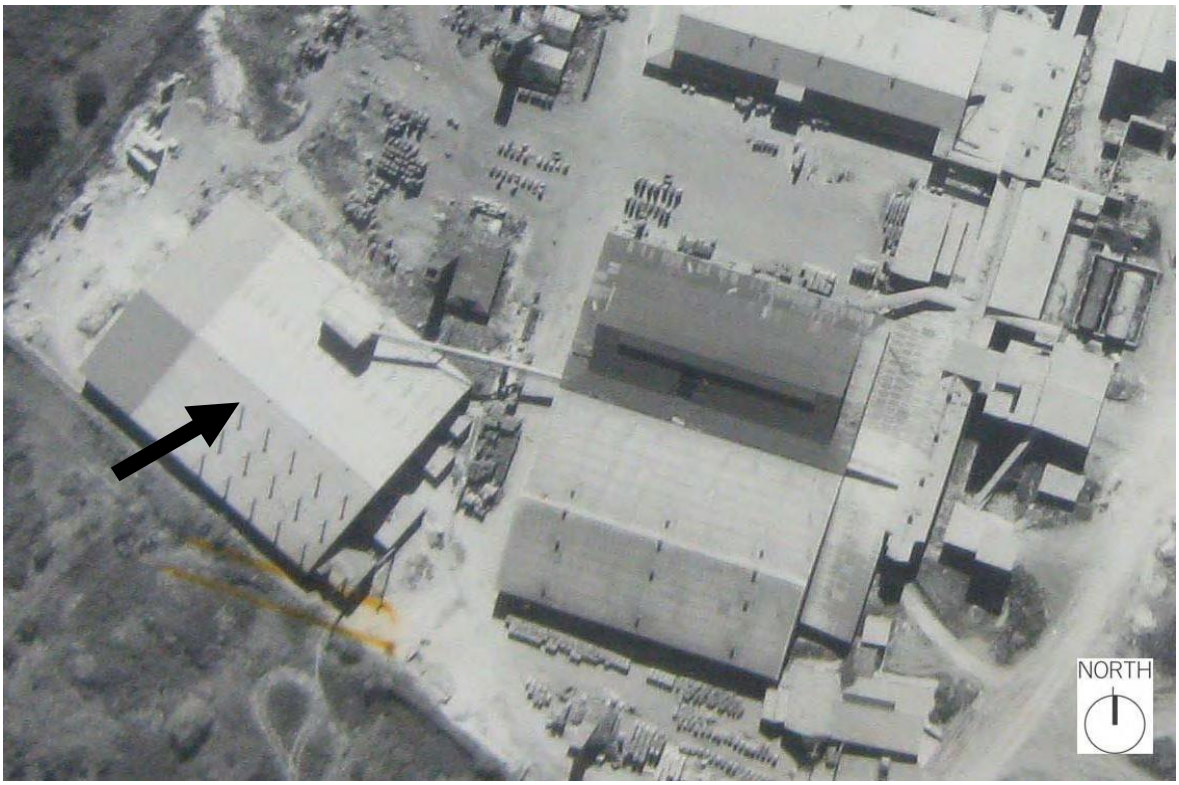


Figure 1 Detail of a 1976 aerial photograph showing the extrusion plant and overhead conveyor (indicated). (Source: ACT Heritage Library)



Figure 2 Site of the Brick Extrusion Plant, looking northeast. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 33—Ancillary Storage Building 2

Name of Element	Ancillary Storage Building 2	**CMP No. | ACT No.**	Element 33 | n/a
Historical Phase	Postwar 1944–1976	**Date**	c1960s
Construction	Brick, corrugated galvanised steel		





Historical Background

Ancillary Storage Building 2 is a small brick storage building, which abuts the Toilet Block (Element 27) behind the Office (Element 13). It has been constructed of similar materials to the storage shed that adjoins the Larger Crusher House/White Pan Room, further to the north. It appears to have been built as a store related to the nearby office building.

Description and Condition

The building is of orange face brick with a timber framed door and window to the south elevation. It has a skillion roof of metal roof decking. The interior walls are lined and part- fitted with shelving unit brackets.

The building is unsecured, impacted by vandalism and in poor condition.

Significance	Element is not identified to be of heritage significance

Ancillary Storage Building 2 is one of a series of relatively minor ancillary and service building at the Brickworks from the postwar phase. A number of these buildings are typical of the support functions found on any industrial site and do not inform the process or contribute to its significance.

Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- Ancillary Storage Building 2 could be retained or demolished as required.

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 1 Ancillary Storage Building 2 is sited behind the Office (Element 13). (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 34—Storage Shed

Name of Element	Storage Shed	**CMP No. | ACT No.**	Element 34 | n/a
Historical Phase	Postwar 1944–1976	**Date**	c1960s
Construction	Brick, corrugated galvanised steel		





Historical Background

The Storage Shed is a small brick building located on the southern edge of the quarry, behind the Large Crusher House/White Pan Room. It is similar in size and uses similar materials to the Toilet Block (Element 27) and Ancillary Storage Building 2 (Element 33) behind the Offices, and Amenities Block 2 (Element 31) adjacent the brick extrusion plant. The original function of the shed is not known. Its construction of vari-coloured brickwork suggests it was built from materials at hand, as needs dictated.

Description and Condition

The shed is of vari-coloured brickwork and has a skillion roof of metal roof decking. Internally, it has a concrete floor and the timber door to the large opening at its north elevation is stored within the building. The walls are not lined, and the reflective insulation has been damaged by vandals. The shed is vacant and in reasonable condition.

Significance	Element is not identified to be of heritage significance

The Storage Shed is one of a series of relatively minor ancillary and service buildings at the Brickworks from the postwar phase. A number of these buildings are typical of the support functions found on any industrial site and do not inform the process or contribute to its significance.

Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- The Storage Shed could be retained or demolished, as required.

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 1 The storage shed. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 35—Model Railway Workshop

Name of Element	Model Railway Workshop	**CMP No. | ACT No.**	Element 35 | n/a
Historical Phase	Post-closure 1976–2017	**Date**	c1979
Construction	Brick, corrugated galvanised steel		





Historical Background

Similar to the Model Railway Storage Shed, the Model Railway Workshop was constructed in 1979, utilising the brick walls of a former oil storage facility/coal storage bay associated with the Brickworks (see Figure 1). The workshop relates to the post-closure phase and housed an engine and carriages for a narrow-gauge railway, established as part of A R Marr Pty Ltd's operation at the site. A 1970s site plan showing works relating to the proposed re-use of the site outlines the sites of both model railway buildings and annotates the drawing 'replace demolished buildings'.

Description and Condition

Located to the west of the quarry, the shed is a steel framed skillion-roofed structure clad in corrugated galvanised steel. To the west, north and south the building incorporates the brick walls of a former fuel storage facility or coal bay. The structure abuts a deep excavated pit to its west, and the brick wall to the north and west is atop the concrete retaining wall. It has a row of louvred windows running along the northern wall looking out onto the quarry. There is a roller door entry and a single door entry to the south elevation.

Internally the corrugated galvanised steel walls are lined, with much of the lining panels damaged. The brick is not lined. The floor is of concrete and the roof is not lined. The louvred glazing has been broken/removed.

Significance	Element is not identified to be of heritage significance

The Model Railway Workshop is one of two buildings constructed following the closure of the Brickworks. It does not inform the process of the site or contribute to its significance.

Structural Advice as at 2021	No structural concern. Rectification may be required as part of the construction works—refer to Appendix G for detail.

Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- The Model Railway Workshop could be retained or demolished as required.

Canberra Brickworks: Inventory of Individual Historic Elements

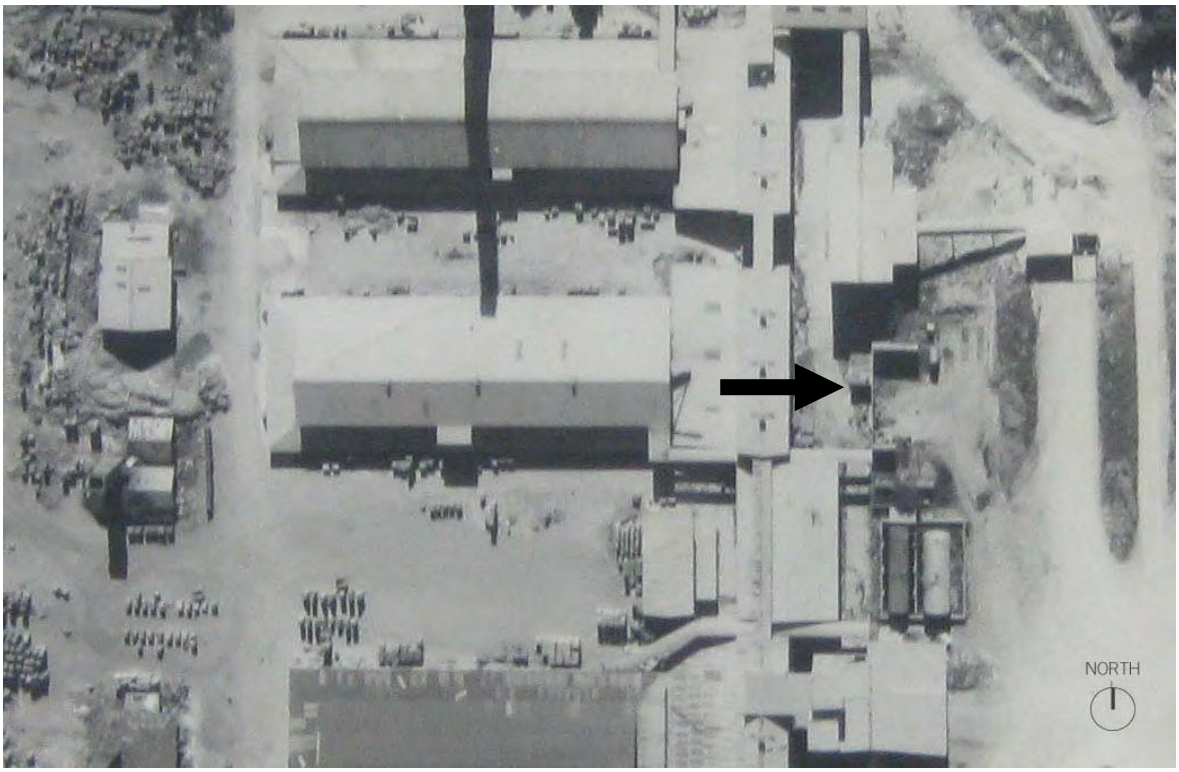


Figure 1 Detail of a 1976 aerial photograph, with the brick component of the Model Railway Workshop—at that time a storage bunker—indicated. (Source: ACT Heritage Library)



Figure 2 Exterior of the Model Railway Workshop showing the south and east elevations. The brick wall is an earlier element incorporated into the workshop building. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements

Element 36—Model Railway Storage Shed

Name of Element	Model Railway Storage Shed	**CMP No. | ACT No.**	Element 36 | n/a
Historical Phase	Post-closure 1976–2017	**Date**	c1979
Construction	Corrugated galvanised steel on brick plinth		





Historical Background

The Model Railway Storage Shed was constructed in 1979 utilising the brick footings and dwarf walls of a former oil storage facility/coal storage bay, associated with the Brickworks, and shown on the 1976 aerial photograph (see Figure 1). It housed an engine and carriages for a narrow-gauge railway, which formed part of A R Marr Pty Ltd's operation of the site. A 1970s site plan showing works relating to the proposed re-use of the site outlines the sites of both model railway buildings and annotates the drawing 'replace demolished buildings'.

Description and Condition

The Model Railway Storage Shed is of steel frame construction over an earlier brick base and is similar in scale to a domestic garage with corrugated galvanised steel cladding on the walls and roof. It has a tilt-up metal garage door and is presently used for timber storage. It is in reasonable condition.

Significance	Element is not identified to be of heritage significance

The Model Railway Storage Shed is one of two minor buildings constructed following the closure of the Brickworks. It does not inform the process of the site or contribute to its significance.

Structural Advice as at 2021	No structural concern to the building, although the embankment should be stabilised. Rectification may be required as part of the construction works—refer to Appendix G for detail.

Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- The Model Railway Storage Shed could be retained or demolished as required.

Canberra Brickworks: Inventory of Individual Historic Elements

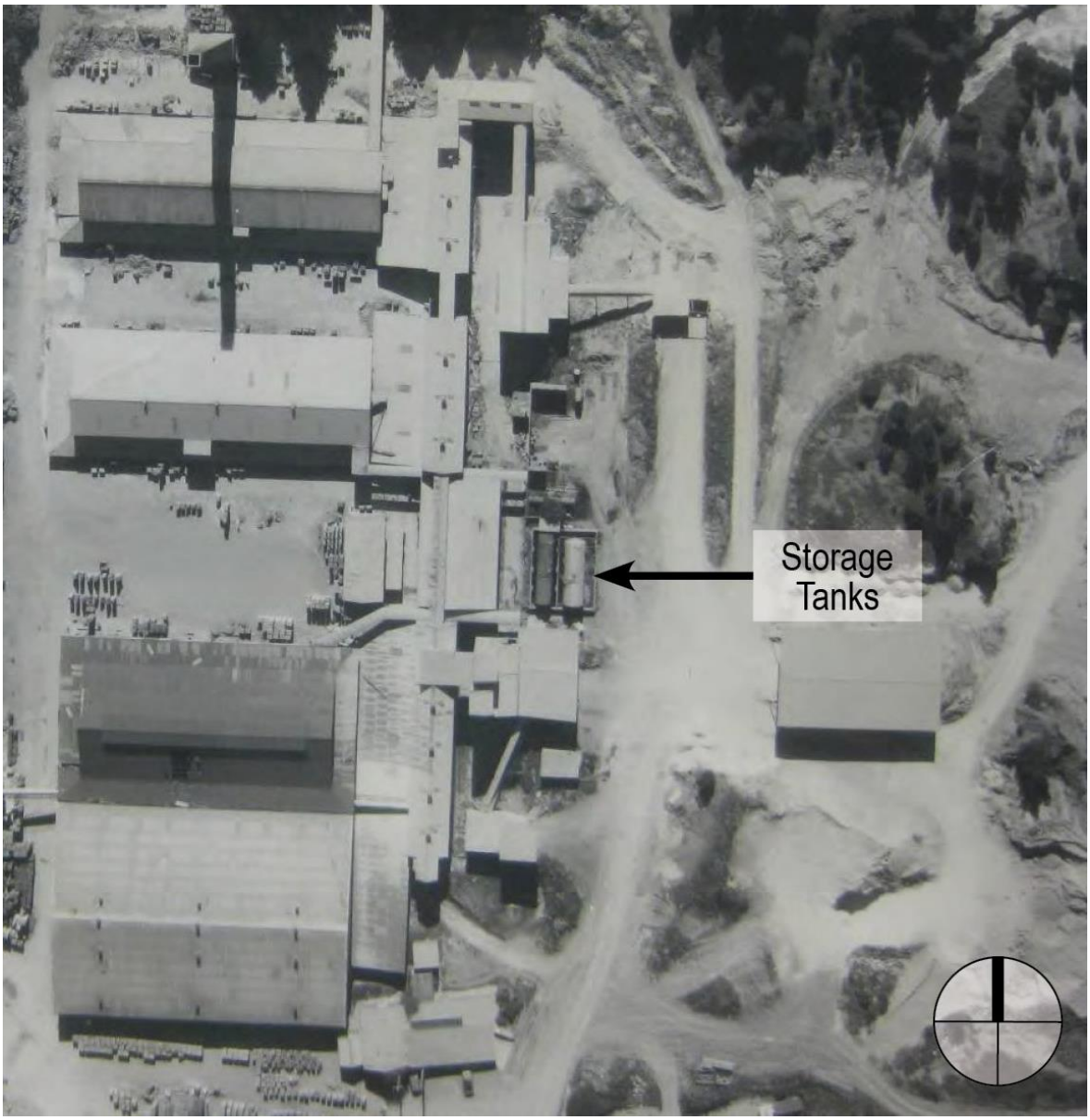


Figure 1 Detail of a 1976 aerial photograph, with the site of Element 36—at that time an oil storage facility—indicated. (Source: ACT Heritage Library, Woden, ACT, with GML additions)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 2 Exterior, showing the east and north elevations. (Source: Lovell Chen, 2010)

Canberra Brickworks: Inventory of Individual Historic Elements

Elements 37 and 38—Brickyards

Name of Element	Brickyard	**CMP No. | ACT No.**	Element 37 and Element 38 | n/a
Historical Phase	Establishment 1911–1920	**Date**	c1915, c1926
Construction	Concrete slab base		





Historical Background

The brickyard area forms part of the original core of the Brickworks, from the early establishment of the site. The space was 'enclosed' following the construction of the Hardy Patent Kiln 1 in 1926 to the north of the Staffordshire Kiln. Originally the ground surface was unfinished, and later laid with concrete slabs. The area has been used for open-air storage.

Description and Condition

The brickyard area is the open space between the Staffordshire Kiln and Hardy Patent Kiln 1, extending west to the fan houses and chimneys and east to the Amenities Block. The ground between the kilns is covered with concrete slabs, with deep concrete drainage pits in front of both buildings. A gravel roadway separates the kilns and fan houses.

The brickyard is in reasonable condition. Grass is growing in some gaps between the concrete slabs, and cracks are evident.

Significance	Element is not identified to be of heritage significance

The open yard area between the two earliest kilns historically was the early brickyard and was a key space within the complex. It demonstrates key aspects of the layout of the site and its operation.

Conservation Policy and Adaptation Guidelines	Element can be retained or demolished as required

- The brickyard should be retained and conserved, as a landscape element with an associated historic function of the Brickworks.
- New development within the historic core area of the Brickworks should be managed in a way that retains an understanding of the historic function of the yard.
- Any change to the area should be of a nature that relates to the industrial character of the surrounding built forms and the site. They should consider the surrounding elements in their massing, scale and form and respect the orthogonal layout of the existing built elements, and follow the same arrangement.
- Some repairs/replacement of surface to remove trip hazards should be undertaken. .Avoid impacts on the underground flue systems and connections between the kilns and fan houses, if services and earthworks beneath the slab are required.
- Assess all proposed actions, including conservation works or adaptation, for potential adverse impacts on the heritage significance, through the preparation of a Statement of Heritage Effects (SHE) in accordance with the ACT guidelines and in reference to the sensitivity zoning outlined in the historic archaeological analysis of the site provided at Section 3.5 of this CMP.

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 1 Staffordshire Kiln (Element 1), showing ground surface and open area of the original brickyard c1928. (Source: NAA A3560 BC 3149348)



Figure 2 View toward the Staffordshire Kiln over the original brickyard in 1926, prior to the completion of Hardy Patent Kiln 1. (Source: NAA A3560 BC 3130625)

Canberra Brickworks: Inventory of Individual Historic Elements



Figure 3 View toward the Staffordshire Kiln over the original brickyard in 1929. (Source: NAA A3560 BC 3174823)



Figure 4 Original brickyard in 1927. (Source: NAA A3560 CS2696)

Appendix B

ACT Heritage Register Listings for ‘Yarralumla Brickworks’ and the ‘Yarralumla Brickworks Railway Remnants’

ACT Heritage Council

Entry to the ACT Heritage Register

Heritage Act 2004

20068. Yarralumla Brickworks

Section 102 Block 1

YARRALUMLA

This document has been prepared by the ACT Heritage Council.

This entry which was previously part of the old heritage places or the old heritage objects registers (as defined in the ***Heritage Act 2004***), as the case may be, is taken to be registered under the ***Heritage Act 2004***.

Conservation Requirements (including Specific Requirements), as defined under the ***Heritage Act 2004,*** that are contained within this document are taken to be Heritage Guidelines applying to this place or object, as the case may be.

Information restricted under ***the old heritage places register or old heritage objects register*** is restricted under the ***Heritage Act 2004***.

Contact: ***ACT Heritage Council*** ***c/o Secretary*** ***PO Box 144*** ***Lyneham ACT 2602***
Enquiries: ***phone 02 6207 2164*** ***fax 02 6207 5715*** ***e-mail heritage@act.gov.au***

68. Yarralumla Brickworks, Yarralumla [V118][1]

Location

District of Canberra Central, Division of Yarralumla, Section 102 Block 1 as identified in Figure 68 and indicated on the Territory Plan Map by the Heritage Places Register Overlay H68.

Features Intrinsic To The Heritage Significance Of The Place
The place comprises the elements listed in Schedule 1 (rated as possessing exceptional significance) and Schedule 2 (rated as possessing considerable significance), as identified in Figure 68a.

Schedule 1 Elements Of Exceptional Significance

1) Kiln - Staffordshire (1915)
2) Fan House for Staffordshire Kiln (1915)
3) Kiln - Hardy-Patent (1927)
4) Fan House for Hardy Patent Kiln (1953)
5) Kiln - Hardy-Patent (1953)
6) Kilns - Downdraft a, b, c (1963)
7) Chimney Stacks for Staffordshire Kiln (1915)
8) Chimney Stack for Hardy Patent Kiln (1927)
9) Chimney Stack for Hardy Patent Kiln (1953)
10) Chimney Stack for Downdraft Kiln (1963)
11) Quarry
12) Geological features A, B, C, D

Schedule 2 Elements Of Moderate Significance

13) Office (1916)
14) Power House (1915)
15) Machine Bay for Staffordshire and Downdraft Kilns (1955)
16) Machine Bay for Hardy-Patent (1955)
17) Machine Bay for Hardy-Patent (1955)
18) Workshop (1955)
19) Large Crusher House (1955)
20) Primary Crusher House (1955)
21) Small Crusher House
22) Elevator Conveyor (1955)
23) Remains of the Brickworks Accommodation Village

Statement Of Significance

Operational from 1913 to 1976, the Yarralumla Brickworks is of historical value as the first industrial manufacturing facility within the ACT, and for its integral role in providing the base material used in the construction of the early buildings in the National Capital.

The Yarralumla Brickworks is a relatively intact representative example of large urban brickworks from the early 20th Century, a type that is becoming increasingly rare nationally and internationally. The Brickworks comprise a cultural landscape where the remaining buildings, structures, equipment and landscape features have the ability to demonstrate the evolution of a range of industrial processes associated with brick and clay production-over a 60 year period.

The Yarralumla Brickworks is of considerable technical value from the presence in the one location of a number of different kiln types: Staffordshire (1915), Hardy-Patent (1927) and Downdraft (1953) kilns, which demonstrate an unusually wide range of firing processes. The Staffordshire kiln is especially significant as the only surviving example of this kiln type in Australia. The Staffordshire kiln variation to the Hoffman design of kiln allowed bricks, tiles and pipes to be fired in cycles and utilises an unusual fan-forced draft system to aid firing.

[1] [V118: Added to Heritage Places Register Number 68 10/05/2001 (Variation Number 118)]

The largest chimney stack (element 9) is of aesthetic and social value as a prominent landmark in the central urban area, visible from the Lake Burley Griffin foreshores, New Parliament House and mountain lookouts around the City. Additional aesthetic value is associated with the composition and sculptural forms of the built elements, specifically the kilns, stacks and larger elements of equipment.

The Yarralumla Brickworks is one of a broad thematic group of remnant industrial and engineering heritage places that were built to facilitate the initial development of Canberra including the Cotter Dam and Pumping Station and the Kingston Power House.

The brickpits have historical value as a primary source of clay and are also of considerable geological value as the type locality for the 'Yarralumla Formation', dating from the Silurian Period 425 million years ago. The scheduled stratigraphic rock units constitute the reference section against which all other outcrops within the Formation are compared. It is the only fossil marine unit within the extensive volcanic marker horizons of South Canberra. Sites A and D show excellent examples of an anticline in calcareous siltstone, Site B shows a typical tuffaceous mudstone and siltstone of the Yarralumla Formation and Site C shows abundant fossils of mainly gracitiopods, trilobites, coral and a simple crinoid preserved in a bedding plane.

Specific Requirements

In accordance with s54 (1) of the *Land (Planning and Environment) Act 1991* the following requirements are identified as essential to the conservation of the heritage significance of the place. These requirements are prepared to implement the following conservation policy for the place:

The identified heritage values and intrinsic features of the place shall be conserved whilst allowing for the integrated and sympathetic redevelopment of the place as a single entity, consistent with contemporary practices for the adaptive reuse of industrial and commercial heritage places. In conserving and developing the place, its significant historical use as an industrial site for the production of bricks and clay products shall continue to be evident and accessible to the public.

Redevelopment of all or part of the place shall be in accordance with a Conservation and Management Plan endorsed by the ACT Heritage Council.

i) Landscape Setting

a) The quarry landform (11) should be retained in a manner whereby it is clearly evident to be a man made excavation, associated with the industrial use of the site. Subject to the recommendations of the Conservation and Management Plan, revegetation, enhanced hard and soft landscaping and low-medium height buildings with a high proportion of landscape open space may be permitted in the vicinity of the quarry, including on land overlooking the quarry and within the quarry excavation. The shape of the quarry may be altered in a minor manner, however access points into and out of the quarry area should utilise existing openings and gradients within the landform. The historical linkage between the quarry and kiln areas shall be expressed in any new development.

b) The geological features (12 A-D) shall be integrated within any site landscaping treatment. Disturbance of the immediate surface shall be limited to works that protect, stabilise or enhance the interpretation of the geological values. The immediate environs of the geological features to a distance of approximately 10 metres shall be retained as landscape open space.

c) To reflect historical usage patterns at the site and protect the setting of significant elements, the immediate environs of the kilns (1, 3, 5, 6) as identified below shall be retained as landscape open space, clear of any major structures. Minor structures and landscaping treatments that retain the kilns, stacks and fan houses as the dominant visual elements to the space may be permitted within:

- The open concourse running north-south from the Hardy Patent Kiln (Element 5) to the Downdraft Kilns (6a-c), between the kilns and fan houses (2, 4),
- The spaces between the kilns: (5-3, 3-1, 1-6)
- The immediate environs of the chimney stacks (7, 8, 9, 10), fan houses (2, 4) and primary crusher house and elevator conveyor (20, 22) to a distance of generally 10m.

d) New hard and soft landscaping treatment should generally express the historical spatial relationships and movement patterns of brick making operations about the site.

ii) Built Structures - including alterations and additions

a) The existing large chimney stack (9) shall be conserved and maintained in its current form as a prominent urban landmark.
b) The external form, including the arrangement of openings and detailing that reflects the industrial use of the built elements in Schedule 1 (1-10) and the Primary Crusher House (Schedule 2: 20) shall be retained.
c) Minor external alterations and additions and major internal alterations to the built elements in Schedule 1 may be permitted to suit a new use where the proposed works will not adversely affect the heritage significance of the elements or the place as a whole.
d) Alterations and additions to the original built fabric of elements in Schedule 1, including alterations to external finishes, shall complement the historical industrial use and architectural style of the place.
e) Subject to the recommendations of the Conservation and Management Plan, the elements in Schedule 2 may be conserved to interpret the historical use of the place or adapted to suit a new use for the place.
f) Elements in Schedule 2 that no longer include substantial evidence to describe industrial processes (15, 16, 17, 18, 19 and 21) may be replaced with new development that is generally consistent with the scale, form, external materials and industrial character of the place. The Office, the Powerhouse, Primary Crusher House and the Elevator Conveyor (13, 14, 20 and 22) may be relocated elsewhere within the place, subject to the relocation process being fully documented and full reconstruction of the buildings taking place within a specified period. Development may occur on the site of the remains of the Brickworks Accommodation Village (23), subject to detailed recording and suitable interpretation of the historical significance of the site.
g) Construction of new buildings or elements in the place may be permitted if any new building(s) or element(s) do not significantly diminish the heritage value of the place. The scale, form, detailing and external materials of any new buildings or structures shall be consistent with the architectural style and industrial character of the built elements in Schedule 1.

iii) Industrial Equipment

a) Major equipment and machinery associated with the historical industrial use of the place shall be retained and conserved in situ. Minor equipment should be retained and conserved but may be relocated to a new location within the site for interpretative purposes and/or its own protection.
b) The Primary Crusher House (20), including the integral equipment and machinery, and the Elevator Conveyor (22) shall be conserved for their ability to demonstrate and interpret industrial processes and secondary aesthetic values.

iv) Demolition

a) Subject to (iv)(b) (c) and (d) demolition of elements listed in Schedule 1 and 2 shall not be permitted, other than in exceptional circumstances, including circumstances in which the building or structure is structurally unsound and beyond economic repair or where there are significant public health and safety reasons to warrant demolition. Demolition shall not be permitted unless it can be demonstrated that there is no prudent and feasible alternative.
b) The demolition of the original internal fabric of buildings within Schedule 1 shall only be permitted in the context of sympathetic alteration and additions, as identified within the Conservation and Management Plan.
c) Elements in Schedule 2 may be demolished only to allow for new development in accordance with the Conservation and Management Plan and specific requirements (ii) (e) and (f).
d) Comprehensive recording of a building or structure shall be undertaken prior to any demolition or removal of fabric.

Figure 68: Yarralumla Brickworks, Yarralumla: Location

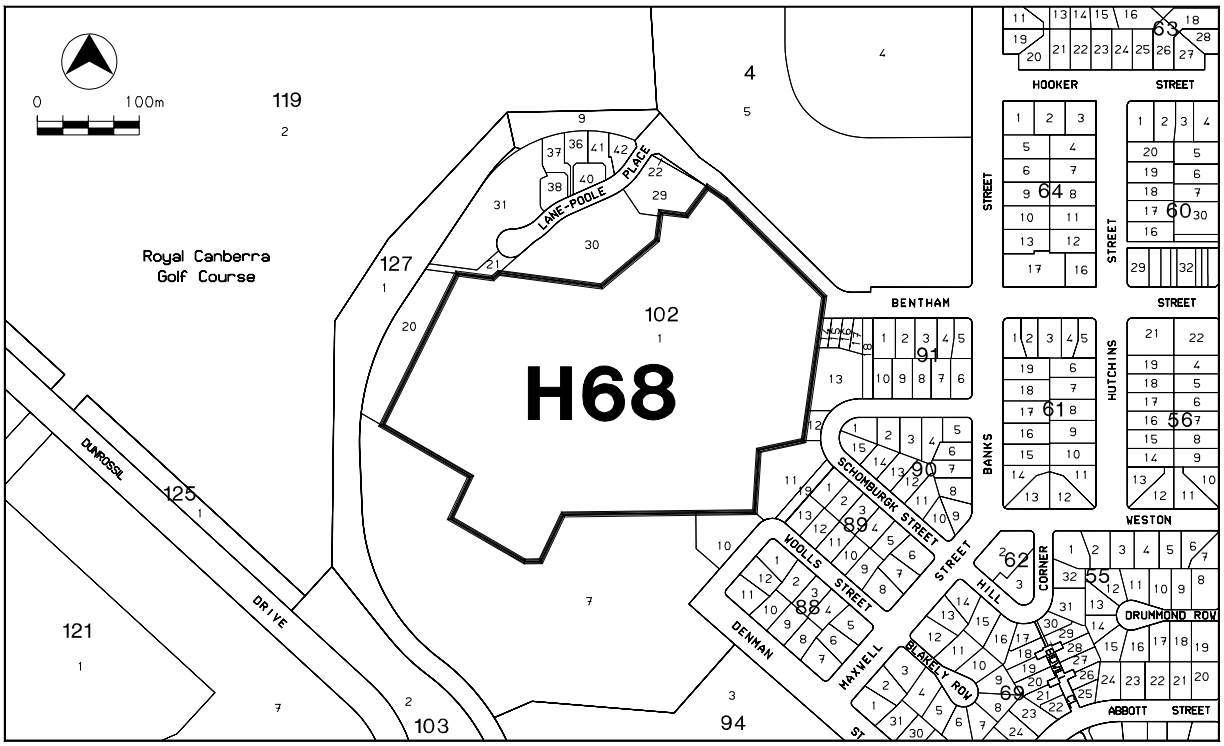
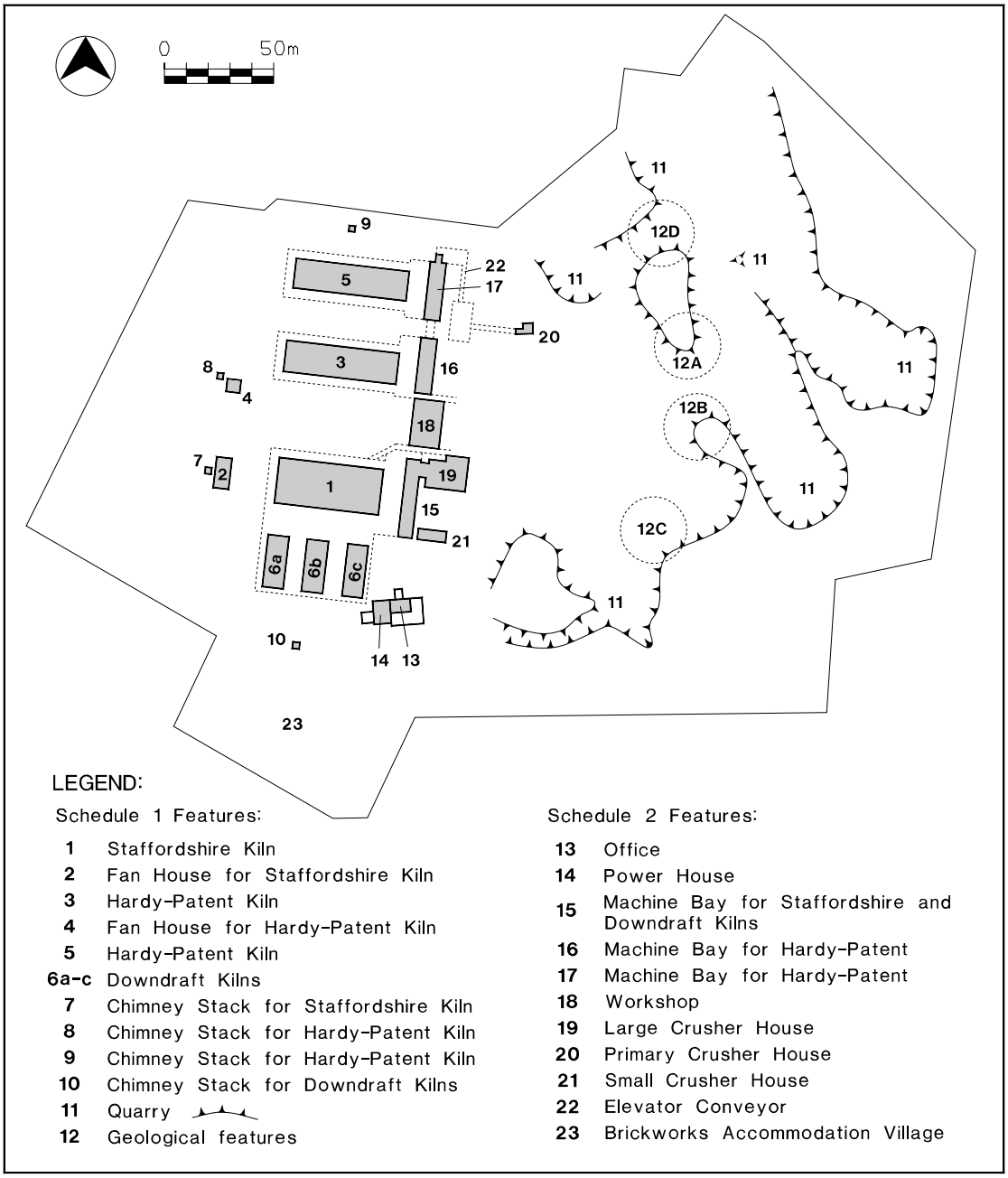


Figure 68a: Yarralumla Brickworks, Yarralumla: Significant Features



Australian Capital Territory

Heritage (Decision about Registration of Yarralumla Brickworks Railway Remnants) Notice 2013 (No 2)*

Notifiable Instrument NI2013–507

made under the

Heritage Act 2004, section 42 Notice of decision about registration

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1 Revocation

This instrument revokes the *Heritage (Decision about Registration of Yarralumla Brickworks Railway Remnants) Notice 2013*, NI 2013-38.

2 Name of instrument

This instrument is the *Heritage (Decision about Registration of Yarralumla Brickworks Railway Remnants) Notice 2013 (No 2).*

3 Registration details of the place

Registration details of the place are at Attachment A: Register entry for Yarralumla Brickworks Railway Remnants.

4 Reasons for decision

On 24 January 2013, the ACT Heritage Council (the **Council**) decided to register the Yarralumla Brickworks Railway Remnants (the **Decision**), see NI 2013-38.

On 5 March 2013, the Land Development Agency made an application to the ACT Civil and Administrative Tribunal (the **Tribunal**) seeking a review of the **Decision**.

On 10 September 2013, the Tribunal made orders by consent to vary the Decision.

On 7 November 2013 the Council prepared a register entry for the Remnants to accord with the Tribunal orders. The register entry is at Attachment A.

5 Date of registration

7 November 2013

Jennifer O'Connell
A/g Secretary (as delegate for)
ACT Heritage Council
8 November 2013

*Name amended under Legislation Act, s 60

Authorised by the ACT Parliamentary Counsel—also accessible at www.legislation.act.gov.au

ACT Heritage Council

AUSTRALIAN CAPITAL TERRITORY

HERITAGE REGISTER
(Registration Details)

For the purposes of s. 41 of the *Heritage Act 2004*, an entry to the heritage register has been prepared by the ACT Heritage Council for the following place:

Yarralumla Brickworks Railway Remnants

Part Block 7 Section 102 Yarralumla, Canberra Central

DATE OF REGISTRATION

7 November 2013 Notifiable Instrument: 2013—

Copies of the Register Entry are available for inspection at the ACT Heritage Unit. For further information please contact:

The Secretary
ACT Heritage Council
GPO Box 158
Canberra ACT 2601

Telephone: 13 22 81 Facsimile: (02) 6207 2229

IDENTIFICATION OF THE PLACE

Part Block 7, Section 102 Yarralumla, extending south of the Yarralumla Brickworks (See Figure 1).

This statement refers to the Heritage Significance of the place as required in s12(d) of the *Heritage Act 2004*.

STATEMENT OF HERITAGE SIGNIFICANCE

The Remnants of the former Yarralumla Brickworks Railway is significant for its association with the early construction of the national capital from 1923 until 1927. This was a critical period in the development of Canberra, and included major construction works in the lead-up to the Commonwealth Parliament moving to Canberra. The railway transported bricks for many prominent as well as ordinary buildings from this period, and major examples include Old Parliament House, Hotel Canberra, East Block and the Hotel Kurrajong.

The Remnants highlights one of the many challenges of building a city within a short time frame, in a relatively undeveloped area and with constraints on transport and technology.

The brickworks railway, of which the Remnants is a remaining portion, transported up to six million bricks per annum. The Remnants provides tangible evidence that can assist an understanding of the circumstances surrounding aspects of Canberra's construction.

FEATURES INTRINSIC TO THE HERITAGE SIGNIFICANCE OF THE PLACE

Features intrinsic to the heritage significance of the place which require conservation include:

- Remnants of the original earthen railway embankment, cutting and terraces.

APPLICABLE HERITAGE GUIDELINES

The guiding conservation objective is that the Yarralumla Brickworks Railway Remnants shall be conserved and appropriately managed in a manner respecting its heritage significance and the features intrinsic to that heritage significance, and consistent with a sympathetic and viable use or uses. Any works that have a potential impact on significant fabric shall be guided by a professionally documented assessment and conservation policy relevant to that area or component (i.e. a Statement of Heritage Effects – SHE).

The ACT Heritage Council may adopt heritage guidelines applicable to the place under s25 of the *Heritage Act 2004*.

For further information on whether guidelines apply please contact the ACT Heritage Council.

REASON FOR REGISTRATION

The Yarralumla Brickworks Railway Remnants have been assessed against the heritage significance criteria and been found to have heritage significance when assessed against three criteria under the ACT *Heritage Act 2004*:

(c) it is important as evidence of a distinctive way of life, taste, tradition, religion, land use, custom, process, design or function that is no longer practised, is in danger of being lost or is of exceptional interest;

(f) it is a rare or unique example of its kind, or is rare or unique in its comparative intactness;

(h) it has strong or special associations with a person, group, event, development or cultural phase in local or national history;

ASSESSMENT AGAINST THE HERITAGE SIGNIFICANCE CRITERIA

Pursuant to s.10 of the *Heritage Act 2004,* a place or object has heritage significance if it satisfies one or more of the following criteria. Significance has been determined by research as accessed in the references below. Future research may alter the findings of this assessment.

(a) it demonstrates a high degree of technical or creative achievement (or both), by showing qualities of innovation, discovery, invention or an exceptionally fine level of application of existing techniques or approaches;

The Yarralumla Brickworks Railway Remnants does not meet this criterion.

(b) it exhibits outstanding design or aesthetic qualities valued by the community or a cultural group;

The Yarralumla Brickworks Railway Remnants does not meet this criterion.

(c) it is important as evidence of a distinctive way of life, taste, tradition, religion, land use, custom, process, design or function that is no longer practised, is in danger of being lost or is of exceptional interest;

The Yarralumla Brickworks Railway Remnants meets this criterion.

Bricks were first manufactured at the Canberra (Yarralumla) Brickworks in 1913 for use in the construction of major developments across Canberra including provisional Parliament House and the Hotel Canberra. From 1923 – 1927 bricks were transported from the Brickworks via rail across the city to major developments. The railway ceased operation in 1927 and the remnants of the embankment, cuttings and terraces are important as evidence of the process by which bricks used in the construction and development of the new city were transported.

(d) it is highly valued by the community or a cultural group for reasons of strong or special religious, spiritual, cultural, educational or social associations;

The Yarralumla Brickworks Railway Remnants does not meet this criterion.

(e) it is significant to the ACT because of its importance as part of local Aboriginal tradition;

The Yarralumla Brickworks Railway Remnants does not meet this criterion.

(f) it is a rare or unique example of its kind, or is rare or unique in its comparative intactness;

The Yarralumla Brickworks Railway Remnants meets this criterion.

The Remnants of the former railway is rare in their comparative intactness, an example of one of few surviving remnants of the once extensive rail network used in the early development of Canberra.

(g) it is a notable example of a kind of place or object and demonstrates the main characteristics of that kind;

The Yarralumla Brickworks Railway Remnants does not meet this criterion.

(h) it has strong or special associations with a person, group, event, development or cultural phase in local or national history;

The Yarralumla Brickworks Railway Remnants meets this criterion.

The Remnants of the former Yarralumla Brickworks railway have a strong association with the development of Canberra between 1923 – 1927. Bricks (especially those referred to colloquially as 'Canberra Reds') manufactured at the Brickworks were loaded onto timber tip wagons and transported via a narrow gauge rail line to major developments across the city such as Parliament House, the Kingston Powerhouse, Hotel Canberra and buildings in Civic.

The railway enabled faster transport of the bricks than the previous use of steam traction engines that hauled heavy iron wheeled trailers on mostly unmade roads. The railway was removed in 1927 prior to the opening of Parliament House. However, it had a strong association with the early development of the new city.

(i) it is significant for understanding the evolution of natural landscapes, including significant geological features, landforms, biota or natural processes;

The Yarralumla Brickworks Railway Remnants does not meet this criterion.

(j) it has provided, or is likely to provide, information that will contribute significantly to a wider understanding of the natural or cultural history of the ACT because of its use or potential use as a research site or object, teaching site or object, type locality or benchmark site;

The Yarralumla Brickworks Railway Remnants does not meet this criterion.

(k) for a place—it exhibits unusual richness, diversity or significant transitions of flora, fauna or natural landscapes and their elements;

The Yarralumla Brickworks Railway Remnants does not meet this criterion.

(l) for a place—it is a significant ecological community, habitat or locality for any of the following;

(i) the life cycle of native species;

(ii) rare, threatened or uncommon species;

(iii) species at the limits of their natural range;

(iv) distinct occurrences of species.

The Yarralumla Brickworks Railway Remnants does not meet this criterion.

SUMMARY OF THE PLACE
HISTORY AND PHYSICAL DESCRIPTION

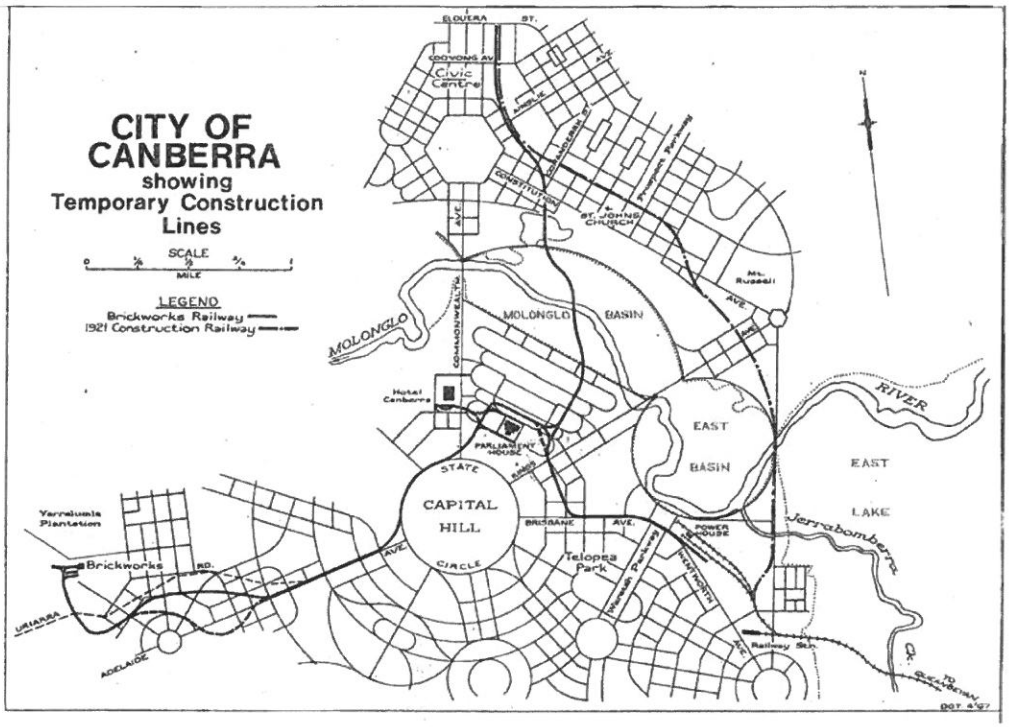
Description of Place

Remnants of the three lines of the former Brickworks railway are evident closest to the southwest corner of the Yarralumla Brickworks, converging to form a single embankment. Close to the Brickworks two of the former lines are evident as earth terraces, which go through a short cutting to become distinctive earth mounds. The third line runs approximately parallel to the western boundary of the Brickworks and is evident as an earth terrace. Along some sections of the embankment there are mature pine trees within close proximity, with other trees and shrubs growing along side and over the former rail line. The setting of the remnants of the former rail line within the pines creates an attractive vista.

In 2011 the area was extensively slashed and cleared for survey purposes, allowing greater visibility and identification of the railway remnants.

The following description is given of the former railway: *The track at the Brickworks was set out in three parallel lines, one on either side of the Staffordshire kilns and the remaining one ran to the coal dump. Immediately after leaving the proximity of the kilns, these tracks swung around rather sharply to the left, the points that gave access to the sidings being at an angle of 53 degrees to the straight part along the kilns.....After converging to a single track, the line ran straight for about two hundred yards, then, after crossing Uriarra Road swung again to the left in a curve on an*

embankment and straightened out with a slight down grade for ¾ mile where a reverse curve brought it alongside Adelaide Avenue. It continued beside this road to the State Circle where it followed the left contour of the Circle for about one third of its circumference until it met Commonwealth Avenue which it crossed at an angle……'. (Australian Railway Historical Society Bulletin No 355- May, 1967)



Source: the *Australian Railway Historical Society Bulletin No 355- May, 1967*

History

One of the most obvious prerequisites to the speedy establishment of Canberra, which was in an open, relatively uninhabited area, was an adequate supply of good bricks. No time was lost therefore in seeking out a local site for a brick-works, and satisfactory clays were found at Yarralumla or "Westridge" as Griffin had named it. There the Commonwealth Brickworks was established in 1913.

Bricks were required for construction at the Power House at Kingston (completed 1915), Parliament House(1927), Hotel Canberra (now the Hyatt, 1927) and other public buildings and offices including Telopea Park School (1923), East Block (1927), Albert Hall (1928) and Hotel Kurrajong (1926).

The bricks were moved by steam traction engines that hauled heavy iron-wheeled trailers on mostly unmade roads. This proved unsatisfactory and time consuming as the traction engines only achieved two round trips a day between the brick-works and the Parliament House. By the end of 1923, a 3 ft 6 inch (1067 mm) gauge steam-hauled railway was constructed to provide more effective transport. The southern terminus was at the Power House, where the line connected with a small engine shed.

After the failure of the standard gauge railway to Civic Centre, following collapse of the causeway bridge in the floods of 1922, the brickworks railway was extended to Civic, crossing the Molonglo River on a small timber bridge near the Scott's Crossing

Road. It is understood that in the city area the abandoned standard gauge track was used by moving one rail a distance of 14.5 inches across on the existing sleepers to form the narrower gauge. It is believed the brickworks tramway terminated about 40 feet beyond the Civic Centre platform.

In the clean up and extensive landscaping works prior to the opening of Parliament House on 9 May 1927, and possibly also because it had by that stage become more economical to transport the bricks by motor lorry, the railway was removed. At the time of closure, the capacity of the brickworks was 6 million bricks per annum. The bricks produced at the Brickworks are often colloquially referred to as 'Canberra Reds'.

References

Institution of Engineers, *Engineering Heritage of the ACT, Chapter 2, The Canberra Branch*

BT McDonald, The Australian Historical Railway Society, Vol. XVIII Bulletin No 355 May 1967, *Railways in the Australian Capital Territory*.

Draft Proposed Entry to an interim Heritage Places Register Yarralumla Brickworks Railway Remnants, National Trust of Australia c 2004

IMAGES



One of the three former lines where it goes through a short cutting

SITE PLAN

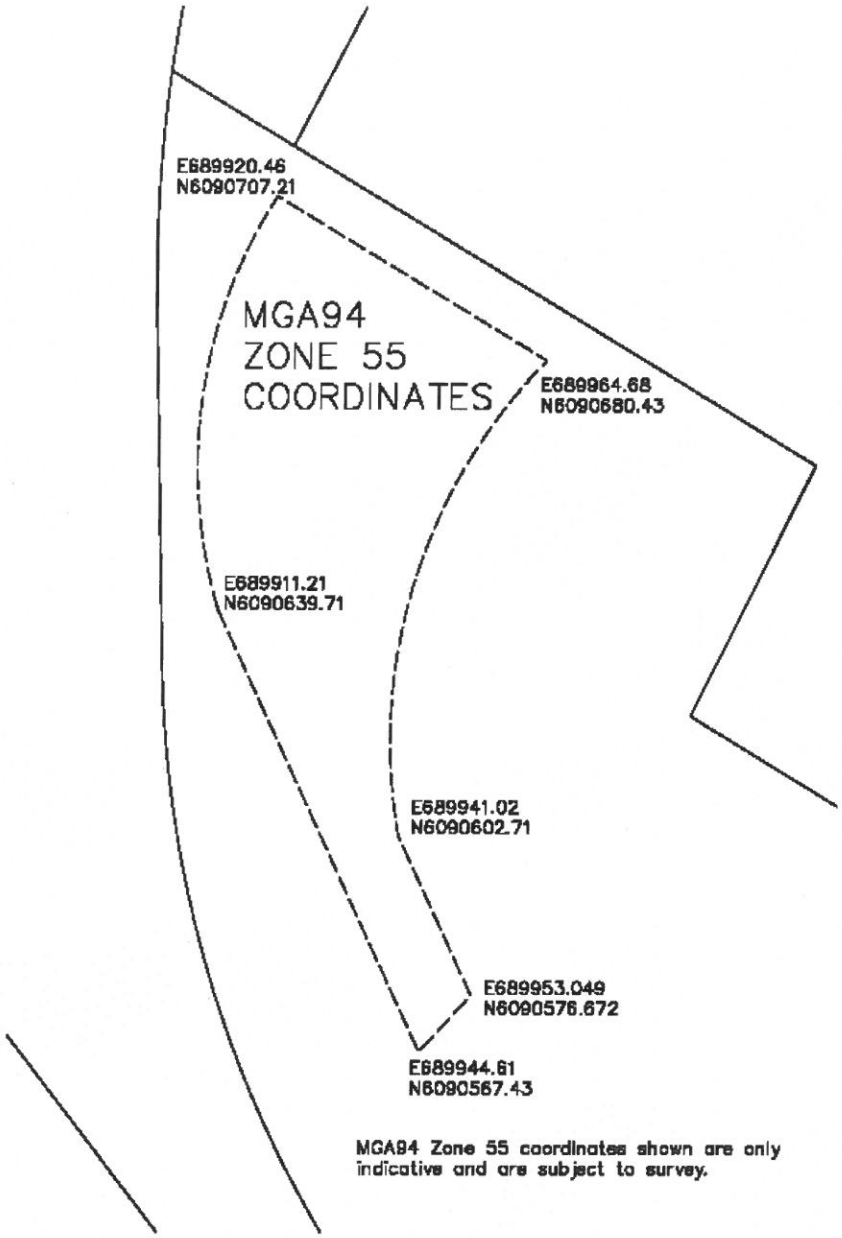


Figure 1 – Yarralumla Railway Brickworks Remnants GPS references

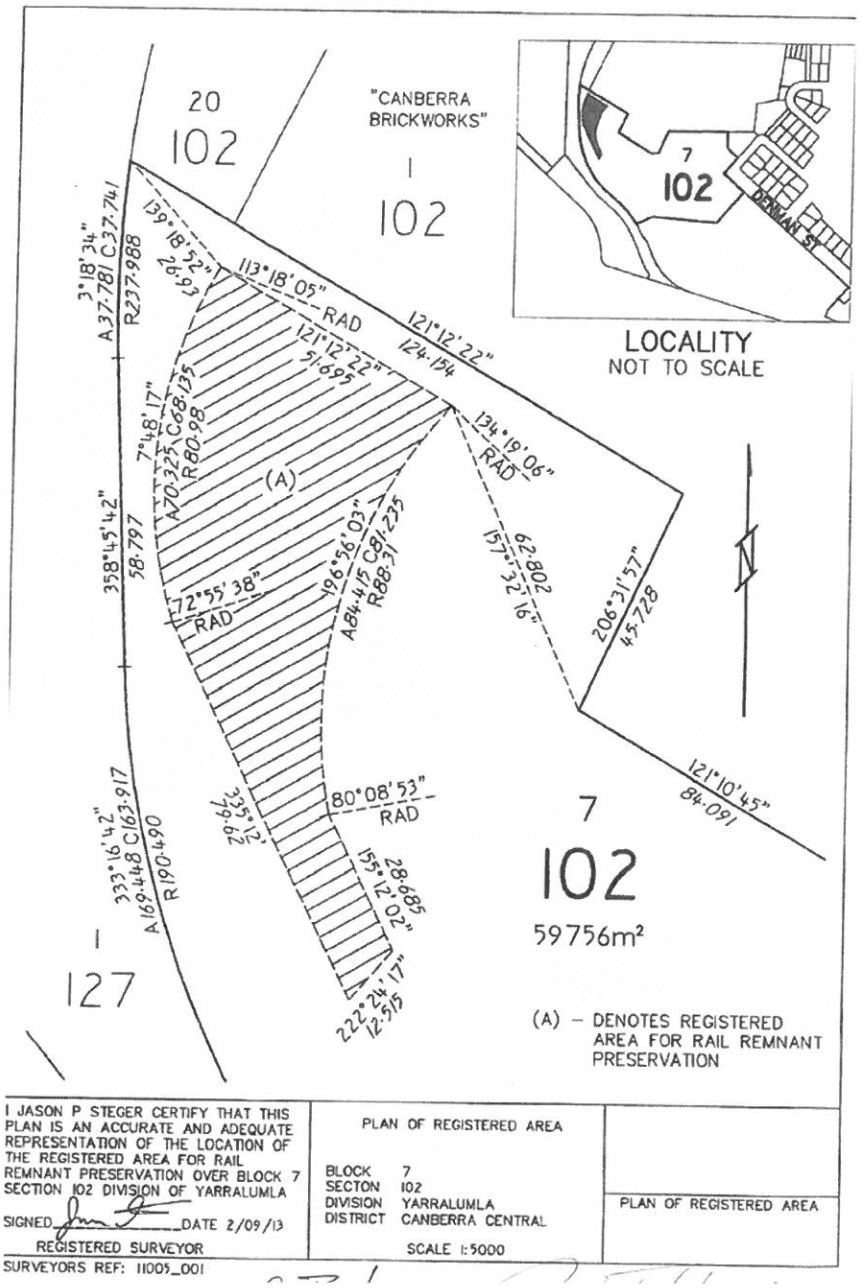


Figure 2 – Yarralumla Railway Brickworks Remnants boundary survey

Appendix C

Detailed History of the Canberra Brickworks

Appendix C—Detailed History of the Canberra Brickworks

C.1 Introduction

The following detailed history of the development of the Canberra Brickworks Precinct has been drawn predominantly from the 2010 CMP, and revised and updated where necessary. The 2010 CMP history also references the history provided in the 1986 Conservation Plan by Lester Firth Associates.

C.2 The Operation of the Canberra Brickworks

C.2.1 The Process of Brick Production

A number of processes and elements related to brick production are common to large twentieth century brickworks and are summarised below.

Quarrying

Because of the cost of transporting raw materials in both the nineteenth and early twentieth centuries, the raw materials of clay and shale for brickmaking were typically quarried close to the brickworks.

In the case of the Canberra Brickworks, the shale was quarried on site (though clay is thought to have been brought onto the site for tilemaking from the early 1920s) up until c1940. From around this time onwards, all raw materials were quarried elsewhere and delivered to the site.[1]

Crushing, Grinding and Pressing

Raw materials, quarried in lumps, were crushed to a manageable size in a crusher. In some brickworks, crushers were located at the point of quarrying with the material then conveyed to another location closer to the brick presses, where it would pass through grinding mills and pugmills to be further refined, worked and mixed. The material was then fed into the brick presses.

A series of conveyors and hoppers moved the materials between and within buildings and through the different stages of the process. In the nineteenth century, the presses and other machinery were steam powered but this changed to electricity in the twentieth century. Electricity was the only source of power used for machinery at the Canberra Brickworks.

Firing

Once pressed, the bricks were transported (the means varied at different sites), and loaded into the kilns. The loading was done by hand until the mid to late-twentieth century when the use of forklifts began. This often necessitated the widening of the wicket openings to the kiln chambers.

In terms of the firing process there were a number of different kiln types used in Australian brickworks of the late nineteenth and twentieth centuries. Refer to Section B.2.4.

Transport Offsite

Once fired, bricks were rarely stored for any length of time or in large quantities. They were generally transported off site relatively quickly. At many brickworks, the bricks were transported by rail. At the Canberra Brickworks, the bricks were transported for a period by traction engine, and in the 1920s by a dedicated light rail line to the major construction sites in the centre of Canberra.

Types of Bricks Produced

The 'Canberra Red' was the quintessential Brickworks product. This product came to house the provisional parliament house (Old Parliament House- 4 million bricks), the engine room powering the Capital (Kingston Powerhouse), the heart of the city (Civic), governance, postal and telegraph communications (Secretariat–East Block and West Block 813,000 bricks); the new Canberra suburbs and the roofs over, not only politician's heads (Hotel Canberra, Hotel Kurrajong – 544,00 bricks), but the brickmakers (Yarralumla Brickworks Housing) and the public servants who lived in the Hotel Acton and other 'hostel' accommodation—Gorman House. The bricks themselves had unique frogged symbols: *C'WEALTH CANBERRA* or *CANBERRA C'WEALTH* (1920s), *CANBERRA* (1930s) and following Second World War simply *CB*.[2] Commentary in some of the building and design publications reported the shift in taste away from the red, the *Building* magazine reporting: 'the brick made at Canberra is excellent, but unfortunately it is without variety.'[3]

White shale from the Attunga Point Quarry was used to make the Canberra Cream. This was reported as the 'result of a challenge thrown out by architects who maintained that the red brick did not tone with Canberra surroundings.'[4] The Canberra Times described the:

> *The development of new types of light-coloured bricks that have established favour with architects in Canberra is expected to lead to substantial orders for housing requirements, while experiments in tinted briquettes and glazed tiles have established further avenues for employment.*[5]

However, ultimately the Brickworks was unable to keep pace with the demand for bricks with supplementary bricks purchased from the Bowral works in New South Wales during 1939.[6] The last major output recorded the annual production of 7.25 million bricks in 1940. The subsequent 1959 report by HH Macey concluded that bricks were a 'little on the coarse side' and only moderate in quality.[7]

C.2.2 Operation of the Canberra Brickworks, 1913–1940s

At the beginning of operations at the Canberra Brickworks, the raw material for brick making was obtained on site, primarily by levelling a knoll comprised a hard, yellow shale to the north of the 'temporary' works. Minor quarrying also occurred on the western side of the site. Due to variety in the shale, material from various seams was mixed thoroughly to achieve a uniform colour in the bricks. Quarrying at the site was reported to be a complex process, and costlier than the average brickworks due to numerous seams of unusable material such as limestone and sandstone.

After spalling, the shale was conveyed to the works in tip trucks running on small gauge rails. It first passed through a jaw crusher that reduced the material to 75mm and was then raised by bucket elevator to an overhead storage bunker. From the storage bunker, the crushed material was taken in one cubic yard truck that lead to grinding mill hoppers. After grinding to pass through a fine mesh screen, the shale was elevated by bucket to a loft immediately above the brick presses and moved by gravity to the presses. Owing to the comparatively high lime content of the shale, a 'semi-plastic' pressing process was employed. The pressed bricks were then transported to the kilns for firing.

A description of the kilns, presses and output in the 1930s is given below:

- one 20 compartment 'Staffordshire', with an output capacity of 125,000 per week;
- one 'Hoffman' continuous kiln (Hardy patent), with an output of 120,000 per week; and
- two single compartment down-draft kilns, with a capacity of 30,000 each per week.

The Downdraught kilns were used almost exclusively for the production of face and special bricks. The bricks presses were the ‘New Era’ semi-plastic type, made by Messrs Whittaker Bros. in England.

There were six brick making units, three for each of the two large kilns, and each unit consisting of a 10ft grinding mill, a ‘New Era’ brick press, and pug mixer, driven by a 150-horsepower electric motor. The output of each unit is approximately 1500 bricks per hour. Two units are required to serve each kiln, the third unit being a spare.

In addition to ordinary bricks, wire-cuts and specials were made, and the attractive colour range produced was the subject of favourable comment from many quarters.[8]

Aspects of the brickmaking process as it occurred in this phase of the site’s history remain legible through the overall site layout and key buildings and site elements remaining from the establishment and expansion periods (1913–1940s). However, the early crushing, grinding and pressing buildings have all been removed as has much of the associated plant.

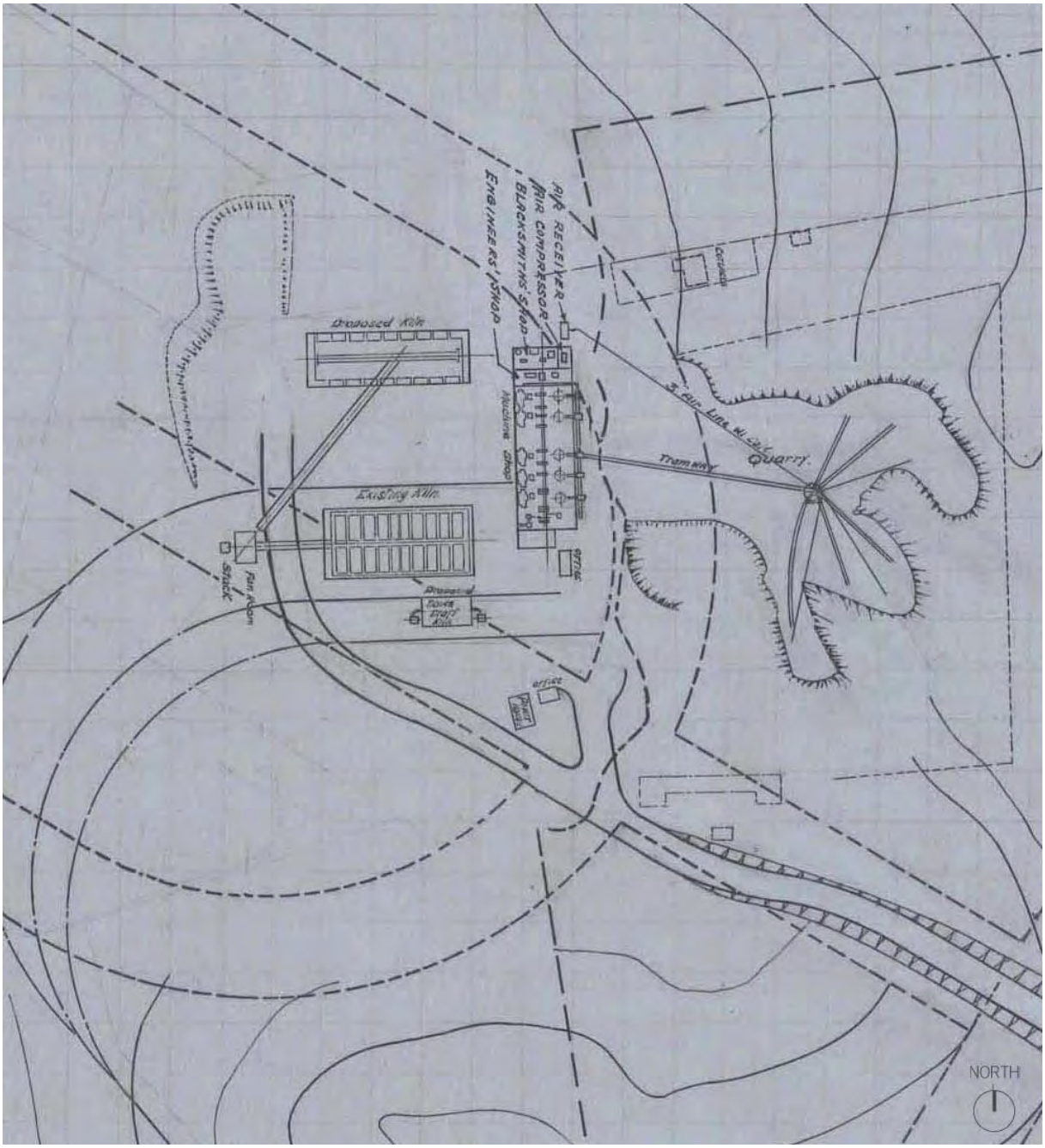


Figure 1 Site plan, 6 April 1926. On this plan, the processes occurred from east to west (right to left on this plan); the quarried material was transported via a tramway to the machinery shop to be crushed, ground and pressed in the centre, and then to the kilns on the left. The plan shows both the existing Staffordshire kiln and the proposed Hardy patent kiln to its north. It also shows the power house and office. (Source: National Archives of Australia)



Figure 2 View from the northeast towards the brick processing buildings, c1926. (Source: National Archives of Australia, A3560, 2447)



Figure 3 Another view, c1929. Note the excavated quarry on the left. (Source: National Archives of Australia, A3560, 5843)

C.2.3 Operation of the Canberra Brickworks, 1950s–1976

While the major brick kilns on the site were retained, the expansion of the Brickworks that occurred in the 1950s saw the replacement of other early plant features and buildings (see Figure 5). The early machine shop was replaced with a series of brick press buildings (machine bays) and a workshop, all of which remain today. The Brickworks was also equipped with a series of new crushers and 'pan rooms' connected to a conveyor system.

A Hazemag crusher (small crusher house, Element 21) was located closest to the office building and was connected by a conveyor to the 'White Pan Room' (large crusher house, Element 19), where 10'6" diameter grinding pans were used to further reduce the shale. The large crusher house could also be fed directly from the quarry area and had two hoppers. Material was crushed, elevated, sorted, re-crushed and then conveyed across to the brick press at the top conveyer level. It was then directed southwards into hoppers above the gravity fed individual brick presses.

The primary crusher house (Element 20) was located further north of the site. This building had two hoppers, a Ross feeder and a 'grissly feeder', with rail bars across the opening to allow manual crushing. A Jacques swing jaw crusher was located under the Ross feeder. Material was then fed by conveyer to a 'Pan Building' for further processing. Only the foundations of this building remain today. From this pan building, material was elevated by conveyor (Element 22, which is partially demolished) and could be stored in massive bins or taken into the northern end of the brick press buildings for distribution throughout the plant. The material was conveyed along the length of the press buildings on conveyors and could be manually diverted into hoppers directly above the brick presses. The conveyor system, hoppers, control panels and chutes remain today. The southern brick press building was subsequently extended by two structural bays to service the 1970s extrusion plant.

Anderson double re-press semi plastic presses were in use from the 1950s. Bricks were pressed twice for additional strength. While no brick presses survive at the site, it is possible that they were removed to the new brickworks at Mitchell following the closure of the Canberra Brickworks in 1976.[9]

Comparative to the earlier phases of the site's history, the brickmaking processes from the 1950s through to the 1970s are strongly represented on the site with the majority of physical evidence remaining dating to this period. It is, however, not a complete representation of the Brickworks at the time with buildings like the Red Pan Room and the conveyor linking this with the Primary Crusher having been demolished.

Critically, while sections of the conveying system and associated hoppers remain in the machine bays, the ability of the complex to demonstrate the processes is limited following the removal of the majority of the manufacturing plant including crushing and pressing machinery.



Figure 4 Aerial view of the Brickworks, c1976. Raw materials had for many years been brought onto the site but the process continued to occur moving from east to west across the site. The 'spine' of process buildings (grinding, crushing and pressing) was located east of the kilns (between the kilns and the quarry). (Source: ACT Heritage Library)

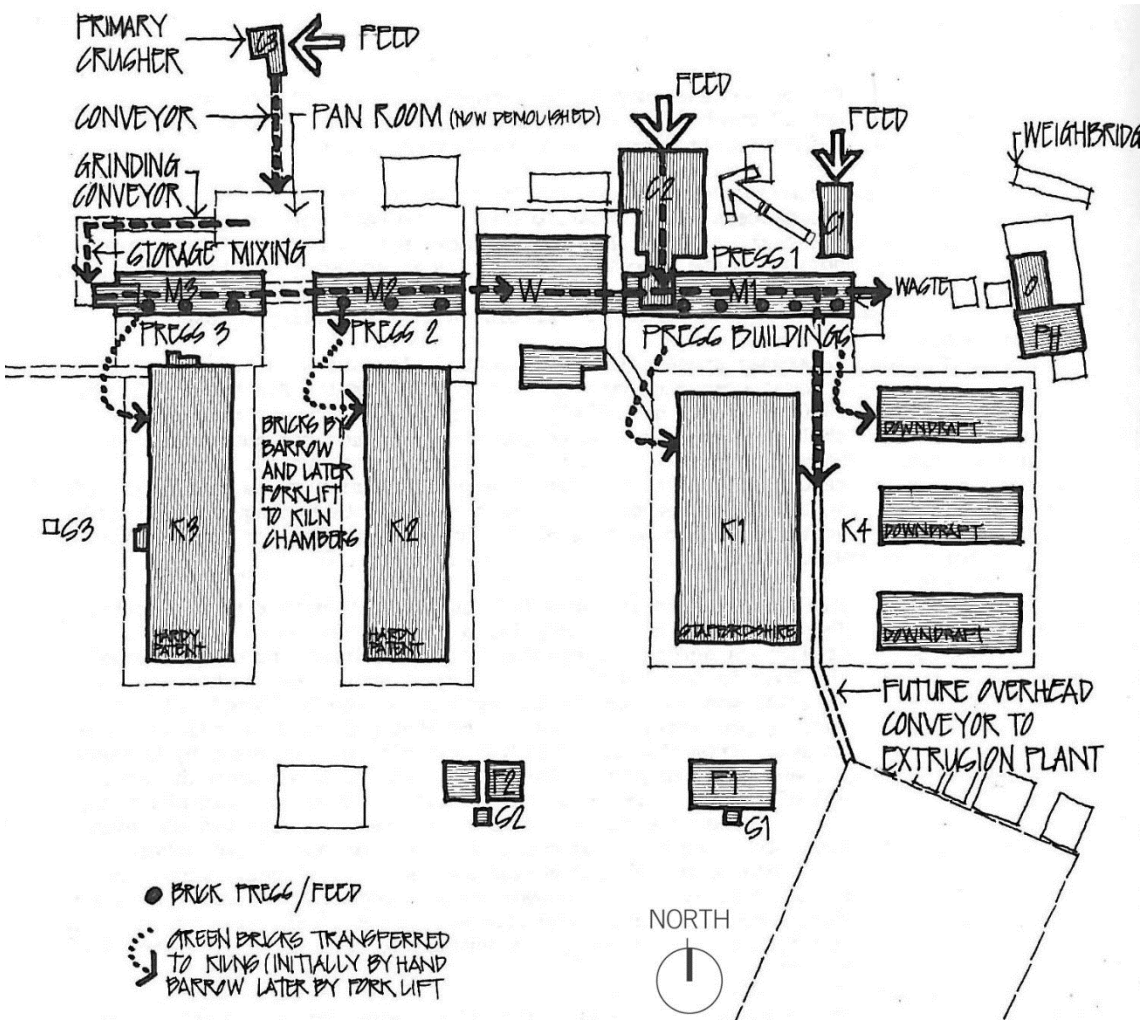


Figure 5 Sketch diagram of site operation c1960. (Source: Lester Firth Associates Pty Ltd, Old Canberra Brickworks, Conservation Plan, 1986, Section 2.2.1.)

C.2.4 Major Brick Kiln Types in Australia

Intermittent Kilns

All kilns in Australia prior to the 1870s were intermittent, meaning that the fires went out after each burning.

Clamp Kilns

The earliest kilns were clamps, an ancient technique used globally where stacks of unfired (green) bricks with fire holes below are sealed, possibly with mud, and fired in the open air (see Figure 7). In clamps, heat distribution is extremely uneven and brick wastage unavoidably high. Clamps typically leave little archaeological residue apart from a shallow depression in the ground; however, channels and flues have survived in the more sophisticated examples of the kiln.[10] Four clamp kilns were built at the Canberra Brickworks as part of the 'temporary' works, and these were operational by August 1913. The clamp kilns were located southeast of the present office building (see Figure 6).

Scotch Kilns

Among the first permanent kiln types to be constructed in Australia were 'Scotch' kilns. They were roofless constructions with three permanent walls and one temporary wall, which would be erected

after the green bricks were placed in the kiln and demolished after firing (see Figure 8). The permanent walls directed the draught upwards. A Scotch kiln was in operation at Canberra during the mid-1920s (see Figure 9).

Downdraught Kilns

The last of the broad typologies of intermittent kiln used in Australia was the Downdraught. Downdraught kilns are typically circular or rectangular in plan with fire holes and wickets in the walls. Inside the single chamber the fire gases are funnelled to the roof through flues built against the side walls and channelled out through underground flues to a detached chimney stack (see Figure 10). Two temporary Downdraught kilns were built at the Canberra Brickworks in 1925 close to the site of the present Downdraught kilns (Element 6) and prior to the construction of the first of the Hardy patent kilns (Element 3). They were demolished in 1958. The present Downdraught kilns, constructed in 1963, are barrel vaulted. Circular kilns with domed roofs were also common. As occurred at the Canberra Brickworks site, it was typical to build Downdraught kilns in groups to enable consistent use through rotation.

Downdraught kilns were common prior to World War II, particularly in small country works. The three extant examples at Canberra are relatively late examples of the typology.

Continuous Kilns

Continuous kilns are fired consistently to enable full-time use and production. This is achieved through the principle of continuous burning around a fire passage, which is typically circular or rectangular. The passage accommodates a series of chambers, each with an opening (or wicket) through which the bricks are loaded and unloaded. A branch flue leads to a main flue and chimney stack. The chambers can be set, burnt, cooled, and emptied independently with the kiln's excess heat used to dry green bricks prior to firing.

One of the earliest continuous kilns, and arguably the best known, is the Hoffman kiln, designed by German Friedrich Hoffman in 1856 and patented in 1858 (Figure 12, Figure 13).[11] The Hoffman kilns in Australia are generally oval in form with straight sides and semi-circular ends. Each kiln contains a continuous vaulted annular firing chamber, which is filled with bricks for firing through wickets along the outer walls of the kiln. As for other continuous kiln types, Hoffman kilns are fired from above with the fire holes located in the roof of the vault and controlled from a floor above. Originally coal was dropped through the firing holes but later the kilns were adapted to use oil and gas, still from the firing holes.

The first Hoffman kiln in Australia was built in 1870 by the Hoffman Patent Brick and Tile Company at its works on Albert Street in Brunswick, Melbourne.[12] By the 1890s the Hoffman Company was claimed to be the largest enterprise of its kind in the Australian colonies.[13]

From the 1880s, multiple variations of the Hoffman concept were developed around the world. Generally known as 'patent kilns', these involved subtle variations on the original Hoffman model. Modifications were related to avoiding brick discolouration, and achieving a more even heat distribution and more efficient regulation of heat to allow greater certainty about the quality of products.

Many patent kilns were developed in Australia in this period. In 1889, a patent for an 'improved kiln' was taken out by Isaac Button, Edward Peters, and John Wesley Goodsell, all of Sydney. This was the 'Centennial kiln', which was built at the Croydon Brickworks in Sydney. Architectural historian Miles Lewis offers a detailed description of the form of the Centennial kiln.

> *Compared with the Hoffman kiln, [the Centennial kiln] was rectangular in plan, and consisted of two rows of chambers in parallel, none of them sweeping around at either end. The chambers were separately barrel vaulted, running in at*

> *right angles to the length of the kiln as opposed to the continuous vault of the Hoffman, and they were large enough for a dray or truck to be driven right into them for loading and unloading. Fuel was fed through holes in the top. The chambers at either end continued right across the kiln, with provision to divide them, but the rest were separated by a relatively long and narrow 'smoke chamber' along the spine, which connected with flues from either end of each chamber, and discharged to a stack. The kiln as built at Croydon had eighteen chambers, held 35,000 bricks, and was reckoned to turn out 200,000 bricks in a fortnight.*[14]

Evidence indicates that the Centennial kiln was typically constructed with a long chimney or flue at one end of the main chamber.

Another variation on the Hoffman format was known as the 'Hardy patent', which was developed at around the same time as the Centennial kiln.

Patent records from 1889 indicate that Samuel Kirk, Thomas Kirk, and John Richardson Hardy, all from Sydney, had also developed an improved brick kiln design, specifically described as 'improvements in the construction of kilns for burning bricks, tiles, pottery or other analogous materials'.[15] On 4 December 1891, the specifications of their application were accepted and the patent granted in Victoria.[16] The following year the men attempted to register the patent in New South Wales and Queensland.[17]

Hardy patent kilns are distinguished by their freestanding stacks, as opposed to the integrated and centralised stack of the standard Hoffman kiln.

Two Hardy patent kilns were constructed at the Canberra Brickworks and are associated with major expansions at the Brickworks. The first kiln (Element 3, and its stack and fan house, Elements 4 and 8) was built in 1926–27 as part of the drive to double the output of the plant ahead of the relocation of Parliament and public servants to Canberra.[18] The second kiln (Element 5 and its associated stack, Element 9) (see Figure 16) was constructed in 1953 as part of the post-World War II expansion of the site.

Another variation of the Hoffman model of continuous kiln was developed in the 1890s, when the capacity of the kilns was increased through the introduction of transverse arches. The maximum arch span of Hoffman kilns had previously been around 5.5m; orientating the arches so that they lay across the flow of fire allowed the length of arches to be increased without increasing the distance that the fire was required to travel in a circuit.[19]

In 1904, Dean and Hethrington of Lancashire, England, patented the 'Staffordshire kiln', incorporating transverse arches, a detached chimney stack and a complex system of flues and dampers (see Figure 20). This enabled the use of a combination of chambers at any time, thereby allowing the simultaneous production of a range of products, bricks, tiles, and pipes.

The first of the permanent continuous kilns at the Canberra Brickworks was based in this model and built in 1915 (Element 1), along with its associated fan-house and stack (Elements 2 and 7). The fan induced draught of Element 1 enabled even greater temperature control, and obviated the requirement for a tall stack.

The construction of a Staffordshire kiln at the Canberra Brickworks was commissioned in 1913, less than a decade after the model was patented. The kiln was completed and brought into service in 1915. At the time, Staffordshire kilns were at the leading edge of brick burning technology, offering the potential for firing multiple types of products simultaneously. Given its isolation from the major urban centres and suppliers of construction materials, this flexibility was ideally suited to the requirements of the nascent Federal Capital.

Tunnel kilns (also referred to as car tunnel kilns) are a contemporary form of continuous kiln, albeit with eighteenth-century origins. The model, used by the French Royal Porcelain Factory in 1751, comprises a pair of tunnels linked by flues.[20] Green bricks are set on cars and passed through the first tunnel, which is divided into zones for preheating, firing and cooling. Clean hot air from the cooling zone of the kiln is channelled to the parallel drying tunnel. In England, until the 1970s, tunnel kilns were considered expensive to build and beset by technical problems, which outweighed the benefits of fuel saving and improved working conditions. Subsequent revisions improved the model, which is now commonly used in industrial brick production, with kilns as large as 1.8m wide by 120m long.[21]

A tunnel kiln was planned and partially built at the Canberra Brickworks after World War II, before being abandoned in 1952. The foundations were incorporated into the second Hardy patent kiln completed in 1953 (Element 5).[22]

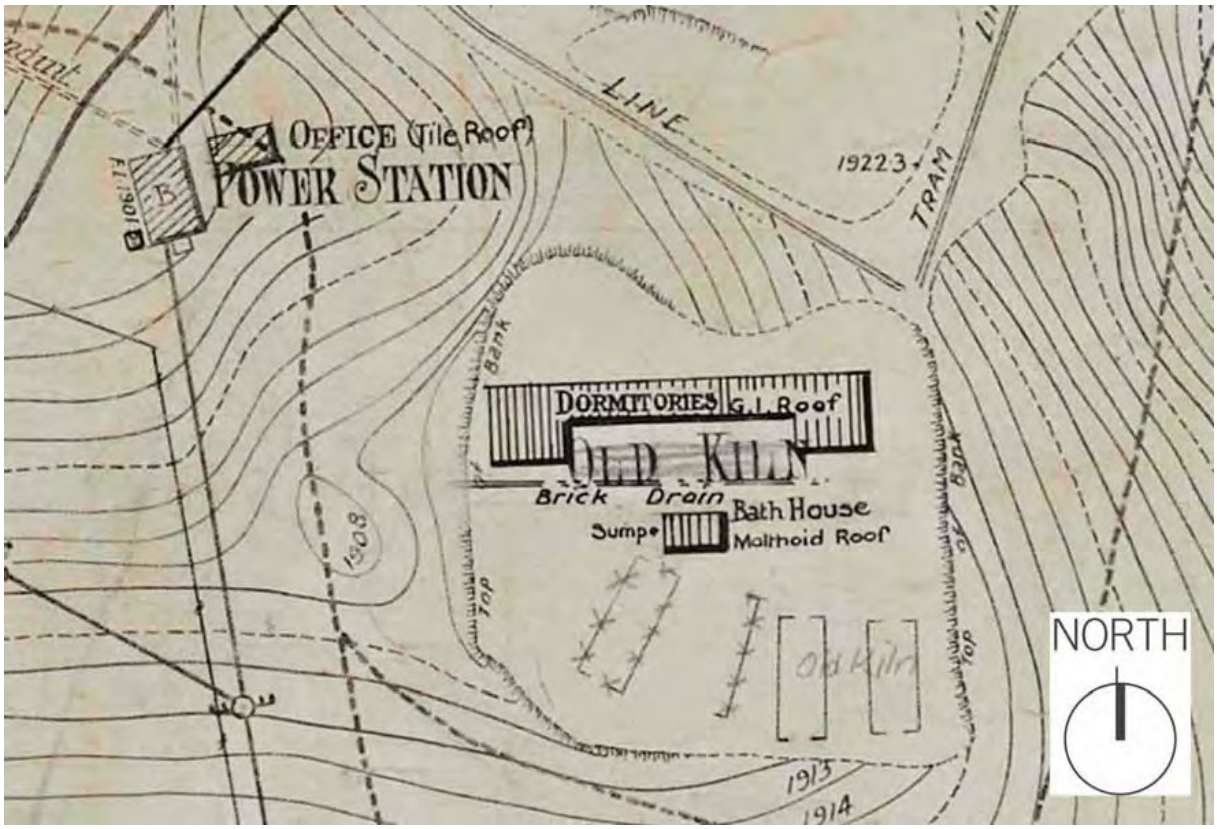


Figure 6 Detail of 'Contour and Detail Survey, Canberra Brick Yards, 20 December 1916'. Note the four clamp kilns ('Old Kiln') below the 'Dormitories' to the southeast of the power station. (Source: National Archives of Australia)

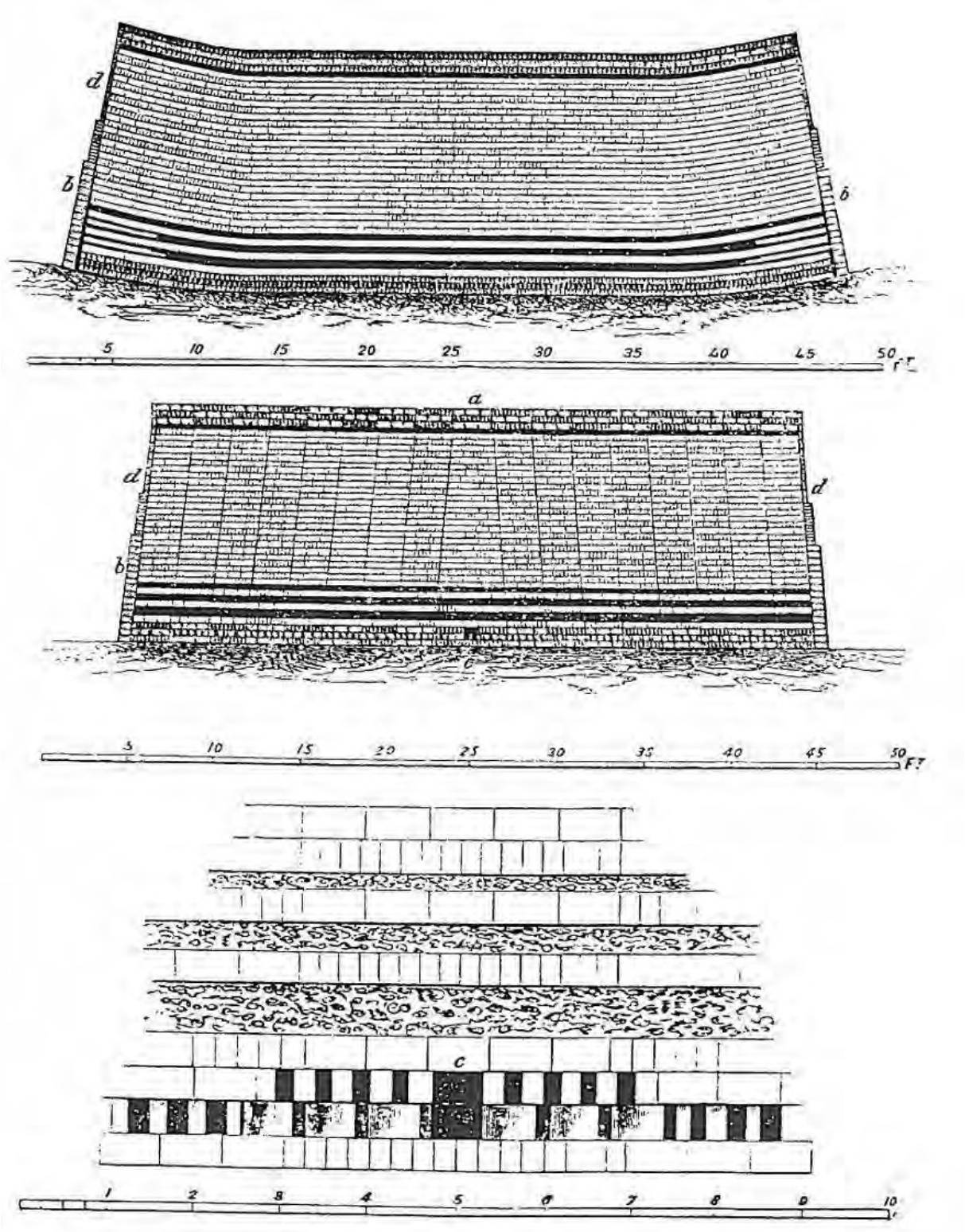


Figure 7 Sections through a clamp kiln, c1850, demonstrating the typical arrangement of bricks and fuel. (Source: Edward Dobson, *Rudimentary Treatise of the Manufacture of Bricks and Tiles*, 1850, from John Warren, *Conservation of Bricks*, 1999, p 24)

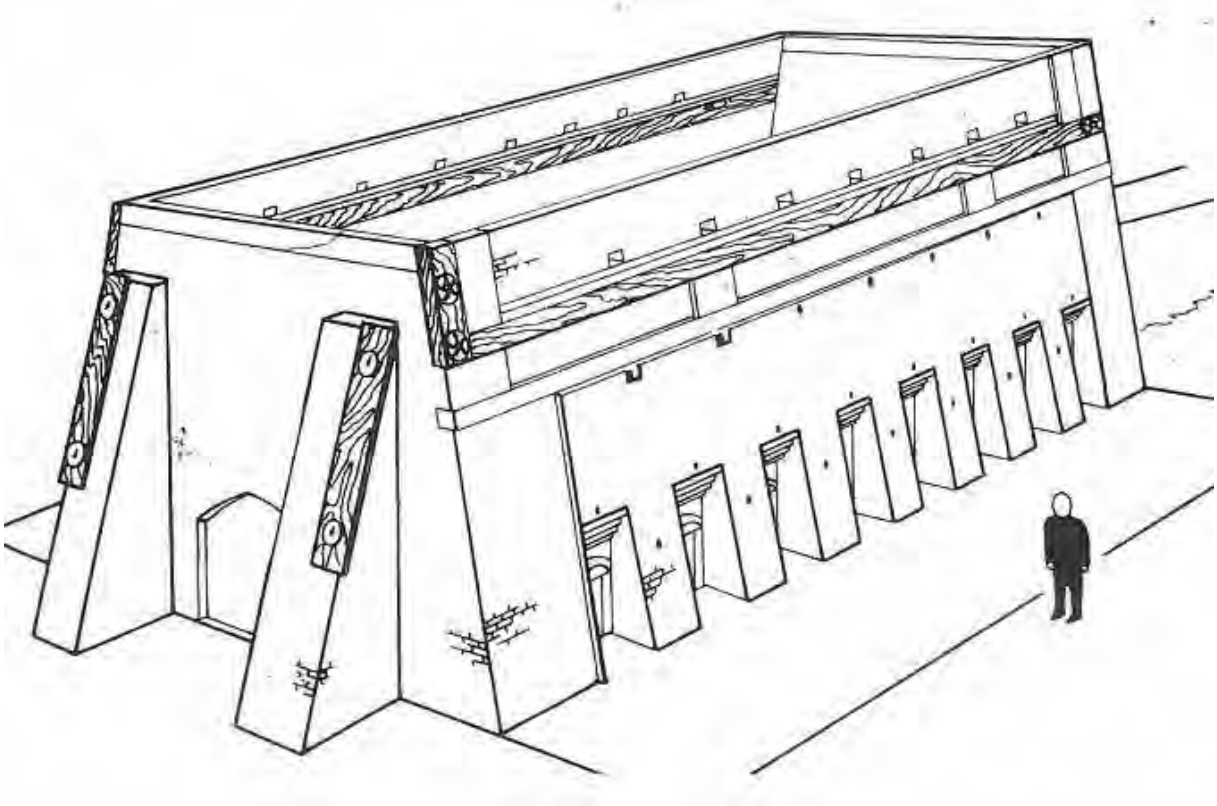


Figure 8 Sketch of Scotch kiln: roofless with three permanent walls to direct the draught upwards. (Source: Alan Cox, *Brickmaking: A History and Gazetteer,* 1979, p 26)



Figure 9 Scotch kiln at the Brickworks (right), 1926. The first Hardy patent kiln is under construction at the rear of the picture. (Source: National Archives of Australia)

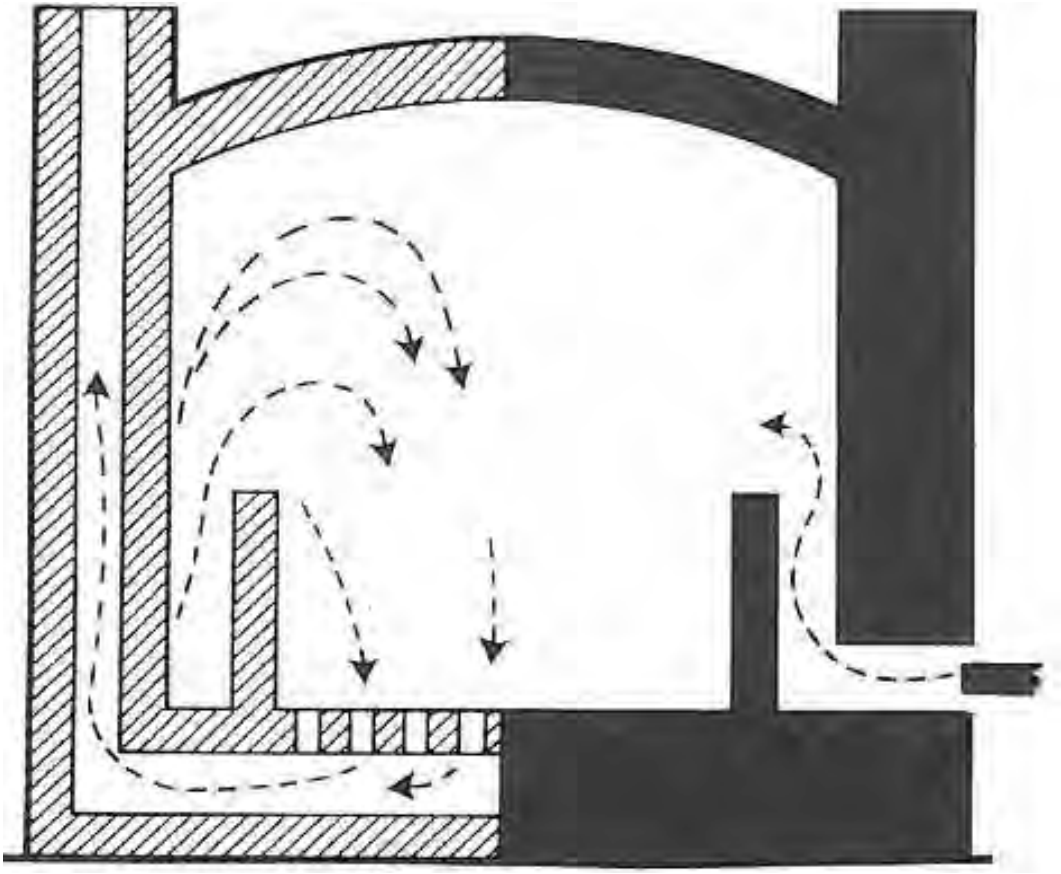


Figure 10 Section through a Downdraught kiln. (Source: Alan Cox, *Brickmaking: A History and Gazetteer*, 1979, p 26)



Figure 11 Downdraught kilns at the Brickworks (Element 6). (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 25)

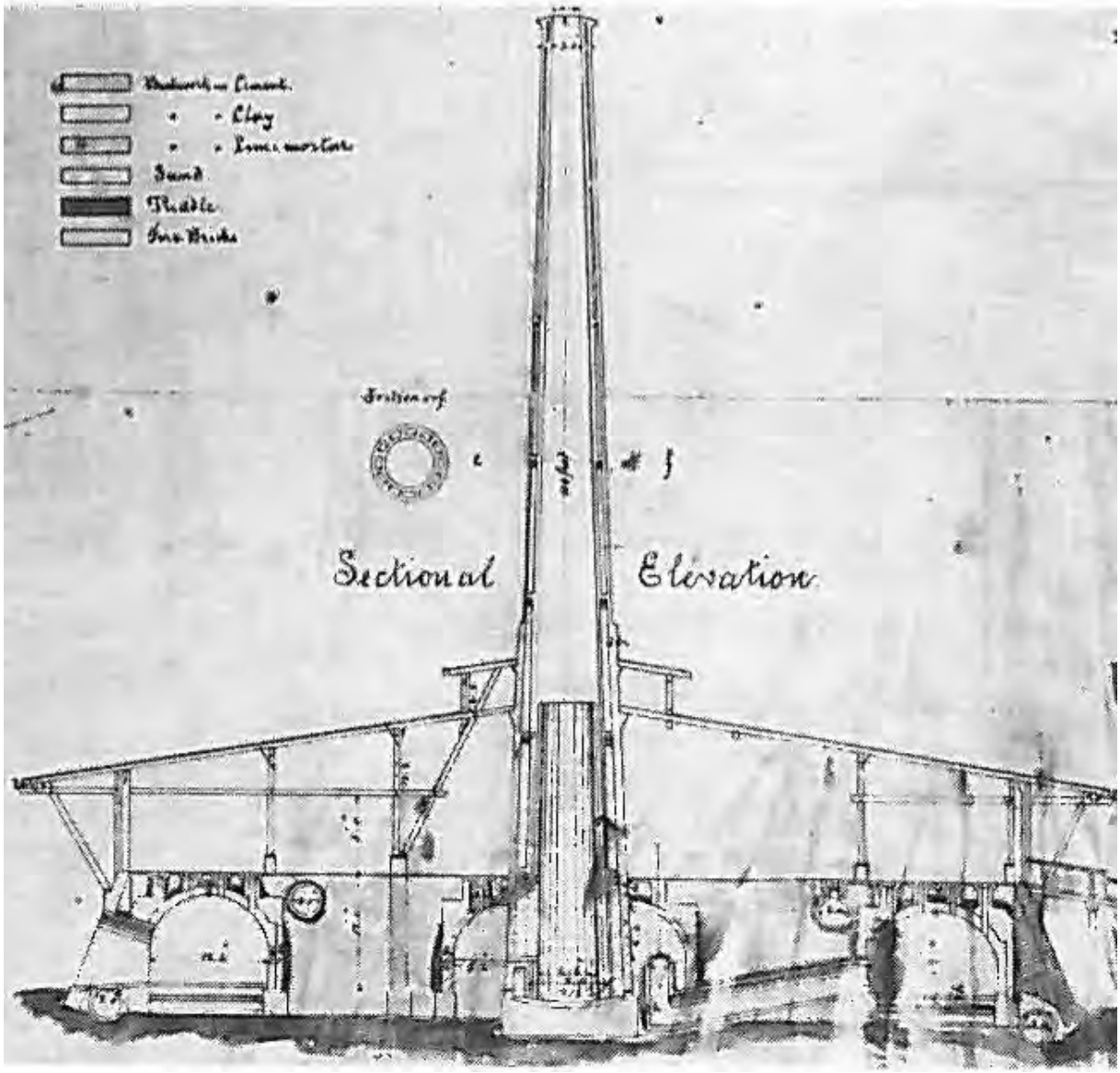


Figure 12 Section through a circular Hoffman kiln prepared by the office of Friedrich Hoffman, Berlin, in 1875. (Source: Martin Hammond, *Bricks and Brickmaking*, p 23)

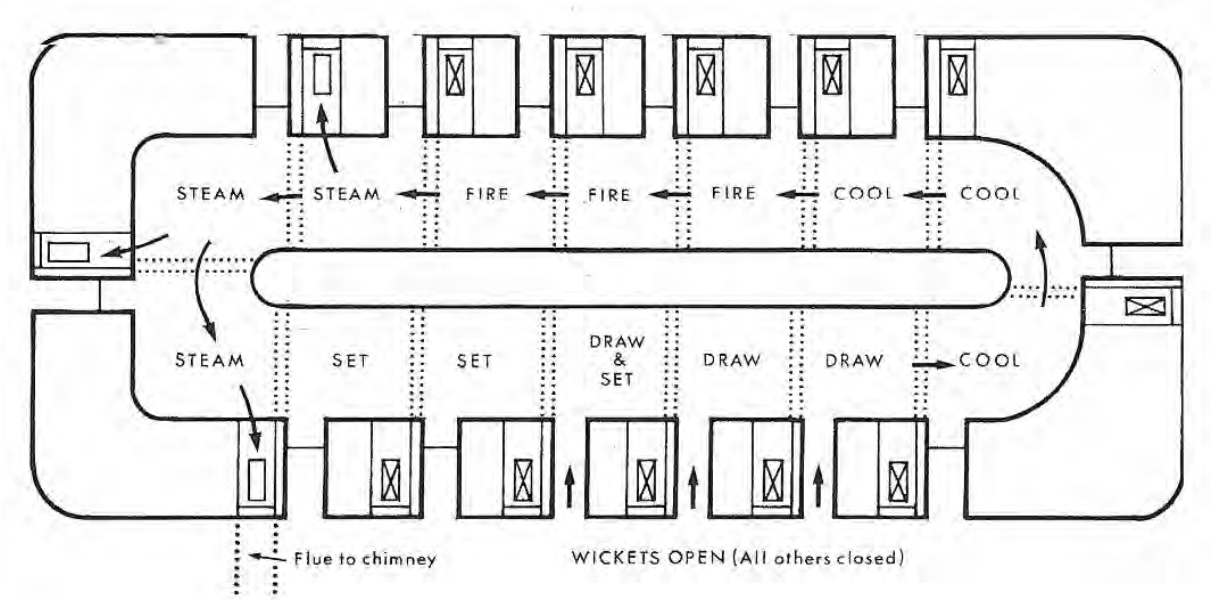


Figure 13 Plan of a rectangular 14-chamber Hoffman kiln. (Source: Alan Cox, *Brickmaking: A History and Gazetteer*, 1979, p 43)



Figure 14 Hoffman kiln at the former Standard Brickworks at Box Hill in Victoria. (Source: Lovell Chen, January 2010)

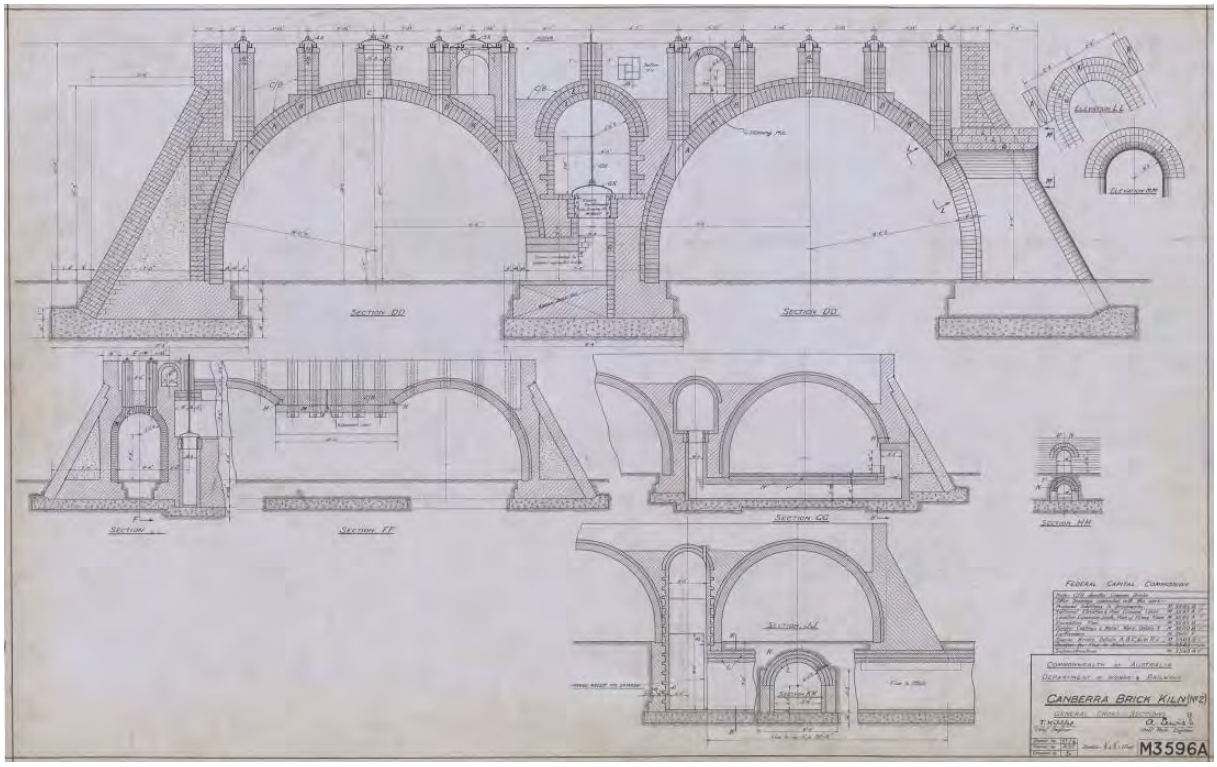


Figure 15 Cross-section of the first Hardy patent kiln at the Brickworks (Element 3), 1926. (Source: National Archives of Australia)

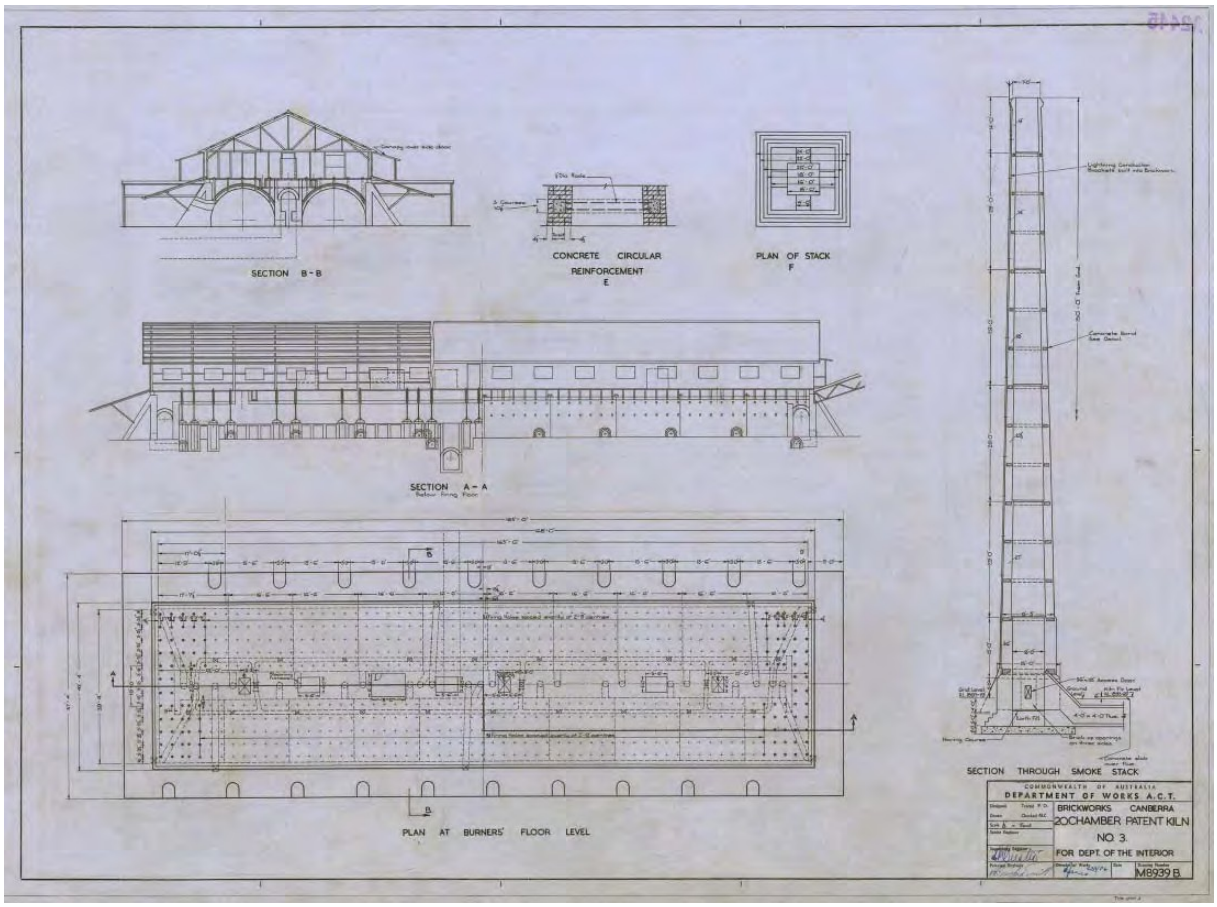


Figure 16 Drawing of 20-chamber Hardy patent kiln (Element 5) and stack (Element 9) at the Brickworks, 1953. (Source: National Archives of Australia)



Figure 17 Hardy Patent Kiln 1 at the Brickworks. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 29)



Figure 18 View into the firing chamber of one of the Hardy patent kilns at the Brickworks. Note the wickets (openings) on the right where the bricks were loaded and unloaded, and the firing holes in the ceiling/walls. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 30)



Figure 19 Interior of the firing floor to one of the Hardy patent kilns at the Brickworks. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 30)

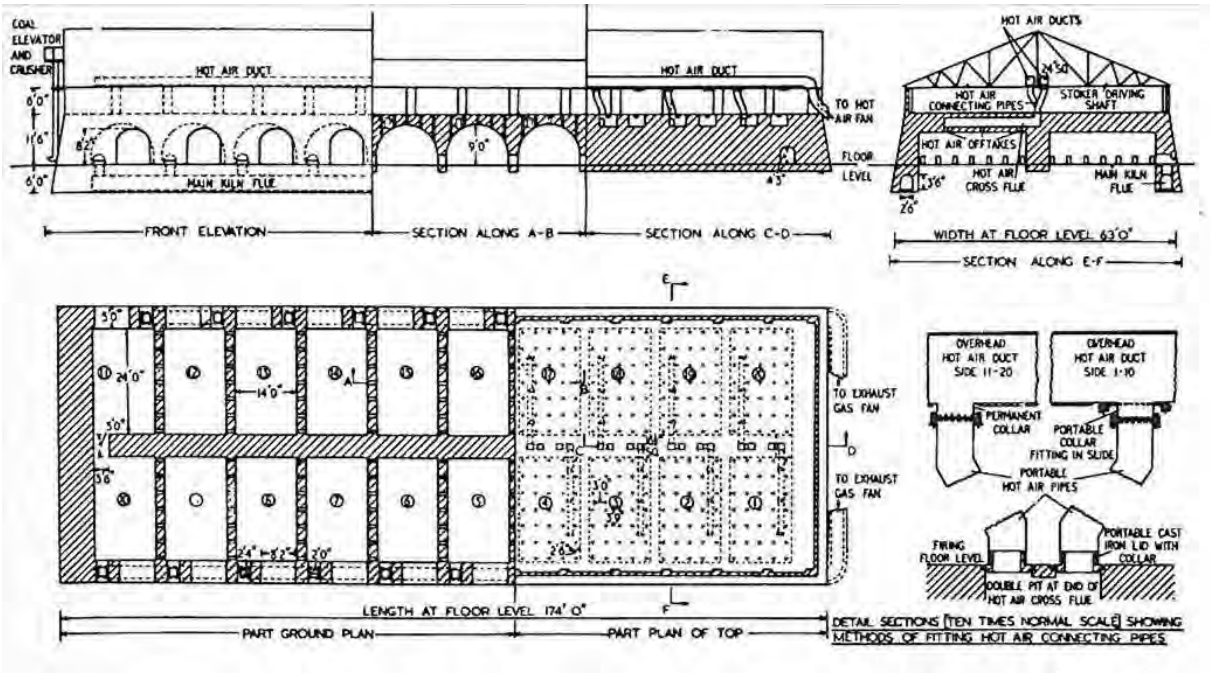


Figure 20 Plan, sections, front elevation and details of a Staffordshire kiln. (Source: Martin Hammond, *Bricks and Brickmaking*, p 25)



Figure 21 The Staffordshire Kiln at the Brickworks. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 30)



Figure 22 Interior of one of the Staffordshire Kiln chambers. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 30)

C.3 Background History of Canberra

C.3.1 Yarralumla Formation

The underlying geology of Canberra is made up of sedimentary and volcanic rock types formed when the landscapes were positioned on the margins of the supercontinent, Gondwana. The Brickworks site lies on the Yarralumla Formation created 425 million years ago by sedimentary mudstone or siltstone deposited in a shallow sea. Evidence of fossils including brachiopods, trilobites, corals, bivalves, bryozoans and crinoids remain as evidence of this ancient landscape. This geological composition included shale, a fine-grained sedimentary rock, ideal for brickmaking as it was both hard and porous. However, the shale varied greatly in quality, limestone and sandstone intrusions into seams of the rock made processing more expensive and some material unusable.

From the 1950s, geologists in Canberra explained in greater detail the geological significance of the Brickworks. They traced the sedimentary sequences of the Yarralumla Formation identifying in the

centre of Canberra principally at the Brickworks but also at Red Hill, the outcrops in suburbs of Deakin, Hughes and west of Curtin.

C.3.2 Ngunnawal Country

The Brickworks is located on traditional lands held by the Indigenous people of the Ngunnawal group. The Ngunnawal people have occupied the land for thousands of years and their descendants continue to live in Canberra and the surrounding region. Several Indigenous groups, including the Ngunnawal and Ngambri, were recorded to have settled along the sandy banks of the Molonglo River. As an important resource, the Molonglo River corridor attracted a hunter-gatherer lifestyle and Aboriginal people set up shelter and camps throughout the area as they travelled in response to the availability of natural resources.

The Aboriginal people were displaced from their land following European settlement of the area and their numbers dwindled dramatically, possibly associated with a smallpox epidemic in 1830, influenza and a measles epidemic in the 1860s. There are few records of Aboriginal people on the Limestone Plains after it was settled by pastoralists, perhaps because of Indigenous seasonal lifestyles, or because they retreated from settlers and their horses, and moved to the hills. The new settlers may also have simply failed to record their ongoing presence in any detail.

C.3.3 Colonial History

European colonisation of the area commenced in the 1820s with small and large estates for farming and grazing. The Brickworks site was established on part of a large sheep grazing property held by Frederick Campbell, a descendant of Robert Campbell who owned the early Canberra pastoral estate ‘Duntroon’.

During the late 1890s, there was much debate over the location of the seat of government for the new Commonwealth of Australia. It was eventually decided that the future capital’s location would be selected by the new Parliament following Federation in 1901. On the recommendation of Commonwealth surveyor Charles Scrivener, the district of Yass–Canberra was chosen in 1908. Scrivener’s specific choice was an elevated site straddling the Molonglo River with mountains and hills to the northwest, northeast and south.

C.4 Establishment Phase 1911–1920

C.4.1 Historical Background

Establishing the National Capital

The location of the capital of a federated Australia was debated for at least 10 years before Federation was achieved in 1901. The matter was raised at the Australian Federation Conferences in Melbourne in 1890 and in Sydney in 1891, and the National Australasian conventions of 1897–98.[23] The debates over the location of the capital were dominated by inter-colonial rivalries. However, a broad consensus was reached on the requirement for an inland location to obviate the perceived security risk presented by a coastal location. It was eventually decided that the decision on the location of the future capital would be taken by the new Parliament following Federation.[24]

The Australian Constitution of 1900 included direction to hold land for the National Capital:

> *(125) The seat of Government of the Commonwealth shall be determined by the Parliament, and shall be within territory which shall have been granted to or acquired by the Commonwealth, and shall be vested in and belong to the*

> *Commonwealth, and shall be in the State of New South Wales, and be distant not less than one hundred miles from Sydney.*
>
> *Such territory shall contain an area of not less than one hundred square miles, and such portion thereof as shall consist of Crown lands shall be granted to the Commonwealth without any payment therefore. The Parliament shall sit at Melbourne until it meets at the seat of Government.*[25]

At least 40 districts were proposed for the national capital, of which 23 were inspected by parliamentarians, a Commission and a Royal Commission. In 1904, a Seat of Government Act was introduced nominating Dalgety in New South Wales. However, the New South Wales State Government objected and refused to release the land to the Federal Government.[26] Finally, on 8 October 1908 (following the repeal of the 1904 Act), it was determined that the site would be in the Yass-Canberra district. The New South Wales District Surveyor, Charles Scrivener, was dispatched to Yass-Canberra to determine the precise location of the future city. His brief was as follows:

> *The Federal Capital should be a beautiful city, occupying a commanding position with extensive views, and embracing distinctive features … consequently the potentialities of the site will demand careful consideration from a hygienic stand-point, with a view to securing picturesqueness, and also with the object of beautification and expansion.*[27]

Scrivener's choice was an elevated site straddling the Molonglo River, with mountains and hills to the northwest, northeast, east, and south. The *Seat of Government Surrender Act 1909* (NSW) and *Seat of Government Acceptance Act 1909* (Cwlth) officially named Yass-Canberra as the site of the federal capital. The site was formally handed over to the Commonwealth on 1 January 1911.

In April 1911, King O'Malley, Minister for Home Affairs for the standing Labor Government, initiated an international competition for designs for the layout of the new city. The conditions of the competition stated: 'The premiated [sic] Designs shall become the property of the Government for its unrestricted use… Any claim for further remuneration by… the authors… will not… be recognised…'[28] In May 1912, a proposal by architect Walter Burley Griffin (1876–1937) and his wife and fellow architect Marion Mahony Griffin (1871–1961), of Chicago, was awarded first prize (see Figure 23). Second prize was awarded to Eliel Saarinen of Helsinki (Helsingfors), Finland, and third prize to Alf Agache of Paris, France.[29] The emphasis of the Griffins' proposal, largely determined by topography, combined a number of specialised centres (such as for administration, government, and the capitol) in circular, octagonal and hexagonal street systems. The centres were linked by the primary axes, which were aligned to the surrounding hills and mountains.

In November 1912, O'Malley established a Departmental Board to review the three winning schemes. The Board prepared a new plan, which incorporated aspects of all of them. The composite 'Departmental Plan' was accepted by O'Malley in January 1913 and the foundation stone of the city was laid on 12 March 1913. The city was formally named Canberra at the ceremony.[30]

A change of government stalled progress and led to Walter Burley Griffin being invited to Australia to advise on the development of the city. The new Minister for Home Affairs, W H Kelly, subsequently disbanded the Departmental Board and appointed Griffin as Federal Director of Design and Construction for the National Capital, a position that he held from 1913 to 1920.[31]

In October 1913 Griffin submitted a revised version of his plan ('Preliminary Plan', see Figure 24), with a report expanding on his ideas for the development of the city ('Report Explanatory'). Parliamentary factions and funding cutbacks caused by World War I contributed to the slow progress in the development of the national capital in the following years.



Figure 23 Walter Burley Griffin's winning competition entry (1912), overlaid on the contour map prepared by CR Scrivener. (Source: National Archives of Australia, A710, 36–37)

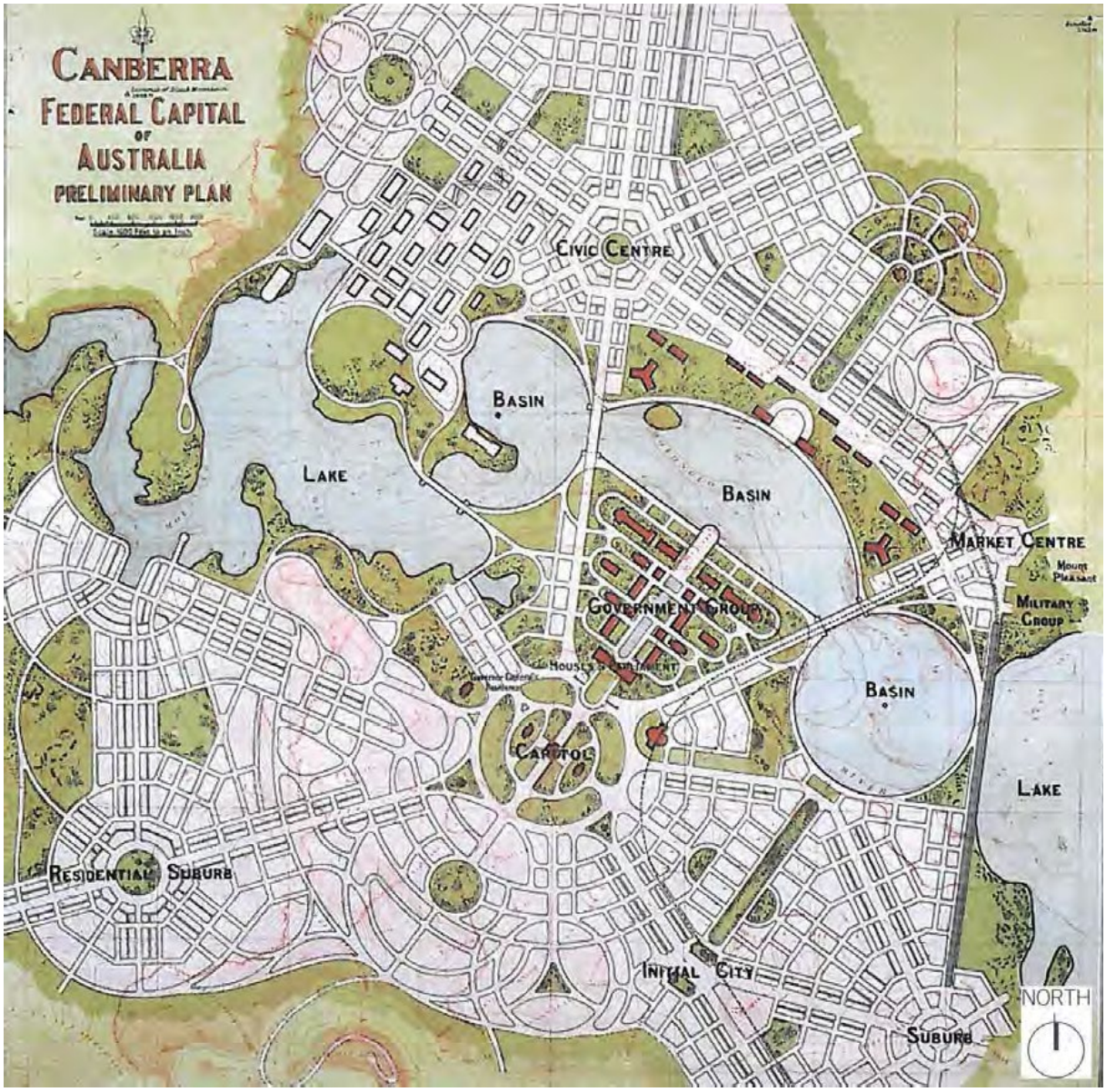


Figure 24 Plan prepared by Griffin to accompany his 'Report Explanatory' of 1913. (Source: National Archives of Australia, A1, 1917/7242)

Commonwealth Brickworks

In 1910, King O'Malley announced Government plans for the construction of a brickworks to serve the Federal Capital.[32] Other industries considered essential for the inland city included a power station, a dam and a pumping station, which became the Kingston Power House and the Cotter Dam.

Various experiments on shale in the region were carried out in early 1911. Two potential sites were investigated, one at the Duntroon Station and the other on Frederick Campbell's Yarralumla property. Samples from both sites were sent for testing.[33] Reports concluded that samples from Yarralumla produced bricks of excellent quality, equal to the best commercially produced bricks for hardness and porosity, while those produced from the Duntroon sample produced bricks of a better colour, but the material was 'little in weight, its absorption is greater and it has not burnt too well'.[34] The Yarralumla site was selected on this basis. Frederick Campbell agreed to the acquisition of approximately 38 acres of his land holding (see Figure 25). The area was gazetted on 27 July 1912, and development of the site began in 1913.[35]

As originally proposed, the permanent Commonwealth Brickworks was to include three Staffordshire kilns, one rock breaker, five American Ring Pulverisers, five Whittaker mixing pans and 10 Whittaker presses (see Figure 26). The kilns were to have induced draft fans in place of high chimneys. It was proposed to convey the bricks by aerial ropeway to a city depot.[36]

At this time (c1911–12), no other kilns of the Staffordshire type had been constructed in Australia, although the New South Wales State Brick Works at Homebush, west of Sydney, had announced plans for the imminent construction of several.[37]

A temporary plant was established and operational by 19 June 1913.[38] This comprised a grinding pan, brick making machine and elevator made by Geo. Foster and Sons, Sydney, and a portable steam engine. By contrast the permanent plant was to be electrically driven, with power from the 'Central Generating Station' (Kingston Power House), then under construction. By August 1913, four open kilns were in use at the temporary plant (see Figure 27), with plans for a fifth.[39] The temporary brickworks plant had an output of between 44,000 and 50,000 bricks per week[40] and was producing bricks for the construction of the kilns for the permanent brickworks,[41] and the Kingston Power House complex.[42]

The first stage of the construction of the permanent Brickworks, which comprised a single Staffordshire kiln, was approved on 1 December 1913 by PT Owen, the Director-General of Works.[43] It was proposed to use this kiln to produce bricks for the construction of a further two kilns.

The decision to build the Staffordshire kiln type at the site was based on the recommendations of Andrew Christie, a consulting engineer, who together with Owen, had inspected 'the latest equipment' at the State Brickworks in Homebush. In correspondence dated 24 July 1911, Christie noted in relation to the Staffordshire that:

> *… all drying, burning and cooling temperatures are under perfect control and high class goods of perfect colouring is the result. The kiln can also be for fancy and facing bricks, finials, pipes, etc., as well as ordinary bricks, the use of downdraught kilns is dispensed with and the cost of fuel materially reduced'.*[44]

Plans for the Staffordshire kiln were purchased in early 1914 from the Australian agent of the patentees, RE Odd, and Christie prepared plans for machinery sheds to be constructed adjacent to the kiln. Tenders were accepted in March 1915 for major plant, equipment and materials for the permanent works. Messrs Jaques Bros. of Richmond tendered for three rotary rockbreakers at a cost of £502; Messrs Timmings and Gardiner of Sydney for two grinding mills at a cost of £834; George Foster for ironwork for the Staffordshire kiln at a cost of £842; and George Weymouth of Melbourne for electric motors at a cost of £494.[45]

In September 1915, the brickwork for a 20 chamber Staffordshire kiln was nearing completion (see Figures 28–30).[46] The internal chamber bricks, shaped to provide the arched form, were imported from England together with the steel work trusses in the kiln loft. Three burners are also believed to have been imported from England.[47]

A Survey Plan of the site, dated 20 December 1916 (see Figure 27), shows a small galvanised iron office building close to the 'Machine Shop', and a galvanised iron 'Cottage' with associated coal store and stable to the northeast of the site. Other features shown on the plan include the temporary 'Old Kiln' area with four kilns (shown in outline on the plan, with 'Dormitories' immediately to the north), a coal stage, a long concrete retaining wall separating the quarry zone and the working areas, water storage tanks on a high knoll, a remote powder depot, three detached WCs south of the kiln, an elevated gangway connecting the coal stage to the kiln and overhead electrical connections linking the 'Power Station' to the 'Fan Room', and the 'Power Station' to the 'Machine Shop' and 'Cottage'. A tram line is indicated linking the quarry to the machine shop. The 2ft (610mm) gauge line was laid so that

loaded trucks ran downhill to the works, and the empty trucks were pushed uphill by manpower. The tram lines could be relocated as the quarry face advanced.[48]

Elements shown on the 1916 plan and remaining on the site today are the 'Power Station', the Staffordshire kiln (without verandahs to the north and south), the 'Fan Room' and 'Stack', and the long concrete retaining wall.

The Staffordshire kiln, together with crushing, processing equipment and brick presses, was ready for production in early 1916. However, the commitments of World War I and consequent restrictions on the works program for Canberra, together with a coal strike, saw the brickworks close in December 1916.[49]

In 1917, the Royal Commission on Federal Capital Administration considered the validity and functionality of the Brickworks at Canberra.[50] Walter Burley Griffin had complained that the Brickworks were a 'nullification' of his plan and that they were 'established without any consultation with him'. It was found that this charge was not fairly made since the Brickworks were established while the Departmental Plan was in force, and before Griffin came to Australia.

The Royal Commission also established that the 250,000 bricks made at the temporary plant were of poor quality and not suitable for major building work. Instead they were used for filling and lining drains, and for the Staffordshire kiln. The Commission also reported that construction of the Staffordshire kiln was begun in November 1914; that it was the first Staffordshire kiln built in Australia; and that there was evidence of construction errors in estimating and design. The findings of the Royal Commission are confusing when compared with the report in which Andrew Christie recommended the use of a Staffordshire kiln, following an inspection of the works at Homebush, which suggests a Staffordshire in operation there. This anomaly in the historical record has not been resolved.

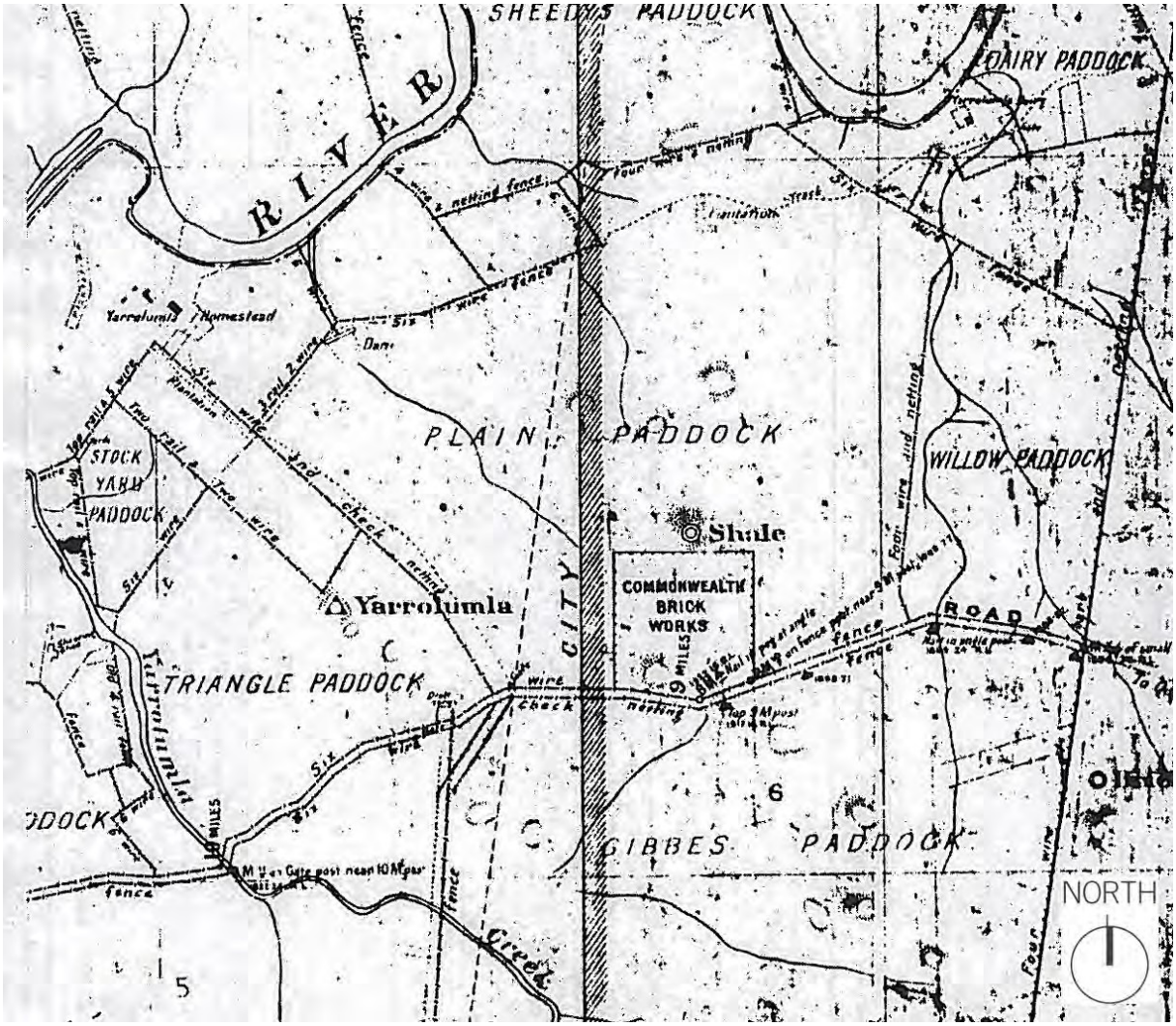


Figure 25 Site survey c1911, showing the dimensions of the 38ha site acquired in 1912. (Source: Lester Firth Associates, Section 2.1.1., original source not cited)

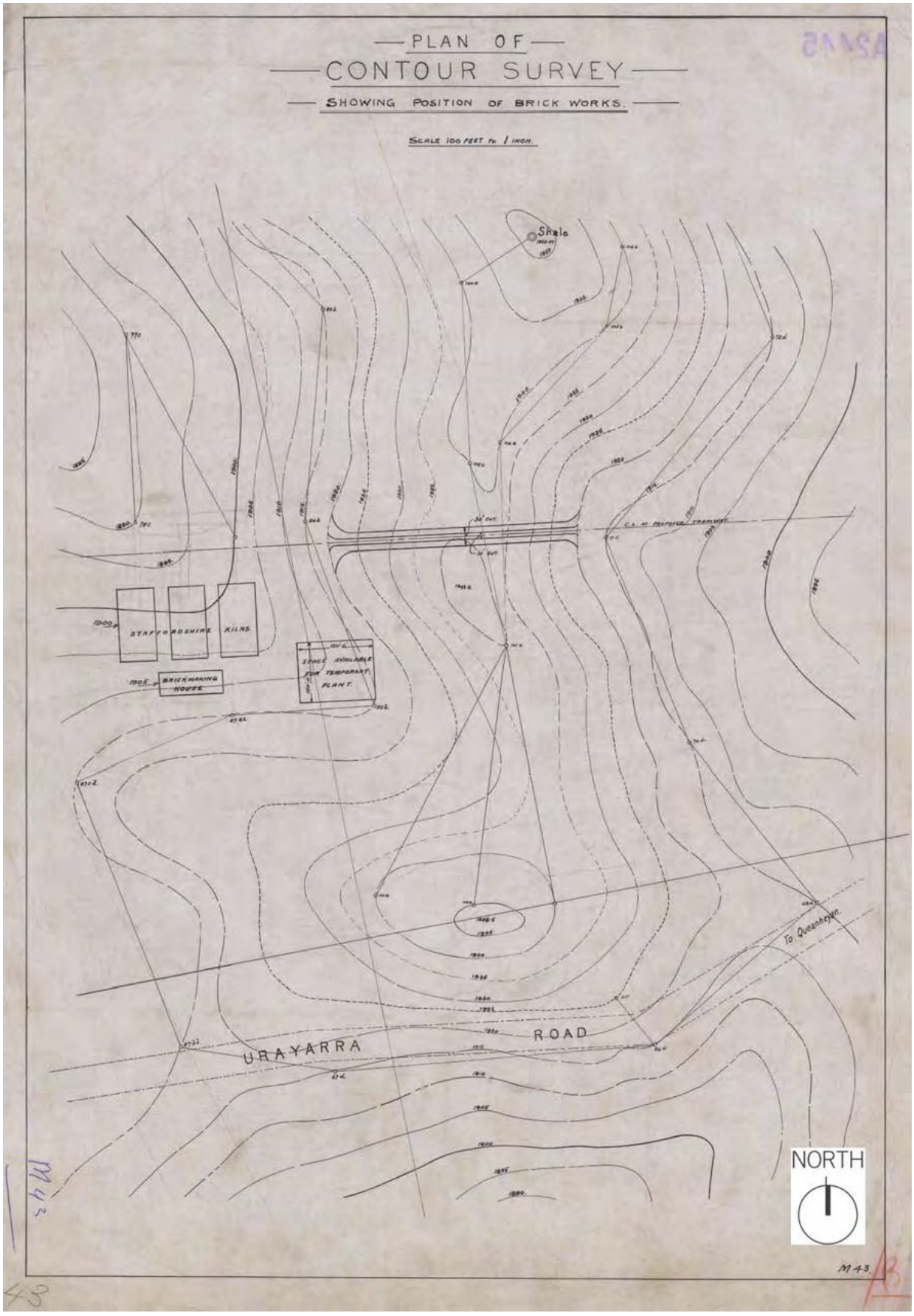


Figure 26 Contour plan with the layout of the Brickworks as proposed in c1911, showing three Staffordshire kilns and the location of the brick making plant. (Source: National Archives of Australia)

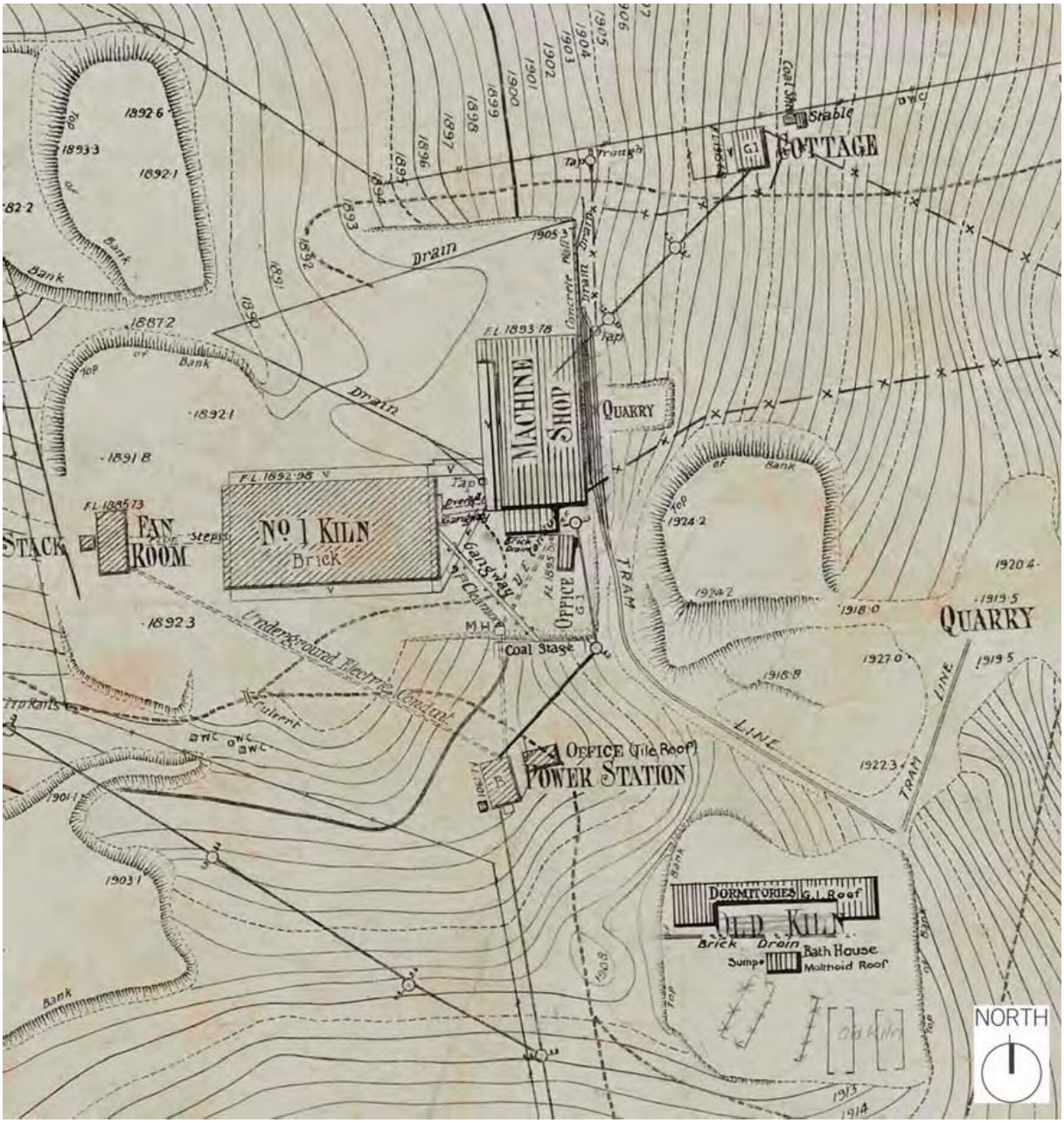


Figure 27 Excerpt from the 'Contour and Detail Survey, Canberra Brick Yards, 20 December 1916'. Note the locations of the clamp kilns below the 'Dormitories' to the southeast of the power station. (Source: National Archives of Australia)



Figure 28 Staffordshire Kiln under construction, c1915. (Source: National Library of Australia)



Figure 29 Constructing the transverse arches of the Staffordshire Kiln, c1915. (Source: National Library of Australia)

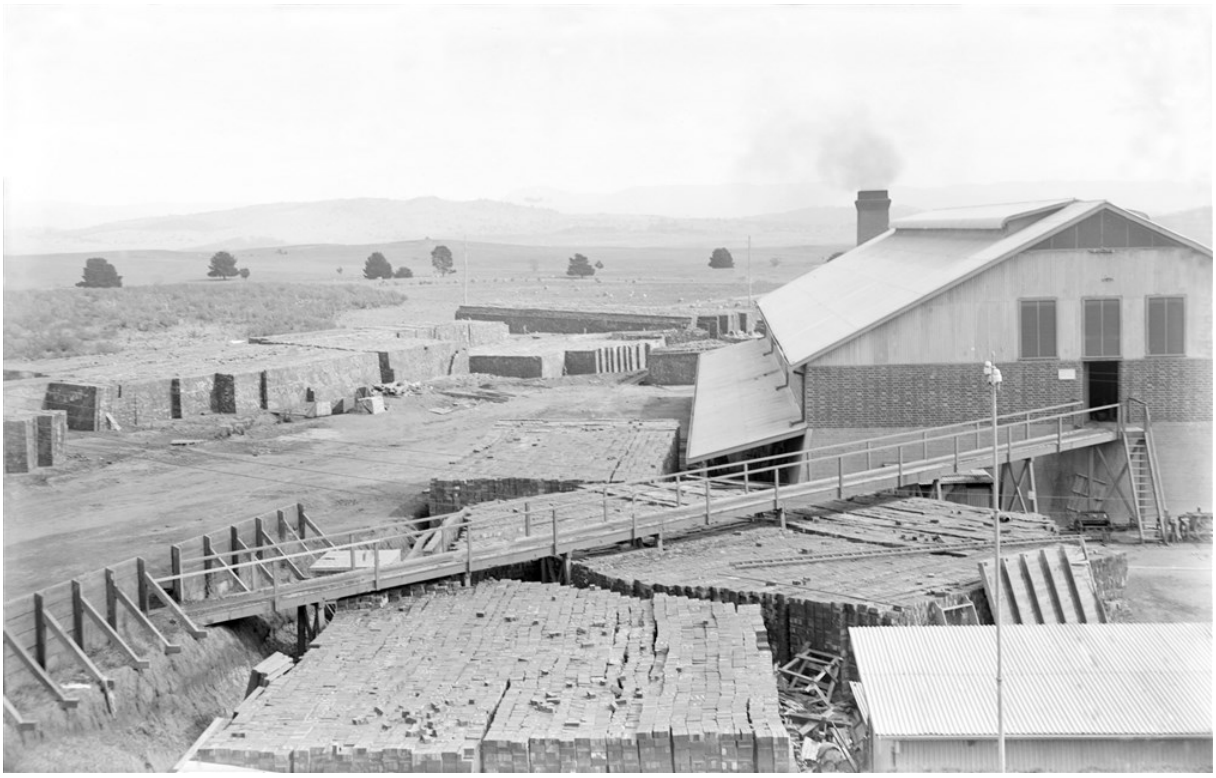


Figure 30 The Staffordshire Kiln pictured in c1917. (Source: National Archives of Australia, A3560, 188)

The Development of 'Westridge' (Yarralumla)

Walter Burley Griffin envisaged the area to the west of the 'Capitol Centre' as a lakefront suburb. The Plan (of City and Environs) of 1918, which was the last plan signed by Griffin during his tenure as Federal Capital Director of Design and Construction,[51] shows a broadly triangular area extending from the 'Capitol Centre' in the west, and defined by 'Adelaide Avenue' to the south, 'Westlake Esplanade' to the north and 'Mountain Way' to the west (see Figure 31).

Some elements of this plan were developed, including Adelaide Avenue and the southern section of 'Mountain Way', which is on the approximate alignment of the present Novar Street. 'West Lake', which is the western element of the waterway now known as Lake Burley Griffin, was formed in 1963, following the construction of the Scrivener Dam. Griffin named the suburb 'West Lake'. The area to the west of this proposed suburb, now Yarralumla, was popularly known as 'Westridge'.

Two enterprises underpinned the development and identity of the area between the city boundary and the west of Griffin's proposed layout for Westlake. The first, operational from June 1913, was the Canberra Brickworks. The second, established in 1914, was Westbourne Woods Arboretum (also known as Westbourne Woods), which was a proving ground for the suitability of native and exotic plants to the Canberra climate. The Arboretum is associated with Charles Weston, the first Superintendent of Park and Gardens for the national capital.

Since 1960, much of the site has been incorporated into the grounds of the Royal Canberra Golf Course.[52]

During the establishment phase of the Canberra Brickworks, prior to its closure from late 1916 until 1920, workers were accommodated in two camps of tents: one for married couples; the other for single men. The camps were located on Banks Street, near the present Forestry School (see Figure 31).[53]

The census of 31 December 1913 recorded a total of 62 residents of Westridge (Yarralumla), comprising 37 men and 25 women, the majority of whom were employed at the Brickworks.[54]

A dormitory block is shown on the site of the 'Old Kilns' on later versions of the 1916 survey plan (see Figure 32). It has not been established whether this was built. The first recorded permanent dwellings for workers at the Yarralumla works were constructed in the 1920s: at the top of Denman Street was a single men's camp; and to the southwest of the Brickworks was married quarters.[55]

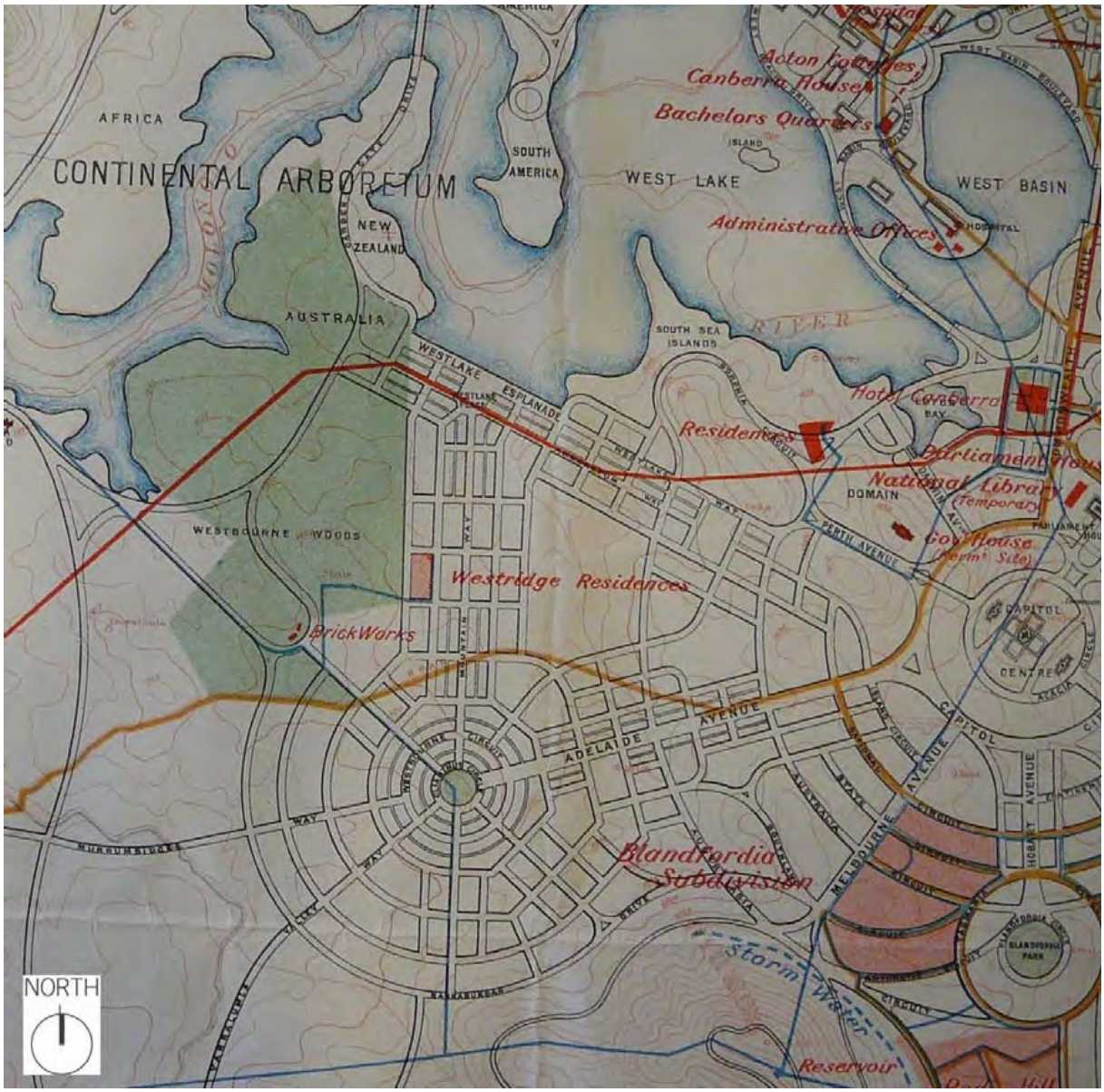


Figure 31 Detail of *Plan (of City and Environs*), 1918. The 'Westridge Residences' may be the location of the Brickworks Camp. (Source: State Library of Victoria)

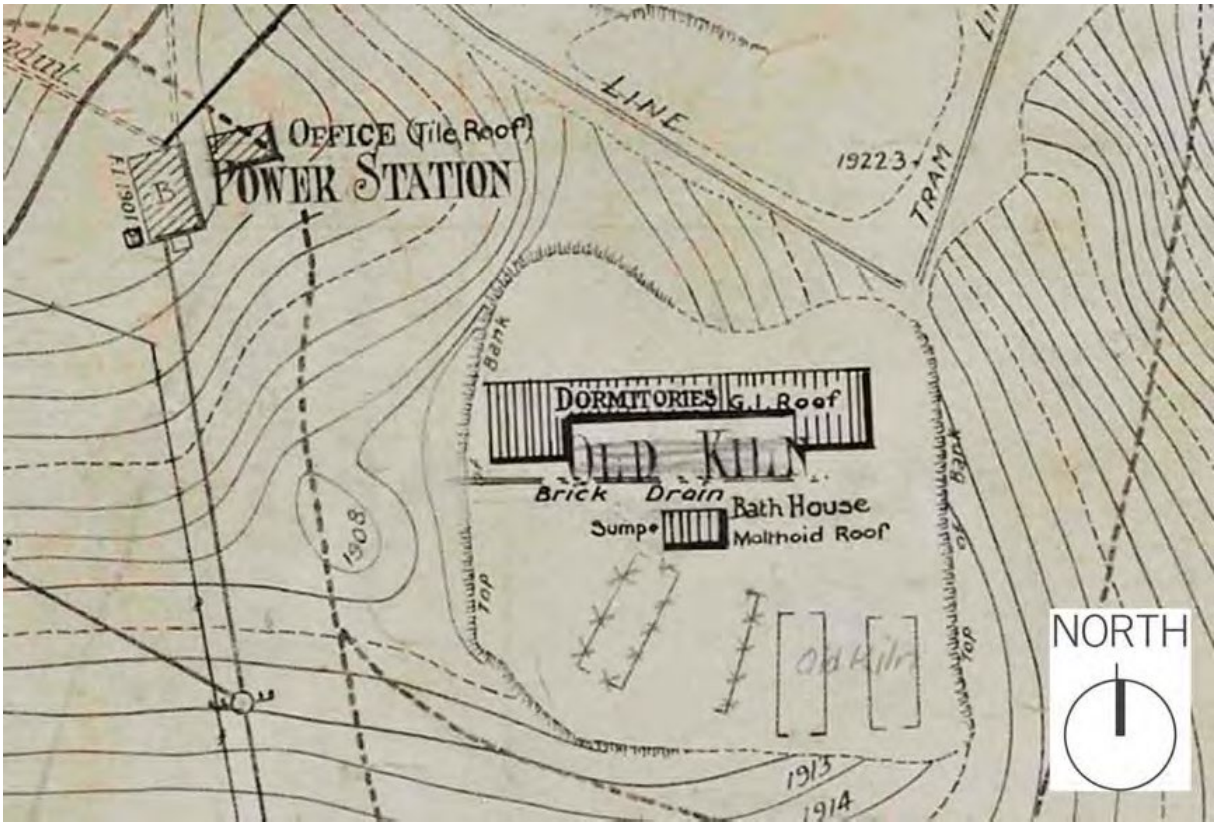


Figure 32 'Contour and Detail Survey, Canberra Brick Yards, 20 December 1916'. It has not been established if the 'Dormitories' on the site of the 'Old Kiln' had been built. (Source: National Archives of Australia)

C.4.2 Establishment Phase Elements at the Brickworks

Remaining Elements

The following elements at the Brickworks date from the establishment phase of the site. They are listed with their identifying number (refer to Figure 1.4) and date of construction. For a full history of each element refer to the Element Inventory Sheets at Appendix C.

- No. 11 + 12: Quarry, shale extraction undertaken from 1913 until c1940;
- No. 24: Concrete retaining wall, c1913–16;
- No. 14: Power house, 1915–16;
- No. 1: Staffordshire kiln, 1914–15;
- No. 2: Fan house for Staffordshire kiln, 1914–15; and
- No. 7: Stack for Staffordshire kiln, 1914–15.

C.5 Expansion Phase 1921–1942

C.5.1 Historical Background

Interwar Canberra

At the end of 1920, following the end of World War I, the Hughes Government decided to proceed with the construction of Canberra. Major works completed in the 1920s included the Provisional Parliament House, Sydney and Melbourne Buildings, Albert Hall, Forestry School, Hotel Canberra, Hotel Ainslie and the Capital Theatre, as well as housing at Ainslie, Reid, Forest and elsewhere. Residential construction peaked in 1927, the year that Parliament first sat at Canberra, and just prior to the transfer of public servants to the national capital in May 1928.

During the 1920s, the population of Canberra was approximately 3000, the majority being construction workers. The influx of public servants effectively doubled the population of the city.[56] The construction workers were housed in 'barrack-like camps'[57] located around the edges of the evolving city. One of these camps was built on Stirling Ridge, elevated ground to the east of the Brickworks. Westridge (as Yarralumla was then known) was also the location of Canberra's night soil depot, located on Adelaide Avenue, close to the present-day Kent Street–Novar Street overpass.[58]

When the Canberra Brickworks was reactivated (see Section B.4.2), accommodation was required to attract workers to Canberra. In 1921/22, seven timber tenements and a number of brick cottages were constructed adjacent to the Brickworks Camp, near the present Forestry School on Banks Street. These were among the first permanent dwellings at Westridge. At around this time, a recreation ground and tennis courts were also constructed for the benefit of the workers at the Brickworks Camp. Further development in Westridge followed during the 1920s and included the construction of 62 timber cottages for workers involved in building the Provisional Parliament House.

The next phase of residential development at the Brickworks began in February 1927, when a new single men's camp was constructed on the south side of Denman Street, close to the entrance to the site. New married quarters were located to the south of the Brickworks in the same year (see Figure 33).[59]

In 1925, Yarralumla was selected as the site of the Australian Forestry School (see Figure 34). A new building, designed in the Interwar Stripped Classical style by JH Kirkpatrick of the Federal Capital Commission (FCC), was completed in 1927. This was followed in 1928 by Westridge House, a house designed by Melbourne architect Harold Desbrowe Annear in collaboration with the noted interior designer Ruth Lane Poole as the premises of the Principal of the Forestry School, Charles Lane Poole (see Figure 35).[60] The property survives, and the Lane Pooles are remembered in the name of the residential street to the north of the Brickworks.[61] Also in 1927/28, 27 'lined cubicles' and 'mess, recreation and ablution areas' for students were constructed in the grounds of the Forestry School.[62]

In the late 1920s, Westridge was an isolated outpost of the emerging national capital. The area was not recognised as a suburb until October 1935, following complaints from local residents that they had been overlooked by the authorities (see Figure 36 and Figure 37).[63]



Figure 33 The married quarters camp (background), built to the southwest of the Brickworks in 1927. (Source: National Archives of Australia)



Figure 34 Forestry School, Banks Street, Yarralumla, built 1927. (Source: National Archives of Australia)



Figure 35 Westridge House, Yarralumla, built 1927/28. (Source: National Archives of Australia)



Figure 36 Plan of Canberra, 1933, showing the Brickworks to the west of the camp at 'Westridge' (Yarralumla). (Source: National Library of Australia, G8984 C3 G45)

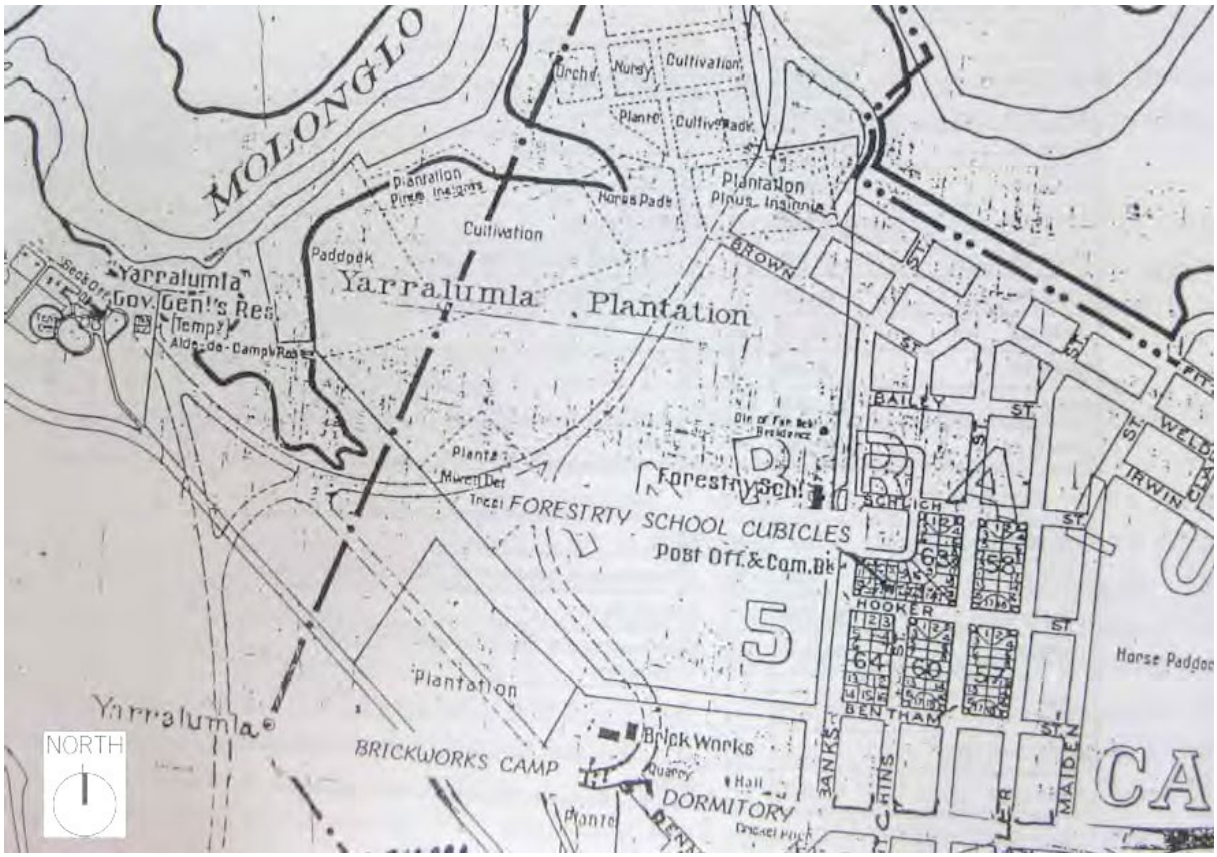


Figure 37 Plan of Yarralumla, 1927. The street layout derives from Griffin's scheme and was not fully realised. (Source: Ann Gugler, *The Builders of Canberra 1909–1929*, Chapter 3)

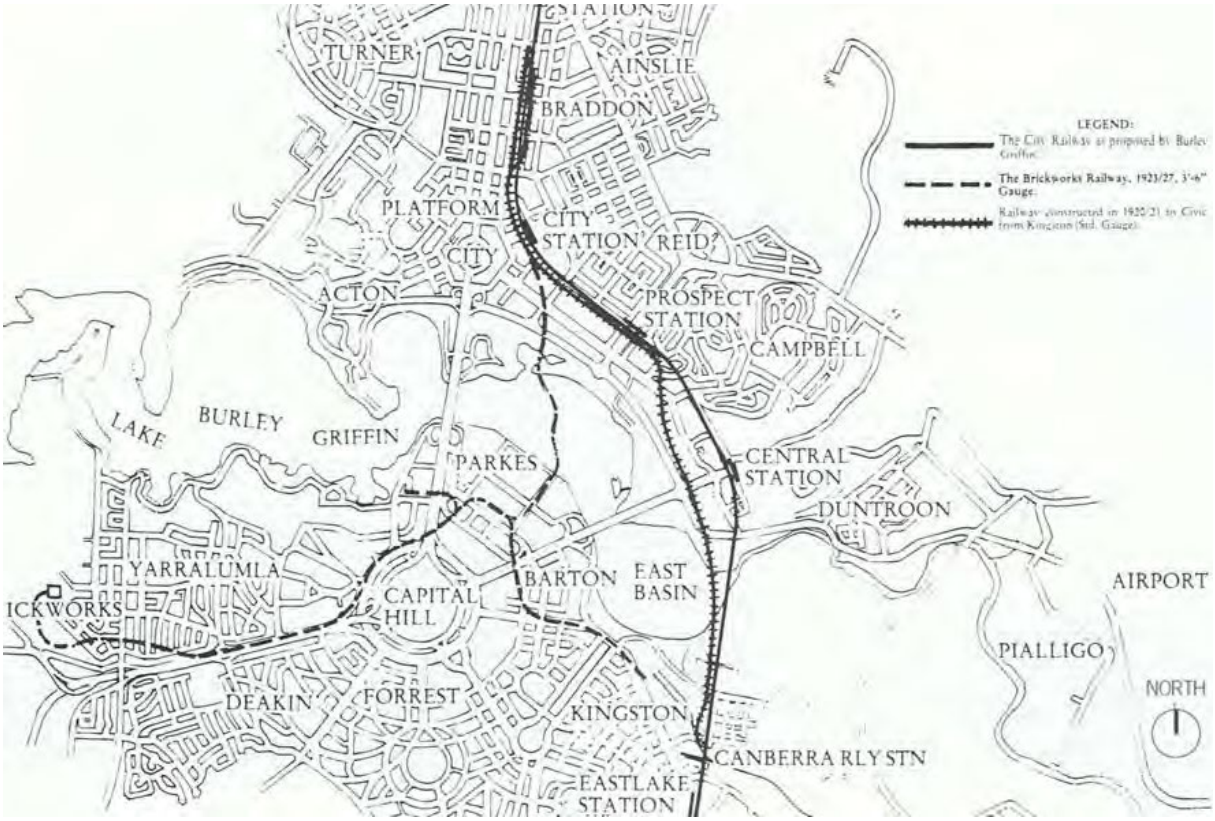


Figure 38 Plan of Canberra with the Brickworks Railway (broken lines) superimposed. (Source: Canberra's Engineering Heritage <www.engineer.org.au>)



Figure 39 Aerial view of Canberra Brickworks, 1961. Note the railway cutting to the west of the site. The route of the railway east towards the city is also evident. (Source: ACT Planning and Land Authority)

Canberra Brickworks Revived

Repairs to machinery at the Canberra Brickworks were made in 1920 and the complex was re-opened in early 1921, with a staff of only 35 and Mr WK Newbold as manager.[64]

A tile making plant was installed in 1922, located to the south of the 'Machine Shed'. In 1925, Dr Wunderlich of the Wunderlich Tile Company, Sydney, reported to the government that £5,000 had been expended on a small tile making plant, and that the tiles were of a poor quality. He recommended a £15,000 upgrade, however the government decided to spend £2,000 on improving the product.[65]

By the end of 1923, five million bricks and 50,000 tiles had been produced at the plant by a workforce of 53.[66] The bricks produced at Yarralumla in this period were generally regarded as being of a high quality. In 1925, Dr Wunderlich reported: 'the Canberra Brickworks has been turning out a brick of remarkably fine quality; in fact a quality unnecessary for ordinary construction work'.[67]

Initially, bricks were transported from the Brickworks to the construction sites in the emerging city centre by traction engine. However, the machines were only able to make two daily round trips. To accelerate the process, a light railway was constructed, leading from the southwest of the brickworks site, before aligning with the present Denman Street and heading east to the construction sites (see Figure 38). A bridge was constructed to carry the trains over the Molonglo River to the Civic Centre (now known as Civic). The 3' 6" (1,067mm) gauge steam powered railway was operational by the end of 1923.[68]

The 'branch lines' of the light railway were removed prior to the opening of the Provisional Parliament Building in May 1927 and the remaining sections of the railway were removed in 1929. From the late 1920s, bricks were transported by truck. The route of the railway is shown on a 1961 aerial view of the site (see Figure 39). Remnants of the three lines of the former Brickworks railway are evident closest to the southwest corner of the Canberra Brickworks, converging to form a single embankment. Close to the Brickworks two of the former lines are evident as earth terraces, which go through a short cutting to become distinctive earth mounds. The third line runs approximately parallel to the western boundary of the Brickworks and is evident as an earth terrace.[69] The remnants of the railway have been recognised for their significance and contribution to the early construction of Canberra and were individually listed on the ACT Heritage Register in 2013.[70]

To cope with increased demand during the 1920s, two 'temporary' Downdraught kilns and an associated stack were constructed in October 1925. These were oriented east–west and located close to the site of the three 1960s Downdraught kilns that remain today (see Figure 40). However, the additional output was insufficient to cope with the demands of the national capital construction program. During this period, at least five million bricks were purchased from outside the Australian Capital Territory. In 1926, the *Canberra Times* reported that by October of that year an additional plant capable of doubling the output of the Brickworks was to be operational.[71]

In 1926 the existing machine shed (see Figure 41) was expanded by two bays for two new New Era 'Whittaker' brick machines and grinding pans. A Hardy patent kiln (a modified Hoffman-type kiln with a detached stack) was built and in use by early 1927, located to the north of and parallel to the Staffordshire kiln (see Figure 42 and Figure 43).[72] This kiln remains today, albeit in extensively modified form. Also during this period, a 'Scotch' kiln was in operation to the north of the Staffordshire kiln (see Figure 42), and the original section of the present office building was constructed (refer to Element Inventory Sheet: Offices—Figure 1, at Appendix C). In January 1927, the *Canberra Times* commented on the expanded capacity of the works, noting that in addition to the new Hardy patent kiln of 18 chambers with a potential annual output of six million bricks, a new down draft tile kiln was

operating with an annual output of 420,000 tiles, and a new Roman tile machine had a daily output of 2,000 tiles. It also noted that three hand presses had been installed (presumably in the machine shed) 'for all classes of special work'.[73]

Despite the scale of the expansion works, the demands on the Brickworks were greatly reduced with the end of major building operations in the ACT. The 1927/28 Federal Capital Commission Annual Report noted that the plant at Westridge, which comprised one 'Hoffman' (the Hardy patent kiln), one Staffordshire and two Downdraught kilns, was capable of producing 12,000,000 bricks and 500,000 tiles a year. The report also noted that extra crushing plant and equipment was installed at the quarry, and large supplies of material for road construction and use in building works had been obtained. The joinery shop, mechanical and electrical workshops had operated during the year although the joiner's shop was to be closed due to lack of demand.[74]

Due to instability, quarrying was reportedly more difficult and costly at Yarralumla as compared to other brickworks. A comparison of prices in 1929 showed that 1,000 common Canberra bricks cost £6.11s while the State Brickworks in Sydney could supply 1,000 commons for £2.18s 6d. But freighting 1,000 bricks to Canberra cost £5.1s, almost as much as it cost to manufacture them at Yarralumla. In addition, the Brickworks was operating at a loss because of Commission policies to sell bricks to private enterprise at little above cost price to make building as cheap as possible. Bricks for public servant homes were sold below cost price to give further incentive for them relocate to Canberra.[75]

In 1929, the Depression saw production severely curtailed. To minimise costs, timber was used for firing kilns instead of coal. Production eventually ceased altogether and the works closed in February 1931. Stockpiled bricks were used for essential construction purposes only. As the economy revived, government funds were again available for office accommodation for public servant transfers to Canberra. Limited production at the Canberra Brickworks began again in 1935. From this period problems with shale quality through limestone intrusion meant that most material for brick production had to be brought to the site from elsewhere. Evidence of this limestone problem is evident in the rock outcrops in the quarry area.[76]

The late 1930s was a boom time for the construction of Canberra, and the Canberra Brickworks was unable to meet demand. On 19 October 1939, the *Canberra Times* reported that daily production at the Brickworks was 45,800 bricks, and the average consumption in building operations was 50,280—a situation that required the purchase of 631,500 bricks from the Bowral works in New South Wales.[77] For the 12 months ending December 1940, the output of 7.25 million bricks was the highest since the boom days of the 1920s.[78]

World War II diverted peace time activity to works associated with the war effort, and saw the closure of the Brickworks once again. In April 1942 staff were laid off and a caretaker manager was retained to issue bricks for essential works. At the time, three million bricks were in stock, some of which were used in the construction of the US Embassy in Canberra.[79]

The range of products for building purposes produced at the Brickworks in the 1930s was enormous. A 1936 Stock Sheet of the Department of Interior lists all products and includes: 3" (76mm) common bricks, 3" face bricks (red), 3" black bricks common, 2" (51mm) paving bricks, 2" face bricks (red), 3" semi-glazed face bricks, 3" chocolate face bricks, 3" pavers, 2" common bricks, squints, ovolo double return bricks, special mould bricks, ovolo type 8, ovolo type 17, splay on end 3", 3" splay on end flat double, angle bricks, Scotia, cornice, 3" bull nose bricks, plinth single return, double return, bull nose stops—single and double, vents, louvres, air bricks, kerbs, tiles—Marseilles, Roman, with apex, ridge, starters and stops, paving tiles, chimney pots, fluted bricks and facing tiles.[80]

C.5.2 Expansion Phase Elements at the Brickworks

Remaining Elements

The following elements at the Brickworks date from the expansion phase of the site. They are listed with their identifying number (refer to Figure 1.4) and date of construction. For a full history of each element refer to the Element Inventory Sheets at Appendix A.

- No. 13: Offices, c1925;
- No. 3: Hardy Patent Kiln 1, c1926–27 (rebuild 1955);
- No. 4: Fan House for Hardy Patent Kiln, c1927 (second phase c1955); and
- No. 8: Chimney Stack for Hardy Patent Kiln, c1926–27.



Figure 40 Detail of 1947 site plan, indicating the location of the two 'temporary' Downdraught kilns, to the south of the Staffordshire Kiln ('No. 1 Kiln'). (Source: National Archives of Australia)



Figure 41 The machine shop (left) pictured mid-1920s. (Source: National Library of Australia)



Figure 42 Hardy Patent Kiln 1 under construction, 1926. The Scotch kiln is to the right of the picture. (Source: National Archives of Australia)



Figure 43 Hardy Patent Kiln 1 under construction, c1926. (Source: National Archives of Australia)

C.6 Post-World War II Phase 1944–1976

C.6.1 Historical Background

Postwar Growth (1944–1963)

With the end of World War II in sight, the Canberra Brickworks reopened in September 1944, with limited production. From the late 1940s and into the 1950s, output was stepped up to provide material to address the postwar housing shortage, resulting in a major expansion and redevelopment of the Brickworks (see Figure 44 and Figure 45).

Among the first postwar construction projects was the replacement of the married quarters of the Brickworks Camp built during the 1920s, which had been removed by the army during World War II. In the immediate postwar period a request for new quarters was made to attract more workers as recruitment of qualified and experienced workers was a problem during this period. The new 'Brickworks Hostel' was ready for occupation in 1945[81] and was located on the site of, or in close proximity to, the former married quarters (see Figure 46). Demolished c1970, sections of the foundations of this structure survive. The Amenities Block (Element 25) also dates to the early postwar period of investment in staff facilities.

In 1952, plans for a new 'Tunnel' kiln were prepared, equipment was purchased and foundations were laid. However, the project was abandoned amid spiralling costs. The aborted Tunnel kiln project resulted in expenditure of £141,014. Department of Works records show that items of equipment purchased for the project and valued at £39,193 were transferred to other sections of the Department, and that redundant equipment valued at £44,000 was still on site in 1956. A further £28,351 was lost due to sales of redundant equipment, expenditure on site and compensation for equipment not received. Department records also note that a large prefabricated Marsden shed, which had been

acquired to cover the kiln, was to be re-erected at Duntroon as a store for the Australian War Memorial.[82]

In July 1952, following the losses related to the Tunnel kiln project, responsibility for the Canberra Brickworks was transferred from the Department of Works to the Administration Branch of the Department of the Interior.[83] Also in 1952, with demand for construction materials increasing, the Department was advised to build a 20-chamber 'Hoffman' kiln with a capacity of 20,000 bricks per chamber, to be located on the foundations of the Tunnel kiln (see Figure 47).[84] On 16 June 1954, the contract for the construction of a second Hardy patent kiln with loft, awning and tall stack was awarded to McDonald Bros & Co, of Lidcombe, Sydney.[85] This new kiln was to be lined with firebricks, equipped with the latest system of hot air flues and wickets and large enough to permit free movement of fork lift trucks.[86] Its price was a relatively modest £43,455.

Unlike both existing continuous kilns at the Brickworks, the new Hardy patent type kiln was constructed utilising natural draught for firing, as opposed to being fan-induced. As a consequence, a tall chimney stack was required (see Figure 47). Ironically, the natural draught process did not work efficiently and a fan was installed within about a year.

The expansion of the Brickworks in the 1950s saw a change in the process of brick making and in the machinery required for production. The early machine shop, adjacent to the Staffordshire kiln, was replaced with a series of brick press buildings and a workshop. The Brickworks was also equipped with a series of new crushers and hoppers, an elevator and a 'Pan Building'; and a sequence of conveyor belts (see Figure 48 and Figure 49).[87] In 1955 the existing Hardy patent kiln (Element 3) was also substantially rebuilt and enlarged by two bays.

By 1956, it was reported that progress had been made in re-organising the layout of the brickworks; that a large new kiln was in operation with other kilns being substantially reconstructed; and that all brick machines were of recent installation.[88]

In 1959, a report was prepared by HH Macey on the operations, management, equipment, and economics of the Canberra Brickworks to address concerns about the low productivity of the plant.[89] Macey found that the works were generally well planned and maintained; that the grinding was 'a little on the coarse side' resulting in bricks of moderate quality; and that a reliable supply of high quality clay at reasonable costs was a notable problem. He also expressed concerns about heat 'leakage' to the Staffordshire kiln, which he suggested could be addressed with minimal difficulty.[90]

Macey's conclusion on the low productivity of the plant was:

> *The works is basically a good one and capable of a much greater output than at present. The essential cause of the low output is an ill-advised bonus payment [scheme] which not only provides no incentive towards greater output, but actually encourage a lack of production … Provided that the men can be made to work steadily and regularly at reasonable rate common elsewhere, the works is capable of making a considerable profit.*[91]

The development of Canberra received renewed attention with the creation of the National Capital Development Commission (NCDC) in 1958. To meet construction needs, the two 'temporary' 1925-built Downdraught kilns were demolished to make way for three new Downdraught kilns, which were reputed to be the longest in Australia.[92] These were constructed on the site of the former 'temporary' kilns in 1960–63 (Element 6), although oriented north–south rather than east–west. Each held 120,000 bricks; the process of loading, firing and unloading took seven days. With the completion of the Downdraught kilns the Brickworks had a capacity of 800,000 bricks per week.[93]

During the 1960s, oil replaced coal as the fuel for firing the kilns, and modifications were made to the entrances of the three continuous kilns (the Staffordshire and two Hardy patents) for the use of forklift trucks to set and remove bricks.[94]

Decline

In 1967, the ACT Health Services Branch inspected the Brickworks Hostel and reported that the buildings were in a state of disrepair. Late in 1970 it was reported that the hostel was to be demolished.[95]

In 1971, a large building to the west of the 1960s Downdraught kilns was constructed to house drying kilns and machinery for making extruded bricks was installed ($500,000.00 plant)[96] (Element 32). This operated until the closure of the works in 1976.

By 1973, the Canberra Brickworks were considered to be in need of extensive modernisation and proposals were prepared by Commonwealth Brickworks Pty Ltd for upgrade works. These proposals were rejected by the NCDC on environmental grounds and a new brickworks site was released at Mitchell, north of Canberra. The *Canberra Times* cited the reasons for moving the brickworks as: the land being required for residential purposes; excessive use of neighbourhood roads by heavy traffic; and levels of air pollution incompatible with the amenity of residential development nearby.[97] The kilns were unloaded for the last time in August 1976. All usable material was moved to the new site and the remainder offered for sale. Bricks were first produced in the Mitchell plant in October 1976.

By the time of its closure it was estimated that some 600 million bricks had been produced at the Canberra Brickworks.[98] The Sixteenth Annual Report (1975–1976) of the Commonwealth Brickworks (Canberra) Limited recorded that the company received $2.25 million from the Department of the Capital Territory as compensation upon having to vacate the Yarralumla site. The report also indicates that between 1972 and the closure of the works in 1976 the workforce had halved, from 106 to 53, and total brick sales reduced from $22.25 million to $12.76 million.

Substantial operational losses made during this period were attributed to the imminent relocation of the plant and the depressed state of the economy.[99]

C.6.2 Post-World War II Phase Elements at the Brickworks

Remaining Elements

The following elements at the Brickworks date from the post-World War II phase of the site. They are listed with their identifying number (refer to Figure 1.4) and date of construction. For a full history of each element refer to the Element Inventory Sheets at Appendix C.

- Element 25: Amenities Block, c1950, c1977;
- Element 5: Hardy Patent Kiln 2, c1953;
- Element 9: Chimney Stack for Hardy Patent Kiln 2 (Element 12), c1953, c2005;
- Element 15: Machine Bay 1 for Staffordshire Kiln (Element 3), c1955;
- Element 16: Machine Bay 2 for Hardy Patent Kiln 1 (Element 8), c1955;
- Element 17: Machine Bay 3 for Hardy Patent Kiln 2 (Element 12), c1955;
- Element 18: Workshop, c1955;

- No. 21: Small Crusher House, c1958;
- No. 19: Large Crusher House, c1955;
- No. 20: Primary Crusher House, c1955;
- No. 22: Elevator/Conveyor, c1955;
- No. 6: Downdraught Kilns, c1960–63;
- No. 26: Downdraught Kiln Control Room, c1963;
- No. 10: Chimney Stack for Downdraught Kilns, c1950s;
- No. 27: Toilet Block, c1960s;
- No. 28: Ancillary Storage Building, c1971;
- No. 29: Substation/Control Room, c1971;
- No. 30: Boiler House, c1971;
- No. 31: Amenities Block 2, c1960s;
- No. 32: Extrusion Plant, c1971;
- No. 33: Ancillary Storage Building 2, c1960s; and
- No. 34: Storage Shed, c1960s.

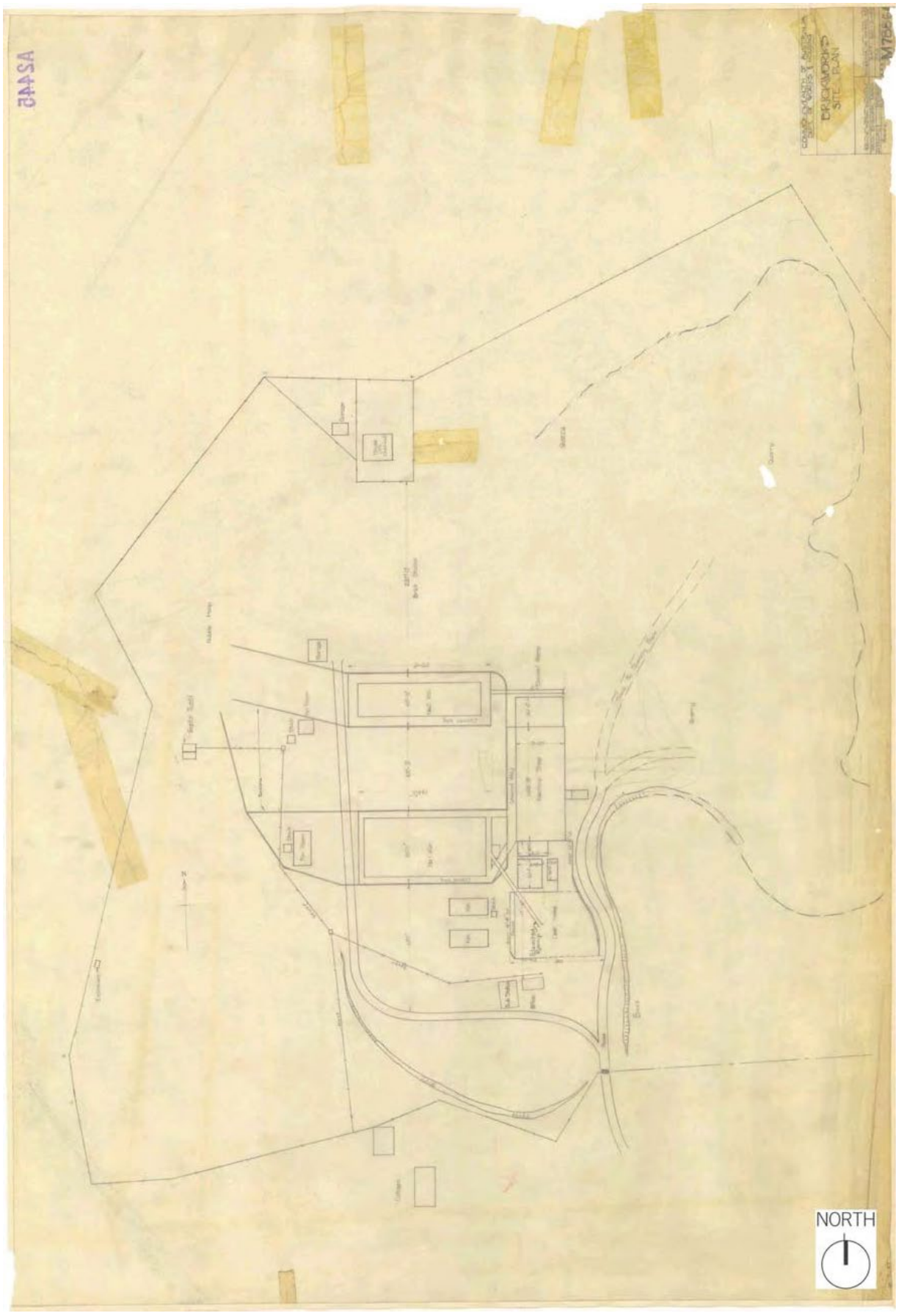


Figure 44 Site plan, 1947. (Source: National Archives of Australia, A2445, M7668A)

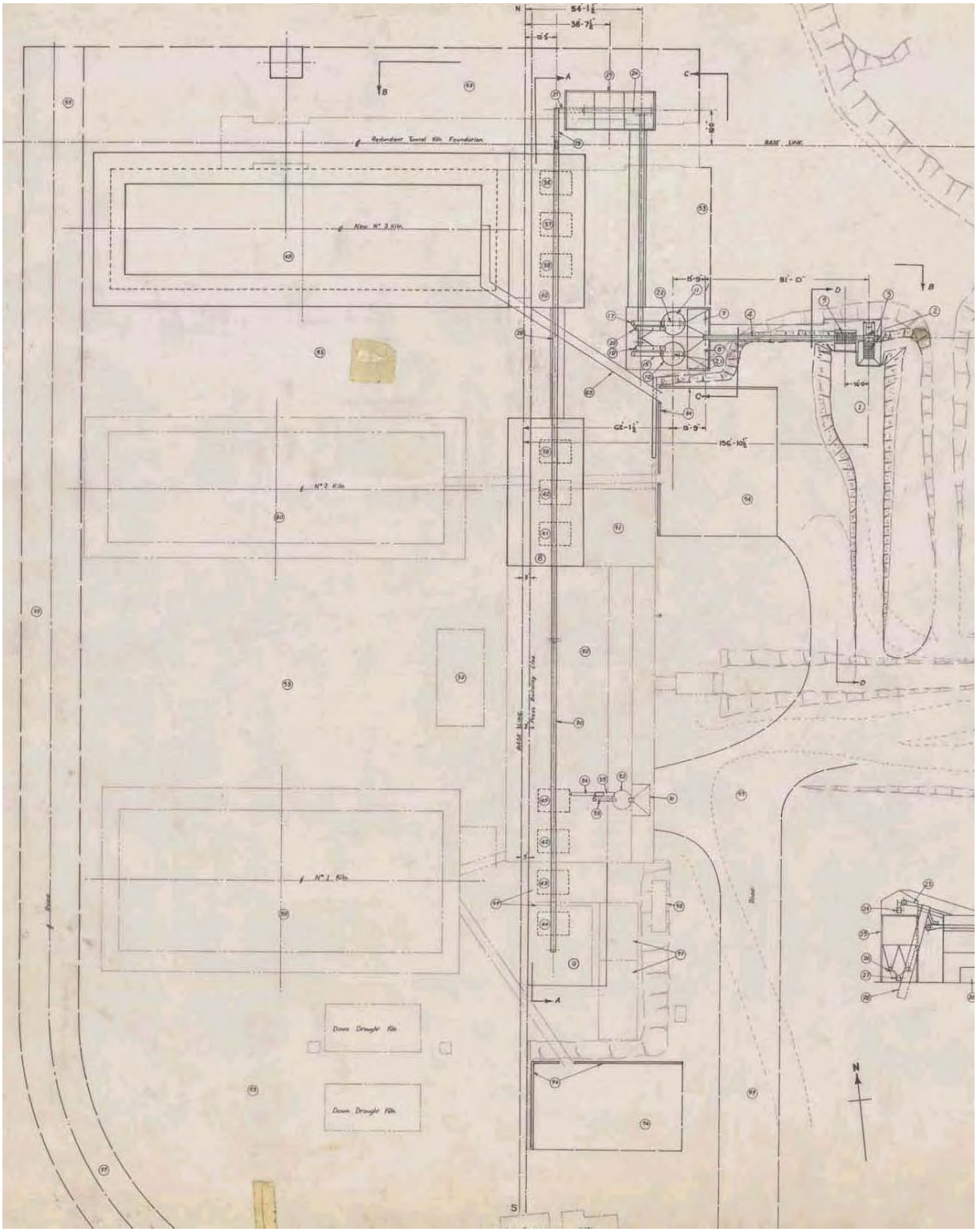


Figure 45 Layout of the site, 1954. (Source: National Archives of Australia)



Figure 46 Aerial view of the Brickworks, 1950. Note the new 'Brickworks Hostel' to the south of the site. (Source: ACT Planning and Land Authority)

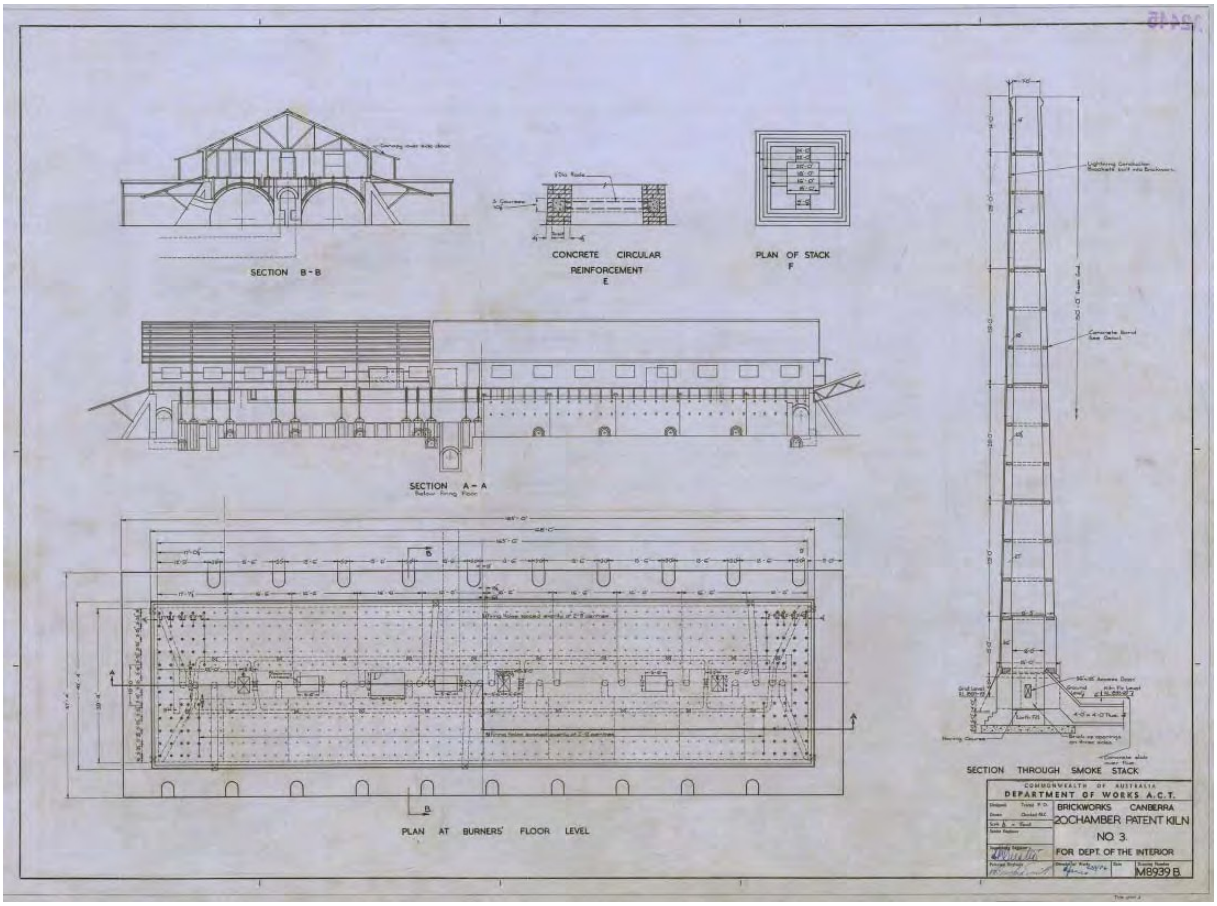


Figure 47 Plans for the Hardy Patent Kiln 2 (Element 5) and stack (Element 9), built 1954/55. (Source: National Archives of Australia)

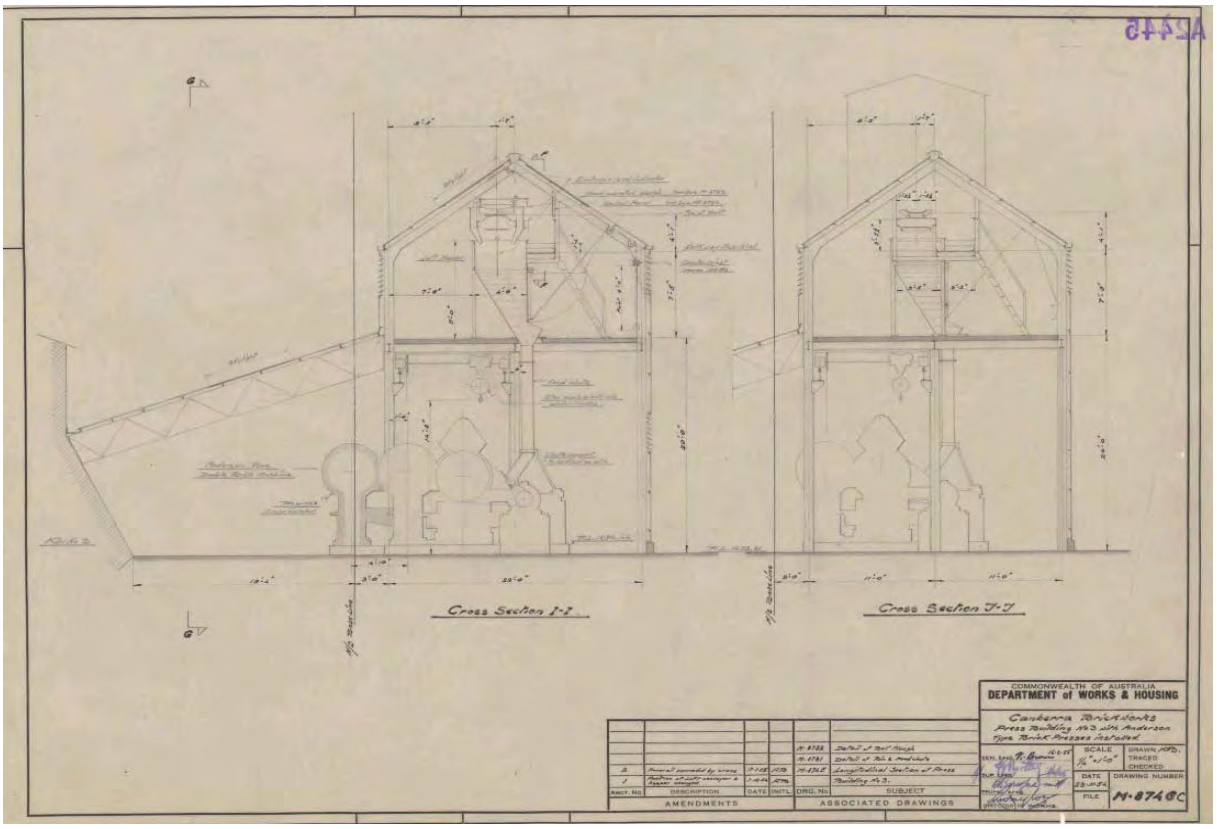


Figure 48 Cross-section through machine bay for Hardy Patent Kiln 2 showing brick press below and conveyor in the gable. (Source: National Archives of Australia)

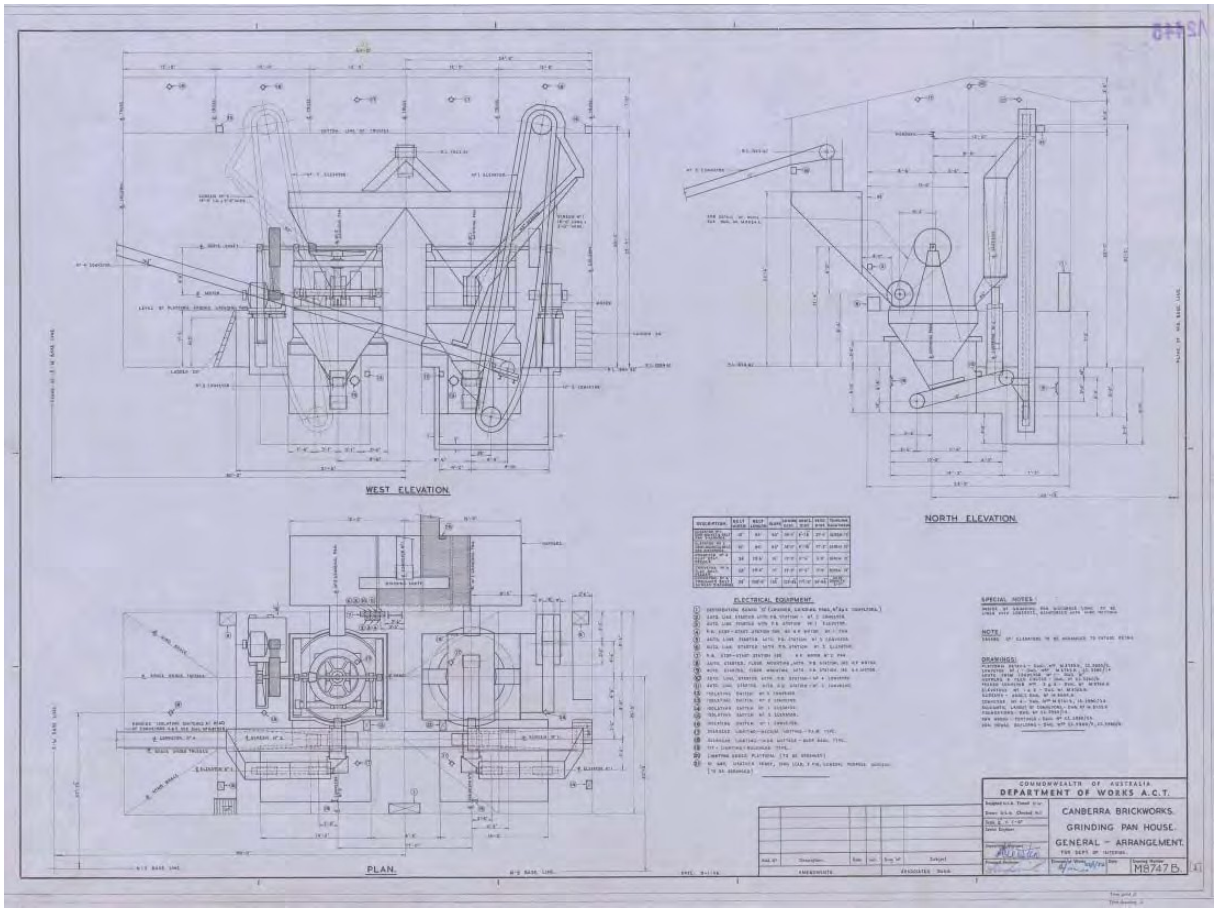


Figure 49 Grinding Pan House General Arrangement, 1956 (Red Pan Room,demolished). (Source: National Archives of Australia)

C.7 Post-Closure Phase 1976–2017

C.7.1 Introduction

The following section summarises the uses, and some of the proposed uses, of the Canberra Brickworks since the site was decommissioned in 1976.

A R Marr Redevelopment Proposals (1976–84)

In September 1976, all removable structures at the Canberra Brickworks were offered 'for sale for removal', and the extrusion plant shed to the southwest of the site was relocated to the Canberra Showgrounds.[100] The NCDC anticipated that costs incurred during the relocation process would be recovered during the subsequent adaptive re-use of the site, which the NCDC initially proposed to achieve by redeveloping the site with medium density housing.[101]

Also in 1976, local developer and businessman Alan Marr (A R Marr Pty Ltd) put forward a proposal to develop the brickworks as an integrated tourist, recreation, and retail centre. Uses envisaged included manufacturing (including a pottery, winery, and crafts), speciality shops, an antiques market, plant nursery, restaurant and tavern, offices, art displays in the upper levels of the three continuous kilns, and museums, including collections of vintage cars and fire engines. Medium density housing was proposed to the east and north of the site. Under Marr's scheme, the quarry was to be landscaped to include picnic areas, walking trails and a miniature railway.[102] Marr succeeded in having the land re-zoned to accommodate his vision for a mixed-use tourism, recreation, and residential development. The present zoning at the site dates from this period.[103]

Works undertaken by Marr on the existing buildings included re-roofing the Staffordshire and Downdraught kilns; re-constructing the external brick walls of the Staffordshire kiln; some internal lining to the Staffordshire kiln; electrical work to the Hardy patent kilns; paving to some areas of the Hardy patent kilns; and re-roofing of ancillary buildings.[104] Work on the quarry commenced towards the end of 1978, including land fill and the creation of the reflection lake (see Figure 50).

The redeveloped Brickworks was opened to the public as a tourist attraction in July 1979. However, limited income opportunities and high capital costs (over $1 million was invested in works to the site)[105], forced A R Marr into provisional liquidation.[106] Auctions of the vintage car collection and site equipment took place in September and November 1980. Two of the items, a 1913 Austral Otis Steam Roller and a 1925 Fowler Road locomotive, both associated with Canberra's early development, were purchased for the National Museum of Australia.[107]

At this time, Marr also held an option to develop up to 212 townhouses on parts of the brickworks site. In 1980 the first stage, comprising 20 houses on the eastern side of the site, was commenced. Work on houses to the north of the brickworks (now Lane Poole Place) began the following year.[108]

In the early 1980s, Marr was seriously injured in a fall at the Brickworks, and later died of complications.[109] On 18 September 1984, the Commonwealth accepted surrender of the AR Marr Pty Ltd lease and paid $1.1 million for the lessee's interest in the site.[110] The surrender included options to acquire adjoining land for the construction of 151 townhouses. The Commonwealth paid the lessee $1.1 million for its interests.[111]

A number of tenants from the Marr lease, including artists, the antiques market and a timber recycling merchant, Thor's Hammer, remained at the site. In the mid-1990s, due to concerns about the safety of some of the buildings[112] and in anticipation that the site was going to be redeveloped (see below), the tenants were required to leave. The role of the caretaker (Bruce McDonald), who had been responsible for the management of the site since the Marr lease, was also abolished. In recognition of the considerable volume of its timber stock, Thor's Hammer was granted an extended period to relocate. The company was still at the site by the time it was clear that the development proposal was not going to proceed.

Hooker Projects Proposal (1988)

In February 1979, the NCDC issued the *Yarralumla Policy Plan: Report on Environmental Issues Incorporating Draft EIS and the Development of Section 100 Yarralumla*. This document was 'intended to provide additional demands for housing, recreation, tourism and national capital uses which were deemed compatible with the existing use and character of Yarralumla.'[113] The recommendations provided in the Plan were poorly received by the local community, with objections over the loss of open space, the scale of the tourism and recreation development and medium density development.[114]

The Plan was followed in 1988 by the *Canberra Brickworks South Canberra Policy Plan*. This document suggested a range of potential uses for the site, including:

- medium density housing in the western and southern areas of the brickworks—c250 dwellings of 30 households per hectare;
- commercial accommodation in some of the site's historic buildings; and
- limited amounts of office and retail space.

In addition, it was noted that a combination of the above uses would be appropriate in the development of the Brickworks as a tourism destination, and that future uses of the site needed to be financially self-sufficient.[115]

Susan Conroy and Munns Sly Architects suggest that the 1988 Policy Plan 'appears to have been instigated by the Commonwealth because of what it considered an innovative plan [the Hooker proposal, described below] for redevelopment and use of the Canberra Brickworks Site [sic]'.[116]

Once again, the Policy Plan was poorly received by the community and led to the establishment of the Yarralumla Residents Association (YRA), in November 1988. The Association took the view that the Plan had been hastily prepared and failed to address key issues.[117]

Regardless of the YRA's views, the Plan was adopted, and formed the basis of calls for Expressions of Interest (EOI) for the development of the site in November 1988. The preferred EOI was submitted by Hooker Projects, which proposed a sports precinct in the south and the southwest of the site, with the kilns adapted to multiple uses, including a museum, restaurant, hotel and visitor attractions. Sections of the machine bays were proposed for adaptive re-use, including the conveyor belt in the roof space as a 'museum walkway' (see Figure 51).

By 1990, Hookers had been placed in provisional liquidation due to the depressed economy. Susan Conroy and Munns Sly Architects noted that 'negotiations continued with the liquidator, Halwood Corporation Ltd, who transferred development rights to a subsidiary Hooker Projects (Castlereagh Management), to allow progress on the project… [However] by August 1992, the Hookers proposal was defunct'.[118]

Local Area Planning Committee Proposal (1998)

In 1998, following a failed development proposal by the Canberra Theatre,[119] the Burley Griffin Local Area Planning Committee (LAPAC) was invited by the government to submit its recommendations on the future development of the brickworks. The committee that developed the proposal comprised representatives of the LAPAC and Yarralumla Residents Association,[120] with assistance from local architect Ric Butt.[121]

The LAPAC scheme recommended that, following stabilisation, the Brickworks should be retained as a ruin and that the site should be developed as an industrial archaeology park with a heritage centre and public gardens. Other uses included low intensity commercial uses such as markets and performance venues between kilns, and 'landscape buffers linking to surrounding recreation and open space'.[122] Mixed residential and commercial areas, including limited manufacturing, were proposed for sites adjacent to the brickworks. In these areas, housing density was proposed at c15 dwellings per hectare. On this basis, the LAPAC anticipated a total of c100 dwellings.

The ACT's planning body subsequently worked with the local community on the development of the site based on the LAPAC recommendations.[123] The LAPAC proposal also formed the basis of the Brief for a Development Control Plan (DCP)[124] for the Canberra Brickworks and surrounding un-leased land which was initiated in 2000 by the Office of Infrastructure and Asset Management. Connell Wagner was commissioned to prepare the DCP.[125]

Options identified by the DCP included the development of the site for housing; the creation of fenced gardens in the former quarry; adaptive re-use of the Brickworks, dependent on remediation; the potential for adaptive re-use for aged care accommodation; and leaving the site substantially undeveloped.[126]

The YRA responded to the DCP with a recommendation that a maximum of 25 units be developed, to the south of the Brickworks. As noted by Susan Conroy and Munns Sly Architects, the YRA also proposed that the Defence Housing Authority develop and manage the site. The ACT Government entertained the proposal, but concluded that any development should be based on a competitive process for land sales.[127]

In May 2002, the ACT Land and Property Group engaged a firm of civil consultants to evaluate the YRA's 25-unit dwelling proposal, including costings and consideration of an access road from Dudley Street to the south.[128]

Continued Use Post Closure

Since its closure in 1976, the Brickworks site has been tenanted to small, creative businesses, some of which remain today. As one of the site's longest standing tenants, recycled timber designers and furniture makers, Thor's Hammer released a short history of the site's residents and their businesses since the late 1980s on its website. Parts of this have been reproduced with minor edits below.

Antiques and Furniture Restoration (1986 to 1996)

There were up to six businesses operating in the kilns and office spaces at the southern entrance of the Brickworks and included Virgo's Old Wares (architect Theo Bischoff), Lightning Rod Antiques (Clark Mueller), Harlequin Antiques (Andrew Whitehead), Nicky's Antiques, Seaward Antiques, Rose Cottage Antiques and Lasseter's Gallery.[129]

Brickworks Design Studio (1988–1998)

Established by ANU Art School graduates Tom Harrington and Mark Spain, the Brickworks Design Studio was focused on working in timber. The first projects were undertaken for the interior design and fit out of the New Parliament House. The workshop continued producing works for commercial and domestic clients in fine woodwork with artisans including Paul O'Donnell, Kate Cooke, Bruce Egan and Johnno Everett.[130]

Splinters Theatre Company

Splinters used the Brickworks space for set construction, rehearsals, and the development of over 60 productions performed in Canberra and around Australia. Splinters also mounted *Whirled on a Fatal Floor* at the Brickworks site as part of the 1989 Canberra Fringe Festival.[131]

Thor's Hammer (1994–current)

Thor's Hammer predominantly operates out of the Downdraught kilns to the southeast portion of the site designing and making furniture and architectural products from recycled timbers sourced from demolition sites.

Artillion Studio—Geoff Farquhar-Still (2011–current)

Artillion Studio employs a team of artisans and industrial designers including Dan Lorrimer, and Mitchell Brookes, gold and silver smith Sean Booth and ex UAP pattern maker Matt Smith. It has produced significant work for both Canberra and Sydney. The studio collaborates with architects, engineers, landscape architects and a range of local industry to develop bespoke responses to urban design, architectural and public art briefs.[132]

In addition to the individuals and businesses mentioned above, several other artists, designers and sculptors have worked at the Canberra Brickworks over the last three decades.

Doma Group Proposal (2017)

In September 2013, the ACT Government's Land Development Agency (LDA), (now the Suburban Land Agency) released the *Canberra Brickworks and Environs Planning and Development Strategy*, which sought to promote the adaptive re-use of the site and its surrounds with respect to its heritage significance. Following revision of the strategy in 2015, it was announced that the LDA would sell a 16-hectare development area within the Canberra Brickworks site. The sale objective was that interested developers were to submit proposals for the redevelopment of the site. In August 2016, the LDA confirmed that two proposals were shortlisted for the redevelopment of the Canberra Brickworks and, in April 2017, it was announced that the preferred tenderer was local Canberra developer Doma Group with its submission for a mixed-use residential, commercial, and retail development that utilises much of the historic Brickworks infrastructure.

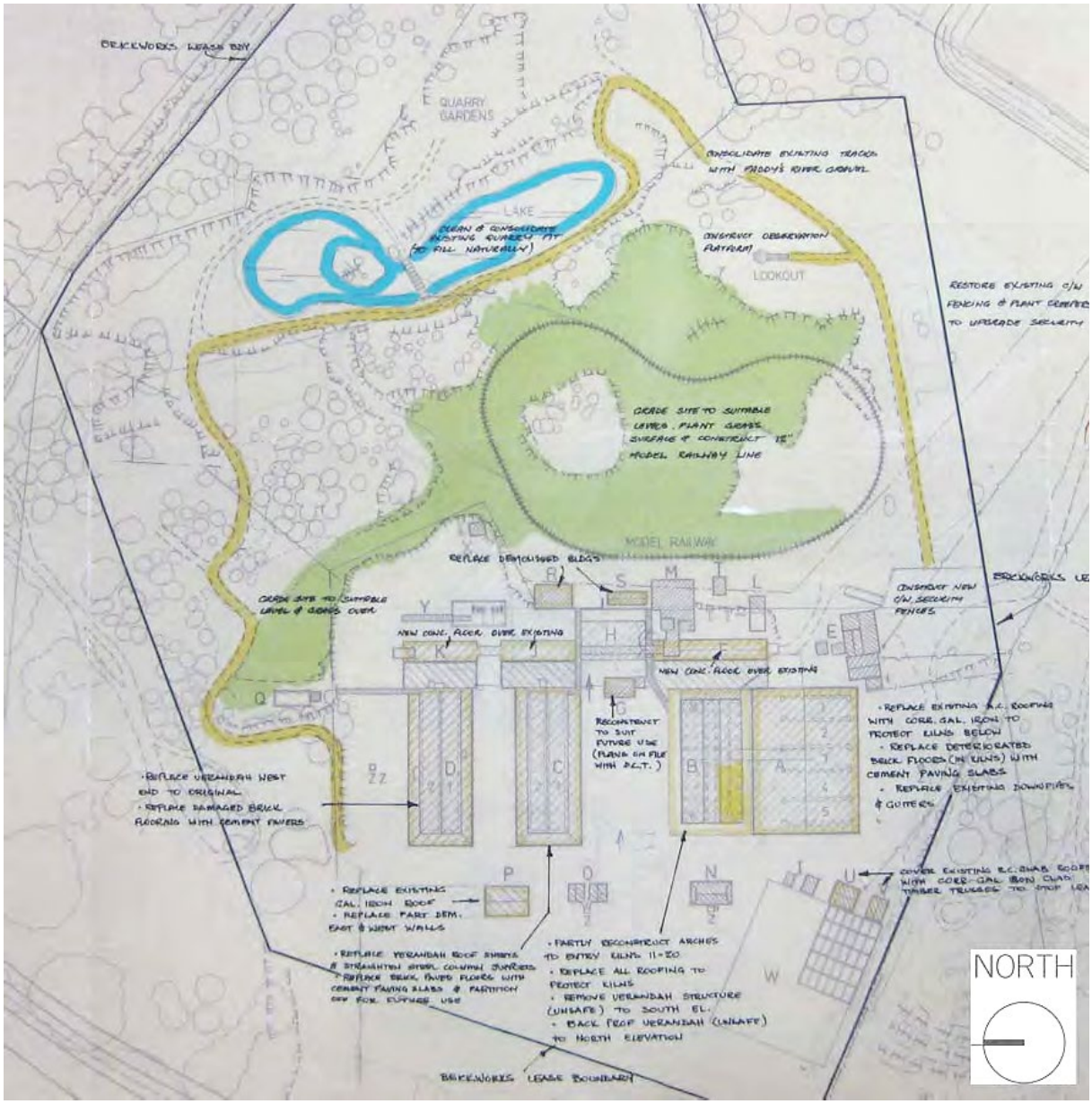


Figure 50 The A R Marr proposal for the Brickworks, c1977. (Source: ACT Heritage Library)

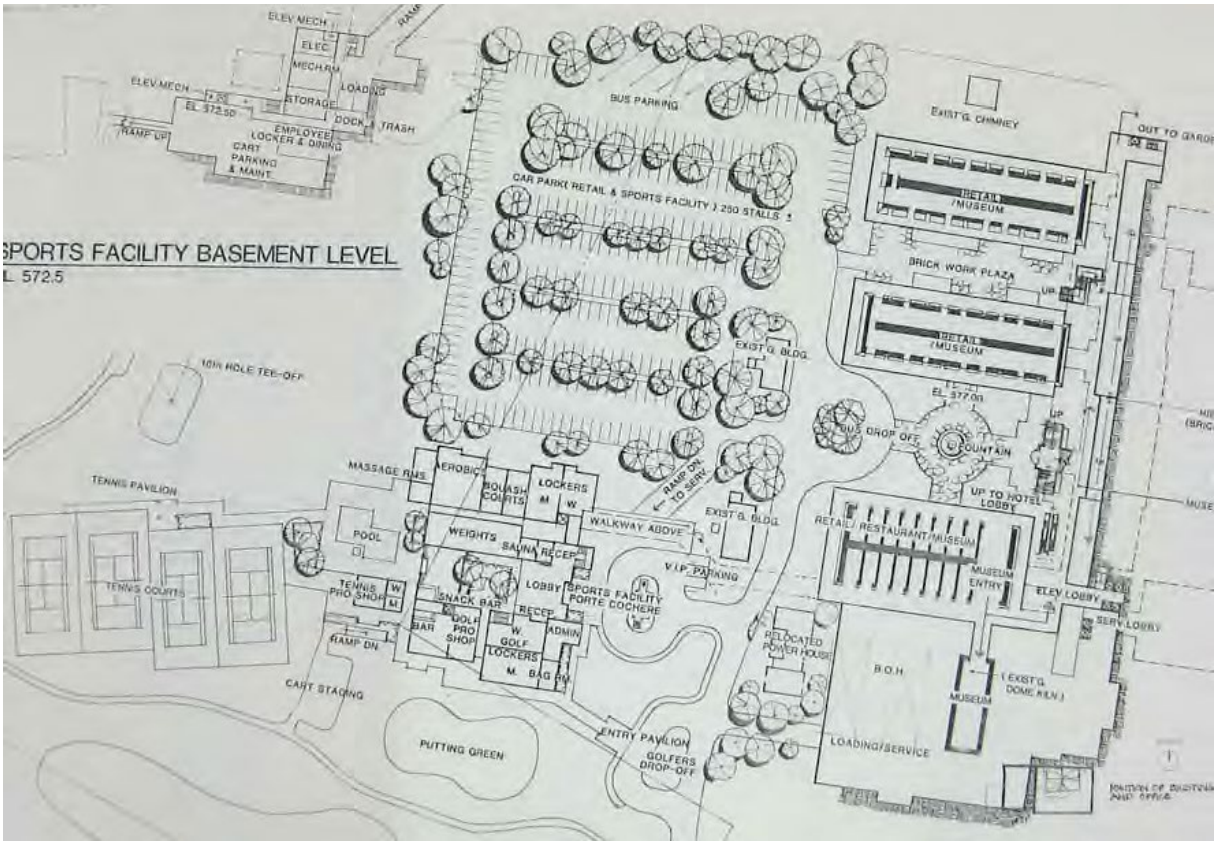


Figure 51 Ground level plan of Hooker Project's proposal for the Brickworks, 25 November 1988. (Source: ACT Heritage Library)

C.7.2 Post-Closure Phase Elements at the Brickworks

Remaining Elements

The following elements at the Brickworks date from the post-closure phase of the site. They are listed with their identifying number (refer to Figure 1.4) and date of construction. For a full history of each element refer to the Element Inventory Sheets at Appendix C.

- No. 35: Model Railway Workshop, c1979; and
- No. 36: Model Railway Storage Shed, c1979.

C.8 Demolished Structures

C.8.1 Establishment Phase

Structures from the establishment phase of site that have been demolished include temporary kilns, early housing for workers, explosive store, and carpenter's shed. They are described briefly below.

Temporary Kilns

The precise location of the temporary kilns (possibly clamps), delineated as four structures on the 1916 Survey Plan (see Figure 27), is unclear. It appeared that little discernible evidence of the structures was visible at the date of the compilation of the 1986 Conservation Plan.

Brickworks Hostel/Accommodation Village

Initially workers were housed in tents along the ridge to the east of the works. Permanent dwellings for workers at the Yarralumla works were constructed in the 1920s, at the top of Denman Street (single men's camp), and to the southwest of the Brickworks (married quarters). The single men's camp was disused by 1928 (see also Section B.4). The buildings that comprised the married quarters are shown in a detail of a 1929 photograph of the Brickworks, as well as in an image of the kiln 'road', running north–south between the kilns and fan houses, also of 1929 (see Figure 52, Figure 53). The married quarters were removed during World War II, and replaced by a new Brickworks Hostel in 1945. It was demolished in the early 1970s. Little evidence of the former residential accommodation is visible, with revegetation returning to much of the area (Figure 54).

Cottage Complex

This complex of buildings, according to the 1986 Conservation Plan, comprised a cottage with outbuildings located to the north of the second Hardy patent kiln and stack (Elements 3 and 8). Set above the complex, the site today has been redeveloped as part of Lane Poole Place and is outside the study area.

Explosives Store

The explosives store was relocated from a site approximately 180 metres south of the Power House to the opposite side of the Brickworks, behind the brick extrusion plant.

Cottage and Stable

A cottage and stable building are delineated on the 1916 Survey Plan (see Figure 27), sited to the northeast of the quarry with its approximate site within the present-day bounds of the quarry.

Carpenter's Shed

This structure was located approximately 50 metres southeast of the Power House. Its date of construction is not known and it was removed during the 1960s with the site later used as a carparking area—refer to detail of the 1976 aerial photograph at Figure 55.



Figure 52 Detail of a 1929 photograph of the Brickworks looking southwest showing the accommodation village buildings (indicated). (Source: National Archives of Australia)



Figure 53 Looking south along the kiln 'road', the Staffordshire Kiln at left, 1929. The mess hall building and the roofs of several of the sleeping quarters are visible in the background. (Source: National Archives of Australia, A3560, 5837)



Figure 54 The remains of the accommodation village today, looking northeast. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 72)



Figure 55 Detail of a 1976 aerial photograph with the then carpark, thought to be the site of the former carpenter's shed, indicated. (Source: ACT Heritage Library)

C.8.2 Postwar Phase

As well as the structures relating to the establishment phase of site, it is noted that there were also structures relating to the postwar phase of development that have since been demolished. These include a clay storage shed, carpenter's workshop, oil and coal bunkers, weighbridge and a forklift shed. They are described briefly below.

Clay Storage Shed

The storage shed was located within the quarry area to the immediate east of the Brickworks. It stored clay, brought to the site by trucks prior to crushing. It is visible in a 1976 aerial photograph of the site (see Figure 56).

Coal Storage Bunker

The coal storage bunker was located on an elevated site to the north of the Hardy Patent Kiln 2 chimney stack (Element 9), as indicated at Figure 56. The site today forms part of the Lane Poole Place housing complex and is outside the study area.

Former Forklift Shed

The forklift shed was extant at the time of the compilation of the 1986 Conservation Plan. The building was constructed in c1965 to house forklifts and replaced an earlier shed structure. The forklift shed was a brick structure with a corrugated galvanised steel roof. The structure contained a petrol bowser linked to a large underground tank sited between the shed and the fan house associated with the Hardy Patent Kiln 1 (Element 4). The description of the building provided in the 1986 Conservation Plan noted that it was in poor condition. The site of the building today is overgrown with little evidence of its form, apart from some remnant brickwork and rubble (Figure 57). As noted, the structure replaced an earlier shed building, the date or purpose of which is not known.

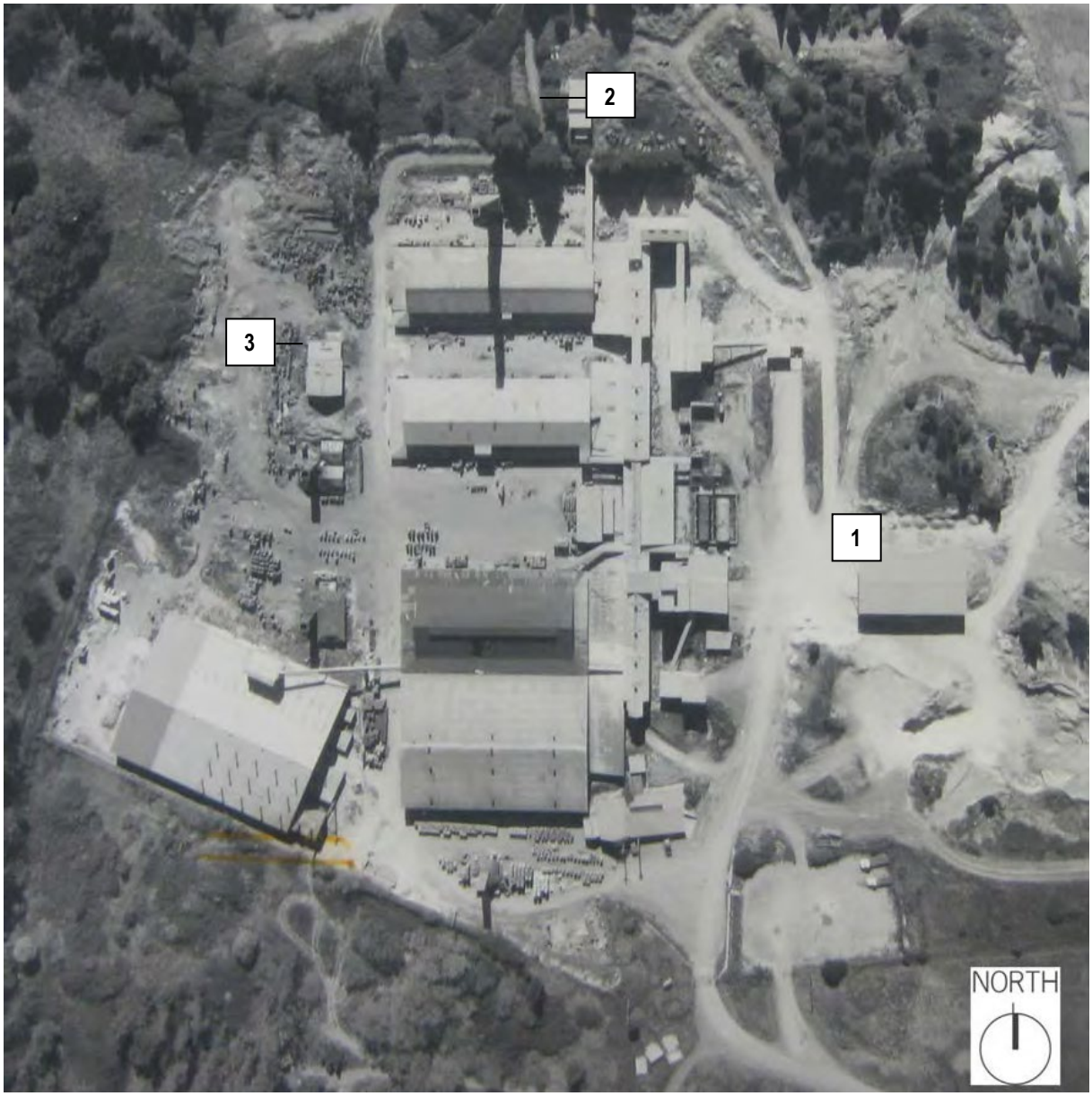


Figure 56 Aerial photograph, 1976, with the following postwar site elements indicated: clay storage shed (1); coal storage bunker (2) and former forklift shed (3). (Source: ACT Heritage Library)



Figure 57 The approximate site of the former forklift shed indicated by the arrow. (Source: Lovell Chen, 2010, Canberra Brickworks CMP, p 169)

C.9 Endnotes

1 Unlike their nineteenth-century counterparts, the scale and investment required in twentieth-century brickworks meant that they were able to survive the expiration of available raw materials on site. This occurred at Canberra, which imported raw materials from c1935 to 1976.

2 Gugler, A, Hidden Canberra: History of Canberra – Brickyards Westridge, https://hiddencanberra.webs.com/historyofcanberra.htm, accessed on 10 December 2020.

3 'Queensland State Insurance Building Brisbane', 12 September 1925, *Building: the magazine for the architect, builder, owner and merchant*, Vol. 37 No. 217, p50.

4 'Busy Days Returning for the Brickworks: New Light Bricks Favoured by Architects', *Canberra Times,* Thursday 12 March 1936, p6.

5 'Busy Days Returning for the Brickworks: New Light Bricks Favoured by Architects', *Canberra Times,* Thursday 12 March 1936, p6.

6 Land Development Agency & Lovell Chan 2010, Canberra Brickworks, Denman Street, Yarralumla, Canberra : conservation management plan, Land Development Agency, Canberra, p 100.

7 As quoted in Land Development Agency & Lovell Chan 2010, Canberra Brickworks, Denman Street, Yarralumla, Canberra : conservation management plan, Land Development Agency, Canberra, p 100.

8 Cited as 'Ref. I.E. Aust. October 1938', in Lester Firth Associates, 1986, Section 2.2.1.

9 Lester Firth Associates Pty Ltd, at Section 2.1.4 (Post War Growth) of the *Old Canberra Brickworks, Conservation Plan*, June 1986, notes that following the closure of the Brickworks 'all useable material was moved to the new site [Mitchell] and the remainder offered for sale'. It has not been established whether the 'useable material' included the brick presses.

10 Lester Firth Associates Pty Ltd, *Old Canberra Brickworks, Conservation Plan*, June 1986, Section 2.1.1 (Brick Firing Kilns).

11 Hammond, M 1981, *Bricks and Brickmaking*, Shire Publications Ltd, Buckinghamshire, England, p 23.

12 'Former Victorian Brickworks', 72–106 Dawson Street, Brunswick, Victorian Heritage Database, viewed 18 January 2010 <vhd.heritage.vic.gov.au>; and Line, GJR 1979, *Industrial Awakening: A Geography of Australian Manufacturing 1788–1890*, ANU Press, Canberra, p 265.

13 Nigel Lewis & Associates, *Brunswick Conservation Study*, prepared for the City of Brunswick and the Australian Heritage Commission, Melbourne, 1982, p 26.

14 Miles Lewis, Australian Building: A Cultural Investigation, Section 6.02.12 <http://mileslewis.net/australian-building/>.

15 Refer to correspondence with applicant Samuel Kirk, Thomas Kirk and John Richardson Hardy concerning invention entitled 'Improvements in the construction of kilns for burning bricks, tiles, pottery or other analogous materials', 1889, Series A4617/2, barcode 5150233, and 'New South Wales Letters Patent. Improvement in the construction of kilns for burning bricks, tiles, pottery or other analogous materials', Specification by Samuel Kirk and Thomas Kirk, item listing in series A4617/2, Barcode 4195049, National Archives of Australia. Samuel and Thomas Kirk, both of Croydon, in Sydney, were brick burners, while Hardy himself was listed as a contractor. See *Supplement to the Victorian Government Gazette*, 27 November 1891, p 4658.

16 The patent was granted by Thomas Prout Webb, the Commissioner of Patents. See *Victorian Government Gazette*, 4 December 1891, p 4683.

17 Application for Letters Patent by Samuel Kirk, Thomas Kirk and John Richardson Hardy titled 'Improvements in the construction of kilns for burning bricks tiles pottery or other analogous materials', in Applications for Registration of Queensland Patents — Second system, Series A12572, barcode 7666027, National Archives ofAustralia.

18 As noted in Chapter 3, the Hardy patent kiln (Element 3) failed and was substantially re-built in 1955.

19 Hammond, M 1981, *Bricks and Brickmaking*, Shire Publications Ltd, Buckinghamshire, England, p 24.

20 Hammond, M 1981, *Bricks and Brickmaking*, Shire Publications Ltd, Buckinghamshire, England, pp 25–26.

21 Hammond, M 1981, *Bricks and Brickmaking*, Shire Publications Ltd, Buckinghamshire, England, pp 25–26.

22 Department of Works, 'Canberra Brickworks No. Kiln, 20 Chamber Hardy Kiln Layout Plan', drawing M8713c, National Archives of Australia.

23 Lovell Chen, *Nomination of Canberra to the National Heritage List: An examination of the merits*, prepared for the National Capital Authority, April 2008, pp 42–43.

24 The National Capital Development Commission, *Tomorrow's Canberra: Planning for Growth and Change*, Australian National University Press, Canberra, 1970, pp 3–7; and Lovell Chen, *Nomination of Canberra to the National Heritage List: An examination of the merits*, prepared for the National Capital Authority, April 2008, pp 42–43.

25 Commonwealth of Australia Constitution Act, Chapter VII.

26 The National Capital Development Commission, *Tomorrow's Canberra*, p 3.

27 Quoted in Headon, D 2003, *The Symbolic Role of the National Capital: From colonial argument to 21st century ideals*, Commonwealth of Australia (National Capital Authority), ACT, p 36.

28 *Preparation of Competitive Designs for the Federal Capital City,* National Archives of Australia, A1818/12, quoted in McGregor, A 2009, *Grand Obsessions: The Life and work of Walter Burley Griffin and Marion Mahony Griffin*, Lantern (Penguin), Australia, p 121.

29 The National Capital Development Commission, *Tomorrow's Canberra*, p 6.

30 The National Capital Development Commission, *Tomorrow's Canberra*, p 6.

31 The National Capital Development Commission, *Tomorrow's Canberra*, p 6; and McGregor, A 2009, *Grand Obsessions: The Life and work of Walter Burley Griffin and Marion Mahony Griffin*, Lantern (Penguin), Australia, pp 197–204 and 321–41.

32 Lester Firth Associates Pty Ltd, *Old Canberra Brickworks, Conservation Plan*, June 1986, Section 2.1.1, citing the *Queanbeyan Age*, 23 February 1910.

33 Lester Firth Associates (Section 2.1.1) state that 1,000 test bricks were fired at the Hoffman Brick Co., Melbourne.

34 National Archives of Australia, Series A110/FC 1913/1055, in Ian Carnell, 'Canberra's Cornerstone', *Canberra Historical Journal*, No. 5, March 1990, cited by Lester Firth Associates, 1986, Section 2.2.1.

35 Gugler, A 1994, *The builders of Canberra, 1909–1929. Part one, Temporary camps & settlements*, CPN Publications, Canberra, p 77.

36 National Archives of Australia, Series A110/FC 1913/1985, cited in Lester Firth and Associates, 1986, Section 2.1.1.

37 Lester Firth and Associates, 1986, Section 2.1.1, source uncited. It has not been confirmed if Staffordshire kilns were constructed at the State Brick Works at Homebush, which was developed from 1911 (see Chapter 6). However, the Royal Commission on Federal Capital Administration (RC No. 378), which ran from June 1916 to 14 June 1917, found that the Staffordshire kiln at the Canberra brickworks was the first constructed in Australia.

38 National Archives of Australia, Series A119 Item 1914/723, cited in Lester Firth and Associates, 1986, Section 2.1.1. See also: Gugler, A 1994, *The builders of Canberra, 1909–1929. Part one, Temporary camps & settlements*, CPN Publications, Canberra, Chapter 2. Copy viewed at ACT Heritage Library, Woden, ACT, Woden.

39 Four open kilns are indicated on the survey plan of 1916, but newspapers reports refer to only three open kilns. *Queanbeyan Observer,* 18 February 1913, cited in Lester Firth and Associates, 1986, Section 2.1.1.

40 National Archives of Australia, Series A119 Item 1914/723, cited in Lester Firth and Associates, 1986, Section 2.1.1.

41 By September 1913, some 250,000 bricks had been produced for construction of the main kilns. *Queanbeyan Observer,* 9 September 1913, cited in Lester Firth and Associates, 1986, Section 2.1.1.

42 The Kingston Power House is a steel framed structure with roughcast concrete walls. It was designed by John Smith Murdoch, Chief Architect of the Department of Works and Railways, and completed in 1915. As originally envisaged, the building was to be portable. As such the steel frame was to be clad in galvanized steel. When a permanent site was found for the power house it was decided to change the cladding to brick. A total of 1.5 million bricks were manufactured at the Canberra Brickworks for the task. However, the bricks produced at the temporary works disintegrated before they could be used on the Power House. As a cost-effective solution, the steel frame was clad in unreinforced in situ concrete made with river gravel. The Power House was adapted to the Canberra Glassworks visitor centre in 2005–07 by Tanner Architects. Pers comm, Jocelyn Jackson, Project Director/Architect for the adaptive re-use of the Kingston Power House, Tanner Architects, and Adam Mornement, Lovell Chen, 3 February 2010. See also: Peter Freeman Pty Ltd, *Kingston Power House Precinct, Kingston, ACT*, Conservation Management Plan Review, 2001, Volume 1 of 2, pp 18–20.

43 National Archives of Australia, Series A119 Item 1914/723, cited in Lester Firth and Associates, 1986, Section 2.1.1.

44 National Archives of Australia, Series A110 FC 1913/1055, 24 July 1911, cited in Lester Firth and Associates, 1986, Section 2.1.1.
45 Lester Firth Associates 1986, Section 2.1.1. Sources uncited.
46 *Queanbeyan Age,* 14 September 1915, cited in Lester Firth and Associates, 1986, Section 2.1.1.
47 Lester Firth Associates 1986, Section 2.1.1. Sources uncited.
48 Walter M Shellshear, author of Chapter 2 (Railways) in Andrews, WC, Fitzgerald, A et al, *Canberra's Engineering Heritage*, Institution of Engineers, Australia, Canberra Division, 1983, viewed online (unpaginated) 29 January 2010 <www.engineer.org.au>. The side-tipping trucks used at the brickworks were manufactured by Francis Theakston Ltd., Light Railway Engineers, Crewe Works, 66 Tufton Street, London.
49 Lester Firth Associates 1986, Section 2.1.1. Sources uncited.
50 The Royal Commission on Federal Capital Administration (RC No. 378) ran from 14 June 1916 until the report was tabled on 14 June 1917. The Commissioner was W Blacket and matters examined included issues relating to Mr. Griffin; accounts and finance at Canberra; wasteful expenditure at Canberra; sewerage at Canberra; brickworks at Canberra and water supply, power. References to the Royal Commission are from the *Report of the Royal Commission on Federal Capital Administration*, Victoria (1917), and Lester Firth Associates, 1986, Section 2.1.1. The source is uncited.
51 Reid, P 2002, *Canberra Following Griffin: A Design History of Australia's National Capital*, National Archives of Australia, Canberra, p 16.
52 Register of the National Estate, Westbourne Woods Area, Place ID 13337.
53 Gugler, A 1994, *The builders of Canberra, 1909–1929. Part one, Temporary camps & settlements*, CPN Publications, Canberra, Chapters 2 and 3.
54 Gugler, A 1994, *The builders of Canberra, 1909–1929. Part one, Temporary camps & settlements*, CPN Publications, Canberra, p 77.
55 The single men's camp had been abandoned by 1928. Gugler, A 1994, *The builders of Canberra, 1909–1929. Part one, Temporary camps & settlements*, CPN Publications, Canberra, Chapter 2.
56 Reid, P 2002, *Canberra Following Griffin: A Design History of Australia's National Capital*, National Archives of Australia, Canberra, p 193.
57 Reid, P 2002, *Canberra Following Griffin: A Design History of Australia's National Capital*, National Archives of Australia, Canberra, p 193.
58 Gugler, A 1994, *The builders of Canberra, 1909–1929. Part one, Temporary camps & settlements*, CPN Publications, Canberra, Chapter 3.
59 Dates and details in this paragraph are from Gugler, A 1994, *The builders of Canberra, 1909–1929. Part one, Temporary camps & settlements*, CPN Publications, Canberra, Chapters 2 and 3.
60 'Westridge House', viewed 31 January 2010 <uncommonlives.naa.gov.au>.
61 Lane Poole Place was developed during the 1980s, following the decommissioning of the Brickworks (1976), and subsequent re-zoning of the site (1979). See Chapter 6.
62 Gugler, A 1994, *The builders of Canberra, 1909–1929. Part one, Temporary camps & settlements*, CPN Publications, Canberra, Chapter 3.
63 Gugler, A 1994, *The builders of Canberra, 1909–1929. Part one, Temporary camps & settlements*, CPN Publications, Canberra, p 77.
64 Lester Firth and Associates, 1986, Section 2.1.2. Sources are not cited.
65 National Archives of Australia, File no. 25/15958, cited in Lester Firth and Associates, 1986, Section 2.1.2.
66 Dates and figures in this paragraph are taken from Lester Firth and Associates, 1986, Section 2.1.2. Sources are not cited.
67 *Queanbeyan Age,* 16 July 1925, cited in Lester Firth and Associates, 1986, Section 2.1.2.
68 Walter M Shellshear, author of Chapter 2 (Railways) in Andrews, WC, Fitzgerald, A et al, *Canberra's Engineering Heritage*, Institution of Engineers, Australia, Canberra Division, 1983, viewed online (unpaginated) 29 January 2010 <www.engineer.org.au>.
69 Heritage (Decision about Registration of Yarralumla Brickworks Railway Remnants) Notice 2013 (No 2)*—Notifiable Instrument NI2013-507 <http://www.environment.act.gov.au/__data/assets/pdf_file/0011/348680/249.pdf>.
70 Heritage (Decision about Registration of Yarralumla Brickworks Railway Remnants) Notice 2013 (No 2)*—Notifiable Instrument NI2013-507 <http://www.environment.act.gov.au/__data/assets/pdf_file/0011/348680/249.pdf>.
71 Cited in Lester Firth and Associates, 1986, Section 2.1.2. The date of the *Canberra Times* article is not included.
72 Lester Firth and Associates, 1986, Section 2.1.2. Source uncited.
73 *Canberra Times*, 6 January 1927, p 1.
74 Lester Firth and Associates, 1986, Section 2.1.2, citing the *Annual Report of the Federal Capital Commission*, 1927 and 1928.
75 Lester Firth and Associates, 1986, Section 2.1.2, citing the *Annual Report of the Federal Capital Commission*, 1929.
76 Lester Firth and Associates, 1986, Section 2.1.2. Source uncited.
77 'Canberra Bricks — Local Production Inadequate, Imports From Bowral', *Canberra Times*, 19 October 1939, reproduced in Gugler, A 2002, *Canberra 1930–1943 & 1949, articles from the* Canberra Times *& other sources*, Mawson, ACT.
78 *Canberra Times,* 17 January 1941, cited in Lester Firth and Associates, 1986, Section 2.1.2.

79 Department of the Interior memo, No. C480, 16 April 1942, cited in Lester Firth and Associates, 1986, Section 2.1.2.
80 Department of Interior, Stock Sheet, 1936, referenced in Lester Firth and Associates, 1986, Section 2.1.2.
81 National Archives of Australia, Series A431, cited in Lester Firth and Associates, 1986, Section 2.1.4.
82 National Archives of Australia, Series A431, cited in Lester Firth and Associates, 1986, Section 2.1.4.
83 National Archives of Australia, File No. 171/8, cited in Lester Firth and Associates, 1986, Section 2.1.4.
84 National Archives of Australia, Series A431, cited in Lester Firth and Associates, 1986, Section 2.1.4.
85 National Archives of Australia, Series A431, cited in Lester Firth and Associates, 1986, Section 2.1.4.
86 The recommendation for wide wickets was not carried through. As built, the wickets of the Hardy patent kiln were only a metre wide. See drawing 'Canberra Brickworks layout of firing holes for No. 3 Kiln for Dept. of the Interior, n.d. M8759B', National Archives of Australia.
87 Department of Works, Canberra Brickworks — Works Programme, 31 May 1955, drawing M8866D, National Archives of Australia.
88 Lester Firth and Associates, 1986, Section 2.1.4. Original sources for the content of this paragraph are not cited.
89 H H Macey, *Report on Canberra Brickworks*, April 1959. Copy supplied by the LDA.
90 H H Macey, *Report on Canberra Brickworks*, pp 1–18.
91 H H Macey, *Report on Canberra Brickworks*, p 19.
92 Lester Firth and Associates, 1986, Section 2.1.4. Source uncited.
93 Lester Firth and Associates, 1986, Section 2.1.4. Source uncited.
94 Lester Firth and Associates, 1986, Section 2.1.4. Dates and precise details relating to these modifications are not included, and sources are not cited.
95 Lester Firth and Associates, 1986, Section 2.1.4. Original sources uncited.
96 Lester Firth and Associates, 1986, Section 2.1.4. Source uncited.
97 *Canberra Times*, 18 June 1974, cited in Lester Firth and Associates, 1986, Section 2.1.4.
98 Lester Firth and Associates, 1986, Section 2.1.4. Source uncited.
99 The Sixteenth *Annual Report* (1975–1976) of the Commonwealth Brickworks, cited in Lester Firth and Associates, 1986, Section 2.1.4.
100 Lester Firth and Associates, 1986, Section 2.1.5. Sources uncited.
101 'Proposed Land Uses for Undeveloped Land in Inner Canberra', National Capital Development Committee, cited in Lester Firth and Associates, 1986, Section 2.1.5.
102 Lester Firth and Associates, 1986, Section 2.1.5.
103 Connell Wagner Pty Ltd, *The Old Canberra Brickworks and Environs Development Control Plan*, February 2001, p 4.
104 Lester Firth and Associates, 1986, Section 2.1.5.
105 Lester Firth and Associates, 1986, Section 2.1.5, uncited reference.
106 AR Marr Pty Ltd was put into provisional liquidation on 9 January 1980. Lester Firth and Associates, 1986, Section 2.1.5.
107 Lester Firth and Associates, 1986, Section 2.1.5.
108 Lester Firth and Associates, 1986, Section 2.1.5.
109 Pers comm, Peter Vandermark (artist based at the Canberra Brickworks) and Adam Mornement, Lovell Chen, 4 December 2009.
110 Susan Conroy & Munns Sly Architects, *The Yarralumla Brickworks & Environs Planning Review*, March 2005, pp 21–22, and Lester Firth and Associates, 1986, Section 2.1.5.
111 Lester Firth and Associates, 1986, Section 2.1.5.
112 A brick is rumoured to have fallen from the ceiling of one of the Downdraught kilns. Pers comm, Thor Diesondorf, Thor's Hammer and Adam Mornement, Lovell Chen, 4 December 2009.
113 Susan Conroy & Munns Sly Architects, *The Yarralumla Brickworks & Environs Planning Review*, March 2005, p 21.
114 *Yarralumla Section 94, Brickworks Redevelopment Section 2, variation no. 5* (anonymous and undated), a compilation of responses to the *Draft Yarralumla Policy Plan*, held in ACT Assembly Library, cited by Susan Conroy & Munns Sly Architects, p 21.
115 NCDC, *Yarralumla Brickworks South Canberra, Policy Plan*, October 1988, pp 14–15.
116 Susan Conroy & Munns Sly Architects, p 21.
117 Susan Conroy & Munns Sly Architects, p 22, citing a letter (December 1988) from the Yarralumla Residents Association to the Hon Clive Holding.
118 Susan Conroy & Munns Sly Architects, p 23.
119 See: Cameron Chisholm and Nicol Architects, *A Proposal for the redevelopment of the Old Canberra Brickworks*, prepared for Canberra Theatre, instructed by Allied Projects (ACT), July 1996, cited in Susan Conroy & Munns Sly Architects, p 23.
120 Connell Wagner Pty Ltd, 2001, p 5.
121 Susan Conroy & Munns Sly Architects, p 23.
122 Susan Conroy & Munns Sly Architects, p 24.
123 Connell Wagner Pty Ltd, 2001, p 5. See also, PALM, *Expressions of Interest Old Canberra Brickworks* (Blocks 1, 7, 20, Section 102, Yarralumla [undated], c1997), cited in Susan Conroy & Munns Sly Architects, p 24.

124 Connell Wagner Pty Ltd, 2001, p 5, and Susan Conroy & Munns Sly Architects, p 24.
125 Connell Wagner Pty Ltd, *The Old Canberra Brickworks and Environs Development Control Plan*, February 2001.
126 Connell Wagner Pty Ltd, 2001, Chapters 6 and 7.
127 Susan Conroy & Munns Sly Architects, pp 24–25.
128 Ribeny F J & Associates, *Multi-Unit Site, The Old Canberra Brickworks Yarralumla* DUS, 26/05/02, cited by Susan Conroy & Munns Sly Architects.
129 Thor's Hammer, Yarralumla ACT, viewed 14 June 2017 <http://www.thors.com.au/brickworks-history/>.
130 Thor's Hammer, Yarralumla ACT, viewed 14 June 2017 <http://www.thors.com.au/brickworks-history/>.
131 Thor's Hammer, Yarralumla ACT, viewed 14 June 2017 <http://www.thors.com.au/brickworks-history/>.
132 Thor's Hammer, Yarralumla ACT, viewed 14 June 2017 <http://www.thors.com.au/brickworks-history/>.

Appendix D

The Australia ICOMOS Charter for Places of Cultural Significance, The Burra Charter, 2013 (Burra Charter)

THE BURRA CHARTER

The Australia ICOMOS Charter for Places of Cultural Significance 2013



AUSTRALIA ICOMOS
International Council on Monuments and Sites

Australia ICOMOS Incorporated
International Council on Monuments and Sites

ICOMOS

ICOMOS (International Council on Monuments and Sites) is a non-governmental professional organisation formed in 1965, with headquarters in Paris. ICOMOS is primarily concerned with the philosophy, terminology, methodology and techniques of cultural heritage conservation. It is closely linked to UNESCO, particularly in its role under the World Heritage Convention 1972 as UNESCO's principal adviser on cultural matters related to World Heritage. The 11,000 members of ICOMOS include architects, town planners, demographers, archaeologists, geographers, historians, conservators, anthropologists, scientists, engineers and heritage administrators. Members in the 103 countries belonging to ICOMOS are formed into National Committees and participate in a range of conservation projects, research work, intercultural exchanges and cooperative activities. ICOMOS also has 27 International Scientific Committees that focus on particular aspects of the conservation field. ICOMOS members meet triennially in a General Assembly.

Australia ICOMOS

The Australian National Committee of ICOMOS (Australia ICOMOS) was formed in 1976. It elects an Executive Committee of 15 members, which is responsible for carrying out national programs and participating in decisions of ICOMOS as an international organisation. It provides expert advice as required by ICOMOS, especially in its relationship with the World Heritage Committee. Australia ICOMOS acts as a national and international link between public authorities, institutions and individuals involved in the study and conservation of all places of cultural significance. Australia ICOMOS members participate in a range of conservation activities including site visits, training, conferences and meetings.

Revision of the Burra Charter

The Burra Charter was first adopted in 1979 at the historic South Australian mining town of Burra. Minor revisions were made in 1981 and 1988, with more substantial changes in 1999.

Following a review this version was adopted by Australia ICOMOS in October 2013.

The review process included replacement of the 1988 Guidelines to the Burra Charter with Practice Notes which are available at: australia.icomos.org

Australia ICOMOS documents are periodically reviewed and we welcome any comments.

Citing the Burra Charter

The full reference is *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013*. Initial textual references should be in the form of the *Australia ICOMOS Burra Charter, 2013* and later references in the short form (*Burra Charter*).

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The Burra Charter consists of the Preamble, Articles, Explanatory Notes and the flow chart.

This publication may be reproduced, but only in its entirety including the front cover and this page. Formatting must remain unaltered. Parts of the Burra Charter may be quoted with appropriate citing and acknowledgement.

Cover photograph by Ian Stapleton.

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The Burra Charter

(The Australia ICOMOS Charter for Places of Cultural Significance, 2013)

Preamble

Considering the International Charter for the Conservation and Restoration of Monuments and Sites (Venice 1964), and the Resolutions of the 5th General Assembly of the International Council on Monuments and Sites (ICOMOS) (Moscow 1978), the Burra Charter was adopted by Australia ICOMOS (the Australian National Committee of ICOMOS) on 19 August 1979 at Burra, South Australia. Revisions were adopted on 23 February 1981, 23 April 1988, 26 November 1999 and 31 October 2013.

The Burra Charter provides guidance for the conservation and management of places of cultural significance (cultural heritage places), and is based on the knowledge and experience of Australia ICOMOS members.

Conservation is an integral part of the management of places of cultural significance and is an ongoing responsibility.

Who is the Charter for?

The Charter sets a standard of practice for those who provide advice, make decisions about, or undertake works to places of cultural significance, including owners, managers and custodians.

Using the Charter

The Charter should be read as a whole. Many articles are interdependent.

The Charter consists of:

- Definitions Article 1
- Conservation Principles Articles 2–13
- Conservation Processes Articles 14–25
- Conservation Practices Articles 26–34
- The Burra Charter Process flow chart.

The key concepts are included in the Conservation Principles section and these are further developed in the Conservation Processes and Conservation Practice sections. The flow chart explains the Burra Charter Process (Article 6) and is an integral part of the Charter. Explanatory Notes also form part of the Charter.

The Charter is self-contained, but aspects of its use and application are further explained, in a series of Australia ICOMOS Practice Notes, in *The Illustrated Burra Charter*, and in other guiding documents available from the Australia ICOMOS web site: australia.icomos.org.

What places does the Charter apply to?

The Charter can be applied to all types of places of cultural significance including natural, Indigenous and historic places with cultural values.

The standards of other organisations may also be relevant. These include the *Australian Natural Heritage Charter*, *Ask First: a guide to respecting Indigenous heritage places and values* and *Significance 2.0: a guide to assessing the significance of collections*.

National and international charters and other doctrine may be relevant. See australia.icomos.org.

Why conserve?

Places of cultural significance enrich people's lives, often providing a deep and inspirational sense of connection to community and landscape, to the past and to lived experiences. They are historical records, that are important expressions of Australian identity and experience. Places of cultural significance reflect the diversity of our communities, telling us about who we are and the past that has formed us and the Australian landscape. They are irreplaceable and precious.

These places of cultural significance must be conserved for present and future generations in accordance with the principle of inter-generational equity.

The Burra Charter advocates a cautious approach to change: do as much as necessary to care for the place and to make it useable, but otherwise change it as little as possible so that its cultural significance is retained.

Articles

Explanatory Notes

Article 1. Definitions

For the purposes of this Charter:

1.1 *Place* means a geographically defined area. It may include elements, objects, spaces and views. Place may have tangible and intangible dimensions.

Place has a broad scope and includes natural and cultural features. Place can be large or small: for example, a memorial, a tree, an individual building or group of buildings, the location of an historical event, an urban area or town, a cultural landscape, a garden, an industrial plant, a shipwreck, a site with in situ remains, a stone arrangement, a road or travel route, a community meeting place, a site with spiritual or religious connections.

1.2 *Cultural significance* means aesthetic, historic, scientific, social or spiritual value for past, present or future generations.

Cultural significance is embodied in the *place* itself, its *fabric*, *setting*, *use*, *associations*, *meanings*, records, *related places* and *related objects*.

Places may have a range of values for different individuals or groups.

The term cultural significance is synonymous with cultural heritage significance and cultural heritage value.

Cultural significance may change over time and with use.

Understanding of cultural significance may change as a result of new information.

1.3 *Fabric* means all the physical material of the *place* including elements, fixtures, contents and objects.

Fabric includes building interiors and sub-surface remains, as well as excavated material.

Natural elements of a place may also constitute fabric. For example the rocks that signify a Dreaming place.

Fabric may define spaces and views and these may be part of the significance of the place.

1.4 *Conservation* means all the processes of looking after a *place* so as to retain its *cultural significance*.

See also Article 14.

1.5 *Maintenance* means the continuous protective care of a *place*, and its *setting*.

Maintenance is to be distinguished from repair which involves *restoration* or *reconstruction*.

Examples of protective care include:

- maintenance — regular inspection and cleaning of a place, e.g. mowing and pruning in a garden;
- repair involving restoration — returning dislodged or relocated fabric to its original location e.g. loose roof gutters on a building or displaced rocks in a stone bora ring;
- repair involving reconstruction — replacing decayed fabric with new fabric

1.6 *Preservation* means maintaining a *place* in its existing state and retarding deterioration.

It is recognised that all places and their elements change over time at varying rates.

1.7 *Restoration* means returning a *place* to a known earlier state by removing accretions or by reassembling existing elements without the introduction of new material.

1.8 *Reconstruction* means returning a *place* to a known earlier state and is distinguished from *restoration* by the introduction of new material.

New material may include recycled material salvaged from other places. This should not be to the detriment of any place of cultural significance.

1.9 *Adaptation* means changing a *place* to suit the existing *use* or a proposed use.

1.10 *Use* means the functions of a *place*, including the activities and traditional and customary practices that may occur at the place or are dependent on the place.

Use includes for example cultural practices commonly associated with Indigenous peoples such as ceremonies, hunting and fishing, and fulfillment of traditional obligations. Exercising a right of access may be a use.

Articles	Explanatory Notes
1.11 *Compatible use* means a *use* which respects the *cultural significance* of a *place*. Such a use involves no, or minimal, impact on cultural significance.	
1.12 *Setting* means the immediate and extended environment of a *place* that is part of or contributes to its *cultural significance* and distinctive character.	Setting may include: structures, spaces, land, water and sky; the visual setting including views to and from the place, and along a cultural route; and other sensory aspects of the setting such as smells and sounds. Setting may also include historical and contemporary relationships, such as use and activities, social and spiritual practices, and relationships with other places, both tangible and intangible.
1.13 *Related place* means a *place* that contributes to the *cultural significance* of another place.	
1.14 *Related object* means an object that contributes to the *cultural significance* of a *place* but is not at the place.	Objects at a place are encompassed by the definition of place, and may or may not contribute to its cultural significance.
1.15 *Associations* mean the connections that exist between people and a *place*.	Associations may include social or spiritual values and cultural responsibilities for a place.
1.16 *Meanings* denote what a *place* signifies, indicates, evokes or expresses to people.	Meanings generally relate to intangible dimensions such as symbolic qualities and memories.
1.17 *Interpretation* means all the ways of presenting the *cultural significance* of a *place*.	Interpretation may be a combination of the treatment of the fabric (e.g. maintenance, restoration, reconstruction); the use of and activities at the place; and the use of introduced explanatory material.

Conservation Principles

Article 2. Conservation and management

2.1 *Places* of *cultural significance* should be conserved.

2.2 The aim of *conservation* is to retain the *cultural significance* of a *place*.

2.3 *Conservation* is an integral part of good management of *places* of *cultural significance*.

2.4 *Places* of *cultural significance* should be safeguarded and not put at risk or left in a vulnerable state.

Article 3. Cautious approach

3.1 *Conservation* is based on a respect for the existing *fabric*, *use*, *associations* and *meanings*. It requires a cautious approach of changing as much as necessary but as little as possible.

The traces of additions, alterations and earlier treatments to the fabric of a place are evidence of its history and uses which may be part of its significance. Conservation action should assist and not impede their understanding.

3.2 Changes to a *place* should not distort the physical or other evidence it provides, nor be based on conjecture.

Article 4. Knowledge, skills and techniques

4.1 *Conservation* should make use of all the knowledge, skills and disciplines which can contribute to the study and care of the *place*.

Articles

4.2 Traditional techniques and materials are preferred for the *conservation* of significant *fabric*. In some circumstances modern techniques and materials which offer substantial conservation benefits may be appropriate.

Explanatory Notes

The use of modern materials and techniques must be supported by firm scientific evidence or by a body of experience.

Article 5. Values

5.1 *Conservation* of a *place* should identify and take into consideration all aspects of cultural and natural significance without unwarranted emphasis on any one value at the expense of others.

Conservation of places with natural significance is explained in the Australian Natural Heritage Charter. This Charter defines natural significance to mean the importance of ecosystems, biodiversity and geodiversity for their existence value or for present or future generations, in terms of their scientific, social, aesthetic and life-support value.

In some cultures, natural and cultural values are indivisible.

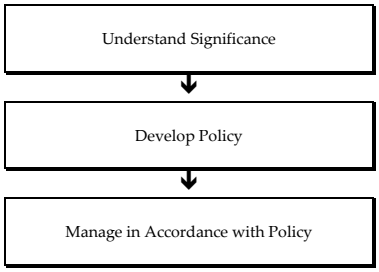
5.2 Relative degrees of *cultural significance* may lead to different *conservation* actions at a place.

A cautious approach is needed, as understanding of cultural significance may change. This article should not be used to justify actions which do not retain cultural significance.

Article 6. Burra Charter Process

6.1 The *cultural significance* of a *place* and other issues affecting its future are best understood by a sequence of collecting and analysing information before making decisions. Understanding cultural significance comes first, then development of policy and finally management of the place in accordance with the policy. This is the Burra Charter Process.

The Burra Charter Process, or sequence of investigations, decisions and actions, is illustrated below and in more detail in the accompanying flow chart which forms part of the Charter.



6.2 Policy for managing a *place* must be based on an understanding of its *cultural significance*.

6.3 Policy development should also include consideration of other factors affecting the future of a *place* such as the owner's needs, resources, external constraints and its physical condition.

6.4 In developing an effective policy, different ways to retain *cultural significance* and address other factors may need to be explored.

Options considered may include a range of uses and changes (e.g. adaptation) to a place.

6.5 Changes in circumstances, or new information or perspectives, may require reiteration of part or all of the Burra Charter Process.

Article 7. Use

7.1 Where the *use* of a *place* is of *cultural significance* it should be retained.

7.2 A *place* should have a *compatible use*.

The policy should identify a use or combination of uses or constraints on uses that retain the cultural significance of the place. New use of a place should involve minimal change to significant fabric and use; should respect associations and meanings; and where appropriate should provide for continuation of activities and practices which contribute to the cultural significance of the place.

Article 8. Setting

Conservation requires the retention of an appropriate *setting*. This includes retention of the visual and sensory setting, as well as the retention of spiritual and other cultural relationships that contribute to the *cultural significance* of the *place*.

New construction, demolition, intrusions or other changes which would adversely affect the setting or relationships are not appropriate.

Setting is explained in Article 1.12.

Article 9. Location

9.1 The physical location of a *place* is part of its *cultural significance*. A building, work or other element of a place should remain in its historical location. Relocation is generally unacceptable unless this is the sole practical means of ensuring its survival.

9.2 Some buildings, works or other elements of *places* were designed to be readily removable or already have a history of relocation. Provided such buildings, works or other elements do not have significant links with their present location, removal may be appropriate.

9.3 If any building, work or other element is moved, it should be moved to an appropriate location and given an appropriate *use*. Such action should not be to the detriment of any *place* of *cultural significance*.

Article 10. Contents

Contents, fixtures and objects which contribute to the *cultural significance* of a *place* should be retained at that place. Their removal is unacceptable unless it is: the sole means of ensuring their security and *preservation*; on a temporary basis for treatment or exhibition; for cultural reasons; for health and safety; or to protect the place. Such contents, fixtures and objects should be returned where circumstances permit and it is culturally appropriate.

For example, the repatriation (returning) of an object or element to a place may be important to Indigenous cultures, and may be essential to the retention of its cultural significance.

Article 28 covers the circumstances where significant fabric might be disturbed, for example, during archaeological excavation.

Article 33 deals with significant fabric that has been removed from a place.

Article 11. Related places and objects

The contribution which *related places* and *related objects* make to the *cultural significance* of the *place* should be retained.

Article 12. Participation

Conservation, interpretation and management of a *place* should provide for the participation of people for whom the place has significant *associations* and *meanings*, or who have social, spiritual or other cultural responsibilities for the place.

Article 13. Co-existence of cultural values

Co-existence of cultural values should always be recognised, respected and encouraged. This is especially important in cases where they conflict.

For some places, conflicting cultural values may affect policy development and management decisions. In Article 13, the term cultural values refers to those beliefs which are important to a cultural group, including but not limited to political, religious, spiritual and moral beliefs. This is broader than values associated with cultural significance.

Conservation Processes

Article 14. Conservation processes

Conservation may, according to circumstance, include the processes of: retention or reintroduction of a *use*; retention of *associations* and *meanings*; *maintenance, preservation*, *restoration*, *reconstruction, adaptation* and *interpretation*; and will commonly include a combination of more than one of these. Conservation may also include retention of the contribution that *related places* and *related objects* make to the *cultural significance* of a *place*.

Conservation normally seeks to slow deterioration unless the significance of the place dictates otherwise. There may be circumstances where no action is required to achieve conservation.

Article 15. Change

15.1 Change may be necessary to retain *cultural significance*, but is undesirable where it reduces cultural significance. The amount of change to a *place* and its *use* should be guided by the *cultural significance* of the place and its appropriate *interpretation*.

When change is being considered, including for a temporary use, a range of options should be explored to seek the option which minimises any reduction to its cultural significance.

It may be appropriate to change a place where this reflects a change in cultural meanings or practices at the place, but the significance of the place should always be respected.

15.2 Changes which reduce *cultural significance* should be reversible, and be reversed when circumstances permit.

Reversible changes should be considered temporary. Non-reversible change should only be used as a last resort and should not prevent future conservation action.

15.3 Demolition of significant *fabric* of a *place* is generally not acceptable. However, in some cases minor demolition may be appropriate as part of *conservation*. Removed significant fabric should be reinstated when circumstances permit.

15.4 The contributions of all aspects of *cultural significance* of a *place* should be respected. If a place includes *fabric*, *uses*, *associations* or *meanings* of different periods, or different aspects of cultural significance, emphasising or interpreting one period or aspect at the expense of another can only be justified when what is left out, removed or diminished is of slight cultural significance and that which is emphasised or interpreted is of much greater cultural significance.

Article 16. Maintenance

Maintenance is fundamental to *conservation.* Maintenance should be undertaken where *fabric* is of *cultural significance* and its maintenance is necessary to retain that *cultural significance*.

Maintaining a place may be important to the fulfilment of traditional laws and customs in some Indigenous communities and other cultural groups.

Article 17. Preservation

Preservation is appropriate where the existing *fabric* or its condition constitutes evidence of *cultural significance,* or where insufficient evidence is available to allow other *conservation* processes to be carried out.

Preservation protects fabric without obscuring evidence of its construction and use. The process should always be applied:

- where the evidence of the fabric is of such significance that it should not be altered; or
- where insufficient investigation has been carried out to permit policy decisions to be taken in accord with Articles 26 to 28.

New work (e.g. stabilisation) may be carried out in association with preservation when its purpose is the physical protection of the fabric and when it is consistent with Article 22.

Articles

Explanatory Notes

Article 18. Restoration and reconstruction

Restoration and *reconstruction* should reveal culturally significant aspects of the *place*.

Article 19. Restoration

Restoration is appropriate only if there is sufficient evidence of an earlier state of the *fabric*.

Article 20. Reconstruction

20.1 *Reconstruction* is appropriate only where a *place* is incomplete through damage or alteration, and only where there is sufficient evidence to reproduce an earlier state of the *fabric*. In some cases, reconstruction may also be appropriate as part of a *use* or practice that retains the *cultural significance* of the place.

Places with social or spiritual value may warrant reconstruction, even though very little may remain (e.g. only building footings or tree stumps following fire, flood or storm). The requirement for sufficient evidence to reproduce an earlier state still applies.

20.2 *Reconstruction* should be identifiable on close inspection or through additional *interpretation*.

Article 21. Adaptation

21.1 *Adaptation* is acceptable only where the adaptation has minimal impact on the *cultural significance* of the *place*.

Adaptation may involve additions to the place, the introduction of new services, or a new use, or changes to safeguard the place. Adaptation of a place for a new use is often referred to as 'adaptive re-use' and should be consistent with Article 7.2.

21.2 *Adaptation* should involve minimal change to significant *fabric*, achieved only after considering alternatives.

Article 22. New work

22.1 New work such as additions or other changes to the *place* may be acceptable where it respects and does not distort or obscure the *cultural significance* of the place, or detract from its *interpretation* and appreciation.

New work should respect the significance of a place through consideration of its siting, bulk, form, scale, character, colour, texture and material. Imitation should generally be avoided.

22.2 New work should be readily identifiable as such, but must respect and have minimal impact on the *cultural significance* of the *place*.

New work should be consistent with Articles 3, 5, 8, 15, 21 and 22.1.

Article 23. Retaining or reintroducing use

Retaining, modifying or reintroducing a significant *use* may be appropriate and preferred forms of *conservation*.

These may require changes to significant fabric but they should be minimised. In some cases, continuing a significant use, activity or practice may involve substantial new work.

Article 24. Retaining associations and meanings

24.1 Significant *associations* between people and a *place* should be respected, retained and not obscured. Opportunities for the *interpretation*, commemoration and celebration of these associations should be investigated and implemented.

For many places associations will be linked to aspects of use, including activities and practices.

Some associations and meanings may not be apparent and will require research.

24.2 Significant *meanings*, including spiritual values, of a *place* should be respected. Opportunities for the continuation or revival of these meanings should be investigated and implemented.

Article 25. Interpretation

The *cultural significance* of many *places* is not readily apparent, and should be explained by *interpretation*. Interpretation should enhance understanding and engagement, and be culturally appropriate.

In some circumstances any form of interpretation may be culturally inappropriate.

Conservation Practice

Article 26. Applying the Burra Charter Process

26.1 Work on a *place* should be preceded by studies to understand the place which should include analysis of physical, documentary, oral and other evidence, drawing on appropriate knowledge, skills and disciplines.

The results of studies should be kept up to date, regularly reviewed and revised as necessary.

26.2 Written statements of *cultural significance* and policy for the *place* should be prepared, justified and accompanied by supporting evidence. The statements of significance and policy should be incorporated into a management plan for the place.

Policy should address all relevant issues, e.g. use, interpretation, management and change.

A management plan is a useful document for recording the Burra Charter Process, i.e. the steps in planning for and managing a place of cultural significance (Article 6.1 and flow chart). Such plans are often called conservation management plans and sometimes have other names.

The management plan may deal with other matters related to the management of the place.

26.3 Groups and individuals with *associations* with the *place* as well as those involved in its management should be provided with opportunities to contribute to and participate in identifying and understanding the *cultural significance* of the place. Where appropriate they should also have opportunities to participate in its *conservation* and management.

26.4 Statements of *cultural significance* and policy for the *place* should be periodically reviewed, and actions and their consequences monitored to ensure continuing appropriateness and effectiveness.

Monitor actions taken in case there are also unintended consequences.

Article 27. Managing change

27.1 The impact of proposed changes, including incremental changes, on the *cultural significance* of a *place* should be assessed with reference to the statement of significance and the policy for managing the place. It may be necessary to modify proposed changes to better retain cultural significance.

27.2 Existing *fabric, use, associations* and *meanings* should be adequately recorded before and after any changes are made to the *place*.

Article 28. Disturbance of fabric

28.1 Disturbance of significant *fabric* for study, or to obtain evidence, should be minimised. Study of a *place* by any disturbance of the fabric, including archaeological excavation, should only be undertaken to provide data essential for decisions on the *conservation* of the place, or to obtain important evidence about to be lost or made inaccessible.

Articles

28.2 Investigation of a *place* which requires disturbance of the *fabric*, apart from that necessary to make decisions, may be appropriate provided that it is consistent with the policy for the place. Such investigation should be based on important research questions which have potential to substantially add to knowledge, which cannot be answered in other ways and which minimises disturbance of significant fabric.

Article 29. Responsibility

The organisations and individuals responsible for management and decisions should be named and specific responsibility taken for each decision.

Article 30. Direction, supervision and implementation

Competent direction and supervision should be maintained at all stages, and any changes should be implemented by people with appropriate knowledge and skills.

Article 31. Keeping a log

New evidence may come to light while implementing policy or a plan for a *place*. Other factors may arise and require new decisions. A log of new evidence and additional decisions should be kept.

Article 32. Records

32.1 The records associated with the *conservation* of a *place* should be placed in a permanent archive and made publicly available, subject to requirements of security and privacy, and where this is culturally appropriate.

32.2 Records about the history of a *place* should be protected and made publicly available, subject to requirements of security and privacy, and where this is culturally appropriate.

Article 33. Removed fabric

Significant *fabric* which has been removed from a *place* including contents, fixtures and objects, should be catalogued, and protected in accordance with its *cultural significance*.

Where possible and culturally appropriate, removed significant fabric including contents, fixtures and objects, should be kept at the place.

Article 34. Resources

Adequate resources should be provided for *conservation*.

Words in italics are defined in Article 1.

Explanatory Notes

New decisions should respect and have minimal impact on the cultural significance of the place.

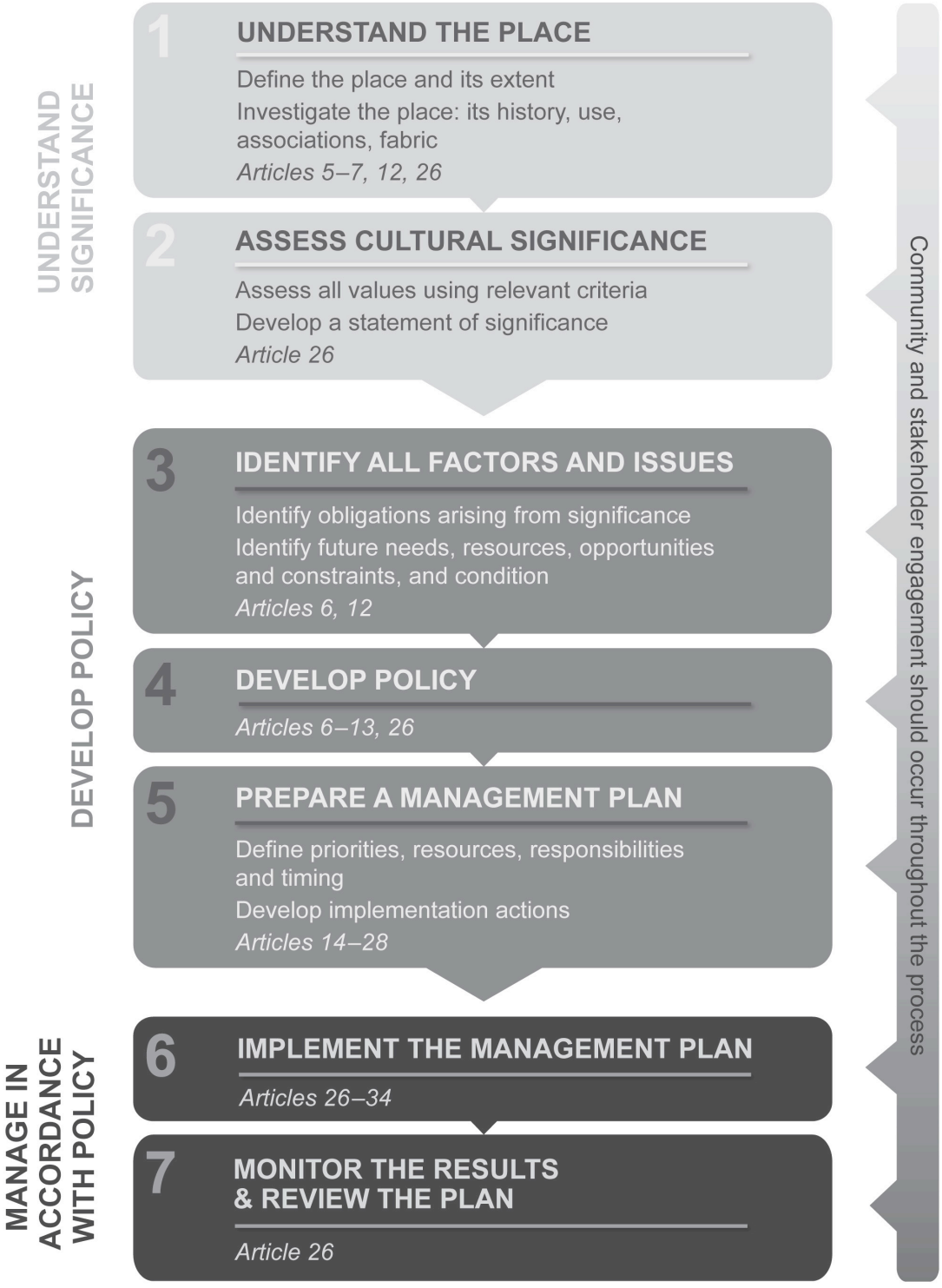
The best conservation often involves the least work and can be inexpensive.

The Burra Charter Process

Steps in planning for and managing a place of cultural significance

The Burra Charter should be read as a whole.

Key articles relevant to each step are shown in the boxes. Article 6 summarises the Burra Charter Process.



Appendix E

Unanticipated Finds Protocol, GML, January 2021

Appendix E—Unanticipated Finds Protocol

Protocol to be followed in the event that previously unrecorded or unanticipated archaeological material (objects, artefacts, deposits or relics) are encountered.

1. All ground surface disturbance in the area of the finds should cease immediately when unanticipated archaeological material is uncovered. The discoverer of the find(s) will notify machinery operators in the immediate vicinity of the find(s) so that work can be halted.

2. All work in the vicinity of the discovery will cease.

3. Contact the project archaeologist to assess the nature of the finds.

4. The project archaeologist will record the finds. This will include a significance assessment and the lodgement of site information for all new recordings with ACT Heritage.

5. If the finds are historical artefacts not in-situ, the finds will be recorded and collected and stored with the project proponent or project archaeologist and incorporated into the assemblage of other historical artefactual material at the conclusion of subsequent archaeological investigation phases.

6. If the finds are in-situ structural features or in-situ archaeological deposits of assessed significance a determination will be made between the project archaeologist and the onsite operators regarding the following:

    a) If sufficient information has been gained by the test location, then the sampling process will not re-commence and the find will be reburied using the excavated soil;

    b) If the test location can be moved to a location not directly impacting surface features, then the sampling process will re-commence at that new location and the finds will be reburied using the excavated soil;

    c) If there are no suitable location alternatives and further sampling is required, the following will be undertaken:

        i. All work in the location will remain on hold as the following steps are completed:

        ii. ACT Heritage will be informed of the findings and a further course of action will be discussed.

        iii. Based on discussions with ACT Heritage further assessment processes and formal permission under the ACT Heritage ACT may be required to facilitate the removal of the features.

        iv. At the completion of the additional assessment phases the agreed mitigation measures will be carried out prior to the removal of the features based on the conditions of approval.

7. If the finds are Aboriginal artefacts, the project archaeologist will contact ACT Heritage and the four ACT Representative Aboriginal Organisations (RAOs) to discuss ongoing management measures.

8. Work will not commence at the find location until ACT Heritage, the RAOs and the Project archaeologist have agreed an approach to managing the artefacts, and the finds location.

Protocol to be followed in the event that suspected human remains are encountered.

1. All ground surface disturbance in the area of the finds, should cease immediately the finds are uncovered.

    a. The discoverer of the find(s) will notify machinery operators in the immediate vicinity of the find(s) so that work can be temporarily halted; and

    b. The site supervisor and the development proponent will be informed of the find(s). If there is substantial doubt regarding a human origin for the remains, then consider if it is possible to gain a qualified opinion within a short period of time. If feasible, gain a qualified opinion (this can circumvent proceeding further along the protocol for remains which turn out to be non-human). If conducted, this opinion must be gained without further disturbance to any remaining skeletal material and its context as possible (Be aware that the site may be considered a crime scene containing forensic). If a quick opinion cannot be gained, or the identification is positive, then proceed to the next step.

2. Immediately notify the following people of the discovery:

    a. The local Police (this is required by law);

    b. ACT Heritage;

    c. Representatives from the Representative Aboriginal Organisations (RAOs) (where appropriate); and

    d. The project archaeologist (if not already present).

3. Facilitate the evaluation of the find(s) by the statutory authorities and comply with any stated requirements. Depending on the evaluation of the find(s), the management of the find(s) and their location may become a matter for the Police and/or Coroner.

4. Construction related works in the area of the find(s) may not resume until the development proponent receives written approval from the relevant statutory authority: from the Police or Coroner in the event of an investigation; and from the ACT Heritage Council in the case of human remains outside of the jurisdiction of the Police or Coroner.

5. In the event that the proponent continues an active role in the evaluation and/or management of the find(s), via a direction or advice from the Police, Coroner and/or Heritage Council, then all or some of the following steps may be conducted:

6. Facilitate, in co-operation with the appropriate authorities, the definitive identification of the skeletal material by a specialist (if not already completed). This must be done with as little further disturbance to any remaining skeletal material and its context as possible.

7. If the specialist identifies the bone as non-human then, where appropriate, the protocol for the discovery of historical or Aboriginal artefacts (above) should be followed.

8. If the specialist determines that the bone material is human, then the proceeding course of action may be of three types:

    a. The bone(s) are of an Aboriginal and non-Aboriginal person who died less than 100 years ago and where traumatic death is suspected. Such remains come under the jurisdiction of

the *ACT Coroner's Act* 1997. All further decisions and responsibilities regarding the remains and find location rest with the ACT Police, and/or the ACT Coroner.

b. The bone(s) are of a non-Aboriginal person who died more than 100 years ago. In this case, and where the Police have indicated that they have no interest in the find(s), the following steps may be followed:

    i. Ascertain the requirements of the ACT Heritage Council, the development proponent, the project archaeologist, and the views of any relevant community stakeholders;

    ii. Based on the above, determine and conduct an appropriate course of action. Possible strategies could include one or more of the following:

        1. Avoiding further disturbance to the find and conserving the remains *in situ* (this option may require relocating the development and this may not be possible in some contexts);

        2. Conducting (or continuing) archaeological salvage of the finds following receipt of any required statutory approvals;

        3. Scientific description (including excavation where necessary), and possibly also analysis of the remains prior to reburial;

        4. Recovering samples for dating and other analyses; and/or

        5. Subsequent reburial at another place and in an appropriate manner determined by the Heritage Council and in consultation with other relevant stakeholders.

c. The bone(s) are of an Aboriginal person who died more than 100 years ago. In this case the following steps may be followed:

    i. Ascertain the requirements of the local RAOs, the ACT Heritage Council, the development proponent, and the project archaeologist;

    ii. Based on the above, determine and conduct an appropriate course of action. Possible strategies could include one or more of the following:

        1. Avoiding further disturbance to the find and conserving the remains *in situ*, (this option may require relocating the development and this may not be possible in some contexts);

        2. Conducting (or continuing) archaeological salvage of the finds following receipt of any required statutory approvals;

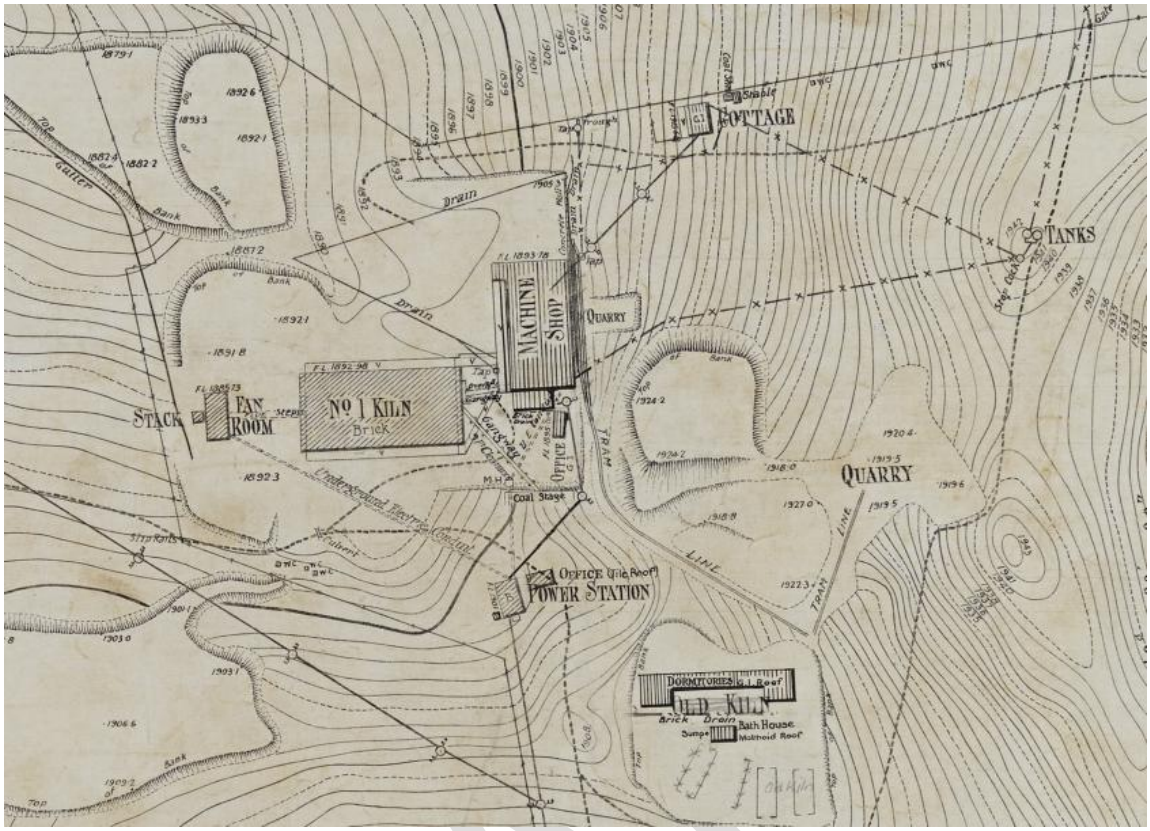
        3. Scientific description (including excavation where necessary), and possibly also analysis of the remains prior to reburial;

        4. Recovering samples for dating and other analyses; and/or

        5. Subsequent reburial at another place and in an appropriate manner determined by the RAOs and the Heritage Council.

Appendix F

Archaeological Assessment, Navin Officer, Draft Report, September 2016



ARCHAEOLOGICAL ASSESSMENT

CANBERRA BRICKWORKS & ENVIRONS

Denman Street, Yarralumla,

South Canberra

Prepared for

Land Development Agency

September 2016

Navin Officer Heritage Consultants Pty Ltd

with

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1.0 EXECUTIVE SUMMARY

This archaeological assessment for the former Canberra Brickworks (Block 1, Section 102) and its environs (Blocks 7 and 20, Section 102) has been prepared for the Land Development Agency (LDA) to inform any future works within the three blocks in Yarralumla. The Canberra Brickworks site is not designated land (areas specified in the National Capital Plan as having 'special characteristics of the National Capital') and is subject to the provisions of the Territory Plan. The Canberra Brickworks and associated Railway Remnants are also included in the ACT Heritage Register and are protected under the *Heritage Act* 2004.

The Commonwealth Government established the Canberra Brickworks in order to support the development of Canberra as the new Federal Capital. The project was announced in 1910 and work began on the development of the complex in 1913. The brickworks supplied materials for the construction of buildings in Canberra in the early period of the capital's development. Bricks and other specialty lines were produced at the site from this time until the closure of the complex in 1976. Production capacity at the site varied in response to fluctuations in demand for bricks and the brickworks was expanded in a number of key phases, notably in the 1920s and the 1950s.

Following closure of the plant, the site was adapted for a range of uses (of varying duration) but other than for the subdivision of land and associated residential development on the perimeter of the site, relatively little physical change has occurred since this time. The surviving complex includes brick manufacturing infrastructure including kilns, stacks and ancillary buildings, with a quarry to the east. Part of the complex is occupied by a timber recycling company.

This Archaeological Assessment has been prepared in response to Policy 15 of the Canberra Brickworks Conservation Management Plan by Lovell Chen, dated April 2010, which states that:

> A predictive archaeological assessment should be undertaken for the study area and abutting sites. This study should identify the relative potential for sub-surface remains on the site and their likely nature and significance. Depending on the outcome of such a study, an Archaeological Management Plan should be prepared prior to any development or disturbance of the site.

As such, the purpose of this document has been to:

- Identify areas of historical archaeological sensitivity at the study area with potential sub-surface features
- consider the likely nature and potential of the sub-surface remains
- provide guidance on the management of any archaeological remains

Areas of potential archaeological sensitivity

Twelve sites of potential archaeological significance were identified during the preparation of this report, with varying levels of potential (low, moderate, high).

The principal areas of archaeological potential include:

BRW1: Building platform and concrete features

BRW2: Married quarters and Brickworks Hostel

BRW3: Area of postholes and other remains

BRW4: Single men's quarters

BRW5: Clay feature and rubble

BRW6: Rubble heap/refuse dump

BRW7: Quarry

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BRW8: Old kiln and dormitories

BRW9: Cottage, stables, coal store

BRW10: Railway remnants

BRW11: Railway siding extension (to north)

BRW12: Flues/subsurface workings

Other works

Prior to the completion of this report, a Statement of Heritage Effects (SHE) was granted by ACT Heritage for Phase 2 contamination and geotechnical testing. The LDA undertook sub-surface testing, which was overseen by NOHC. This work took place within the identified areas of high, medium and low archaeological potential. A summary of results is included at Appendix B.

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2.0 Introduction

This Archaeological Assessment for the former Canberra Brickworks (Block 1, Section 102) and its environs (Blocks 7 and 20, Section 102) has been prepared for the Land Development Agency (LDA). The purpose of the document is to:

- Identify areas of historical archaeological sensitivity at the study area with potential sub-surface features
- consider the likely nature and potential of the sub-surface remains
- provide guidance on the management of any archaeological remains

The Cultural Heritage Reporting Policy prepared by the ACT Heritage Council (dated 1 July 2015) has been referenced in the preparation of this document.[1] An assessment of significance and assessment of potential impacts are included as an appendix to this report (Appendix A).

This report does not address Aboriginal archaeology. The Aboriginal archaeological potential of the study area was considered as part of an Aboriginal Cultural Heritage Assessment (Stage 1) in August 2014. The assessment, prepared by Navin Officer Heritage Consultants Pty Ltd (NOHC), concludes that the brickworks and its environs contain no known Aboriginal places or objects and is of low Aboriginal archaeological potential. Further, any archaeological deposits would have been disturbed as a consequence of past land use practices.[2] As an outcome of the Cultural Heritage Assessment, no statutory implications regarding cultural heritage apply to the study area. The Cultural Heritage Assessment was approved by the ACT Heritage Council on 11 September 2014.[3]

Canberra Brickworks CMP

This Assessment has been prepared in response to Policy 15 of the Canberra Brickworks Conservation Management Plan by Lovell Chen, dated April 2010. The policy is as follows:

> A predictive archaeological assessment should be undertaken for the study area and abutting sites. This study should identify the relative potential for sub-surface remains on the site and their likely nature and significance. Depending on the outcome of such a study, an Archaeological Management Plan should be prepared prior to any development or disturbance of the site.

The CMP provides an assessment of the site's heritage values, and sets out policies to guide the conservation and management of those values. It was endorsed by the ACT Heritage Council on 20 May 2010. The CMP notes that archaeological remnants are likely to survive at the site and comments that, '[these artefacts are unlikely] to be of a level of significance that … would warrant retention in situ, or … preclude development on the site'.[4] Subsurface artefacts located at the site would however have the potential to enhance an understanding of the history and operation of the site.

Canberra Brickworks Railway Remnants

While the Canberra Brickworks CMP has regard for issues of setting and curtilage, it does not provide a detailed analysis of land adjacent to the former brickworks, including the Canberra Brickworks Railway Remnants, which is the subject of a separate entry in the ACT Heritage Register. The registered area for the railway remnants extends south from the brickworks and forms part of Block 7, Section 102, Yarralumla (Figure 1).

2.1 Study area

The study area for this archaeological assessment includes Blocks 1, 7 and 20 Section 102 in Yarralumla. The total area is approximately 16ha. There is an elevated ridge to the south and east of the study area, and lower ground to the north and west. A water course originally ran to the north-west of the site. The study site is located approximately 5km west of the Parliamentary Triangle. It is bounded to the north and east by low density residential development (Woolls, Schomburgk and Bentham streets, and

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Lane-Poole Place). To the west, the site is bordered by Territory land (Block 1, Section 127), and to the south by Block 3 Section 94 (Figure 1). Access to the study area is from Denman Street only.

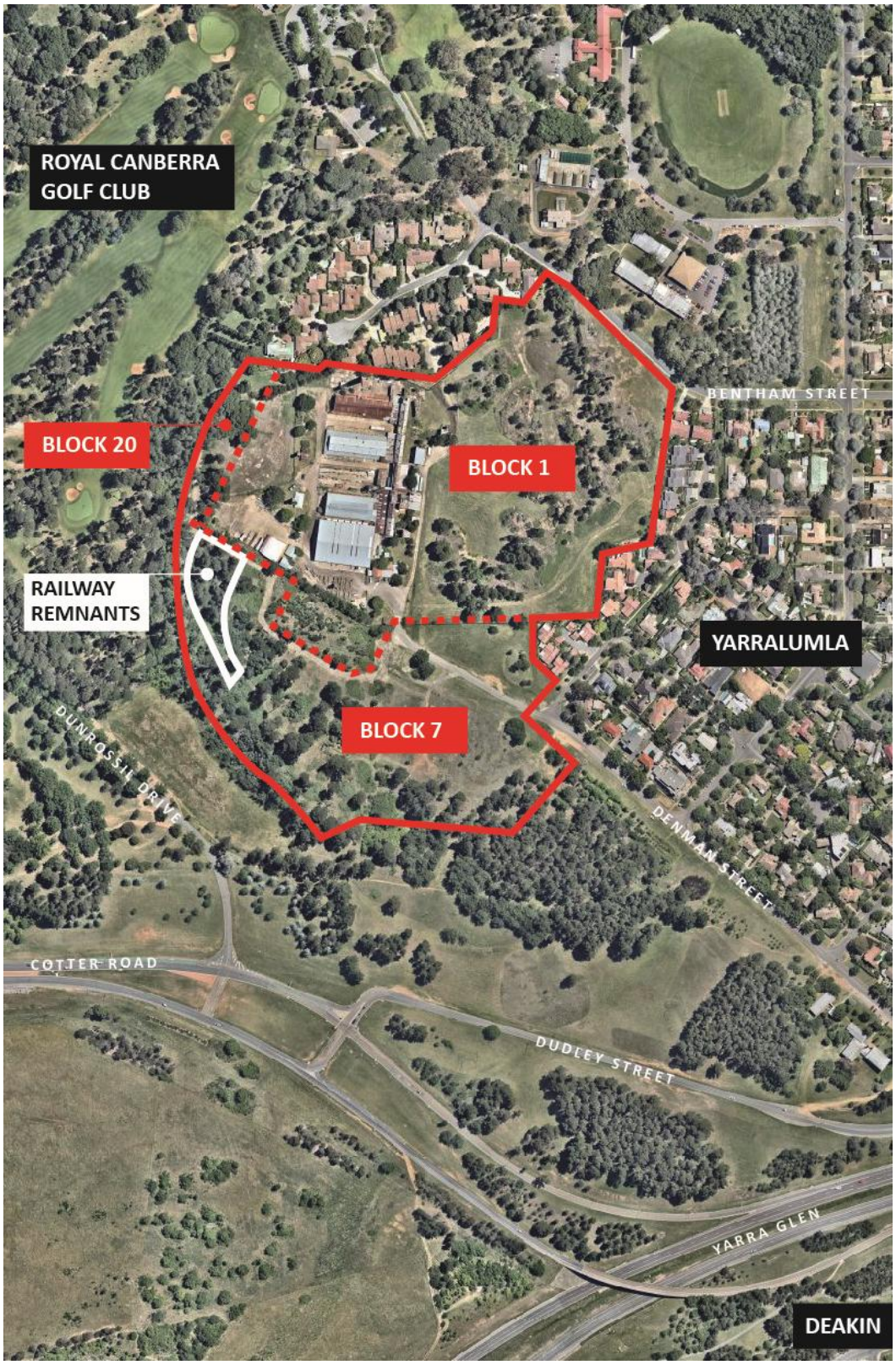


Figure 1 Aerial photograph of the study area (solid red line) and environs, 20 November 2015: Block 1 is the registered extent of the Canberra Brickworks
Source: www.nearmap.com (base photograph), accessed 16 December 2015

3.0 Project description

The nature of future works within the study area is yet to be determined. Based on criteria and land uses defined in the current Territorry Plan and Yarralumla Precinct Map and Code, the study area could be subject to future commercial and/or residential development..

4.0 Statutory context

The *Australian Capital Territory (Planning and Land Management) Act* 1988 established the National Capital Planning Authority, which was required to prepare a National Capital Plan (NCP). The Act also required the preparation of a Territory Plan, which was not to be inconsistent with the NCP. The Territory Plan is the document that informs and guides planning and development in the ACT, with the exception of 'Designated Areas' (an area specified in the NCP as having 'the special characteristics of the National Capital'). The study area is not designated land and as such is subject to the provisions of the Territory Plan. However, land to the south, north and west (Sections 103, 113, 119 and 123) is designated, and forms part of the National Capital Open Space system.

Development approval processes within the ACT can be summarised as follows:

- Work carried out on National Land in Designated Areas is subject to the approval of the National Capital Authority (NCA);
- Work carried out on Territory Land in Designated Areas is generally subject to approval by the NCA but Territory requirements may also apply to development where the Territory is the approving Authority;
- Work carried out on National Land outside of Designated Areas must be in accordance with a Development Control Plan (if applicable) agreed by the NCA that reflects the requirements of the Territory Plan; and
- Work carried out on Territory Land outside Designated Areas is subject to the Territory Plan and Territory Approval processes.

4.1 *Heritage Act 2004* (ACT)

The Canberra Brickworks (Section 102, Block 1) and the Brickworks Railway Remnants (Section 102, Block 7 – part) are included in the ACT Heritage Register and are protected under the *Heritage Act* 2004. This Act provides for the protection, management and conservation of heritage places and objects in the ACT. Under the Act, the ACT Heritage Council is to be responsible for the Heritage Register and the heritage registration process.

Under s.74 of the *Heritage Act*, it is an offence to engage in conduct that diminishes the heritage significance of a place or object. An object is defined as 'a natural or manufactured object, but does not include a building or any other man-made structure' and a place is defined as 'a site, precinct or parcel of land; a building or structure; or part of a building or structure; the curtilage, or setting, of a building or structure, or part of a building or structure; an object or feature historically associated with, and located at, the place'.[5]

Under the Act, penalties apply where other works diminish the heritage significance of a registered or nominated place or object or damages an Aboriginal place or object. The reporting and offence provisions of the Act apply irrespective of land status, or whether the site is listed in the Heritage Register or not.

The only provisions for legally sanctioned disturbance to a place or object, or the diminution of the heritage value of a Heritage Place or Object is to conform to one of the exceptions listed in s76 of the Act (see also Section 13.0).[6] According to this section, the offence provisions of the Act (s74 and s75) do not apply if conduct is engaged in accordance with the following:

(i) a heritage guideline;

(ii) a heritage direction;

(iii) a heritage agreement;

(iv) a conservation management plan approved by the council;

(v) development approval under the Planning and Development Act 2007, chapter 7;

(vi) an excavation permit;

(vii) a statement of heritage effect approved by the council.

4.2 Elements of significance

The features associated with the brickworks are divided between two schedules – elements of exceptional significance, and elements of moderate significance (ACT Heritage Register Item 20068, Figure 2).

Schedule 1 Elements of Exceptional Significance

1) Kiln - Staffordshire (1915)
2) Fan House for Staffordshire Kiln (1915)
3) Kiln - Hardy-Patent (1927)
4) Fan House for Hardy Patent Kiln (1953)
5) Kiln - Hardy-Patent (1953)
6) Kilns - Downdraft a, b, c (1963)
7) Chimney Stacks for Staffordshire Kiln (1915)
8) Chimney Stack for Hardy Patent Kiln (1927)
9) Chimney Stack for Hardy Patent Kiln (1953)
10) Chimney Stack for Downdraft Kiln (1963)
11) Quarry
12) Geological features A, B, C, D

Schedule 2 Elements of Moderate Significance

13) Office (1916)
14) Power House (1915)
15) Machine Bay for Staffordshire and Downdraft Kilns (1955)
16) Machine Bay for Hardy-Patent (1955)
17) Machine Bay for Hardy-Patent (1955)
18) Workshop (1955)
19) Large Crusher House (1955)
20) Primary Crusher House (1955)
21) Small Crusher House

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22) Elevator Conveyor (1955)

23) Remains of the Brickworks Accommodation Village

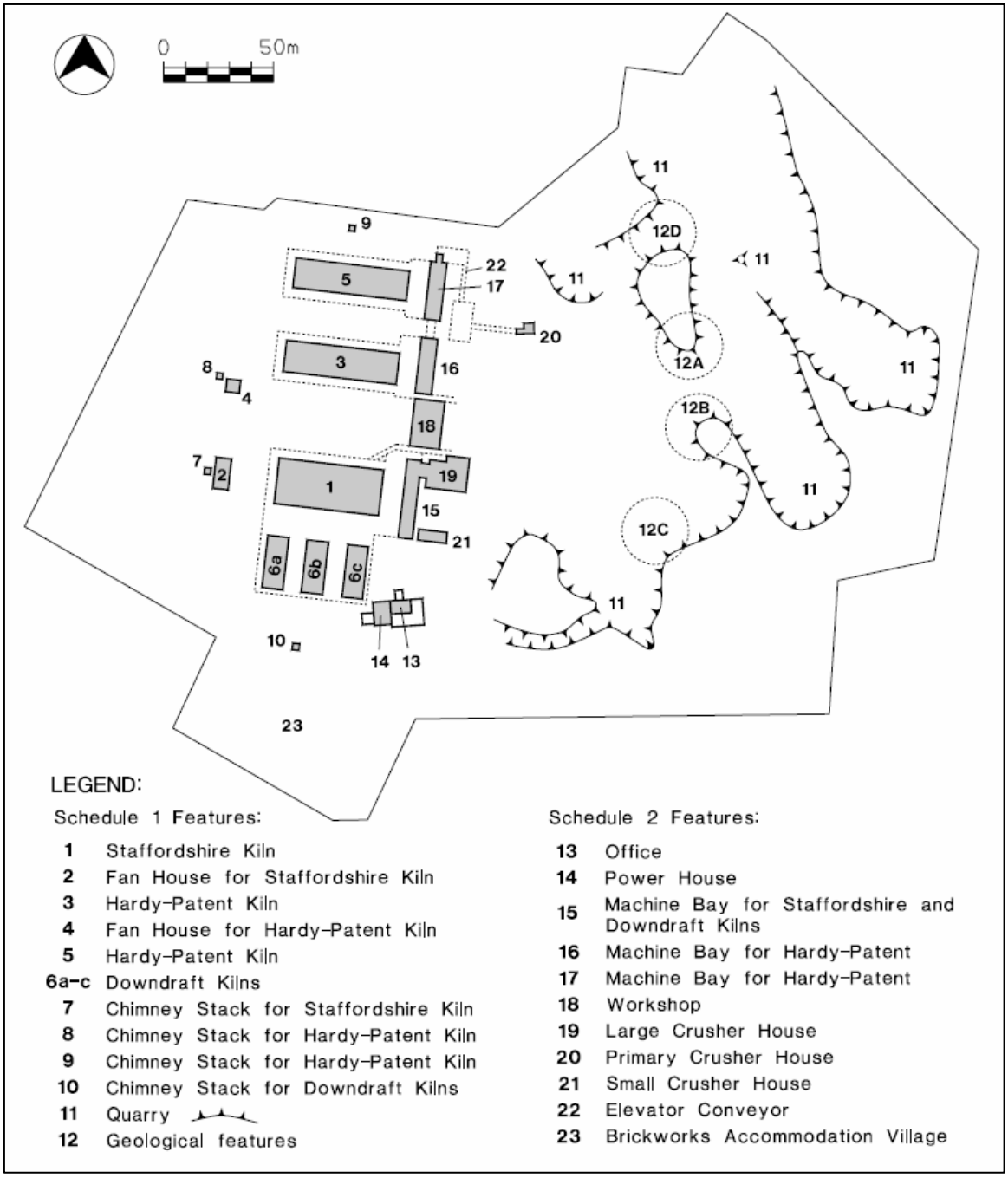


Figure 2 Canberra Brickworks significant features
Source: ACT Heritage Register

5.0 Environmental context

The Canberra brickworks is located within two distinct geological regions: the Deakin Volcanics, which consists of Rhyodacitic ignimbrite and minor volcaniclastic and argillacrous sediments; and the Yarralumla Formation, which consists of calcareous and tuffaceous mudstone and siltstone with minor limestone, calc-silicate hornfels and quartz sandstone.[7]

The area is situated on the Williamsdale soil landscape, characterised by undulating rises with elevation between the highest and lowest points locally being below 10% in natural terrain. The soil landscape consists of moderately deep, moderately well-drained Yellow Chromosols, Red Kandosols and Brown Kandosols. There are elevated ridges to the south and east of the study area, and lower ground to the north and west. A former watercourse ran through the brickworks site in the north-west, at which point alluvial soils are present. The brickworks is located on a minor local topographic high, with a sloping ground surface outside the study area to the south and south-west heading towards Yarralumla Creek, a tributary of the Molonglo River. Topography and drainage in some areas of the study area have been significantly modified due to the brickworks itself, the associated quarry and road infrastructure.[8]

The study area is largely dominated by exotic vegetation. The areas of tree plantings contain an exotic understorey. The areas of exotic pasture surrounding the entrance road to the study area are dominated by Chilean needlegrass, a noxious weed. The predominant tree species within the study area is *Pinus radiata* (weed species), *Pinus ponderosa*, *Pinus sylvestris* and *Ulmus procera* and various tree and shrub weed species. A number of planted trees are located along the eastern boundary and a copse of oak trees is located on the south-east corner of Block 7. Generally the landscape is unmanaged, and weed species (trees, blackberry shrubs and grasses) are prevalent.[9]

6.0 Social context

Investigation of the social context of the brickworks site has not been undertaken for this current assessment. However, a study was undertaken in late 2010 with past employees or their family members to explore their memories and experience of the Brickworks. This study revealed an attachment for people who have worked at the site during its operational life as a brickworks.

Unsurprisingly, given its scale, heritage values and location, the brickworks is a place which has been the focus of major interest for the local community concentrating largely on the issue of potential future development. Significant community sentiment and interest and consultation workshops have taken place with the LDA to provide an opportunity for residents to express opinions regarding the future use and development of the site.

7.0 Archaeological context

The Aboriginal archaeological potential of the study area was considered as part of a Cultural Heritage Assessment undertaken by Navin Officer Heritage Consultants (NOHC) in August 2014. As noted, this report concluded that the brickworks and its environs contained no known Aboriginal places or objects, and any potential deposits would have been disturbed as a consequence of the extensive land use.

No previous historical archaeological assessments of the study area came to light during the preparation of this report.

Site visits undertaken for this Archaeological Assessment, and previously, suggest that there is some above-ground evidence of archaeological features within the study area. This is described in detail in Section 11.3. Some evidence for potential archaeological features is also visible in the form of the landscape. The quarry itself is a highly intact feature and the brickworks railway, which operated between 1923 and 1927, remains partly evident in the form of cuttings in the landscape that follow the original alignment of the siding. Self-seeded vegetation has reclaimed much of this area in recent years. Evidence of man-made intervention is also apparent in the refuse dump to the west of the brickworks.

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8.0 Research design and methodology

Historical research

Historical research using primary and secondary sources formed a significant component of this assessment of archaeological potential. The principal objective of this research was to establish and document the historic development of built form at the study area.

The 2010 CMP prepared by Lovell Chen was a key reference. It is based upon a range of sources, including survey and site plans and historic photography. This report is also informed by the following primary sources:

- Photographic collection, National Library of Australia
- Photographic collection, ACT Heritage Library
- Aerial photography, ACT Planning and Land Authority

Additional research was also undertaken using secondary sources and online databases including published histories, the Canberra Heritage Register, and Nearmap aerial photography.

The historical development of the Canberra Brickworks is presented in this report in four key phases:

- Establishment (1913-1920)
- Reactivation (1920s-1930s)
- Expansion (1940-1970s)
- Closure and Redevelopment (1970s – current)

Archaeological fieldwork

Archaeological fieldwork was conducted to examine the presence and extent of physical features at the site, including their location and potential purpose; confirm the location and archaeological potential of any previously identified features; identify any areas of archaeological potential not recognised through historical research; and where possible, use the results of the above examinations and analyses to identify the potential for these areas to yield further information.

Research questions which were posed included:

- Are there identifiable remains and features that would provide information on the course of the development and use of the study area; and
- Are there areas of archaeological potential, with no surface remains, within the study area that may be able to provide information on its development and use?

A predictive archaeological model was also developed to indicate the types of potential archaeological features, and likely areas of subsurface remains. This model is outlined in Section 11.1.

Site visit

Three site visits were undertaken throughout the duration of this study.

Lovell Chen undertook an inspection on 24 November 2015, to 'ground truth' the outcomes of the historical research and identify any archaeological evidence relating to historic land use. The site visit was undertaken by Adam Mornement, Senior Associate, and he was accompanied by a staff member from the Land Development Agency. The survey covered the quarry, and land to the west and south of the kilns including remnants of the railway siding extending into Block 7.

The focus of this visit was on six locations which had been identified as being of archaeological potential during the review of historical documentary material. Lovell Chen established that one of the locations had been developed, and confirmed that archaeological evidence of previous land use remained

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possible at the other five locations. Underground flues linking the kilns to their respective fan houses and chimney stacks were not inspected during this visit. However, documentary and above-ground evidence (in the form of the kilns, stacks and fan houses) suggests that these flues survive.

A second investigation was undertaken by Travis Gottschutzke and Dr Rebecca Parkes of NOHC in the afternoon of 20 May 2016. This involved a walk over of the area to the south of the brickworks itself, and the quarry. Staff were accompanied by three officers from the Land Development Agency (LDA). The inspection was an opportunity to familiarise NOHC staff with the nature of the brickworks site.

Following this investigation, a detailed survey of sites within the brickworks area was undertaken by Travis Gottschutzke and Julia Maskell (NOHC) on 9 June 2016. Over the course of the survey, contributions were sought from other NOHC staff (Dr. Rebecca Parkes and Dr. Antony Barham).

8.1 Limitations

Access to the entire study area was limited due to a number of factors. The centre of the precinct, the brickworks, is a partially active environment, licensed by the Territory to a joinery business involving processing and recycling of reclaimed timber. Access to this zone was therefore restricted to short windows of time during staff breaks. Fortunately, the built environment of this part of the precinct has been sufficiently analysed in the 2010 CMP, and visible archaeological remains were predicted to be minimal in these areas.

Historical research has largely relied on material in the 2010 CMP, which in turn relied in part on material from the 1986 Lester Firth Associates' *Conservation Management Plan*, with additional research undertaken by Lovell Chen where required. While there is clearly scope to undertake further historical research in relation to the study area, it was considered that sufficient research had been undertaken to inform the analysis and assessment of this report.

9.0 Related reports

The Canberra brickworks site, as well as the surrounding environs, has been the subject of a number of previous studies. These include:

- Lester Firth Associates Pty Ltd, *Old Canberra Brickworks Conservation Plan,* 1986
- National Capital Development Commission, *Canberra Brickworks, South Canberra, Policy Plan*, October 1988
- Connell Wagner Pty Ltd, *The Old Canberra Brickworks and Environs Development Control Plan*, February 2001
- Susan Conroy & Munns Sly Architects, *The Yarralumla Brickworks & Environs Planning Review*, March 2005
- Lovell Chen, *Canberra Brickworks Conservation Management Plan*, April 2010
- Navin Officer Heritage Consultants, *Canberra Brickworks, Yarralumla ACT Aboriginal Cultural Heritage Assessment (Stage 1)*, August 2014

10.0 Historical background and analysis

The following historical overview of the former Canberra Brickworks is derived largely from the CMP prepared by Lovell Chen in 2010. Full reference details are contained in the CMP. The results of any additional research are referenced below.

10.1 Pre-brickworks

In 1910, King O'Malley announced Government plans for the construction of a brickworks to serve the Federal Capital. Various experiments on shale in the region were carried out in early 1911. One potential site was Frederick Campbell's Yarralumla property. Samples from the site were sent for testing and reports concluded that samples from Yarralumla produced bricks of excellent quality. Yarralumla was thus chosen and Frederick Campbell agreed to the acquisition of approximately 38 acres (15ha) of his land holding. The area was gazetted on 27 July 1912, and development of the site began in 1913.

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The map at Figure 3 shows the location of the study area prior to the development of the Federal Capital.

10.1.1 Analysis and conclusion

There is unlikely to be any archaeological features or deposits relating to this period.

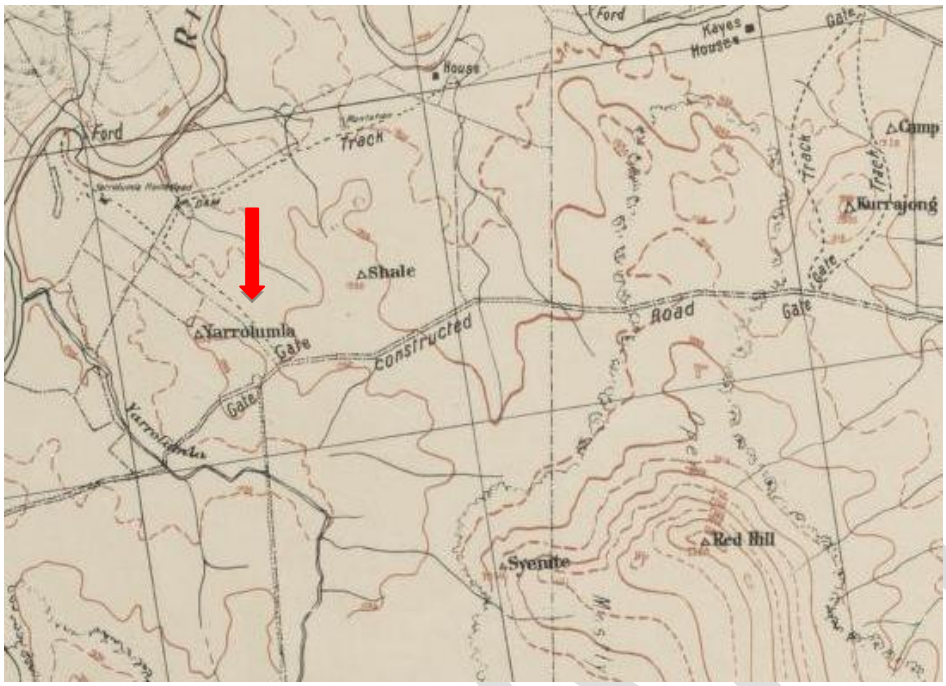


Figure 3 Map of Federal Capital, 1912: the approximate location of the former Canberra Brickworks is indicated
Source: National Library of Australia

10.2 Establishment (1913-1920)

A temporary brick making plant was operational by 19 June 1913. This comprised a grinding pan, brick making machine and elevator made by Geo. Foster and Sons, Sydney, and a portable steam engine. By August 1913, four open kilns were in use at the temporary plant, with plans for a fifth. During this period, workers were accommodated in two camps of tents – one for married couples, the other for single men. The camps were located on Banks Street, near the present Forestry School. This area has been developed for housing.

The first stage of the permanent brickworks, which included a Staffordshire kiln, was approved on 1 December 1913 by P T Owen, the Director-General of Works. It was proposed to use this kiln to produce bricks for the construction of two further kilns. In September 1915, the brickwork for a 20-chamber Staffordshire kiln was nearing completion. This kiln, together with crushing, processing equipment and brick presses was ready for production by early 1916.

A Survey Plan of the site (Figure 4), dated 20 December 1916, shows the layout of the permanent brickworks. A small galvanised iron office building is located close to the 'Machine Shop', and a galvanised iron 'Cottage' with associated coal store and stable is located to the north-east of the site. Other features include a coal stage, a concrete retaining wall separating the quarry pit and the working areas, water storage tanks on a high knoll, a remote powder depot, three detached WCs south of the kiln, an elevated gangway connecting the coal stage to the kiln and overhead electrical connections linking the power station to the fan room, machine shop and the cottage. The Staffordshire kiln was connected to the fan house and stack by means of flues and underground workings. A tram line is indicated linking the quarry to the machine shop – these tram lines could be relocated as the quarry face advanced.

The plan also provides details about the temporary brickworks. The temporary 'Old Kiln' area, shown in outline on the plan, comprises four kilns located to the south-east of the permanent brickworks. There is also a 'Dormitories' building located to the immediate north.

The plan indicates that the land to the immediate north of the Staffordshire kiln and associated fan room was on a rise, and a gutter was developed to the west of this to allow water to flow from the nearby creek to the site. This land later became a rubble heap and refuse dump.

The land to the north-west, west and south of the brickworks was established in 1914 as a designed landscape 'Westbourne Woods' (Figure 5). This land, together with Weston Park and the Yarralumla Nursery, was nursery and arboretum to test the suitability of plantings throughout Canberra.

The commitments of World War I, and consequent restrictions on the works program for Canberra, together with a coal strike, saw the brickworks close in December 1916.

10.2.1 Analysis and conclusion

All structures relating to the temporary brickworks have been demolished.

Elements of the permanent brickworks, as indicated on the 1916 survey plan, that survive include the power station, Staffordshire kiln, the fan room, stack and the concrete retaining wall. It is assumed that the underground workings connecting the kiln to the fan house and stack also survive as intact subsurface remains. Other elements from this period have been demolished. As was the case for the cottage, associated coal store and the office building close to the machine shop, the majority of the demolished buildings are likely to have been constructed of sheet metal.

Archaeological deposits pertaining to built form from this era are expected to comprise footings and machinery remnants. The material discard is expected to be items of an industrial nature. As can be seen from the survey plan (1916), most of the development in this period was located on the flat land to the west of the quarry pit. This area has been heavily disturbed as a result of the expansion of the brickworks, and it is unlikely that archaeological remains will be uncovered here.

The site of the temporary kilns to the south-east of the power station is the most likely location for archaeological deposits dating to this era. This area has not subsequently been developed, although part of it was covered with a concrete slab (see Section 10.4).

The cottage to the north-east may also yield some archaeological remains, although this site is likely to have been disturbed by quarrying activities. The location of the cottage and outbuildings has been heavily trafficked over time, being located on a key route between the quarry pit and kilns and in close proximity to the primary crusher house and the elevator/conveyor. Archaeological deposits or features relating to this area may include timber post holes and/or domestic discard.

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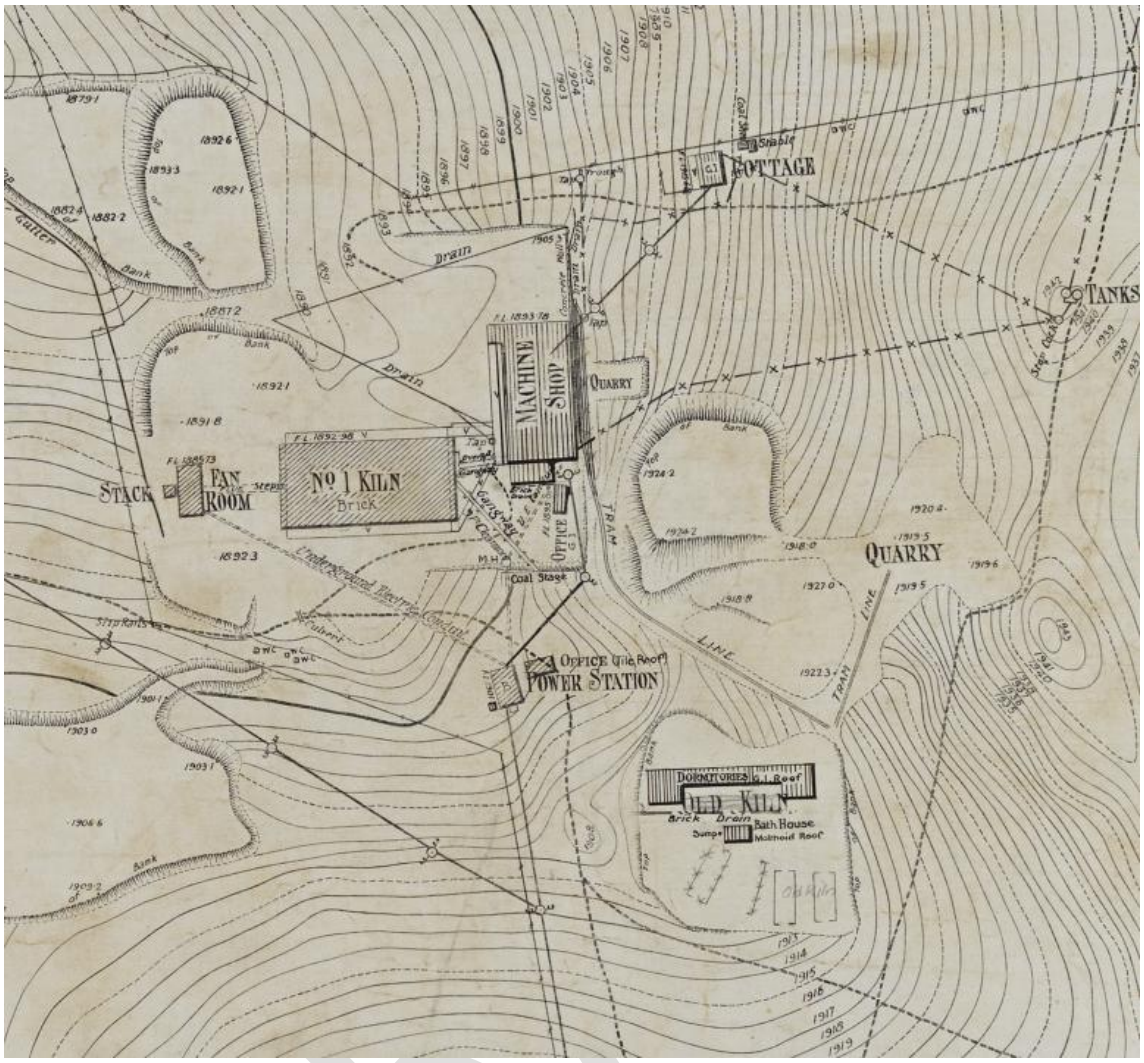


Figure 4 Contour and detail survey of Brick Yards, Canberra, 1916. North is at top
Source: National Archives of Canberra

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Figure 5 Detail of Plan of City and Environs, 1918 showing the Brickworks (indicated) in relation to Westbourne Woods
Source: National Library of Australia

10.3 Reactivation (1920s – 1930s)

The Canberra Brickworks re-opened in 1921 to meet the demands of a developing city. By the end of 1923, 5,000,000 bricks and 50,000 tiles had been produced at the plant.

Bricks were initially transported from the brickworks to construction sites in the emerging city centre by traction engine. However, the machines were able to make only two daily round trips. To speed the process a light railway was constructed. This led from the south-west of the brickworks site, before aligning with the present Denman Street and heading east to the construction sites. The 'branch lines' of the light railway were removed prior to the opening of the Provisional Parliament Building in May 1927 and the remaining sections of the railway were removed in 1929. From the late 1920s, bricks were transported by truck. The only remaining evidence of the light rail network is the formation between Denman Street and the west side of the brickworks (the Canberra Brickworks Railway Remnants).

To cope with increased demand during the 1920s, two 'temporary' downdraught kilns and an associated stack were constructed at the brickworks in October 1925. These were oriented east-west and located to the south of the Staffordshire kiln. They were replaced in the 1960s by three kilns that survive today. In 1926 the existing machine shed was also expanded by two bays.

A 1926 site plan of the brickworks (Figure 6) indicates the changes that occurred following the re-opening of the site after World War I. The old dormitory block and iron cottage with associated stable are still present, but the temporary kilns have been demolished by this stage. The machine shop has

been expanded to the north and a new kiln constructed to the north of the Staffordshire kiln. The location of the two downdraught kilns is also outlined. There was an amusement hall, possibly associated with the Brickworks Camp, to the east of the quarry pit. The quarry itself has altered in shape significantly from the earlier 1916 plan and the tramways follow a different alignment. The plan also provides an indication of the arrangement of the railway siding, just prior to its closure the following year.

Further development took place in 1927. A Hardy patent kiln was built, located to the north of and parallel to the Staffordshire kiln. Today, this kiln has its own fan house and stack, presumably with underground flues, but a 1927 site plan showing the proposed location of this kiln, suggests that it may originally have been supported by the fan house and stack of the Staffordshire kiln. This kiln remains today, albeit in extensively modified form. A 'Scotch' kiln was also in operation to the north of the Staffordshire kiln, and the original section of the present office building was constructed. Single men's quarters were constructed on the south side of Denman Street, close to the entrance to the study area – the location of these quarters is not recorded in historic plans or photographs – and new married quarters were located to the south of the brickworks in the same year. These married quarters can be seen in Figure 7 and Figure 8. They comprised a large two storey building (mess hall) and a number of simple single storey sleeping quarters. The photographs suggest that they were of timber construction.

By the end of the 1920s, the brickworks comprised:

- Staffordshire kiln, fan house and stack
- Hardy patent kiln, fan house and stack
- Two downdraught kilns
- Machine shed
- Amusement hall
- Cottage and associated stables/coal store
- Power house (brick)
- Office (brick)
- Accommodation units to south west and south
- Railway siding remnants

The works closed in February 1931 as a result of the 1929 Depression before reopening again in 1935. However, World War II diverted peace time activity to works associated with the war effort, and the brickworks closed once again. In April 1942 staff were laid off and a caretaker retained to issue bricks for essential works.

10.3.1 Analysis and conclusion

The reactivation phase saw the expansion of the brickworks to something close to its present dimensions. The industrial buildings built during this period were generally constructed of brick with corrugated sheet metal roofs. It is anticipated that accommodation buildings of this era were constructed of timber.

The only buildings that survive from this period were those associated with the industrial workings of the brickworks itself. All accommodation, including the sheet metal cottage, the original dormitories, the single men's camp and the married quarters have been demolished, as has the amusement hall.

The form and location of the single men's quarters constructed to the south of Denman Street, close to the site entrance, is not known. As noted, it is probable that the building (or buildings) were of timber construction. The land to the south of Denman Street, close to the entrance, has not subsequently been

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developed. Archaeological deposits relating to these quarters may include post holes and underfloor refuse deposits. Any material discard is expected to be of a domestic nature.

The married quarters, south of the brickworks, were replaced with a hostel in 1945. As a result, there is limited potential for archaeological deposits relating to the 1920s married quarters. Any deposits are likely to be of a domestic nature.

There are unlikely to be any remains of the quarry pit tramways. These were of an ephemeral nature, being readily relocatable. The floor of the quarry pit has also been modified through quarrying operations, and (in the 1970s) through the adaptation of the pit to a landscaped park and model railway.

Evidence of the railway siding remains in the form of cuttings in the landscape that follow the original alignment of the siding. The potential for subsurface remains relating to the railway, including drainage channels, is low, but cannot be discounted. The railway siding extended right to the brickworks and, although part of this area was later covered with the slab of the extrusion plant, there is potential for the evidence of tracks extending to the north and south of the Staffordshire kiln. Potential archaeological features related to the railway may include timber sleepers, iron bolts and metal rails.

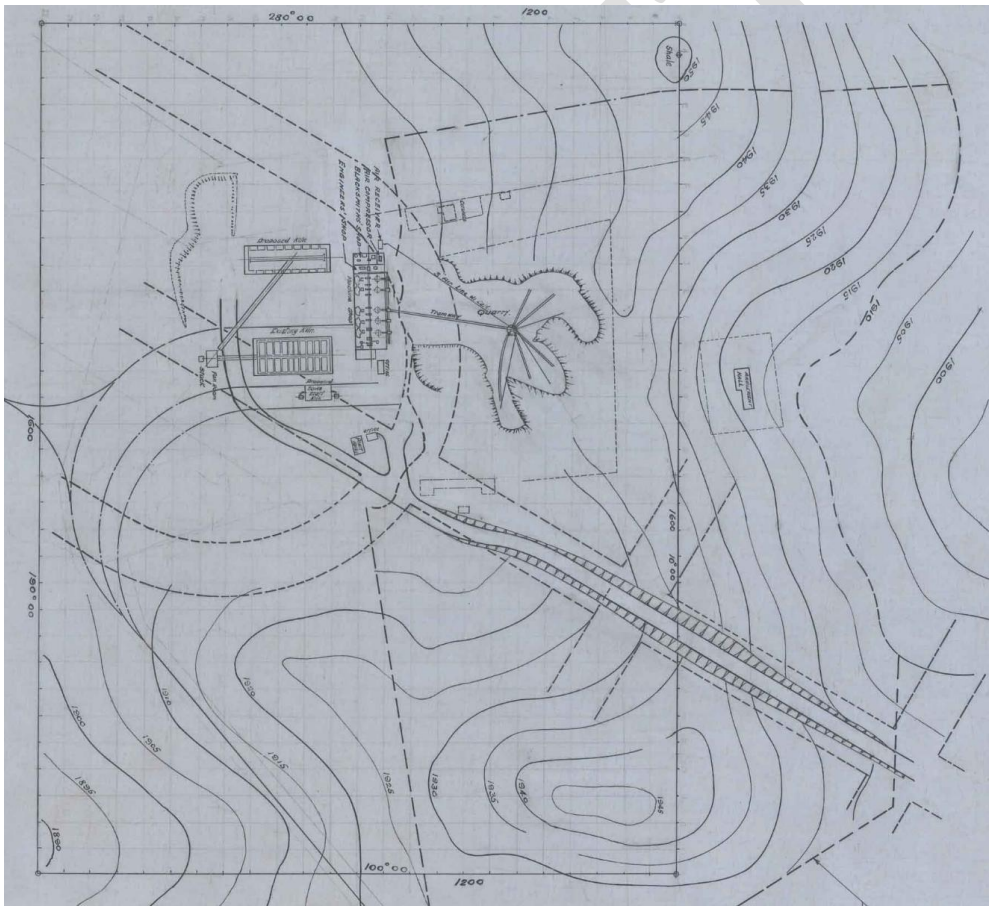


Figure 6 Canberra Brickworks site plan, 1926. North is at top
Source: National Archives of Australia



Figure 7 View of Brickworks, 1929 with married quarters to the left of the image
Source: National Archives of Australia



Figure 8 Brickworks looking south to married quarters buildings, 1929
Source: National Archives of Australia

10.4 Expansion (1940s – 1960s)

With the end of World War II in sight, the Canberra Brickworks reopened in September 1944, with production on a limited scale. From the late-1940s and into the 1950s output was stepped up to provide material to address the post-war housing shortage, resulting in a major expansion and redevelopment of the brickworks.

Among the first post-war construction projects was the replacement of the married quarters at the south-west of the site, built during the 1920s. The new 'Brickworks Hostel' was ready for occupation in 1945 and was located on the site of, and in close proximity, to the former married quarters. The hostel was demolished c.1970.

The expansion of the brickworks in the 1950s saw a change in the process of brick making and in the machinery required for production. While the major brick kilns on the site were retained, other early plant and buildings were replaced. The early machine shop, adjacent to the Staffordshire kiln, was replaced with a series of brick press buildings and a workshop. The brickworks was also equipped with a series of new crushers and hoppers, an elevator and a 'Pan Building'; and a sequence of conveyor belts. The two 'temporary' downdraught kilns that had been built c. 1925 were demolished to make way for three new downdraught kilns. These were constructed on the site of the former 'temporary' kilns in 1960-63.

Westbourne Woods, which surrounded the Brickworks also witnessed change during this period. To solve problems of tree damage as a result of drought, a golf course within the Woods was proposed in 1945. From 1949-1954, fairways were cleared and grassed and in 1962 the Royal Canberra Golf Club was granted a lease that included most of Westbourne Woods.[10] The land to the north-west and west of the brickworks has thus retained a designed landscape character since 1914, with no evidence of development.

This phase of development of the brickworks is reasonably well documented. A site plan dated 1947 (Figure 9) shows the layout of the site at the time, which is substantiated by a 1950 aerial photograph (Figure 10). A 1961 aerial shows further development that took place during this period (Figure 12).

The cottage to the north-west of the quarry pit had been demolished by 1947, with the introduction of roadways to the east side of the machinery shops and kilns likely to have disturbed any material related to the building. A new house had been constructed directly to the north of the brickworks, with an associated garage. As noted above, the Brickworks Hostel replaced the former married quarters in 1945. This new accommodation comprised two buildings with rectangular footprints to the south-west of this area, and a number of smaller buildings to the north and north-east (Figure 11). The amusement hall was extant in 1950 and an explosives store had been erected to the west of the railway siding.

The 1961 aerial shows development to the east and south-east of the brickworks. Residential development to the north-east was also progressing at this stage.

The 1961 aerial also demonstrates the extensive remodelling of the brickworks during the 1950s. A new kiln, constructed c.1953, is located to the north of the older kilns and in close proximity to the residence, presumably with its own sub-surface flue connections; a clay storage shed had been erected to the east of the brickworks; and the machine shop had been remodelled into a series of smaller buildings. The Brickworks Hostel was extant, although it appears to have been modified by this time. A large square expanse is also evident to the south of Denman Street. It is possible this was used as a brick stacking or storage area for the brickworks.

10.4.1 Analysis and conclusion

This period saw the major expansion and redevelopment of the Brickworks, with a mix of residential and industrial buildings being constructed, which generally replaced earlier structures.

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The residence to the north of the brickworks was demolished by the 1970s, with the area later incorporated into the Lane Poole Place development (see Section 10.5). This site now lies outside the study area.

The principal site of archaeological potential relating to this era is the former Brickworks Hostel (built 1945, demolished c. 1970). Footings and concrete slabs were not visible during the first study area visit (due to the extent of vegetation). However, above-ground evidence of built form in this location was visible during the survey conducted by NOHC in June 2016 (Figure 13). Any material discard in proximity to the former hostel is likely to be of a domestic nature.

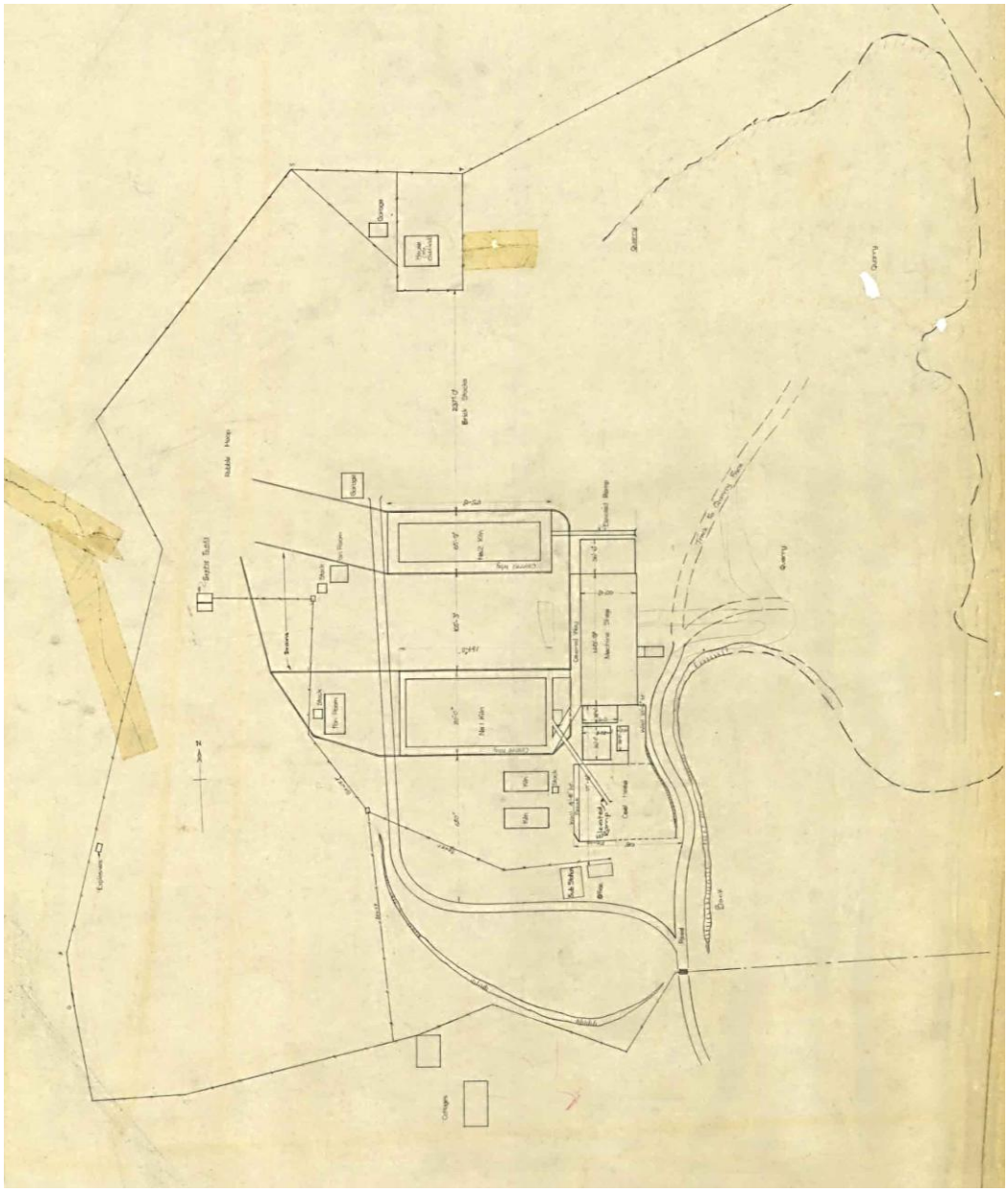


Figure 9 Brickworks site plan, 1947. North is at top
Source: National Archives of Australia



Figure 10 Aerial view of the Brickworks site, 1950
Source: ACTPLA



Figure 11 Aerial view of Yarralumla looking east, with the Brickworks at the lower left showing the Brickworks Hostel (indicated), 1952
Source: ACT Library

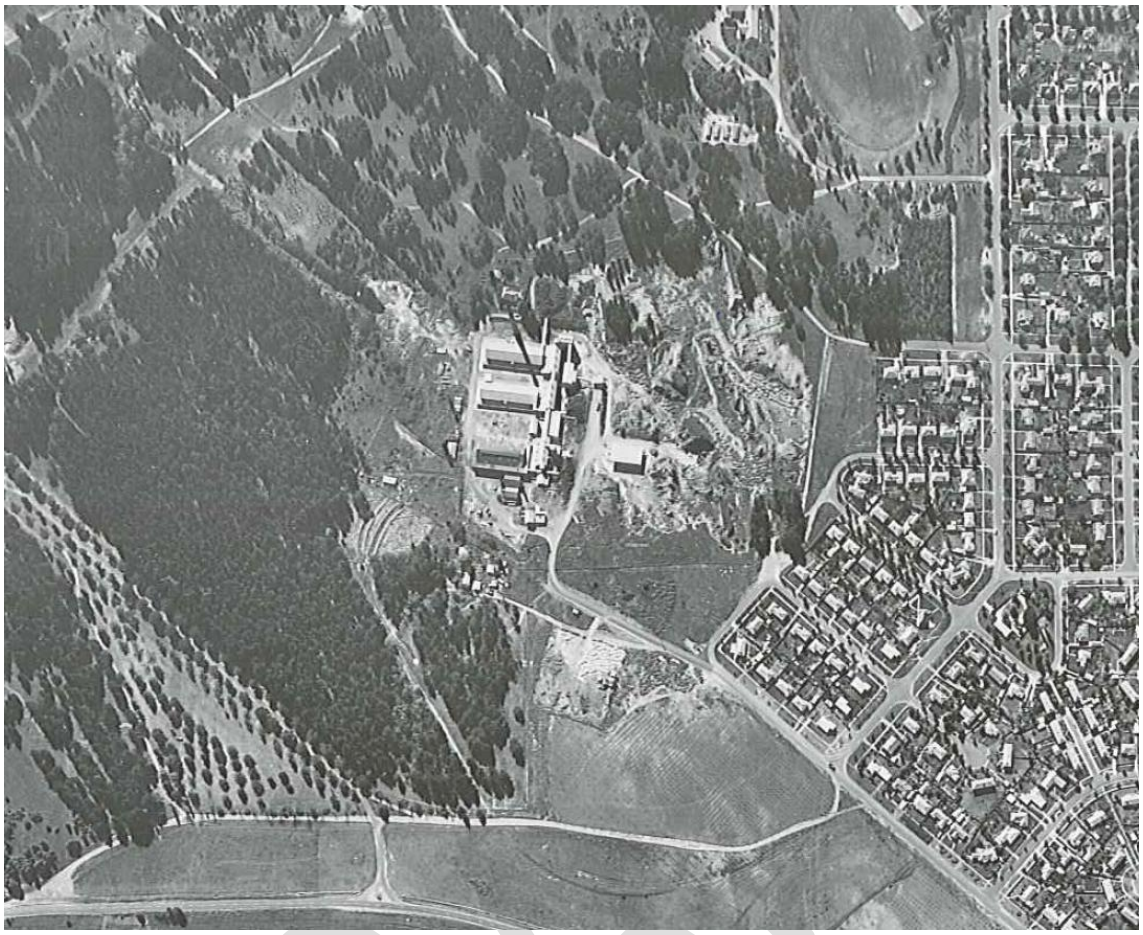


Figure 12 Aerial view of the brickworks site, 1961: note the square fenced area to the south of Denman Street
Source: ACTPLA



Figure 13 Walls/footings of the former Brickworks Hostel, 2010

10.5 Closure and redevelopment (1970s – current)

In 1967, the ACT Health Services Branch inspected the Brickworks Hostel and reported that the buildings were in a state of disrepair. Late in 1970 it was reported that the hostel was to be demolished. The 1972 aerial photograph (Figure 14) shows the site of the hostel as cleared land. The amusement hall had also been demolished by this time, although the associated landscaping (trees) survived. Further residential development had occurred to the north-east and east of the study area and to the north, the Royal Canberra Golf Course had been established.

The three downdraught kilns built in the 1960s can be seen to the south of the Staffordshire kiln, with a large square extrusion plant to its west – part of this large concrete slab was located on top of the rail sidings that extended to the north and south of the Staffordshire kiln. A comparison of the 1960s and 1970s aerial shows that new structures were constructed to the immediate east of the kilns, the latest iteration of development in this location. The c. 1940s residence to the north of the brickworks had been demolished by this time. This area has since been developed as part of the Lane Poole Place housing complex. The area of the old kilns and dormitories had been partly covered by a concrete slab for a car park by the 1970s.

By 1973, the Canberra Brickworks was considered to be in need of extensive modernisation and proposals were prepared by Commonwealth Brickworks Pty Ltd for upgrading. These proposals were rejected on environmental grounds and a new site for a brickworks was released at Mitchell, north of Canberra. The kilns at the Canberra Brickworks were unloaded for the last time in August 1976.

Also in 1976, local developer and businessman Alan Marr (A R Marr Pty Ltd) made a proposal to the NCDC to develop the brickworks and adjacent land as a tourist, recreation and retail destination, with associated housing to the east and north of the study area. Under Marr's scheme, the quarry was to be landscaped to include picnic areas, walking trails and a miniature railway (Figure 15). Marr succeeded in having the land re-zoned, and redevelopment works on the quarry commenced towards the end of 1978. This involved land fill and the creation of a reflection lake. The redeveloped brickworks was opened to the public as a tourist attraction in July 1979. A 1980 aerial photograph shows the study area at this time (Figure 16).

Marr also held an option to develop up to 212 townhouses on parts of the brickworks site. In 1980 the first stage, comprising 20 houses on the eastern side of the study area (along Woolls and Schomburgk Street), was commenced. Work on 45 houses to the north-west of the study area (now Lane Poole Place) began the following year. At this time, the railway remnants were not recognised or registered as a heritage site.

A R Marr Pty Ltd was placed in provisional liquidation in January 1980, and in 1984 the Commonwealth Government accepted the surrender of the lease for the brickworks from the lessee, A R Marr Pty, and paid $1.1 million for its interests.[11]

10.5.1 Analysis

This phase relates to the use of the study area after it ceased operations as a brickworks. The post-operational phase of the Canberra Brickworks makes a limited contribution to the identified values of the place. There are no sites of archaeological potential related to this phase.

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Figure 14 Aerial view of the Brickworks site, 1972: note the demolition of the Brickworks Hostel (indicated)
Source: ACTPLA

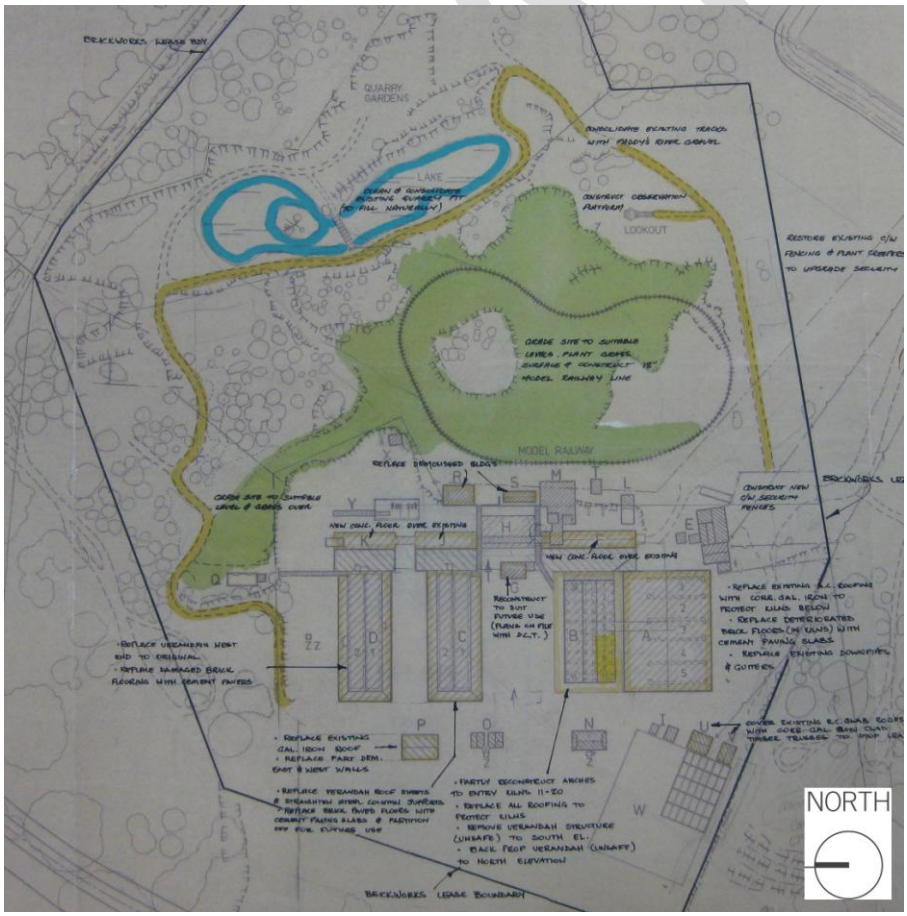


Figure 15 The A R Marr proposal for the Canberra Brickworks, c. 1977
Source: ACT Heritage Library



Figure 16 Aerial view of the brickworks site, 1980

11.0 Physical investigations

The historical analysis identified five areas of potential archaeological sensitivity within the study area. Physical investigations undertaken by NOHC confirmed these areas and also identified a further seven archaeological sites. All twelve sites are discussed below.

11.1 Predictive archaeological model

The core function of brick making in an industrial complex such as the Canberra Brickworks requires a network of interrelated sites and features that include domestic as well as industrial elements. Working from the core to the periphery, archaeological sites and features of heritage significance that may occur within the study area were predicted to include:

- Remains of the brickwork making process including kilns, flues, chimney stacks, conveyors, fan houses and raw material stockpiles;
- Remains of former dwellings including worker's camps, dormitories, houses and huts and associated infrastructure such as drainage;
- Remains of other buildings and structures such as stores, tanks for liquid storage (both above and underground), offices and workshops;
- Old fence lines, such as post and rail fencing; these may occur along inter- and outer-site boundaries;
- Transport infrastructure such as road and railway sites and features;

- Vegetation defining location of sites and features either as introduced plantings or clearings with vegetated borders

Structures of historical interest and heritage significance may be standing, ruined, buried, abandoned or still in use.

11.2 Survey coverage and visibility variables

The effectiveness of archaeological field survey is, to a large degree, related to the obtrusiveness of the sites being looked for and the quality of ground surface visibility. Ground surface visibility is a measure of the bare ground visible to the archaeologist during the survey. There are two main variables used to assess ground surface visibility - the frequency of exposure encountered by the surveyor, and the quality of visibility within those exposures. The predominant factors affecting the quality of ground surface visibility within an exposure are the extent of vegetation and ground litter, the depth and origin of exposure, the extent of recent sedimentary deposition, and the level of visual interference from surface gravels.

Visibility variables were estimated for all areas of survey within the study area. These estimates provide a measure with which to gauge the effectiveness of the survey and level of sampling conducted. They can also be used to gauge the number and type of sites that may not have been detected by the survey.

Visibility across the Canberra Brickworks site was of mixed quality. Vegetation growth and leaf litter across sites was the single largest contributing factor to poor visibility. Growth was either in the form of high growing grasses and weeds, or clusters of bushes and young trees, which at times impeded access as well as visibility. Visibility was low at those sites which have not been maintained (e.g. BRW6 and BRW2), and high at those which have been manicured (e.g. quarry and BRW1).

The built environment which forms the core of the complex was also a key contributor to poor visibility. It is assumed that any archaeology that may have survived the later construction of kilns and other structures in the precinct has been disturbed.

Overall, visibility was moderate, and the survey was able to obtain a comprehensive recording of archaeological sites and features. The individual sites have been described below.

11.3 Surface features

Twelve archaeological sites were identified within the brickworks site during the archaeological investigations. These sites comprised surface features and are described in detail below.

11.3.1 BRW1: Possible building platform and concrete features

A platform and a number of features including concrete and spoil are located on the south side of Denman Street, approximately 25m from the entrance to the brickworks. A vehicular track runs north-east to south-west on the western extremity of the site, and a fence line consisting of star pickets/pine posts and wire netting combined with barbed wire delineates the southern extremity. A small grove of trees are situated at the eastern end of the site. The site measures approximately 20m x 15m.

At the western end of the site there is a square concrete feature, approximately 1m x 1m, with an exposed top (Figure 17). This feature suggests a function associated with water, either for storage or drainage. Approximately 5m to the east of this square concrete feature is a visible line of grass die back, which suggests the presence of subsurface features. This line extends from north to south across the building platform that comprises the bulk of this site (Figure 18).

Site conditions are poor to fair. Two depressions identified within the platform suggest erosion or disturbance has occurred, while the in situ concrete features suggest a level of intactness. Visibility of this area was good, with only some low grass.

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Figure 17 View of BRW1 concrete feature, looking north
Source: NOHC



Figure 18 View looking north across BRW1, showing line of grass die off (centre left)
Source: NOHC

11.3.2 BRW2: Married quarters and Brickworks Hostel

This site is within an area that has been designated through historical records as the brickworks accommodation village.

A complex of structural features is located south of the brickworks fence line, and approximately 40m west of BRW1. The area is approximately 80m x 35m and extends southwards up a gentle slope to a road cutting that transects the southern portion of the site on an east-west alignment. A less formal vehicular track is situated along the same alignment as the more formal road, immediately to the south.

Site visibility was generally poor in this area with thick groves of blackberry bushes to the east, which also spread intermittently towards the west. This was interspersed with moderately dense patches of small saplings/trees, with dense grass throughout. A limited area had enhanced visibility due to a cleared path which ran through parts of the site and around a number of features. Occasional sawn off medium sized tree stumps were visible throughout the site.

The site is defined by a number of highly visible mounds of spoil and a platform. These mounds of spoil, if related to former structures on the site, suggest heavy disturbance and a poor to fair condition across the site generally. Various items of artefactual material are scattered throughout the area, such as sheets of tin, brick and tile fragments, concrete and bottle fragments. Some of the material is relatively modern, including old car parts and even a bicycle frame, suggesting dumping of rubbish not necessarily associated with the site.

Descriptions of identified individual features are provided below:

BRW2-A: Brick Feature and Mound

Situated at the western end of BRW2 and approximately 15m north of the road cutting, is a large mound of brick and concrete rubble covered in grassed topsoil atop a large rectangular brick feature. It measures approximately 6m x 2m, and up to 1 metre in height.

This brick feature is a substantial structural element of a former building and remains in situ unlike many of the other elements at this site. At the northern end of this structural feature is a large concrete lined drain or water trap, with remains of an iron grate (Figure 19). Brickwork around this feature, particularly the southern portion, shows signs of having been covered in tar or bitumen. Along the western side of the feature is a rectangular stall that is reminiscent of a fireplace or hearth recess (Figure 19). A piece of iron flue or furnace was identified as part of the spoil on this site, along with what appears to be a crumpled washtub (Figure 21). The bricks show a combination of different stamps and frog marks on their surface, including the early “CANBERRA C’WEALTH” stamp.

Slabs of brick and concrete are located around the feature, which are suggestive of walls or flooring remains, sheets of tin, iron girders and rods. A linear mound of rubble extends easterly from this main structural feature and is made up of cemented brick segments and other structural detritus.

This feature appears to correspond with the brickworks mess hall which was depicted in images from at least 1929.

BRW2-B: Metal spoil heap

A spoil made up largely of metal remains including tin, iron girders and rods, galvanized and non-galvanized pipes is situated approximately 15m east of BRW2-A (Figure 22). There is some brick material within this spoil, including what appears to be an in situ brick footing. There is also the occasional plank of milled timber. The northern side of this mound is bordered by a blackberry bush cluster.

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Figure 19 Detail of drain at northern end of BRW2-A
Source: NOHC



Figure 20 Detail of brick stall at BRW2-A
Source: NOHC



Figure 21 View looking wast across BRW2; note the washtub and brick stall to the west and rubble to the north
Source: NOHC



Figure 22 View looking east across BRW2-B
Source: NOHC

BRW2-C: Concrete slab

A concrete slab approximately 4m x 6m is located just south of the southern fence line of the brickworks at the western end of the site (Figure 23). The rendering is coloured red and has the remains of four toilet fittings running down the centre of the slab. The toilet bowls have been removed from the platform, although fragments of broken bowl and earthenware plumbing pipe exist around the slab (Figure 24). The alignment of the toilets suggest that the stalls were accessible from the northern side of the slab. A possible step or entrance way extends from the northern part of the slab in the centre. A stamped feature is evident in the north east corner of the slab suggesting a small closet, room or feature for what appears to be an ablutions block. The slab appears to be on the same alignment as BRW2-A, which is just further south. This structural feature appears to correspond with the brickworks ablution block which is depicted in images of this area from at least 1929. The ablution block suggests that it was more to do with the brickworks than it was to do with the accommodation of employees.

BRW2-D: Brick mound

Positioned just east of BRW2-C is a small mound made up largely of brick and brick fragments, along with rendered red brick (Figure 25). There are also segments or clusters of concrete blocks with broken red tile as aggregate. There is also the occasional piece of tin sheeting. It is possible, due to the red rendered brick, that this mound is a spoil heap for structural remains from BRW2-C.

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Figure 23 The concrete slab at
Source: NOHC



Figure 24 Remnant of one of the toilet fitting
Source: NOHC



Figure 25 Looking south-west towards BRW2-D
Source: NOHC

11.3.3 BRW3: Area of postholes and other remains

A complex of features that relate to various structures and infrastructure are located to the south of BRW2. This site covers approximately 100m x 50m. Visibility was fair to good due to patchiness of vegetation ranging from dense to light.

At the western extremity of the site is evidence of a modern "fringe dwellers" camp, with a hearth constructed of brick and concrete remains from structural features such as those encountered at BRW2. The hearth had been in recent use as evidenced by the condition of the fire remains within and the rubbish surrounding this feature. Evidence for a camp or rough shelter was also observed, with various planks nailed to trees and pallets repurposed for flooring or other means amongst a grove of young trees. Sheets of tin were also present and nylon rope tied around trunks in strategic places possibly for the use of attaching a tarpaulin or other such item for shelter purposes. Within the grove of saplings a circular feature with a diameter of approximately 10m was defined by postholes surrounding a large pallet like item in the centre (Figure 26). It is unclear whether the postholes predate the modern fringe camp. Early maps and plans suggest that this area to the west was originally a more ephemeral brickworks camp and then later into the twentieth century the location for dormitories or hostel like accommodation.

In proximity to the hearth and camp are mounds of structural spoil, consisting of brick and concrete, iron rods and metal sheeting, bottles and tin cans. To the east of the modern camp, and almost directly south from BRW2, a rectangular clearing was encountered. At the top of the slope to the south of the clearing a drainage line has been excavated, which runs approximately on an east-west alignment (Figure 27). No other structural features or remains were identified within this clearing between the drainage line and the northern border of the site. However, a slab timber fence or yard post is located at the northern end. The post itself appears to be early in origin, but has had modifications made to it by the addition of another slab bolted to the upright, and use of galvanized wire and nails, as opposed to non-galvanized iron nuts and bolts for other modifications (Figure 28). No other posts or holes were

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identified in the immediate vicinity. This clearing could have been the location of one of the hostels or dormitories.



Figure 26 Circle of post holes (indicated by pink flags), looking north
Source: NOHC



Figure 27 Drainage line at BRW3, looking west
Source: NOHC



Figure 28 Detail of slab post at BRW3
Source: NOHC

11.3.4 BRW4: Single men's quarters

A fenced yard area measuring approximately 80m x 80m is located to the south of BRW1. Defined by a star picket fence line with wire netting along the bottom portion and barbed wire on the upper portion, the yard is accessed by gates at the northern end from Denman Street and a gate in the south-west corner. Visibility was very good as the area is relatively clear of vegetation, with the exception of a light covering of low growing grass across parts, and the occasional low growing shrub and small tree. The yard rises up a gentle slope to the south. A layer of bitumen such as that used for road surfaces covers a good portion of the site (Figure 29) and this sits directly above a layer of bedrock, with only a thin layer of topsoil present in patches throughout the yard. No structural features were identified, although fragments of window glass were found near the northern entrance to the site (Figure 30). The condition of this area is good.

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Figure 29 Asphalted area at BRW4, looking east
Source: NOHC



Figure 30 Window glass at BRW4
Source: NOHC

11.3.5 BRW5: Clay feature and rubble

To the immediate west of the brickworks kilns is a silty clay feature up to 50m in diameter and 1 to 2m high, which appears to be a flat topped mound or stockpile of this resource (Figure 31). It is possible that it is a feature that has been created from earthworks in this area, however it does not sit on the same horizon as other surrounding features, such as the brickworks kilns. The location of this site is close to the former creek that fed into the precinct from its north-west corner. The silty clay material is different to any of the top soils and sediments around the rest of the precinct. Visibility of this area was good and the condition of this feature is good.

To the west of the mound is a series of depressions scattered throughout with brick and concrete rubble (Figure 32). These depressions are located between the mound to the east, and the railway remnants to the west. They could be associated with a former structure in the vicinity or rubble that has been

dumped from another location. An aerial image from 1950 (Figure 33) shows that a rectangular structure was once located in this vicinity. The overall condition of this element is generally fair and visibility is good.



Figure 31 Clay mound feature at BRW5, looking west
Source: NOHC

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Figure 32 Rubble and depressions at BRW5
Source: NOHC

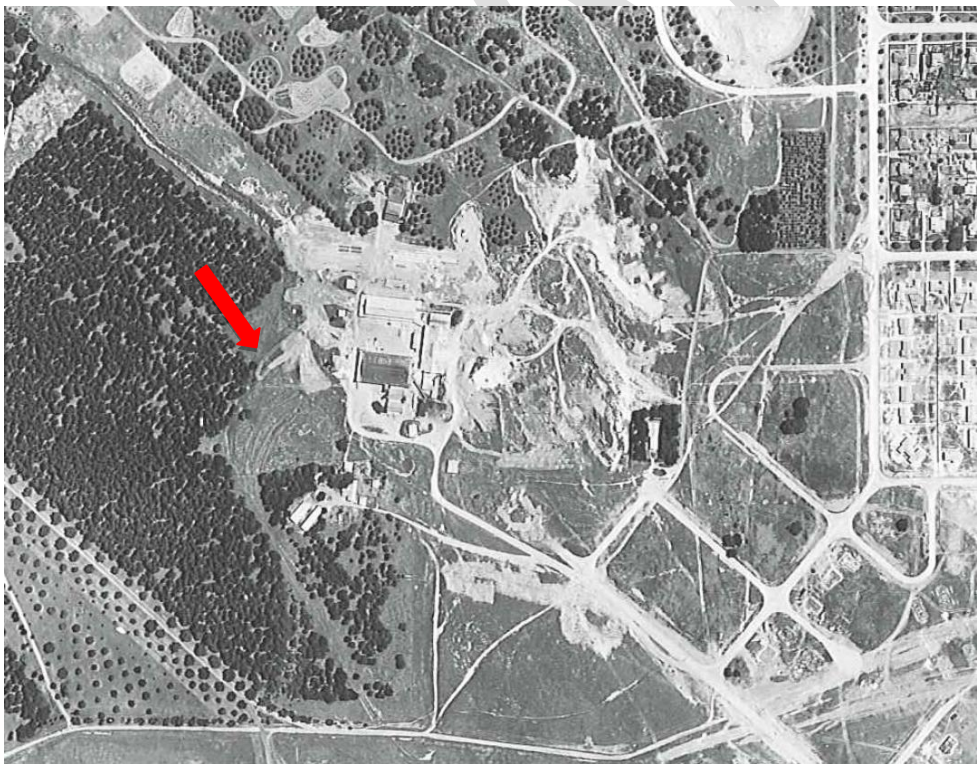


Figure 33 Aerial photograph of the Brickworks, 1950; the rectangular feature is indicated
Source: ACTPLA

11.3.6 BRW6: Rubble heap/refuse dump

This site is located at the north-west section of the precinct and consists of a mix of brick and concrete rubble located within a depression at the base of trees (Figure 34). The remains could be associated with a former structure in the vicinity or rubble that has been dumped from another location. An aerial photograph from the 1960s shows that a rectangular structure was once located in this vicinity. Visibility was poor in this area due to high growing vegetation in the form of grasses and weeds. Condition is fair.



Figure 34 Brick and concrete rubble surrounding trees at BRW6, looking north
Source: NOHC

11.3.7 BRW7: Quarry

The brickworks quarry is a large site located to the east of the brickworks buildings. Visibility is generally good across the quarry zone with features and elements able to be clearly identified through the low growing and manicured grass coverage.

Further east and up an incline, there are a number of depressions amongst a grove of pines along the edge of the quarry cliff (Figure 35). These depressions are uniform in size, approximately 1m in diameter and appear to be in a sequence. The historic aerial dating to 1950 (Figure 33) shows a series of circular features similar to these depressions extending west to east up the slope in a double row. The function or purpose of these depressions is unknown. On the eastern side of the quarry zone to the north is an example of an in ground circular tank that has been back filled with brick rubble, approximately 3 metres in diameter (Figure 36). This tank does not resemble the depressions in the south of the quarry in scale and known purpose.

At various locations along the quarry wall, particularly the eastern side, brick rubble has been back-filled against the face (Figure 37). This is either an example of disposing of seconds and damaged bricks, or to provide something of a retaining wall for the cliff face. The exactness of the placement suggests the latter.

A number of features and elements exist within the quarry floor itself. Starting at the south end of the quarry floor, a raised embankment of earth runs along the eastern contour of the quarry wall. This

feature belongs to a much later use of the brickworks as a tourist destination in the form of a model railway.

In the middle of the quarry floor are two mounds that have been covered with topsoil and grassy vegetation. Aerial imagery from the 1960s (Figure 38) shows a structure in the form of a large shelter or shed in the same location. These mounds could be evidence of this structure and its contents. This also confirms that there is likely to be intact subsurface material beneath these mounds dating to the original quarrying.

Along the north eastern edge of the quarry, the floor has been further excavated to create a pond or lake. This excavation dates to the time the brickworks precinct was a tourism facility. The quarry face to the west of this pond or lake in the north, shows stratigraphy that depicts a disposal event that has subsequently been capped by spoil from either the excavation of the pond/lake or from other areas. A layer of brick, concrete, glass, and iron exists along with a line of charcoal and burnt material approximately a metre below the surface (Figure 39).

The condition of the quarry is very good and its level of intactness is the highest standard when compared with other archaeological sites within the precinct.



Figure 35 Depression on south side of quarry edge
Source: NOHC



Figure 36 Tank at north-eastern edge of quarry, looking south
Source: NOHC



Figure 37 Rubble backfill along north-eastern edge of quarry face, looking east
Source: NOHC

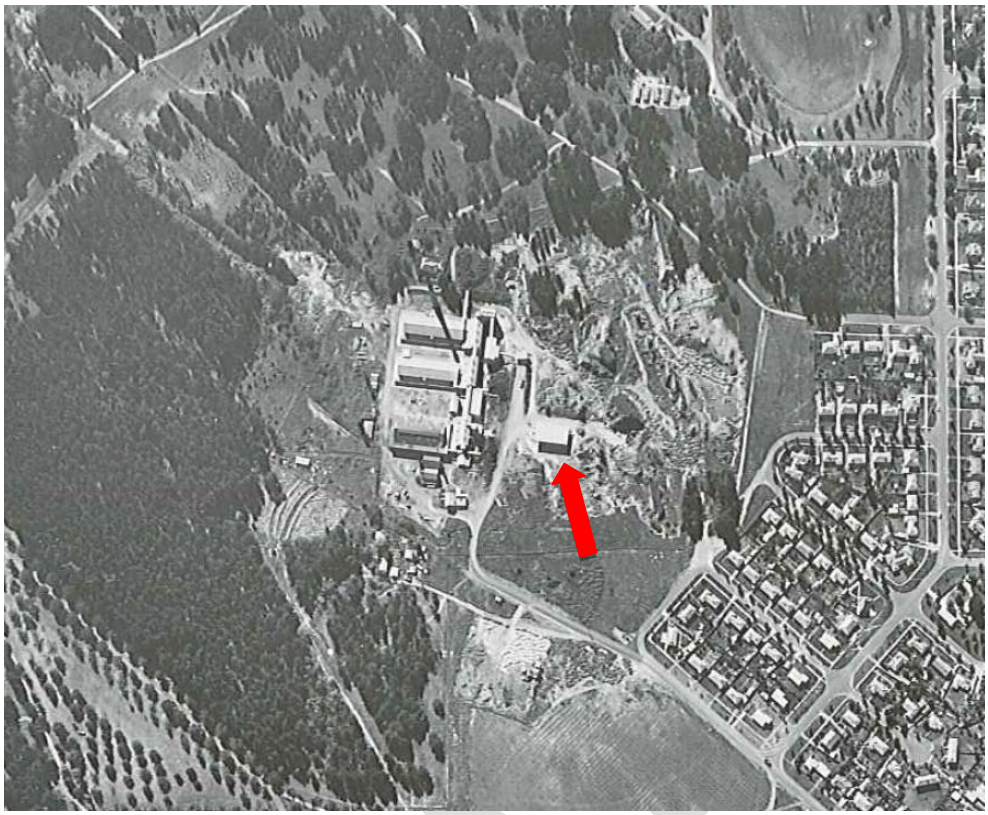


Figure 38 Aerial photograph of the Brickworks, 1961; the shelter is indicated
Source: ACTPLA



Figure 39 Quarry face showing layer of rubble and charcoal at northern end of quarry
Source: NOHC

11.3.8 BRW8: Old kiln and dormitories

The temporary brickworks was established in 1913. By August of that year, four open kilns were in use. This 'Old Kiln' area was located to the south-east of the permanent brickworks and a dormitories building was also located to the immediate north of the temporary kilns. These structures are likely to have been demolished by the mid-1920s.

Analysis of site plans and aerial photography demonstrates that this area has undergone some disturbance since the demolition of the temporary kilns and dormitory. Buildings can be seen in aerial images from the 1950s and car parking was introduced in the vicinity in the 1960s-70s, which involved the laying of concrete. This was removed by 1980. Along with the vehicular track that exists now, there are also occasional fragments of in situ concrete slab that are possibly associated with structures postdating the early kilns. The condition is assessed as poor to fair and likelihood of subsurface features for early kilns is low.

Archaeological deposits pertaining to built form from this era would be expected to comprise footings and machinery remnants. Material discard would be expected to be items of an industrial nature with the potential for some domestic material related to the dormitories (Figure 40).

11.3.9 BRW9: Cottage, stables, coal store

A cottage, with associated stable and coal store, was built c. 1913 to the north-east of the brickworks as part of the first stage of construction of the permanent brickworks. This cottage was demolished by 1947. The location of the cottage and outbuildings has been heavily trafficked over time, being located on a key route between the quarry pit and kilns and in close proximity to the primary crusher house and the elevator/conveyor. The site of the cottage and its outbuildings is therefore likely to have been disturbed by the introduction of roadways to the east of the kiln and machinery shops as a result of successive remodelling of the brickworks.

Material discard would generally be expected to be of a domestic nature, though there may be some industrial materials related to the stables and coal store. There may also be evidence of timber post holes or footings.



Figure 40 Location of the old kiln and dormitories looking east
Source: Lovell Chen

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11.3.10 BRW10: Railway remnants

The brickworks railway operated between 1923 and 1927, and all tracks had been removed by 1929. Evidence of the railway siding, in the form of cuttings in the landscape located to the south-west of the brickworks, could be seen in aerial views of the site well into the 1970s and are still evident (Figure 41 and Figure 42). Self-seeded vegetation has since reclaimed much of the area. Although all remnants of the track were removed in the 1920s, and a period of 90 years has elapsed since then, there is some limited potential for archaeological evidence that would enhance an understanding of the railway and its operation.

The potential for subsurface remains relating to the railway, including drainage channels, is low, but cannot be discounted. Potential archaeological features related to the railway may include the railway cutting, timber sleepers, iron bolts and metal rails.



Figure 41 Cutting in landscape showing the original alignment of the brickworks railway
Source: Lovell Chen



Figure 42 Cutting in landscape showing the original alignment of the brickworks railway
Source: Lovell Chen

11.3.11 BRW11: Railway siding (extension to the north)

The railway siding extended into the brickworks site and terminated to the north and south of the original Staffordshire kiln. Aerials indicate that part of this land was later covered by the concrete slab for the extrusion plant, however there is some potential for archaeological evidence.

There is some potential for the evidence of tracks extending to the north and south of the Staffordshire kiln. Potential archaeological features related to the railway may include the railway cutting, timber sleepers, iron bolts and metal rails.

11.3.12 BRW12: Flues/subsurface workings

Underground flues and workings connected the kilns to their associated fan stacks. These are understood to still remain in situ and are unlikely to have been disturbed.



Figure 43 View looking east over the extrusion plant, part of the northern extension to the railway reserve
Source: Lovell Chen

12.0 Findings

Based on the research and archaeological investigations conducted for this report, 12 areas of archaeological potential have been identified (Figure 44):

BRW1: Building platform and concrete features

BRW2: Married quarters and Brickworks Hostel

BRW3: Area of postholes and other remains

BRW4: Single men's quarters

BRW5: Clay feature and rubble

BRW6: Rubble heap/refuse dump

BRW7: Quarry

BRW8: Old kiln and dormitories

BRW9: Cottage, stables, coal store

BRW10: Railway remnants

BRW11: Railway siding extension (to north)

BRW12: Flues/subsurface workings

The archaeological potential of each area is discussed below.

Area	Comment	Archaeological potential
BRW1 Building platform and concrete features	This feature suggests a function associated with water, either for storage or drainage. The bulk of the feature remains below ground. Site condition is poor to fair, with two depressions within the platform suggesting a level of erosion or disturbance. Even so, the in situ features of concrete, including the square feature and the platform remnants, suggest a level of intactness.	Moderate archaeological potential
BRW2 Married quarters and Brickworks Hostel	The married quarters, comprising a mess hall and a number of smaller sleeping quarters, was built to the south-west of the brickworks in the 1920s. This was replaced in the 1940s by the Brickworks Hostel, at least part of which appears to have been built on the site of the married quarters. The hostel was demolished in the 1970s. This area has remained undisturbed since the demolition of the hostel, and above-ground footings/physical evidence were located at the site in 2010 and 2016. Finds have the potential to inform an understanding of the daily lives and living conditions of the workers who were employed at the brickworks.	High archaeological potential.
BRW3 Area of postholes and other remains	Early maps and plans suggest that this area to the west was originally a more ephemeral brickworks camp and then later into the twentieth century the location for dormitories or hostel like accommodation. Condition of site is good.	High archaeological potential

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Area	Comment	Archaeological potential
BRW4 Single men's quarters	The single men's quarters was located on the south side of Denman Street in close proximity to the entrance of the brickworks site. While the exact location has not been determined, it is possible that it was in the same location as the square expanse identified in the 1961 - 1980 aerials. If so, there is limited potential for archaeological remains as the site has been relatively disturbed.	Low archaeological potential
BRW5 Clay feature and rubble	Clay feature: It is possible that it has been a feature created from earthworks in this area, however, it does not sit on the same horizon as other features surrounding, such as the Brickworks kilns themselves. The condition of this feature is good. Rubble: The remains could be associated with a former structure in the vicinity or rubble that has been dumped from another location. An aerial image from 1950 shows that a rectangular structure stood in this vicinity. The overall condition of this element is generally fair	Low archaeological potential
BRW6 Rubble heap/refuse dump (including clay feature)	The land to the west of the kilns was quarried before being converted into a rubble heap/refuse dump by the 1940s. The man-made modification of this area is discernible in the aerial photography of the site. The use of this area as a rubble heap/rubbish dump means that there is potential for some refuse of an industrial nature to remain sub-surface. This area was overlaid with concrete by the 1970s, which has since been removed. It is possible that these works disturbed any sub-surface remains.	Low archaeological potential
BRW7 Quarry	In 1910, King O'Malley announced Government plans for the construction of a brickworks to serve the Federal Capital. In July 1912, the area at Yarralumla was gazetted and development of the site began in 1913. A detail survey plan of 1916 shows the early configuration of the quarry to the east of the brickworks buildings. Unsurprisingly, this area developed and changed throughout the operation of the site. The condition of the quarry site today ranges from poor to fair and comprises fragments of in situ concrete slab and a number of depressions along the edge of the quarry cliff.	High archaeological potential
BRW8 Old kiln and	The temporary brickworks was established in 1913. By August of that year, four open kilns were in use. This 'Old Kiln' area was located to the south-east of	Low archaeological potential.

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Area	Comment	Archaeological potential
dormitories	the permanent brickworks and a dormitories building was also located to the immediate north of the temporary kilns. These structures are likely to have been demolished by the mid-1920s. Analysis of site plans and aerial photography demonstrates that this area has remained relatively undisturbed since the demolition of the temporary kilns and dormitory. Some car parking was introduced in the vicinity in the 1960s-70s, which involved the laying of concrete. This was removed by 1980. The area is located in close proximity to the main access road leading to the brickworks, and as a result, there may have been some disturbance through vehicle movement. No other land disturbance appears to have occurred here.	
BRW9 Cottage, stables, coal store	A cottage, with associated stable and coal store, was built c. 1913 to the north-east of the brickworks as part of the first stage of construction of the permanent brickworks. This cottage was demolished by 1947. The site of the cottage and its outbuildings is likely to have been disturbed by the introduction of roadways to the east of the kiln and machinery shops as a result of successive remodelling of the brickworks.	Low archaeological potential
BRW10 Railway remnants	The brickworks railway operated between 1923 and 1927, and all tracks had been removed by 1929. Evidence of the railway siding, in the form of cuttings in the landscape located to the south-west of the brickworks, could be seen in aerial views of the site well into the 1970s. Self-seeded vegetation has since reclaimed much of the area. Although all remnants of the track were removed in the 1920s, and a period of 90 years has elapsed since then, there is some limited potential for archaeological evidence that would enhance an understanding of the railway and its operation.	Moderate archaeological potential
BRW11 Railway siding extension (to north)	The railway siding extended into the brickworks site and terminated to the north and south of the original Staffordshire kiln. Aerials indicate that part of this land was later covered by the concrete slab for the extrusion plant, however there is some potential for archaeological evidence.	Moderate archaeological potential
BRW12 Flues/subsurface workings	Underground flues and workings connected the kilns to their associated fan stacks. These are understood to still remain in situ and are unlikely to have been disturbed.	High archaeological potential

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AREAS OF ARCHAEOLOGICAL POTENTIAL

SITE	NAME
BRW1	Building platform and concrete features
BRW2	Married quarters and Brickworks Hostel
BRW3	Area of postholes and other remains
BRW4	Single men's quarters
BRW5	Clay feature and rubble
BRW6	Rubble heap/refuse dump
BRW7	Quarry
BRW8	Old kiln and dormitories
BRW9	Cottage, stables, coal store
BRW10	Railway remnants
BRW11	Railway siding extension (to north)
BRW12	Flues/subsurface workings

LEVELS OF ARCHAEOLOGICAL POTENTIAL

- high
- moderate
- low
- study area

Figure 44 Areas of archaeological potential at the study area: the Canberra Brickworks and environs is indicated by the solid red line

13.0 Next steps

This report has identified areas where historical archaeological remains may be present at the study area and satisfies the conditions of Policy 15, as outlined in the Canberra Brickworks Conservation Management Plan (2010).

In order to manage the potential archaeological sensitivity of the site, and the consequent possibility of archaeological remains being disturbed during future sub-surface works within the study area, archaeological management protocols are recommended. This is in accordance with the *Heritage Act 2004,* which states that, under Section 74 it is an offence to engage in conduct that diminishes the heritage significance of a place or object. Section 76 provides exceptions to Section 74 where the person engages in conduct in accordance with a number of listed processes. This includes obtaining an Excavation Permit, which must be approved by ACT Heritage. While different methods of archaeological management are proposed according to their level of archaeological potential, one Excavation Permit will be required which will cover all archaeological works, including monitoring. This Excavation Permit will set out the proposed archaeological methods (outlined below) for when the archaeological material is encountered and these methods are to be agreed by ACT Heritage.

Areas of moderate-high potential

Areas of moderate to high archaeological potential comprise those parts of the study area which have not been subject to extensive and intensive demolition, site preparation and construction works which have occurred elsewhere within the site during the development of the Brickworks. It is recommended that, prior to any works or development in these areas, a programme of subsurface archaeological testing be implemented for the purposes of determining the actual archaeological values of these areas. As well as identifying the actual level of archaeological sensitivity, testing will also assist in defining the extent of areas which may require further investigation after the completion of the testing programme. As mentioned above, an Excavation Permit will be required for these works.

There are two potential outcomes of the testing programme:

- Areas of moderate to high archaeological significance are identified which will require further investigation through controlled open area excavation
- The actual values of the zone or parts thereof of the area are determined to be of low archaeological significance

In the case of the first outcome consultation and negotiation with ACT Heritage will determine the extent of the area to be subject to detailed manual excavation.

In the second case, areas determined to be of low archaeological significance may either not be subject to further investigation or may be incorporated within the area subject to monitoring (see below).

Areas of low archaeological potential

Areas of low archaeological potential within the site have been subject to significant disturbance through the extensive development and remodelling of the Brickworks site during its operation. No archaeological testing programme is recommended for these areas. Rather a programme of monitoring is recommended for the purposes of providing an assessment of the actual archaeological values of these areas. As mentioned above, an Excavation Permit will be required for these works.

Where the monitoring programme reveals that no or a low potential for historical archaeological remains exists it is recommended that the monitoring programme be replaced by a watching brief, whereby a suitably qualified archaeologist will attend the site as and when archaeological materials are encountered for the purposes of documentation and assessment. This, or a similar, protocol will be agreed upon in consultation with ACT Heritage during the application and approval of the Excavation Permit.

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In the event that the monitoring programme identifies that the archaeological potential of these areas is greater than first predicted or where isolated pockets of relatively intact archaeological materials area present these occurrences will be dealt with as per the requirements outlined above for areas of moderate to high potential.

It is recommended that any works to the railway siding area, whether archaeological or future development, are minimal and do not alter the legibility of the modified landscape as it remains evident today. It is noted however that this area falls with a bushfire prone area, and for bushfire management reasons, removal of some vegetation may be necessary to allow for land management.

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1 ACT Heritage Council, Cultural Heritage Reporting Policy, 1 July 2015, accessed via www.environment.act.gov.au, 6 January 2016.

2 Navin Officer Heritage Consultants Pty Ltd, Canberra Brickworks, Yarralumla, ACT, Stage 1: Aboriginal Cultural Heritage Assessment, 14 August 2014, Executive Summary.

3 ACT Heritage Council, Heritage Advice to Navin Officer Heritage Consultants, 10 September 2014.

4 Lovell Chen, Canberra Brickworks Conservation Management Plan, April 2010, p. 240.

5 ACT Heritage Council, *Heritage Act 2004*, p.6.

6 ACT Heritage Council, *Cultural Heritage Reporting Policy*, July 2015, p.8.

7 SMEC, *Preliminary Geotechnical Site Investigation for the Canberra Brickworks,* prepared for Land Development Agency, 2013.

8 SMEC, *Preliminary Geotechnical Site Investigation for the Canberra Brickworks,* prepared for Land Development Agency, 2013.

9 AECOM, *Stage 1 Ste Investigation Report for Canberra Brickworks Precinct,* prepared for Land Development Agency, 2016.

10 ACT Heritage Council, *Heritage (Decision about Registration for Westbourne Woods, Yarralumla) Notice 2011*, p.5.

11 Lester Firth Associates Pty Ltd, Old Canberra Brickworks Conservation Plan, June 1986, Section 2.1.5.

Appendix G

Yarralumla Brickworks Inspection Report, Sellick Consultants, December 2019









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SELLICK CONSULTANTS PTY LTD
INSPECTION REPORT





Job Title: **Condition Assessment Report**

Job Location: **Yarralumla Brickworks**

Client: **Doma Group**

Reference #: **191148**

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Revision	Issue	Prepared By	Approved By	Date
A	Draft	William Kendall	Don McInnes	05.12.2019
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D	Final	Don McInnes	Darren Sault	20.07.2021
E	Final	Don McInnes	Darren Sault	06.08.2021
F	Final	Don McInnes	Darren Sault	11.08.2021

EXECUTIVE SUMMARY

Sellick Consultants has undertaken a dilapidation survey and report of the existing Old Canberra Brickworks as instructed by David Carey of The Doma Group, as a function of the redevelopment.

The buildings were generally found to be in a reasonable condition given the age and lack of regular maintenance, with isolated areas requiring immediate action to secure, namely loose roof and wall sheets

Given the ongoing deterioration of the structure, early works for repairs of the building fabric and structure will need to be considered as detailed in the report.

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1.0 INTRODUCTION

At the request of David Carey of Doma Group, a dilapidation assessment of the existing brickworks was carried out on the 14th November 2019.

The brickworks, known as the Old Canberra Brickworks was originally built in 1914 and served as the main brick manufacturing facility for the Nation's Capital until its closure in 1976.

The brickworks has since been placed on the heritage register of significant value to the heritage of Canberra.

The Doma Group have entered into contract with the Suburban Land Agency (SLA) to redevelop the site into a mixed-use precinct incorporating the heritage value of the existing buildings.

As a function of the redevelopment, a dilapidation report was prepared for the ACT Government by Northrop Consultants and is attached in Appendix A, from which Sellick Consultants have been engaged by The Doma Group to review and update as part of the Conservation Management Plan.

2.0 OBJECTIVE/SCOPE

The objective of this report is to review Northrop's initial report and prepare an updated dilapidation report incorporating any new findings.

The report is to comment not only on the structural condition but recommend areas requiring further investigation, immediate work to prevent further deterioration, and safety concerns.

It should be noted that areas of various buildings were not accessible, therefore did not form part of this report.

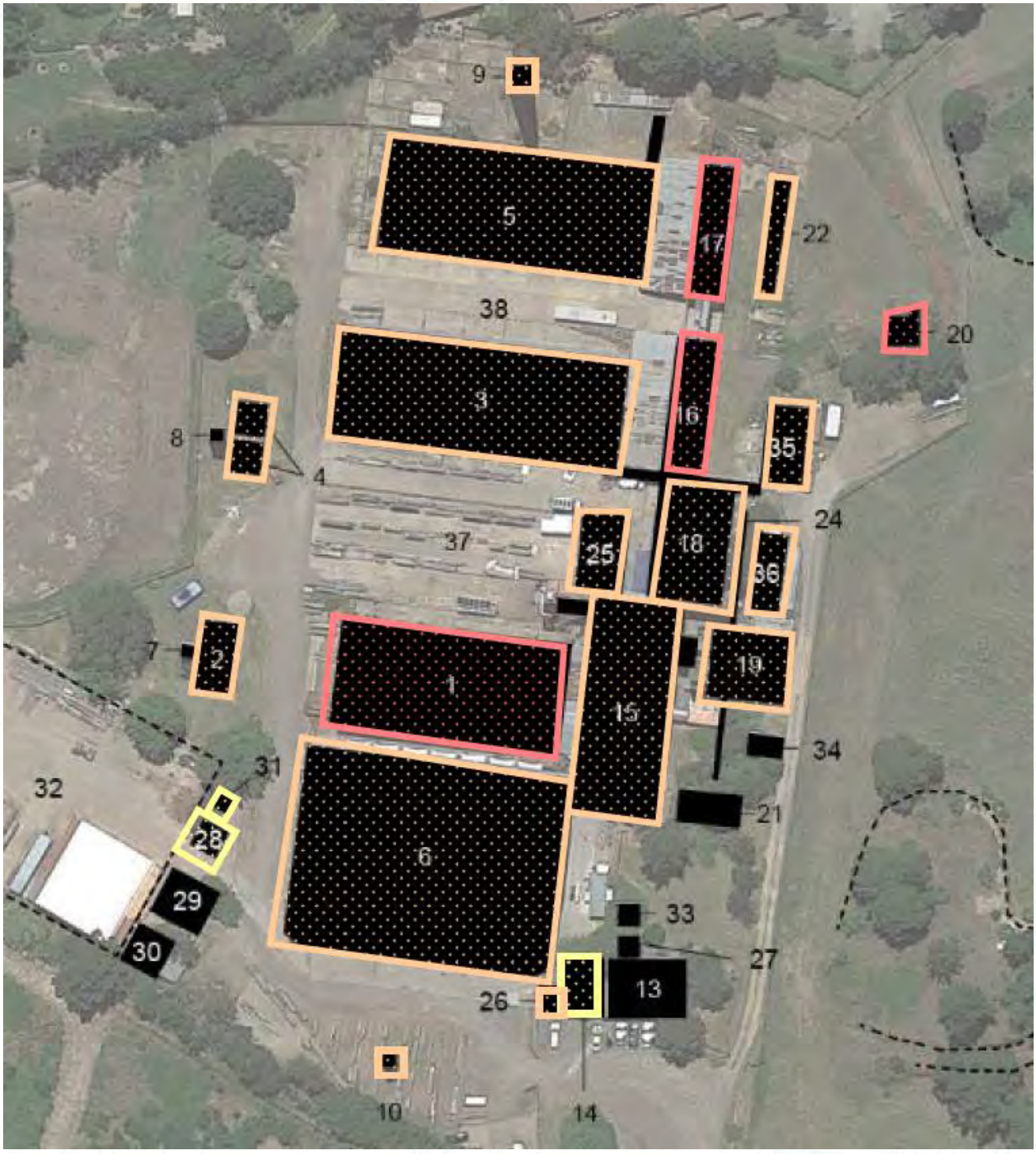
The table below summarises the access limitations for each building and provides a brief comment on the urgency and severity of rectification works required. A full description of recommended rectification works for each building can be found in the body of the report.

Heritage ID	Structure Description	Access	Comment
14	Power house	No internal access	Inspect internal prior to opening to public
6	Downdraft kilns	Full access	Kilns require rebuilding to the entry
1	Staffordshire Kiln	Full access	Moderate rectification works Access to some floor areas to be restricted
3	Hardy Patent Kiln 1	Full access	Moderate rectification works
5	Hardy Patent Kiln 2	Full access	Moderate rectification works
9	Tall chimney stack	Inspected from ground level only	Closer inspection of upper chimney recommended
16 & 17	Machine bays	No access to upper floor areas	Immediate rectification works Loose roof sheets are a hazard Foot traffic not recommended on roof
18	Workshop	No access to upper floor areas	Upper areas require inspection
35	Workshop, Brickwork building	Full access	Minor rectification works
15	Machine bay	No access to upper floor areas	Moderate rectification works
19	White pan room, Steel framed building	Fenced off - no internal access	Moderate rectification works Internal areas require inspection
28 & 31	Storage building & Amenities Block, Brickwork buildings	Roof framing not visually assessed	Inspect roof if required
2	Fan house	Roof framing not visually assessed	Inspect roof if required
4	Fan house	No access to tunnel	Inspect tunnel if required
25	Amenities Block	No internal access	Inspect internal if required
10	Southern Chimney	Inspected from ground level only	Upper area may require rectification, closer inspection recommended
20	Primary Crusher House, Steel framed building	No internal access	Access to floor areas to be restricted
22	Elevator/ Conveyor	Full access	Minor rectification works
26	Downdraught Kilns Control Room	Full access	Minor rectification works

The scope being limited to a visual assessment only and did not extend to any detailed method or repair, invasive work, analytical assessment or review of historical records.

3.0 CONDITION ASSESSMENT

The below site plan will be used as reference:



Remediation Importance Key

Remediation Importance 1	No structural concern, reinstate as required.
Remediation Importance 2	Reinstatement required as part of the construction works
Remediation Importance 3	Immediate rectification recommended.

3.1 Building 26: Downdraft Kilns Control Room

Building description:

- Single storey, brickwork construction
- Timber framed tiled roof

Access was limited to the external of the building only.

Element	Condition	Remediation Requirement
Brickwork	• Brickwork was generally in reasonable condition.	Ensure brickwork weatherproof.
Windows	• Windows and doors were boarded up.	Ensure doors and windows are weatherproof.
Roof Roof access was limited	• Timber fascia weathered in areas. • Roof tiles in sound condition. • Roof sheets appeared to be in reasonable condition.	Timber fascia may require replacement in areas. Ensure roof is weatherproof.
Internal	*No access to internal structure.*	Internal structure to be inspected prior to opening to public.
External	Retaining walls have been compromised, requiring rebuilding/ replacement	Area will need to be cordoned off.



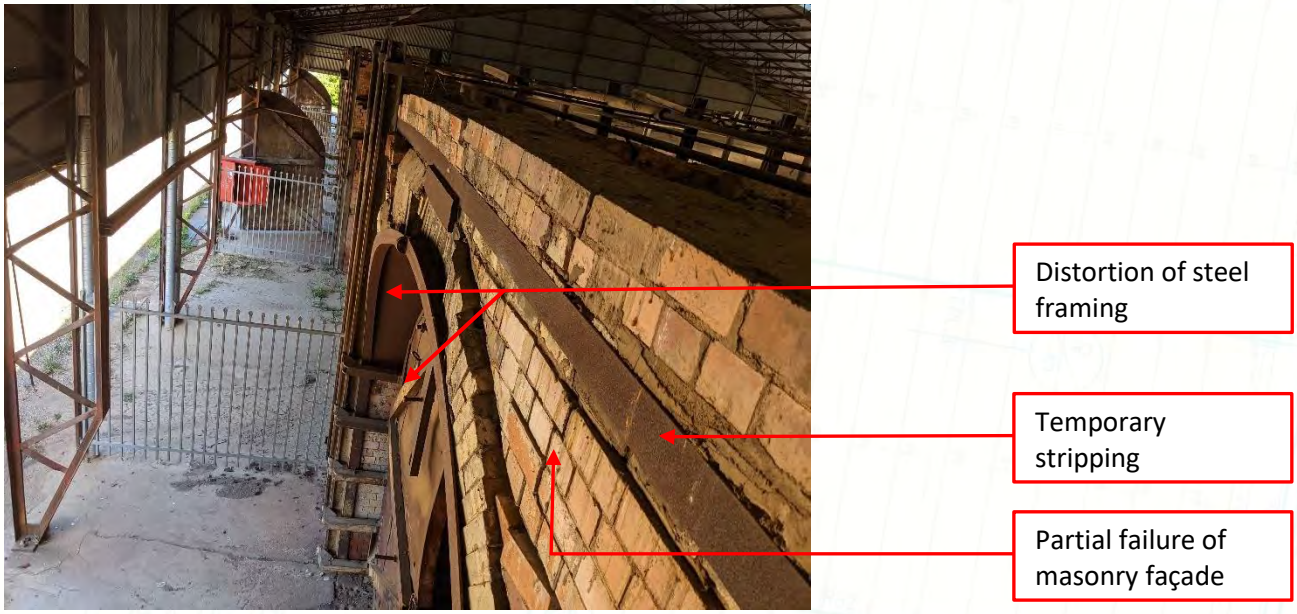


3.2 Building 6: Downdraft Kilns

Building description:

- Roof framing is of open web trusses, with the same as columns acting as a portal frame. Roofing purlins are of timber supporting metal clad roof. *Note: The roof and associated framing is to be removed and does not form part of this report.*
- Kilns are of full masonry, with structural steel rail girder wall ties and rod tension ties over.

Element	Condition	Remediation Requirement
Structural steel	• Steelwork in reasonable condition. • Areas of localised impact damage present. • Bracing angles missing in some locations.	To be demolished
Cladding	• The roof and wall sheeting has been replaced more recently. • Wall sheeting is damaged in some areas. • Sarking has deteriorated in areas.	To be demolished
Masonry entry Façade to Kiln's	• Lateral movement has occurred resulting in failure of the façade which has been retro fitted with steel strapping.	The masonry to the entry will require rebuilding.
Door Frame and Doors	• Door framed and doors showed signs of significant distortion	The frame requires full replacement as with the doors, or fixed in place.
Wall ties	• The steel framing was in fair condition	Repainting of steelwork is required
Main arch masonry of Kiln	• Fair conditions with isolated units dislodged	Rectification of loose masonry units required, with method to be developed



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Entry

Development of severe crack to roof of kiln



Wall ties in fair condition


Damaged wall sheeting


Steel trusses
Kilns


Deteriorated sarking

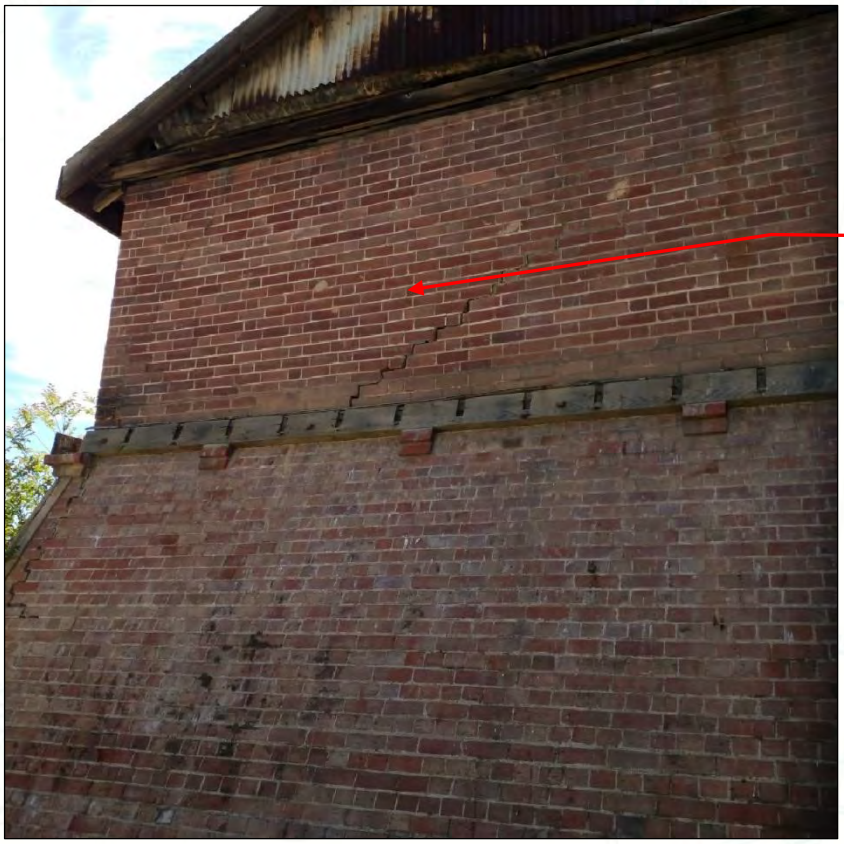
3.3 Building 1: Staffordshire Kiln

Building description:

- Two storey building
- Lower level is full masonry brickwork construction housing 20 kilns
- Upper floor is an open plan with firing holes throughout and brick veneer walls to perimeter.
- Steel framed truss sheet roof
- Lean-to timber framed sheet roof and timber framed floor to eastern side of building

Element	Condition	Remediation Requirement
Cladding	• Wall sheeting to areas of structure had severe deterioration. Sheet fixings noted to be loose in some areas. • Cladding is not weather-proof.	Replace deteriorated wall sheeting, provide new screw fixings. Seal up windows.
Brick veneer	• Reasonable condition for age of structure. • Areas of cracking to brickwork noted.	Ensure brickwork veneer is weatherproof.
Roof	• Roof sheeting appears to have been replaced more recently.	Ensure roof is weatherproof.
Brickwork kilns	• The majority of the entry archways had loose bricks and voids in the brickwork bedding – resulting in displacement of the arch. • The entry arches have displaced laterally in areas which is likely due to swelling of the bricks. • The internal areas of the kilns were generally in sound structural condition, some loose bricks were noted.	**Option 1 -** Bricks locally loose, no overall displacement evident: Reinstate locally displaced bricks to match existing. **Option 2 –** Areas of brickwork loose with significant displacement: Reinstate areas of loose brickwork if practical. If reinstatement not possible, provide structural steelwork support.
Upper floor	• Firing holes throughout floor create a trip hazard. • Steelwork bracing has buckles in some areas, areas of bracing missing and connections loose.	Firing holes to be covered and floor made free of trip hazards. Bracing of structure to be reinstated. Steel roof structure should be assessed further by structural engineer and upgraded where required.
Upper floor roof (eastern side)	• Lean to roof sheets have deteriorated and sheet fixings are loose. • Timber roof framing has weathered in some areas. • Louvre windows broken and not weatherproof.	Replace roof sheet fixings, replace roof sheets as required. Replace badly weather damaged roof framing Rectify louvre windows.
Timber framed floor (eastern side)	• Timber floor structure significantly weathered, timber connections not adequate in some locations.	Areas of floor structure not safe for access. Access of severely weather flooring should be restricted until rectified.


Deteriorated wall sheeting


Stepped cracking to brick veneer wall


Displacement of arch
Voids in brickwork bedding


Arch generally in sound condition
Loose bricks in areas


Buckled roof brace
Firing holes


Newer roof sheeting
Deteriorated roof sheeting (lean-to roof)


Weathered flooring


Joist and floorboards to be demolished

3.4 Building 3: Hardy Patent Kiln 1

Building description:

- Two storey building.
- Lower level is a full masonry brickwork construction housing kilns.
- Timber lean-to awning around perimeter of building.
- Upper floor is an open plan with firing holes throughout.
- Steel framed truss roof with timber purlins. Light weight sheet roof and walls.

Element	Condition	Remediation Requirement
Cladding	• Wall sheeting to exterior of structure in reasonable condition. • Majority of windows are broken.	Replace any loose sheet fixings. Seal up windows.
Roof (Exterior)	• Roof sheeting appears to have been replaced more recently and is in reasonable condition.	Ensure roof is weatherproof. Replace any loose sheet fixings.
Brickwork kilns	• Most of the entry archways had loose bricks and voids in the brickwork bedding – resulting in displacement of the arch. • Several of the entry archways (mainly eastern and western ends) have severe cracking and displacement. • Loose bricks were noted throughout the internal kiln areas.	**Option 1 -** Bricks locally loose, no overall displacement evident: Reinstate locally displaced bricks to match existing. **Option 2 –** Areas of brickwork loose with significant displacement: Reinstate areas of loose brickwork if practical. If reinstatement not possible, provide structural steelwork support.
Upper floor	• Steel trusses are in reasonable condition. Connections are generally welded and are in sound condition. • Firing holes throughout floor create a trip hazard. • Timber battens have been installed to underside of purlins which may have been used to support a ceiling lining. Several battens were loose.	Firing holes to be covered and floor made free of trip hazards. Remove timber battens if not required. If ceiling lining is to be installed, battens shall be secured appropriately. Steel roof structure should be assessed further by structural engineer and upgraded where required.
Awnings	• Roof sheeting is generally in reasonable condition. • Timber rafters are in average condition, some rafters have weather damage. • Steel fascia beam has corroded in areas. Connections between steel fascia and posts has failed in some areas. • Posts connections loose in areas.	Timber rafters shall be replaced as required. Rafter-fascia connection to be upgraded. Steel posts connections to be rectified as required.


Hole in roof
Broken windows


Demolition of this section should be considered
Additional brickwork supporting wall has been provided. Supporting wall is cracking
Severe displacement of arch.



Loose bricks throughout

Cracking to brick wall



Internal structural generally sound overall, loose bricks noted

Displacing entry arch


Steel framed trusses
Firing holes


Timber rafters
Rafter to fascia connection weather damaged
Timber struts and under purlin

3.5 Building 5: Hardy Patent Kiln 2

Building description:

- Two storey building.
- Lower level is a full masonry brickwork construction housing kilns.
- Timber lean-to awning around perimeter of building.
- Upper floor is an open plan with firing holes throughout.
- Timber framed truss roof with timber purlins. Light weight sheet roof and walls.
- Fire damage has occurred to an area upstairs.
- There is a steel framed walkway located to the North side of the building.

Element	Condition	Remediation Requirement
Cladding	• Wall sheeting is in poor condition. Sheets are loose in areas. • Windows and doors are poor condition.	Wall sheeting to be replaced (or at least secured). Nailed fixings to be replaced with screw fixings. Replace/seal up windows as required.
Roof (Exterior)	• Roof sheeting has deteriorated. Sheets are loose in areas.	Roof sheets will need to be replaced (or at least secured). Nailed fixings to be replaced with screw fixings.
Brickwork kilns	• Most of the entry archways had loose bricks and voids in the brickwork bedding – resulting in displacement of the arch. • Loose bricks were noted throughout the internal kiln areas. However, displacement of the internal arches was much less common.	**Option 1 -** Bricks locally loose, no overall displacement evident: Reinstate locally displaced bricks to match existing. **Option 2 –** Areas of brickwork loose with significant displacement: Reinstate areas of loose brickwork if practical. If reinstatement not possible, provide structural steelwork support.
Upper floor	• Roof trusses are in reasonable condition for the age. However, lateral bracing of the roof structure may require upgrading. • Firing holes throughout floor create a trip hazard.	Firing holes to be covered and floor made free of trip hazards. Timber roof structure should be assessed further by structural engineer and upgraded where required.
Awnings	• Areas of awning missing. • Roof sheeting is in poor condition. Sheets are loose in areas. • Timber rafters are weathered in areas. • Steel fascia beam has weathered significantly in areas. • Connections between timber fascia and posts has failed in some areas. • Posts connections loose in areas.	Reinstate missing awning to match existing Roof sheets will need to be replaced (or at least secured). Nailed fixings to be replaced with screw fixings. Replace timber rafters required. Rafter-fascia connection to be upgraded. Steel posts shall be rectified and reconnected to fascia.
Steel framed bridge	• The steelwork has surface oxidation, but in reasonable condition for age. • The timber framed flooring is severely weathered and not suitable for use. • The steel roof framing is weathered.	Replace timber flooring. Structural steelwork can be re-purposed Replace roof sheeting as required.


Weathered roof sheeting
Steel framed bridge
Awning


Deteriorated fascia
Sheet fixings loose


Displaced arch


Loose bricks to arch


Timber framed trusses
Firing holes


Fire damage



Surface rust to steelwork
Steelwork may be reused

Welded connections

Weathered timber boards



Deteriorated sheeting

Rafters not connected to steel fascia beam

3.6 Building 9: Tall Brickwork Chimney

Building description:

- Tall brickwork chimney.
- Full masonry construction.

Note - the chimney was inspected from ground level only. The condition of the upper levels is based on limited visual observations.

Element	Condition	Remediation Requirement
Base of chimney	• Base of chimney was in good condition for the age of the structure. No notable cracking was observed.	Base of structure to be monitored and any loose bricks reinstated as required.
Upper areas of chimney	• Note - Access limited to ground floor. • Brickwork appears to be in reasonable condition for age of structure.	Closer inspection of upper chimney areas recommended due to limited access. **Option 1:** Local areas of loose bricks, but not displacement of chimney – Reinstate loose bricks. **Option 2:** large areas of loose bricks and chimney displaced in areas – Additional structural support may be required.



3.7 Building 16 & 17 : Machine Bays

Building description:
Building 16 and 17 consists of two matching buildings, linked by a steel framed bridge. The construction type of each is as follows:

- Two-storey construction with a steel framed lean-to roof.
- Primary structure is slab on grade, steel columns supporting suspended upper slab and a steel framed sheet roof.
- Lean-to roof is steel framed trusses, timber purlins and sheet roof.
- There is a steel framed bridge on the on the southern side of building 7.
- There is a steel framed tower to the north of the northern building.

The northern building was generally in worse condition compared to the southern building.

Access was limited to the ground floor only. The upper floor of the structure has not been included within this report.

Element	Condition	Remediation Requirement
Cladding	• Steel roof and wall sheeting was highly weathered, loose and missing in areas across both buildings. The northern building was in worse condition. • The third level of the northern building was missing most of the cladding.	The loose roof/wall sheeting presents a high safety risk, sheets may be become airborne in high winds. Loose sheets to be secured prior to public access. Roof areas not recommended for roof traffic in current condition.
Windows	• Windows to both buildings were weathered and broken.	Windows to be replaced as required.
Slab on grade	• The slab on grade is considered to be non-structural and was in reasonable condition. • There were several open trench drains which present a trip hazard.	Provide covers to trench drains to remove trip hazard.
Steel columns	• Steel columns were generally in sound condition. Surface rust was present but is not a structural concern.	Treat surface corrosion if required.
Suspended slab	• Note - Access was limited to underside of slab only • Overall, slab appeared to be in reasonable condition. • Localised areas of slab had minor spalling present which do not present an overall structural concern.	Break away any areas of spalling concrete to remove hazard. Reinstate concrete with cementitious repair mortar. Structural assessment of upper floor recommended prior to opening to public.
Lean-to roof (framing)	• Steel trusses were in reasonable condition. Impact damage noted to bottom truss chord. • Timber purlins weathered in areas. • Box gutter timber framing has deteriorated.	Reinstate damaged steel truss to match existing. Replace weathered timber purlins as required. Replace box gutter and framing or remove altogether.
Lean-to roof (sheeting)	• Roof sheets were significantly weathered and missing in areas. • Fixings had failed across majority of roof. Sheets were loose and not secured.	Roof sheets should be secured (or removed) as they present a hazard. Foot traffic access to roof be prevented
Steel framed walkway (South side)	• Steel structure was in reasonable condition. • Timber flooring was significantly weathered in areas. • Roof sheets were significantly weathered and had loose fixings.	Replace deteriorated timber flooring as required. Replace/secure roof sheeting.



Loose and missing roof sheets

Bridge between north and south buildings



Steel framed third level of northern building

Loose and missing sheeting


Loose and missing sheeting
Weathered and broken windows
Loose sheets


Level 1 slab
Lean-to roof steel trusses



Damaged bottom chords



Deteriorated box gutter timber framing



Weathered and loose sheeting



Loose and missing sheeting

3.8 Building 18: Workshop

Building description:

- Steel framed braced structure constructed on slab on grade.
- Steel truss roof with timber purlins and light cladding.
- There is a timber framed walkway located on top of the building.

Access to the timber framed walkway was restricted.

Element	Condition	Remediation Requirement
Lower floor	• Structural steel was generally in reasonable condition. • Wall sheeting was damaged in areas. • Windows throughout the window were broken. • Roof sheeting was in reasonable condition.	Replace damaged wall sheeting as required. Reinstate/replace windows as required.
Timber framed walkway	***Note - No access to upper level of structure*** • Northrop report indicated that the timber structure had weathered significantly.	Public access to upper level should be restricted. Structural assessment recommended.

Photos included on following page.



Upper level
(No access)

Damaged sheeting

Trench grate is a
trip hazard



Timber framed walkway

Steel trusses

3.9 Building 35 & 36 : Model Railway Workshop & Storage Shed (Buildings to be demolished)

Building description:

- Single storey construction
- Building is founded on edge of unstable embankment. Slab on grade is sitting on concrete retaining wall to edge of embankment.
- Mixed wall construction - double skin brickwork (most likely) and timber framing with light weight sheeting

Element	Condition	Remediation Requirement
Foundations	• Slab on grade was in reasonable condition. • Concrete retaining wall was in reasonable condition. • Embankment on side of structure is unstable and has eroded.	Stabilise embankment on side of structure.
Structure	• Double skin brickwork was in reasonable condition. • Localised areas of brickwork were loose but appears stable overall. • Timber wall framing, roof framing and sheeting appears to be in sound condition.	Reinstate areas of loose brickwork Seal windows and holes to weatherproof building.
Brickwork retaining wall	• Brickwork retaining wall appears to be sliding off concrete retaining wall. • The end of the wall has partially collapsed, bricks have come loose.	Reinstate brickwork retaining wall. Engaged pier or reinforced concrete retaining wall may be required.

Photographs included on following pages.



Timber framed sheet wall



Double skin brickwork

Unstable embankment

Concrete retaining wall


Brickwork retaining wall
Partially collapsed
Concrete retaining wall


Timber wall framing
Timber roof trusses

3.10 Building 15: Machine Bay

Building description:

- Construction type is very similar to building 16 & 17.
- Two-storey construction with a steel framed lean-to roof.
- Primary structure is slab on grade, steel columns supporting suspended upper slab and a steel framed sheet roof.
- Lean-to roof is steel framed trusses, timber purlins and sheet roof.
- There is a steel framed bridge on the on the north-western side of the building.
- There is a smaller building also labelled “building 10” which is positioned to the east of the main building. Construction type is braced steel framed building with timber purlins and light weight cladding.

Access was limited to the ground floor only. The upper floor of the structure has not been included within this report.

Element	Condition	Remediation Requirement
Cladding	• Steel roof and wall sheeting was weathered. Some sheets are loose and missing.	The loose roof/wall sheeting presents a safety risk in high winds. Loose sheets to be secured or removed and stored for re-fitting
Slab on grade	• The slab on grade is considered to be non-structural and was in reasonable condition.	Any trip hazards across the slab should be rectified.
Steel columns	• Steel columns were generally in sound condition.	Treat surface corrosion if required.
Suspended slab	• Note - Access was limited to underside of slab only. • Overall, slab appeared to be in reasonable condition. • Some local areas of spalling were noted, which do not present an overall structural concern.	Break away any areas of spalling concrete to remove hazard. Reinstate concrete with cementitious repair mortar. Structural assessment of upper floor recommended prior to opening to public.
Lean-to roof	• Steel trusses were in reasonable condition. • Timber purlins weathered in areas. • Box gutter timber framing has deteriorated. • Roof sheets were weathered and fixings loose.	Replace weathered timber purlins as required. Replace box gutter and framing. Remove and store all sheets for re-fitting
Steel framed walkway (north-western side)	• Steel structure was in reasonable condition. • Timber flooring was significantly weathered in areas, particularly the western side of the bridge. • Roof sheets were weathered and missing in areas.	Western side of bridge not suitable for access. Replace deteriorated timber flooring. Replace/secure roof sheeting. Measures to be put in place to prevent access.
Small building (East of main building)	• Steelwork was in reasonable condition. • Timber floor structure has deteriorated. • Section of roof has been removed. • Note – access was from ground level only.	Reinstate roof framing if required. Reinstate floor structure, restrict public access. Secure roof/wall sheeting.



Weathered roof sheeting



Steel framed trusses

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Wall sheets loose and missing


Roof framing has been removed
Loose sheets



Braced steel structure



Roof sheets missing

Timber flooring severely weathered and missing

3.11 Building 19: White Pan Room

Building description:

- Braced steel framed structure, steel roof trusses, timber purlins and light weight sheeting.
- Concrete slab on grade

Access was limited to the ground floor only. Upper floor not accessible.

Element	Condition	Remediation Requirement
Steel structure	• Some bracing members appear to be missing • Some steelwork connections may require rectification.	Reinstate bracing members to match existing. Detailed structural assessment required prior to opening to public.
Cladding	• Sheeting is weathered but in serviceable condition. Some loose sheets were noted.	Secure any loose sheeting prior to providing public access.
Ground floor slab	• Areas of suspended slab on grade have collapsed. • Debris is scattered throughout ground floor.	Restrict public access. Reinstate slab if required. Clean up debris.



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3.12 Building 28 & 31: Storage building & Amenities Block 2

Building 28 & 31 are deemed outside the scope of this report. Building 28 & 31 are two small buildings positioned to the south of Building 2 and appears to have been constructed more recently.

Building description:

- Slab on grade.
- Single skin brickwork (most likely).
- Timber framed truss roof (most likely) with light weight sheeting.
- Timber framed lean-to awning on eastern side of buildings.

Roof structure could not be visually inspected due to a ceiling present.

Element	Condition	Remediation Requirement
External	• Brickwork was generally in good condition. • Roof sheeting was in good condition. • Windows and doors broken.	Ensure structure is weatherproof. Rectify doors and windows.
Lean-to roof	• Lean-to roof was in reasonable condition. • Roof sheeting was sagging in areas but is not a structural concern.	Rectify awning structure if required.





Taller of two structures



Ceiling
Could not inspect roof

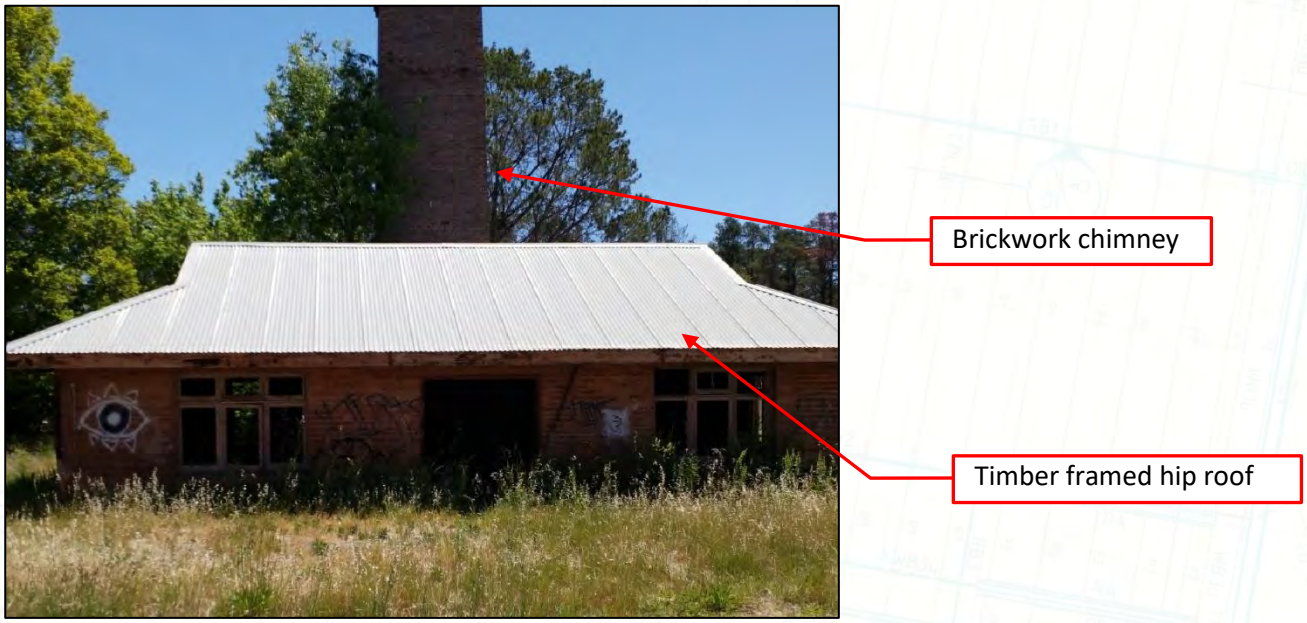
3.13 Building 2: Fan House

Building description:

- Single storey construction.
- Single skin brickwork with engaged piers.
- Timber framed roof with light weight sheeting.
- Basement level is concrete slab on grade.
- A brickwork chimney is located to western side of structure.
- There is a tunnel that runs beneath the road to the east of the building, it appears to be an exhaust tunnel for building 1 kilns.

Roof structure could not be visually inspected due to a ceiling present.

Element	Condition	Remediation Requirement
Main structure	• Brickwork walls in reasonable condition, some cracking to lintels noted. • Ceiling boards were in poor condition and partially collapsed. • Basement was full of debris and murky water. • Handrails loose and not suitable for public access. • Door and windows were broken and deteriorated.	Remove and reinstate deteriorated ceiling boards if public access required. Provide secure handrails to allow safe access. Replace doors and windows to seal structure from the elements.
Kiln exhaust tunnel	• Entrance to tunnel inspected only. • The tunnel was in reasonable condition, no loose bricks were noted.	Tunnel is a confined space, secure access.
Chimney	• Note - observations were made from ground level. • Cracking to the base of the chimney was observed, but overall appears to be stable. • The top of the chimney had more severe cracking and loose bricks.	Secure/reinstate loose bricks at top of chimney. Closer inspection of upper areas of chimney recommended, additional structural support may be required.




Base of chimney in reasonable condition
Weathered fascia beams
Broken windows


Brickwork retaining wall for basement
Debris and murky water



Deteriorated ceiling boards
Partially collapsed



Tunnel under road
Brickwork in sound condition

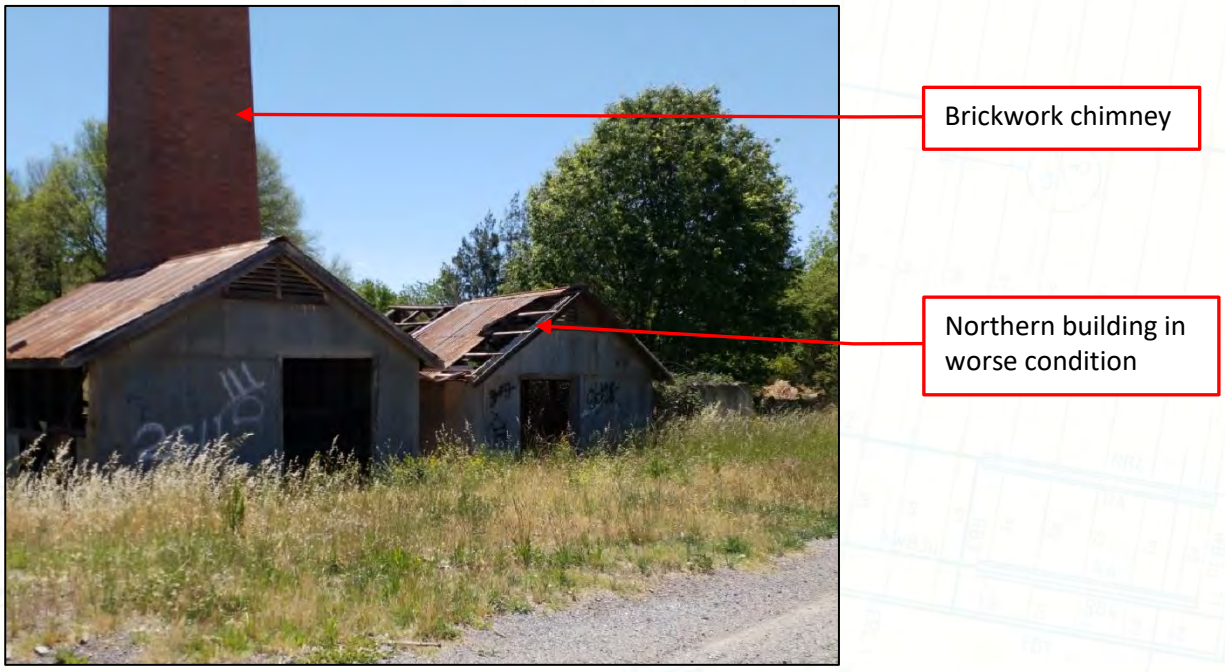
3.14 Building 4: Fan House

Building description:

- Two similar structures located side-by-side, northern structure in worse condition.
- Single storey construction.
- Timber framing with corrugated wall and roof sheeting.
- Concrete basement level.
- A brickwork chimney is located to western side of structure.
- There is a tunnel that runs beneath the road to the east of the buildings which appears to be an exhaust for building 3 kilns.

Access to the tunnel was restricted, condition is not included within report

Element	Condition	Remediation Requirement
Main structure	• Roof sheeting was highly weathered. Buildings have loose and missing roof sheets. • Wall sheeting loose and missing in areas. • Timber framing has deteriorated in areas, particularly to the northern building due to exposure to the weather. Timber framing was falling down in areas. • Concrete basement was full of debris and murky water. • Handrails loose and not suitable for public access.	Secure roof sheeting prior to providing public access. Seal cladding, doors and windows to protect structure from the elements. Replace deteriorated / damaged timber members. Remove debris from basement Provide secure handrails to allow safe access.
Chimney	• Note - observations were made from ground level. • Cracking to the base of the chimney was observed, but overall appears to be stable. • The top of the chimney had more severe cracking and loose bricks.	Secure/reinstate loose bricks at top of chimney. Closer inspection of upper areas of chimney recommended, additional structural support may be required.







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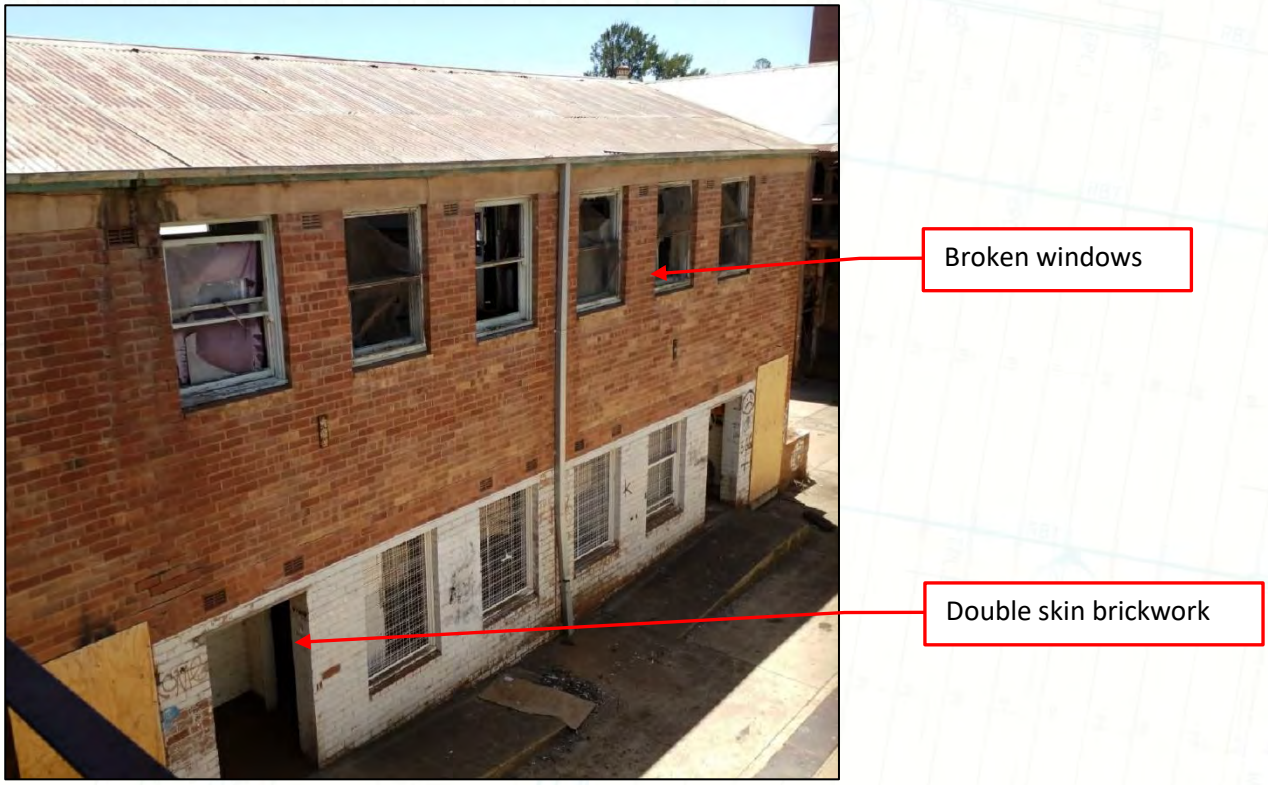
3.15 **Building 25: Amenities Block** (Update: Building has since been burnt down, save for brickwork)

Building description:

- Two storey construction, appears to have been constructed more recently.
- Appears to be double skin brickwork with timber framed sheet roof

Access to the inside of the building was restricted.

Element	Condition	Remediation Requirement
Main structure	• External brickwork was in reasonable condition. • Roof sheets were weathers and had loose fixings. • Fascia boards were weathered. • Window frames weathered and glass broken. • Roof framing could not be inspected due to limited access.	Seal windows to protect structure from the elements. Replace sheet fixings to secure sheeting. Replace fascia boards if required.
Internal structure	• Access to the internal area was restricted. • From external inspection, internal structure appears to be in sound condition.	Inspection of internal structure recommended prior to providing public access.




Broken windows


Weathered sheeting
Loose nailed fixings
Weathered fascia boards

3.16 Building 10: Southern Chimney

The chimney stack is located at the entrance to Brickworks, positioned south of building 6.

Building description:

- Double skin brickwork chimney
- Full masonry construction
- Opening on one side with steel lintel

Element	Condition	Remediation Requirement
Base of chimney	• Base of chimney was in reasonable condition for the age of the structure. • No significant cracking was observed.	Base of structure to be monitored and any loose bricks reinstated as required.
Upper areas of chimney	• Upper section in worse condition compared to base of structure. • Loose and deteriorated bricks were observed. • Some bricks have come loose from the structure; however, the overall structure appears to be stable.	The loose bricks are a hazard and should be rectified prior to providing public access. The upper area should be reinstated to prevent further deterioration. **Option 1:** Local areas of loose bricks, but not displacement of chimney – Reinstate loose bricks. **Option 2:** large areas of loose bricks and chimney displaced in areas – Additional structural support may be required.



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3.17 Building 20: Primary Crusher House, Small Steel Structure to North-East of Site

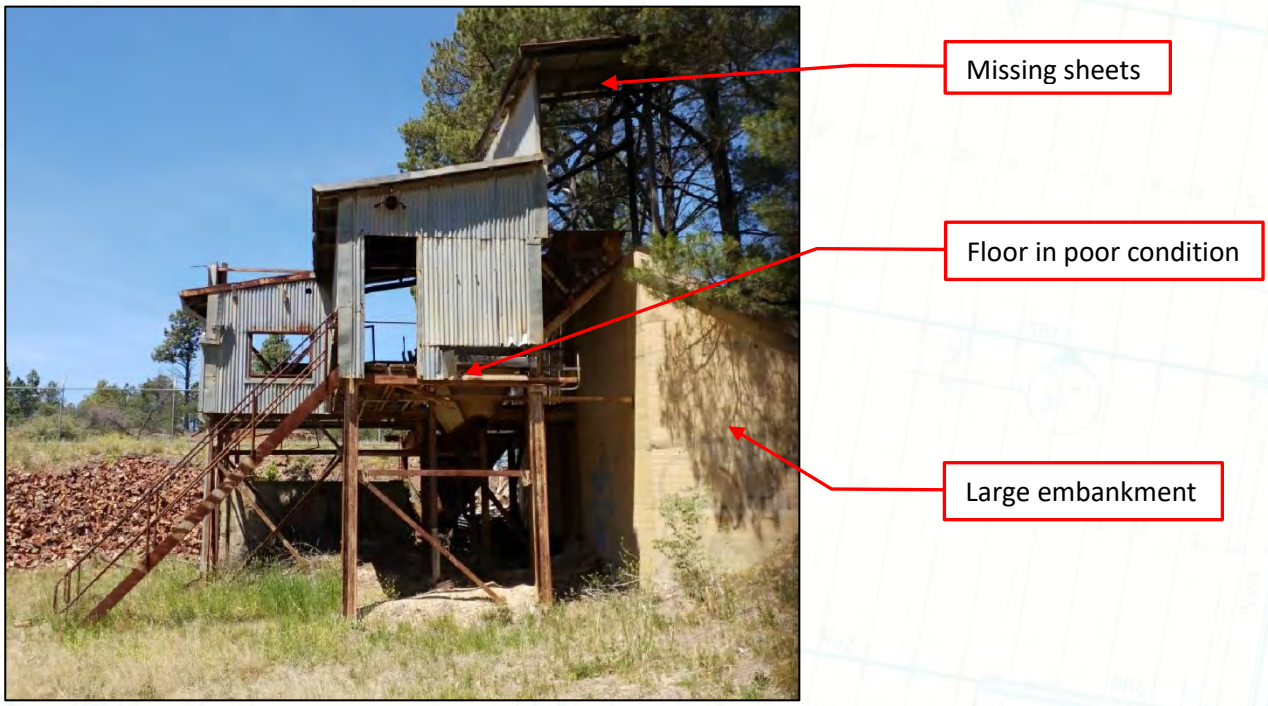
Building 20 is a small steel framed structure positioned north-east of Building 35.

Building description:

- Braced steel framed structure with light weight wall and roof sheeting.
- Timber floor framing.

The structure was inspected from ground level as the floor framing of the structure was in poor condition, access should be restricted.

Element	Condition	Remediation Requirement
Cladding	• Steel roof and wall sheeting was highly weathered, loose and missing in areas.	The loose roof/wall sheeting presents a safety risk, sheets may be become airborne in high winds. Loose sheets to be secured prior to public access. Roof areas not recommended for roof traffic in current condition.
Windows and Doors	• Windows and doors missing/broken.	Replace windows/doors if required.
Steel framing	• Steel framing was generally in reasonable condition. Surface rust was present but is not a structural concern.	Treat surface corrosion if required. Further inspection required prior to providing public access.
Timber framing	• Floor and roof framing were in poor condition.	Areas of floor structure not safe for access. Access should be restricted until rectified.



3.18 Building 22: Elevator/ Conveyor

Building description:

- Steel frame, partially clad, supported of pad footings

Element	Condition	Remediation Requirement
Steel framing	• Fair condition with no evidence of concerning damage	Abrasive blast steelwork and paint.
Roof and Wall sheeting	• Fair condition with isolated loose fixings	Refixing of all connections.
Walkway	• Fair condition and hazardous for use	Replacement required.



View of Conveyor



Typical base fixing



Walkway hazardous

Internal View

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3.19 Building 14: Power House

Building description:

- Single level, high set building of full masonry construction.
- Roof is of cut timber frame.
- Slab on grade.

Element	Condition	Remediation Requirement
Brickwork	• Good to fair condition	Ensure weatherproofing
Roof	• Fair condition with weathering to eaves and facia boards	Replacement of eave boarding and facia boards required.
Slab	• Good condition	Minor clean up and application of a sealer or covering.
External	• Downpipes and gutters in poor condition	Replacement and connection will be required.
	• Doors and louvers in fair condition	Replacement required.
	• Windows broken and flyscreens damaged	Replacement required to western windows.



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Eastern windows in place

Doors require replacement



Weathered facia boards and eave linings

Doors requiring replacement

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4.0 RECOMMENDATIONS

It is a recommendation of Sellick Consultants that the site remains secured with restricted access to authorised personnel with the appropriate PPE (personnel protective equipment).

All roof and wall sheeting noted in section 3 as remediation importance level 3 should be addressed as a matter of priority.

Items noted as remediation importance level 2 should be rectified within 12 months to mitigate ongoing deterioration.

As part of any repair works, a full risk assessment will be required by the responsible contractor before accessing any part of the non-readily accessible areas of the building. Repair work methodologies should be investigated further as these were not within the scope of this report.

I trust this satisfies your enquiries and if I can be of further assistance, please advise.

Yours faithfully,



Darren Sault
Director – Canberra Structural Commercial
for **Sellick Consultants Pty Ltd**

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Appendix H

Inventory of Moveable Relics, GML, January 2021

Appendix H—Inventory of Moveable Relics

H.1 Introduction

Doma engaged GML Heritage Pty Ltd (GML) to prepare an inventory of the moveable relics located at the Canberra Brickworks Precinct (the Brickworks), Yarralumla, Australian Capital Territory (ACT).

This report provides an itemised inventory of **moveable relics**—historic industrial equipment and machinery—associated with the Brickworks. The site has not functioned since 1976, and much of the industrial works of the site has been incrementally removed.

The inventory is a record of the redundant relics and an initial step in the identification of items that should be considered for further investigation, conservation and interpretation. Further assessment should include further identification, provenance, function, significance and historic association with the development phases of the Brickworks.

Historic research regarding the origin, manufacture date, or purpose of each identified item was not undertaken during the compilation of this inventory. Items were included in the inventory if they could be shown to have an integral association with the industrial function of the Brickworks (ie brickmaking). A formal assessment of each item's individual significance against the HERCON criteria was not part of the scope of this inventory and should be developed as part of a future salvage strategy/schedule (see 'Recommendations').

H.2 Methodology

H.2.1 Inventory Content

The inventory is organised with the location, name, general condition of each identified item and a recommendation for the next step to be taken. The function, purpose, provenance, age of some items may not be known – as this is an initial record of what is on site – or may not have been included in the inventory due to:

- dangerous conditions or inability to physically access certain buildings or portions of certain buildings; or
- purposeful concealment of items by other individuals (detailed below).

H.2.2 Site Recording

GML Consultants Kaylie Beasley and Elise Jakeman attended the site on 15 December 2020 to record moveable relics for the inventory.

Moveable relics—the items—have been defined as historic industrial equipment and ephemera associated with the heritage significance and historic function of the Brickworks (ie as a brick manufacturing plant). Other relics—items considered to have been introduced to the Brickworks following its closure in 1976, or not associated with the primary function of the Brickworks—were not recorded in the inventory. However, some exceptions have been made regarding items of artwork/sculpture that repurposes industrial ephemera and introduced materials (post 1976).

The inventory contains information from the time of the site survey and data collection (15 December 2020). It is important to note that the Brickworks is often visited by vandals and 'urban explorers'; such individuals may damage, relocate, or remove items during their visits, altering the information contained

in the inventory. Moreover, the remaining items likely represent only a small portion of the original scale and quantity of industrial equipment – much of this original material has probably been gradually removed from the site since the closure of the Brickworks.

H.2.3 Recording process

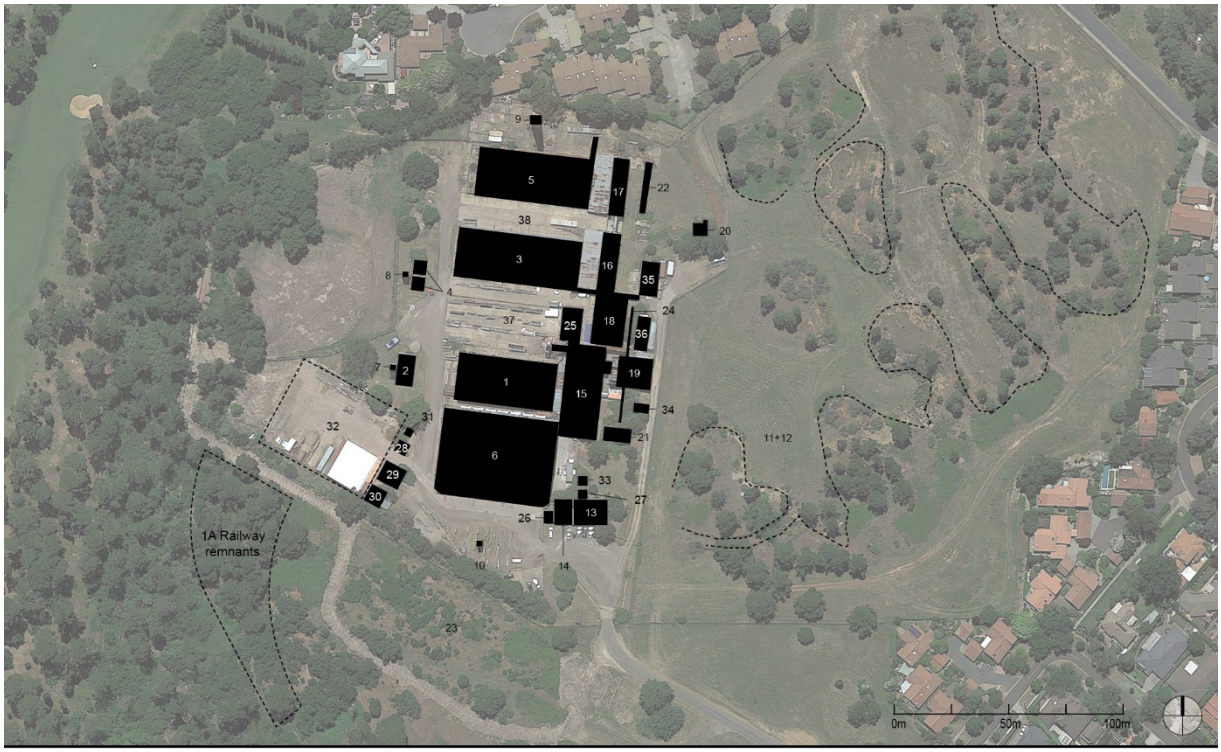
Identified items were recorded using the following process:

1. Each item or 'lot' was assigned an ID.
2. The location coordinate of the item was taken using a Garmin GPSMAP 64sx.
3. The name, description, and condition of the item was recorded.
4. A photograph of the item taken in situ.
5. A recommendation was provided to guide initial advice about salvage, storage, restoration, reuse, or 'to be determined' following further historical investigation. Recommendations have been based on the directives outlined in Section iii) of the ACT Heritage Register citation for 'Yarralumla Brickworks' (Appendix B1):
    a. Major equipment and machinery associated with the historical industrial use of the place shall be retained and conserved in situ. Minor equipment should be retained and conserved but may be relocated to a new location within the site for interpretative purposes and/or its own protection.
    b. The Primary Crusher House (Element 20), including the integral equipment and machinery, and the Elevator/Conveyor (Element 22) shall be conserved for their ability to demonstrate and interpret industrial processes and secondary aesthetic values.

The inventory is organised according to the named Elements (building and areas) of the Brickworks site, and as used in the CMP (Figure 1). The items in the inventory are located inside and around the Elements and have been assigned a locating 'code' (Table 1) as a prefix ID for each item.

The following spaces were not examined for moveable relics due to dangerous conditions or inability to physically access the buildings:

- the upper levels of the Staffordshire Kiln (Element 1), Hardy Patent Kiln 1 (Element 3), and Hardy Patent Kiln 2 (Element 5);
- the rear rooms of the office building (Element 13); and
- the toilet block (Element 27) at the rear of the office building.



Legend:

1	Staffordshire Kiln	9	Chimney Stack for Hardy Patent Kiln 2	17	Machine Bay 3 for Hardy Patent Kiln 2	24	Concrete retaining wall	33	Ancillary Storage Building 2
2	Fan House for Staffordshire Kiln	10	Chimney Stack for Downdraught Kilns	18	Workshop	25	Amenities Block	34	Storage Shed
3	Hardy Patent Kiln 1	11	Quarry	19	White Pan Room (Large Crusher House/Crusher House II)	26	Downdraught Kilns Control Room	35	Model Railway Workshop
4	Fan house for Hardy Patent Kiln 1	12	Geological features	20	Primary Crusher House (Crusher House III)	27	Toilet Block	36	Model Railway Storage Shed
5	Hardy Patent Kiln 2	13	Offices	21	Small Crusher House (Crusher House I)	28	Ancillary Storage Building	37	Original Brickyard
6	Downdraught Kilns	14	Power House	22	Elevator/Conveyor	29	Substation/Control Room	38	Brickyard 2
7	Chimney Stack for Staffordshire Kiln	15	Machine Bay 1 for Staffordshire Kiln and Downdraught Kilns	23	Brickworks Accommodation Village	30	Boiler House	1A	Railway remnants registration area
8	Chimney stack for Hardy Patent Kiln 1	16	Machine Bay 2 for Hardy Patent Kiln 1			31	Amenities Block 2	Refer also to figure 3.38 Areas of Archaeological Potential	
						32	Extrusion Plant (Remnants)		

Figure 1 Numbering and Location of Elements of the Canberra Brickworks Precinct.

H.3 Identified Moveable Relics

Table 1 provides an ID for moveable relics, description and photograph of each item. A map showing the locations of the relics is provided in Figure 2.

Table 1 Moveable Relics Identified at the Canberra Brickworks Precinct, listed in chronological order after Entrance Area.

ID	Description	Photograph
Entrance Area		
EA-01	*Description:* Stack of misfired red bricks, approximately 11 courses *Location:* Adjacent to main entry gate outside Brickworks fencing *Condition:* Good *Comments:* Little apparent fabric damage, some minor lichen attachments *Recommendation:* Retain for interpretation on site	
EA-02	*Description:* Stack of misfired red bricks, approximately 12 courses *Location:* Adjacent to main entry gate inside the site *Condition:* Good *Comments:* Little apparent fabric damage, some minor lichen attachments *Recommendation:* Retain for interpretation on site	
Element 11+12: Quarry and Geological features		
11+12-01	*Description:* Timber steps and ferrous handrails *Location:* Central southern extent of Quarry (Element 11) *Condition:* Poor *Comments:* Affected by soil erosion and slip, rust activity on handrails *Recommendation:* Further research required to determine provenance	

ID	Description	Photograph
Element 24: Concrete Retaining Wall		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 14: Power House		
14-01	*Description:* 'English Electric' ammeter and wattmeter control panel and associated framing, insulators, and other ephemera *Location:* Centre of Power House (Element 14) *Condition:* Poor *Comments:* Non-operational, considerable fabric damage to control panel and components, pigeon activity damage, some graffiti *Recommendation:* Retain and conserve the 'English Electric' ammeter and wattmeter control panel in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site Seek the advice of a conservator regarding the provenance and usefulness of associated ephemera. Some items may be suitable for conservation of the ammeter and wattmeter control panel	  

ID	Description	Photograph
		 
Element 1: Staffordshire Kiln		
1-01	*Description:* Stacks of 'Wunderlich Limited' terracotta roof tiles *Location:* In north-facing kiln of Staffordshire Kiln (Element 1) *Condition:* Fair *Comments:* Little apparent fabric damage *Recommendation:* Undertake additional research to determine provenance. Establish if they are from buildings on site and can be used for restoration of buildings on site	

ID	Description	Photograph
		
1-02	*Description:* Timber ladder with metal fixtures *Location:* In north-facing kiln of Staffordshire Kiln (Element 1) *Condition:* Fair *Comments:* Little apparent fabric or structural damage *Recommendation:* Salvage and store on site. Appropriately label with a catalogue number and provenance Possible conservation and reuse for on site interpretation	
1-03	*Description:* Extractor fan *Location:* Landing of upper level of Staffordshire Kiln (Element 1) *Condition:* Poor *Comments:* Not in situ, some fabric damage, advanced rust activity *Recommendation:* Retain for interpretation on site Seek the advice of a conservator for conservation and interpretation on site	
1-04	*Description:* Boiler *Location:* Landing of upper level of Staffordshire Kiln (Element 1) *Condition:* Poor *Comments:* Advanced rust activity, exposed asbestos insultation *Recommendation:* Retain and conserve in situ Seek the advice of a conservator for conservation and interpretation on site	

ID	Description	Photograph
Element 2: Fan House for Staffordshire Kiln		
2-01	*Description:* Fan equipment *Location:* Centre of Fan House (Element 2) *Condition:* Very poor *Comments:* Considerable fabric damage, graffiti damage, pigeon activity damage, flooding, and advanced rust activity *Recommendation:* Retain and conserve fan equipment in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site	  

ID	Description	Photograph
		 
Element 7: Chimney Stack for Staffordshire Kiln		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 13: Offices		
13-01	*Description:* Dray horse cart collar *Location:* Western-most south-facing room of Offices (Element 13) *Condition:* Good *Comments:* Little apparent fabric damage. *Recommendation:* Undertake additional research to determine provenance. If determined to be appropriate, salvage and store on site. Appropriately label with a catalogue number and provenance	
Element 3: Hardy Patent Kiln 1		

ID	Description	Photograph
3-01	*Description:* Kiln doors *Location:* Adjacent to southern external wall of Hardy Patent Kiln 1 (Element 3) *Condition:* Fair *Comments:* Little apparent fabric damage, some rust activity *Recommendations:* Salvage and store on site. Label with an inventory catalogue number and provenance Seek the advice of a conservator for conservation and on site interpretation	
3-02	*Description:* 'Kent' oxygen analyser *Location:* Southern external wall of Hardy Patent Kiln 1 (Element 3) *Condition:* Poor *Comments:* Fabric damage, some rust activity *Recommendations:* Retain and conserve in situ Seek the advice of a conservator for conservation and interpretation on site	 
Element 4: Fan House for Hardy Patent Kiln 1		

ID	Description	Photograph
4-01	*Description:* Fan equipment *Location:* Centre of each Fan House (Element 4) *Condition:* Very poor *Comments:* Considerable fabric damage, graffiti damage, pigeon activity damage, flooding, and advanced rust activity *Recommendation:* Retain and conserve fan equipment in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site	   

ID	Description	Photograph
		 
Element 8: Chimney Stack for Hardy Patent Kiln 1		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 25: Amenities Block 1		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 5: Hardy Patent Kiln 2		
No moveable relics associated with the primary function of the Brickworks were identified		
Hardy Patent Kiln 2 Area		

ID	Description	Photograph
5A-01	*Description:* Brick press machine base *Location:* West of Hardy Patent Kiln 2 (Element 5) *Condition:* Fair *Comments:* Not in situ, little apparent fabric damage, advanced rust activity *Recommendations:* Salvage and store on site. Label with an inventory catalogue number and provenance Seek the advice of a conservator for conservation and on site interpretation	 
Element 9: Chimney Stack for Hardy Patent Kiln 2		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 15: Machine Bay 1 for Staffordshire Kiln and Downdraught Kilns		
15-01	*Description:* Two bridge cranes *Location:* Centre of Machine Bay 1 (Element 15) *Condition:* Fair *Comments:* Appears to be little fabric or structural damage, some rust activity *Recommendations:* Conserve and retain representative example/s in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and on site interpretation Salvage and store other examples on or off site (see also 16A-03, 16701, 18-01)	

ID	Description	Photograph
		 
15-02	*Description:* Five chutes *Location:* Across first floor of Machine Bay 1 (Element 15) *Condition:* Fair *Comments:* Little apparent structural damage, graffiti damage, some rust activity *Recommendations:* Retain and conserve in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and on site interpretation	 

ID	Description	Photograph
		
15-03	*Description:* Conveyer tracks, rollers, and associated mechanisms *Location:* Second floor of Machine Bay 1 (Element 15) and extends across upper levels of all Machine Bays (Elements 16, 17) *Condition:* Fair–good *Comments:* Appears to be largely complete, most rollers functioning, advanced rust activity *Recommendations:* Retain and conserve in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and on site interpretation	 
15-04	*Description:* Electrical control panel *Location:* Second floor of Machine Bay 1 (Element 15) adjacent to conveyor tracks *Condition:* Fair *Comments:* Non-operational, some fabric damage *Recommendations:* Retain and conserve in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site	

ID	Description	Photograph
		
15-05	*Description:* Chute *Location:* Second floor of Machine Bay 1 (Element 15) at northern end *Condition:* Poor–fair *Comments:* Could not inspect closely *Recommendations:* Retain and conserve in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site	
Element 16: Machine Bay 2 for Hardy Patent Kiln 1		
16-01	*Description:* Conveyor piece *Location:* Floor of Machine Bay 2 (Element 16) at northern end *Condition:* Poor *Comments:* Not in situ, advanced rust activity *Recommendations:* Salvage and restore to 15-03	
Machine Bay 2 for Hardy Patent Kiln 1 Area		

ID	Description	Photograph
16A-01	*Description:* Stack of 'Canberra' terracotta tiles *Location:* Adjacent to external rear wall of Machine Bay 2 (Element 16) and external northern wall of Workshop (Element 18) *Condition:* Poor–fair *Comments:* Some fabric damage *Recommendations:* Undertake additional research to determine provenance. Establish if they are from buildings on site and can be used for restoration of buildings on site (see also 18-02)	
16A-02	*Description:* Dismantled brick barrow *Location:* Space between Machine Bay 2 (Element 16) and Machine Bay 3 (Element 17) *Condition:* Poor *Comments:* Advanced rust, missing timber lining and wheels *Recommendations:* Salvage and store on site. Label with an inventory catalogue number and provenance, likely as part of 27-01 'job lot' Seek the advice of a conservator for conservation and on site interpretation	
16A-03 .	*Description:* Bridge crane *Location:* Space between Machine Bay 2 (Element 16) and Machine Bay 3 (Element 17) *Condition:* Poor *Comments:* Appears to be little fabric or structural damage, advanced rust activity *Recommendations:* Conserve and retain representative example/s in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site Salvage and store other examples on or off site (see also 15-01, 17-01, 18-01)	

ID	Description	Photograph
		
Element 17: Machine Bay 3 for Hardy Patent Kiln 3		
17-01	*Description:* Bridge crane *Location:* Northern end of Machine Bay 3 (Element 17) *Condition:* Fair *Comments:* No apparent fabric damage, some rust activity *Recommendations:* Conserve and retain representative example/s in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site Salvage and store other examples on or off site (see also 15-01, 16A-03, 18-01).	
17-02	*Description:* Crusher and puddler machines *Location:* Northern end of Machine Bay 3 (Element 17) *Condition:* Poor *Comments:* Not in situ, fabric damage, advanced rust activity *Recommendations:* Salvage and store on site. Label with an inventory catalogue number and provenance. Seek the advice of a conservator for conservation and interpretation on site	

ID	Description	Photograph
		
17-03	*Description:* 'Foster & Sons Pty Ltd' pugmill *Location:* Northern end of Machine Bay 3 (Element 17) *Condition:* *Comments:* Not in situ, some fabric damage, advanced rust activity *Recommendations:* Salvage and store on site. Label with an inventory catalogue number and provenance. Seek the advice of a conservator for conservation and interpretation on site	 
Machine Bay 3 for Hardy Patent Kiln 2 Area		

ID	Description	Photograph
17A-01	*Description:* Boiler or exhaust vent *Location:* North of Machine Bay 3 (Element 17) *Condition:* Poor *Comments:* Not in situ, some fabric damage, advanced rust activity *Recommendations:* Salvage and store on site. Label with an inventory catalogue number and provenance Undertake further investigation to determine provenance and whether it can be restored to its original location Seek the advice of a conservator for conservation and interpretation on site	
Element 18: Workshop		
18-01	*Description:* 'Industrial Handling Co' bridge crane *Location:* Centre of Workshop (Element 18) *Condition:* Fair *Comments:* Appears to be little fabric or structural damage, some rust activity *Recommendations:* Conserve and retain representative example/s in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site Salvage and store other examples on site (see also 15-01, 16A-03, 17-01)	 

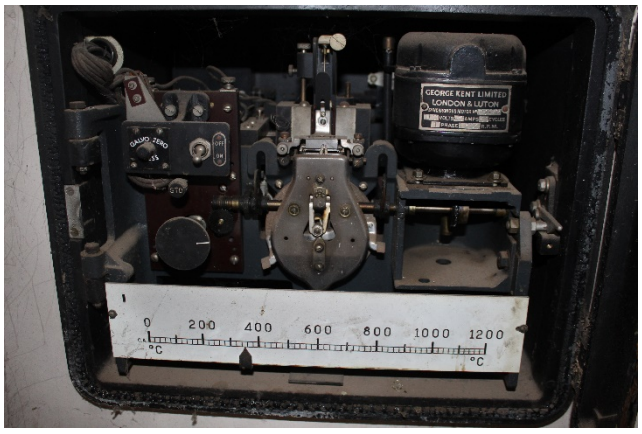
ID	Description	Photograph
18-02	*Description:* Stack of 'Canberra' terracotta tiles *Location:* Behind partition wall at northern end of Workshop (Element 18) *Condition:* Fair *Comments:* Little apparent fabric damage *Recommendations:* Undertake additional research to determine provenance. Establish if they are from buildings on site and can be used for restoration of buildings on site (see also 16A-01)	 
Element 21: Small Crusher House (Crusher House 1)		
21-01	*Description:* Chute *Location:* Centre of Small Crusher House (Element 21) *Condition:* Poor *Comments:* Fabric damage, graffiti damage, advanced rust activity *Recommendations:* Conserve and reuse in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site.	

ID	Description	Photograph
		
Element 19: White Pan Room (Large Crusher House/Crusher House II)		
19-01	*Description:* Miscellaneous chutes *Location:* Lower level of White Pan Room (Element 19) at rear of Machine Bay 1 (Element 15) *Condition:* Fair *Comments:* Little apparent fabric damage, advanced rust activity *Recommendations:* Retain and conserve in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site	 

ID	Description	Photograph
		
Element 20: Primary Crusher House (Crusher House III)		
20-01	*Description:* Crush machinery *Location:* Centre of Primary Crusher House (Element 20) *Condition:* Poor *Comments:* Extensive fabric damage, extensive structural damage, advanced rust activity *Recommendations:* Retain and conserve in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site	
Element 22: Elevator/Conveyor		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 6: Downdraught Kilns		
6-01	*Description:* Kiln fixings, including furnace doors and ladders *Location:* Affixed to external walls of each kiln of Downdraught Kilns (Element 6) *Condition:* Poor *Comments:* Fabric damage, advanced rust damage, missing fixings *Recommendations:* Retain and conserve in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and on site interpretation	

ID	Description	Photograph
		 
6-02	*Description:* Kiln doors *Location:* At northern and southern ends of each kiln of Downdraught Kilns (Element 6) *Condition:* Poor–fair *Comments:* Fabric and structural damage, advanced rust activity, graffiti damage *Recommendations:* Retain and conserve in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and on site interpretation	

ID	Description	Photograph
		 
6-03	*Description:* Fire grate *Location:* Central kiln of Downdraught Kilns (Element 6) *Condition:* Fair *Comments:* Little apparent fabric damage, some rust activity *Recommendations:* Retain and conserve in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site	 

ID	Description	Photograph
Element 26: Downdraught Kilns Control Room		
26-01	*Description:* 'George Kent Limited London & Luton' temperature control panel *Location:* Adjacent to doorway of Downdraught Kilns—Control Room (Element 26) *Condition:* Good *Comments:* Non-operational, some external fabric damage, no damage to internal mechanism *Recommendations:* Retain and conserve in situ. Implement interpretation opportunities Seek the advice of a conservator for conservation and interpretation on site	 
Element 10: Chimney Stack for Downdraught Kilns		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 27: Toilet Block		
The space could not be accessed.		
Element 28: Ancillary Storage Building		

ID	Description	Photograph
28-01	*Description:* Approximately 11 dismantled brick barrows *Location:* Rear of Ancillary Storage Building 1 (Element 28) *Condition:* Poor *Comments:* Advanced rust activity, missing timber lining and wheels *Recommendations:* Salvage and store on site. Appropriately label as a 'job lot', with a catalogue number and provenance, likely will include 16A-02 Seek the advice of a conservator for conservation and interpretation on site	 
Element 29: Substation/Control Room		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 30: Boiler House		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 31: Amenities Block 2		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 32: Extrusion Plant (Remnants)		
32-01	*Description:* Stack of misfired red bricks, approximately 12 courses *Location:* Northeastern end of concrete slab, adjacent to external rear wall of Ancillary Storage Building 1 (Element 28) *Condition:* Good *Comments:* Little apparent fabric damage, some minor lichen attachments *Recommendations:* Retain for interpretation on site	

ID	Description	Photograph
32-02	*Description:* Approximately nine extrusion chutes *Location:* Along southwestern edge of Extrusion Plant (Element 32) *Condition:* Poor–fair *Comments:* Some fabric damage, advanced rust activity on several examples, may be damage from encroaching foliage *Recommendations:* Salvage and store on site. Appropriately label as a 'job lot', with a catalogue number and provenance, likely will include 34A-01 Seek the advice of a conservator for conservation and interpretation on site	 
Element 33: Ancillary Storage Building 2		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 34: Storage Shed		
No moveable relics associated with the primary function of the Brickworks were identified		
Element 35: Model Railway Workshop		
No moveable relics associated with the primary function of the Brickworks were identified		
Model Railway Workshop Area		
35A-01	*Description:* Extrusion chute *Location:* Adjacent to northern external wall of Model Railway Workshop Area (Element 35) *Condition:* Fair *Comments:* No apparent fabric damage, some rust activity *Recommendations:* Salvage and store on site. Label with an inventory catalogue number and provenance, likely as part of 31-02 'job lot' Seek the advice of a conservator conservation and on site interpretation	
Element 36: Model Railway Storage Shed		
No moveable relics associated with the primary function of the Brickworks were identified		

ID	Description	Photograph
Element 1A: Railway Remnants (Narrow-gauge Railway)		
No moveable relics were able to be checked in detail here.		
Element 37: Original Brickyard		
37-01	*Description:* 'DR Patent und Auslandspatente' brick press *Location:* Eastern end of yard, adjacent to rear of Amenities Block 1 (Element 25) *Condition:* Fair *Comments:* Some fabric damage, graffiti damage, some rust activity *Recommendations:* Salvage and store on site. Label with an inventory catalogue number and provenance Seek the advice of a conservator for conservation and interpretation on site	  
Element 38: Brickyard 2		
No moveable relics associated with the primary function of the Brickworks were identified		



Figure 2 Map of moveable relics identified at the Canberra Brickworks Precinct during this assessment. (Source: SIX Maps with GML overlay)

H.4 Recommendations

This inventory provides the initial step in the identification of items that should be considered for further investigation, conservation, and interpretation.

The following recommendations provide general initial information, to inform the next stages of investigation, for the conservation, management and reuse of the items of industrial equipment and machinery in this inventory.

Recommendations include:

1. undertaking further historical research to identify provenance, function and association with the historic function of the Brickworks. This information would allow for a better understanding of potential historic association with the industrial function and heritage significance of the site;
2. retaining fixed industrial equipment and moveable relics for in situ conservation, reuse in the redevelopment and interpretation of the heritage significance of the site (eg the equipment in the Fan Houses [05, 09] and Primary Crusher House [20]);
3. seeking the advice of a conservator, with expertise in large industrial objects, metal and timber conservation. A conservator can assist in undertaking Recommendation 1 (above) and the cataloguing of identified items for restoration, salvage, transport and storage, etc. Storage should be on site if possible (in situ being preferable), or in a weather-proof location for assessment, cleaning and physical conservation (if required);
4. recording where items are proposed to be stored if removed from site and any conservation works taken to items; and
5. undertaking salvage and/or conservation works prior to demolition/construction works commencing on site.

For industrial ephemera not included in this inventory, it is recommended that:

- a salvage schedule should be developed for historical industrial ephemera, including items that are not directly integral with the historic industrial function of the site, its heritage significance or easily identified to be associated with brickmaking function of the site;
- are of historical interest and potentially to collectors of historical industrial equipment;
- obvious rubbish and post-1976 items can be removed without inclusion in the schedule; and
- if any further remnants, relics, historic equipment and ephemera are uncovered during demolition, the Unanticipated Finds Protocol should be followed (Appendix E) and a heritage expert/conservator should be consulted to determine salvage value.

Appendix I

ACAT Orders regarding the Railway Remnants and Dunrossil Estate

File Number

AT 13/17

ACT CIVIL AND ADMINISTRATIVE TRIBUNAL

ACAT
AUSTRALIAN CAPITAL TERRITORY
CIVIL & ADMINISTRATIVE TRIBUNAL

APPLICATION FOR INTERIM OR OTHER ORDERS – GENERAL*

**see attachment for when this application may be used*

APPLICANT	
Name	**Land Development Agency**
RESPONDENT	
Name	**ACT Heritage Council**
THIS APPLICATION is made by the: (strike out what does not apply)	
~~**Applicant**~~ ~~**Respondent**~~	**All Parties**
Orders sought – interim or other orders *(use an attachment if insufficient space and number each order separately)*	
The parties hereby consent to the Tribunal making a decision pursuant to section 55 of the ACT *Civil and Administrative Tribunal Act 2008* (the **Act**) in the terms set out in Attachment A (which refers to and includes Attachments B, C and D).	
Legislation under which orders are sought:	
Section 55 of the Act	

Approved Form AF2009-42 approved by L Crebbin (General President) and B Stefaniak (Appeal President) on 30 January 2009 under section 117 of the *ACT Civil and Administrative Tribunal Act 2008*.

Unauthorised version prepared by ACT Parliamentary Counsel's Office

Grounds relied on *(use an attachment if insufficient space)*

The parties have reached an agreement about the terms of a Tribunal decision in relation to the application. The terms of the agreement have been reduced to writing, signed by the parties and lodged with Tribunal.

Clayton Utz
Solicitor for the Applicant

Date 7 September 2013

ACT Government Solicitor
per: Pamela Mathie
Solicitor for the Respondent

Date 7 September 2013

Applications for Interim or Other Orders

This form may be used when an application has already commenced before the tribunal and a party or someone else wishes to apply for an interim or other order in relation to that application. It should be used only when no other specific form exists for the application. It may only be used when the ACT Civil and Administrative Act 2008 (the Act) or some other law authorises the application.

Examples of applications that may be made include:

1. for an interim order under section 53 of the Act or to vary, revoke or extend such an order
2. to join a person as a new party to an application
3. for an order under section 35 of the Act referring a matter for mediation and requiring the parties to attend a mediation
4. for an order under section 39(3) of the Act relating to hearings in private or partly in private
5. to set aside a subpoena completely or partly under section 41(6) of the Act
6. for a direction to permit a person to take part or give evidence other than in person under section 45 of the Act
7. to amend a document under section 47 of the Act
8. for the tribunal to make an order in accordance with agreed terms under section 55 of the Act
9. for an order to hear an application jointly with another application under section 56 (a) of the Act
10. for orders to be made by consent under section 56(b) of the Act
11. to amend or set aside a tribunal order under section 56(c)
12. to extend the period for compliance stated in a direction made under section 67 of the Act
13. to remove an application to the Supreme Court under section 83 of the Act or for the referral of a question of law to the Supreme Court under section 84 of the Act

NOTE: This is not an exhaustive list of the applications for interim or other orders that may be made using this form.

Unless it is inconsistent with a provision in the Act or in an authorising law or rule, a person may apply to the tribunal for an interim or other order in an application by:

(a) lodging an application in writing using this form or
(b) by writing a letter to the tribunal or
(c) by making an oral application to the tribunal.

A person who wishes to apply for an interim or other order in an application should ensure that every party to the application is aware of what orders are sought and when the application is going to be made.

In making a decision about how an application for an interim or other order should be made in a matter the tribunal will consider:

Approved Form AF2009-42 approved by L Crebbin (General President) and B Stefaniak (Appeal President) on 30 January 2009 under section 117 of the *ACT Civil and Administrative Tribunal Act 2008*.
Unauthorised version prepared by ACT Parliamentary Counsel's Office

(a) the need to observe natural justice and procedural fairness, and;
(b) the requirement for procedures to be as simple, quick, inexpensive and informal as is consistent with achieving justice and
(c) the needs of the particular matter

ATTACHMENT A

AUSTRALIAN CAPITAL TERRITORY)
CIVIL AND ADMINISTRATIVE TRIBUNAL)

NO: AT 13/17

RE: **LAND DEVELOPMENT AGENCY**
Applicant

AND: **ACT HERITAGE COUNCIL**
Respondent

1. WHEREAS the parties have agreed that the document at Attachment B will, subject to necessary approvals, be the basis of any future Estate Development Plan prepared to address heritage issues related to the area registered on the ACT Heritage Register as defined in Notifiable Instrument NI 2013-38 "Heritage (Decision about Registration of Yarralumla Brickworks Railway Remnants) Notice 2013" (the **Railway Remnants**).

2. WHEREAS the parties have agreed that the "Heritage Zone" as shown on Attachment B and depicted in Attachment D (as being the registered area for rail remnant preservation) has heritage significance in accordance with the Heritage Act 2004 (**Heritage Act**) and, in relation to the area in Attachment B marked "Removed Registered Land" (including "Dunrossil Estate"), on the basis of the current information, the Heritage Council will not, in the future, seek to register that area or exercise any other legislative function in relation to that area including making a direction requiring preparation of a Conservation Management Plan.

3. WHEREAS the parties have agreed that in respect of the "Heritage Zone" shown on Attachment B and depicted in Attachment D (as being the registered area for rail remnant preservation) that the matters stated at Attachment C in respect of the "Heritage Zone" will apply, subject to the respondent's functions under the Heritage Act.

4. WHEREAS the parties have agreed that in respect of the "Dunrossil Estate" shown on Attachment B that the matters stated at Attachment C in respect of the "Dunrossil Estate" will apply subject to, in the 3rd bullet point under the heading Dunrossil Estate:
   (a) the words "2 storeys from and including ground level (where storey has the same meaning as the definition of that term in the Territory Plan) or lower subject to consultation" being substituted for the words " level 1"; and
   (b) the words "Dunrossil Estate" being substituted for the words "registered area".

5. WHEREAS the parties have agreed to closely consult and seek agreement with each other in relation to development within the "Heritage Zone" shown on Attachment B

and depicted in Attachment D (as being the registered area for rail remnant preservation), subject to the respondent's functions under the Act.

6. WHEREAS the respondent acknowledges that development within the "Dunrossil Estate" shown on Attachment B is a matter for the applicant, nevertheless, the parties have agreed to closely consult with each other in relation to development within the "Dunrossil Estate".

7. WHEREAS the respondent acknowledges that the interface between the "Heritage Zone" shown on Attachment B and depicted in Attachment D (as being the registered area for rail remnant preservation) and the adjacent area shown as "Development Block (up to 8 storeys)" on Attachment B is a matter for the applicant, nevertheless, the parties have agreed to closely consult with each other in relation to development of the interface.

8. WHEREAS the respondent acknowledges that the possible interpretation (for example, through signage and/or surface treatment) of the linear alignment of the Railway Remnants, as depicted by the survey of Jason Steger in his Surveyor's Report dated 5 July 2013 and filed in these proceedings, in other areas outside of the "Heritage Zone" and the "Dunrossil Estate" shown on Attachment B is a matter for the applicant, nevertheless, the parties have agreed to consult with each other in relation to this possible interpretation.

THE PARTIES HEREBY CONSENT to the decision under review being varied to register the Yarralumla Brickworks Railway Remnants only on part Block 7 Section 102 Yarralumla as depicted on Attachment D (instead of the area marked on figure 1 on page 10 of the registration details at Tribunal Documents page 26).

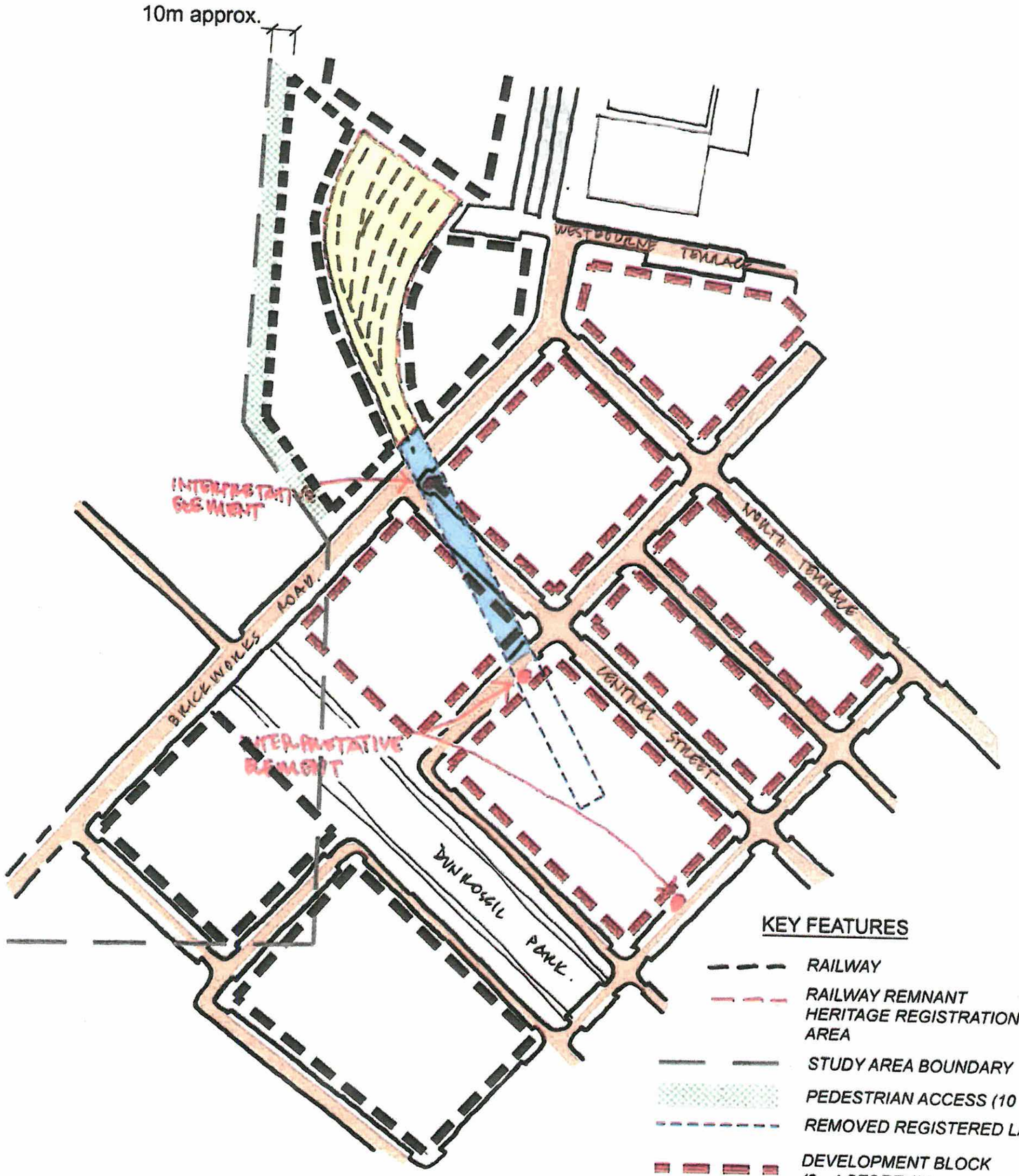
Clayton Utz
Solicitor for the Applicant

Date: 7 September 2013

ACT Government Solicitor
Per:
Pamela Mathie
Solicitor for the Respondent

Date: 7 September 2013

"B"



Note: This proposal, subject to LDA & ACT Heritage Council support, would be the basis of any future Estate Development Plan prepared to address heritage issues related to the Railway remnants

SCALE 0 10 20 50m

CANBERRA BRICKWORKS

LDA PROPOSAL

P00240-04

ACT Government
Economic Development

Land Development Agency
CANBERRA FIRST

ABN 204 199 255 79

TransACT House
470 Northbourne Avenue
Dickson ACT 2602

GPO Box 158 Canberra ACT 2601

Phone: (02) 6205 0600
Fax: (02) 6207 5101
Email: lda@act.gov.au
Web: lda.act.gov.au

Railway Remnants – Explanation of Heritage treatments

Heritage Zone

The Heritage Zone will be treated as landscaped open space, celebrating the history of the railway remnants. Allowable uses within the Heritage Zone may include:

- Pathways
- Playground equipment
- Park benches and seating, picnic tables and barbeque equipment
- Restoration of the railway remnants, where appropriate
- Interpretative elements such as signage and sculpture to enhance understanding of the railway remnants
- Infrastructure to support the landscaped park such as irrigation and Water Sensitive Urban Design elements.

Dunrossil Estate

Allowable uses within the Dunrossil Estate may include:

- Roadways, including in-ground servicing and infrastructure
- Associated landscaping and streetscape works
- Built form elements allowable from level 1, preserving a visual axis for the length of the registered area (refer attached *Highline* images).

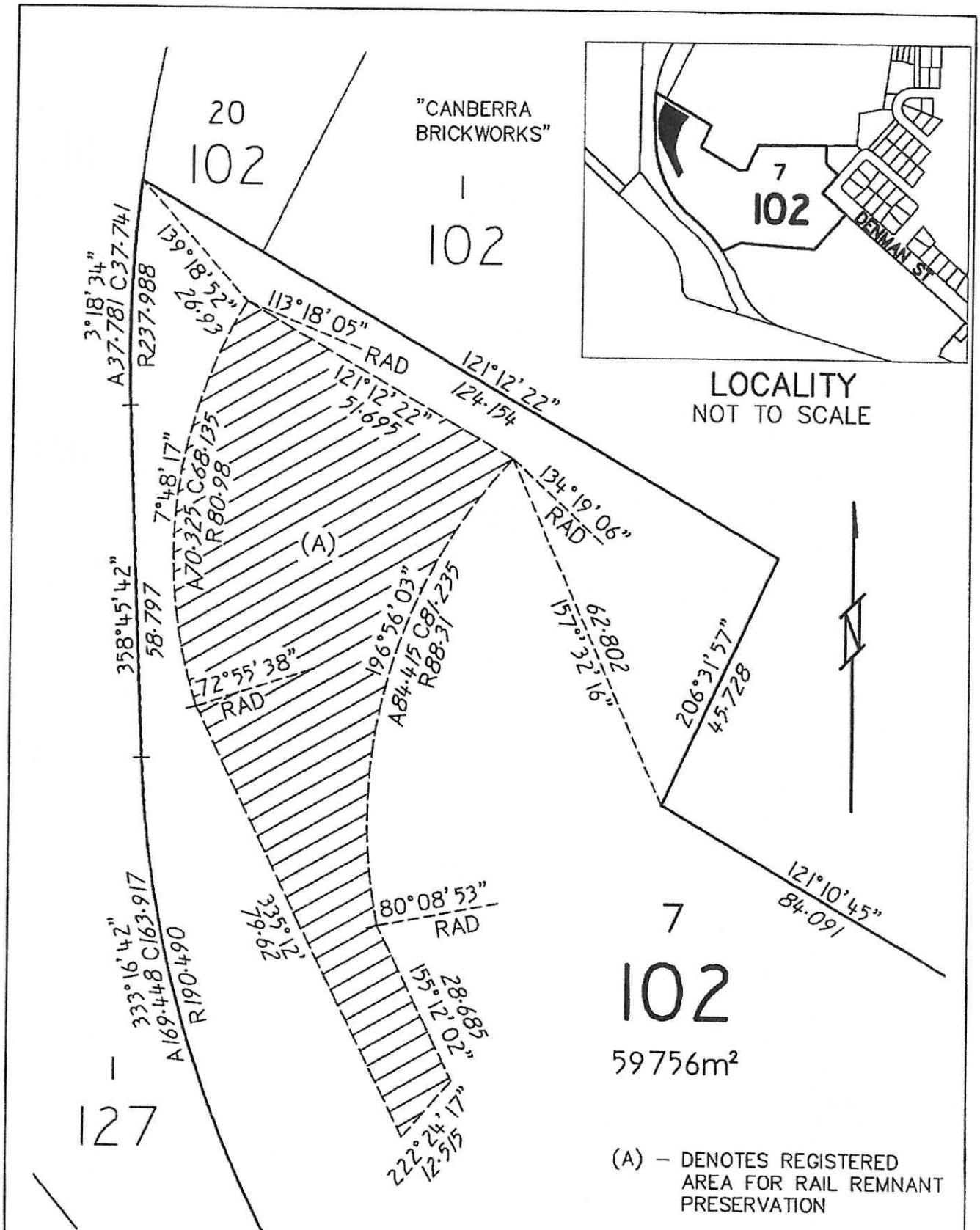
The alignment of the railway remnants will visually be interpreted through the following elements:

- Differentiated paving and ground treatments
- Illustrative and/or educational signage.


thecaledonia.com
LUXURY RENTALS



"D"



I JASON P STEGER CERTIFY THAT THIS PLAN IS AN ACCURATE AND ADEQUATE REPRESENTATION OF THE LOCATION OF THE REGISTERED AREA FOR RAIL REMNANT PRESERVATION OVER BLOCK 7 SECTION 102 DIVISION OF YARRALUMLA

SIGNED _____ DATE 2/09/13

REGISTERED SURVEYOR

SURVEYORS REF: 11005_001

PLAN OF REGISTERED AREA

BLOCK 7
SECTON 102
DIVISION YARRALUMLA
DISTRICT CANBERRA CENTRAL

SCALE 1:5000

PLAN OF REGISTERED AREA

ACT Heritage Council

Conservation Management Plan Approval

Under Section 61K of the *Heritage Act 2004*

Heritage Reference: CMP-Yarralumla Brickworks

Received by Council: 3 March 2020 and 12 August 2021

TO: **Doma Group**
Alex Moulis, Development Manager
alex@domagroup.com.au

Block:	Section:	Division:	Heritage Place:
1	102	Yarralumla	Yarralumla Brickworks
7 (part)	102	Yarralumla	Yarralumla Brickworks Railway Remnants

Status of Place: Registered Heritage Places

Report Details: "*Canberra Brickworks Precinct – Conservation Management Plan. Volumes One and Two*" (GML Heritage, August 2021)

Council Advice provided by: Chair / Heritage Council

Pursuant to Section 61K of the *Heritage Act 2004*, the ACT Heritage Council advises that:

☒ **The Conservation Management Plan is approved, with conditions** as set out below, on the basis that it ensures the conservation and responsible management of the Yarralumla Brickworks and the Yarralumla Brickworks Railway Remnants.

Background:

On 3 March 2020, Doma Group submitted an application to the ACT Heritage Council (the Council) for the approval of a Conservation Management Plan (CMP) under Section 61J of the *Heritage Act 2004*.

On 12 August 2021, a revised CMP was submitted to support the application, being the *"Canberra Brickworks Precinct – Conservation Management Plan (Volumes One and Two)"* (GML Heritage, August 2021); which was amended in response to Council advice on 10 October 2020 and 28 April 2021.

The CMP relates to the Yarralumla Brickworks and the Yarralumla Brickworks Railway Remnants, being places registered on the ACT Heritage Register (the Register), and presents an assessment of the heritage significance of the place against contemporary *Heritage Act 2004* criteria, a conservation policy and management framework, an implementation schedule and an inventory of individual historic elements.

Decision:

Following review, the Council is satisfied on reasonable grounds that the plan ensures the conservation and responsible management of the Yarralumla Brickworks and the Yarralumla Brickworks Railway Remnants. On this basis, the Council approves the Conservation Management Plan application subject to the following conditions:

1. The CMP is approved for a maximum period of five years.

2. Implementation of conservation policies and actions described in this CMP are the responsibility of the owner/manager of the heritage place.

3. Within three months of the date of this approval, the ACT Government, as the current owner of the Precinct, is to submit a Scope of Works for essential maintenance and conservation works of the Precinct for Council approval.

4. Within six months of the date of this approval, an Interpretation Strategy for the Precinct is to be submitted to the Council for approval.

5. Within twelve months of the date of this approval, or within 30 days of Doma Group assuming management responsibility of the site, a Scope of Works for the ongoing maintenance and conservation of the Precinct is to be submitted to the Council for approval.

6. The attached Notice of Approval is to be inserted in front of the CMP contents page, and circulated to any user or other interested party, and also submitted to the ACT Heritage Library for public reference.

The Council also notes that *Heritage Act 2004* provisions require the conservation and responsible management of all significant features of the place, as set out in Section 5 of the CMP; and that the reference to supporting elements being preferably retained in Section 6.4 is not supported.



Dr Kenneth Heffernan
Chair (as delegate for),
ACT Heritage Council
30 August 2021

Canberra Brickworks Precinct

Archaeological Research Design

Report prepared for DOMA Group

April 2020



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Canberra Office 2A Mugga Way Red Hill ACT Australia 2603 T +61 2 6273 7540
GML Heritage Pty Ltd ABN 60 001 179 362
www.gml.com.au

Report Register

The following report register documents the development and issue of the report entitled Canberra Brickworks Precinct—Archaeological Research Design, undertaken by GML Heritage Pty Ltd in accordance with its quality management system.

Job No.	Issue No.	Notes/Description	Issue Date
19-0443A	1	Draft Report	6 February 2020
19-0443A	2	Final report	29 April 2020

Quality Assurance

GML Heritage Pty Ltd operates under a quality management system which has been certified as complying with the Australian/New Zealand Standard for quality management systems AS/NZS ISO 9001:2016.

The report has been reviewed and approved for issue in accordance with the GML quality assurance policy and procedures.

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Appendix A
Archaeological Assessment

Executive Summary

Doma Group is undertaking a project to redevelop the Canberra Brickworks Precinct site located in Yarralumla, ACT (the site). The proposed redevelopment includes new residential areas and associated infrastructure, as well as retail and office spaces which will be accessible to the public. Several historical structures at the site will be retained and adapted into these new facilities. Doma Group has commissioned GML Heritage Pty Ltd (GML) to provide heritage and archaeological services for the project.

An Archaeological Assessment (AA) of the site was previously prepared by Navin Officer in 2016. This report identified 12 areas of archaeological sensitivity and recommended that areas of moderate and high archaeological potential be subjected to an archaeological testing program prior to any works or development in these areas (BRW1–BRW12). This report presents the Archaeological Research Design (ARD) for a preliminary archaeological testing program at the site. The aim of this program is to determine the nature and extent of archaeological deposits within the site and to develop recommendations for any future management requirements for archaeological deposits.

Based on a review of the AA and an inspection of the site, GML determined that eight of the 12 areas of archaeological sensitivity identified in the AA should be subjected to further archaeological testing (BRW1, BRW2, BRW3, BRW7, BRW8, BRW10, BRW11 and BRW12). The proposed methodologies for archaeological testing at these areas are presented in this report and have been developed based on a review of the AA and relevant documents, as well as a site inspection undertaken by GML.

This ARD is required to be submitted with an Excavation Permit application under Section 61E of the *Heritage Act 2004* (ACT).

1.0 Introduction

1.1 Project Background

Doma Group is undertaking a project to redevelop the Canberra Brickworks Precinct site located in Yarralumla, ACT (the site/study area). The proposed redevelopment includes new residential areas and associated infrastructure, as well as retail and office spaces which will be accessible to the public. Several historical structures at the site will be retained and adapted into these new facilities.

Doma Group has commissioned GML Heritage Pty Ltd (GML) to provide heritage and archaeological services for the project. GML has recently prepared an updated Conservation Management Plan (CMP) for the site. An Archaeological Assessment (AA) was prepared for the study area by Navin Officer in 2016 to inform future works.

The proposed works have the potential to impact the study area's archaeological resource. This report builds on the AA prepared by Navin Officer in 2016 to provide an Archaeological Research Design (ARD) for the proposed development.

1.2 Study Area

The location of the Canberra Brickworks Precinct, the study area for this CMP, is shown in Figures 1.1 and 1.2.

The Canberra Brickworks Precinct comprises Blocks 1, 7 and 20, Section 102, which includes the heritage listed areas of the 'Yarralumla Brickworks' (located in Block 1, Section 102) and the 'Yarralumla Brickworks Railway Remnants' (located in part Block 7, Section 102) (refer to Figure 1.2).

The Precinct is located in the suburb of Yarralumla, to the west of central Canberra. The site is bordered to the north and east by low density residential development, to the west by the Royal Canberra Golf Course and Westbourne Woods, and to the south by open space.



Figure 1.1 Location of the Canberra Brickworks Precinct in the broader context of Canberra. (Source: Google Earth with GML overlay, 2017)

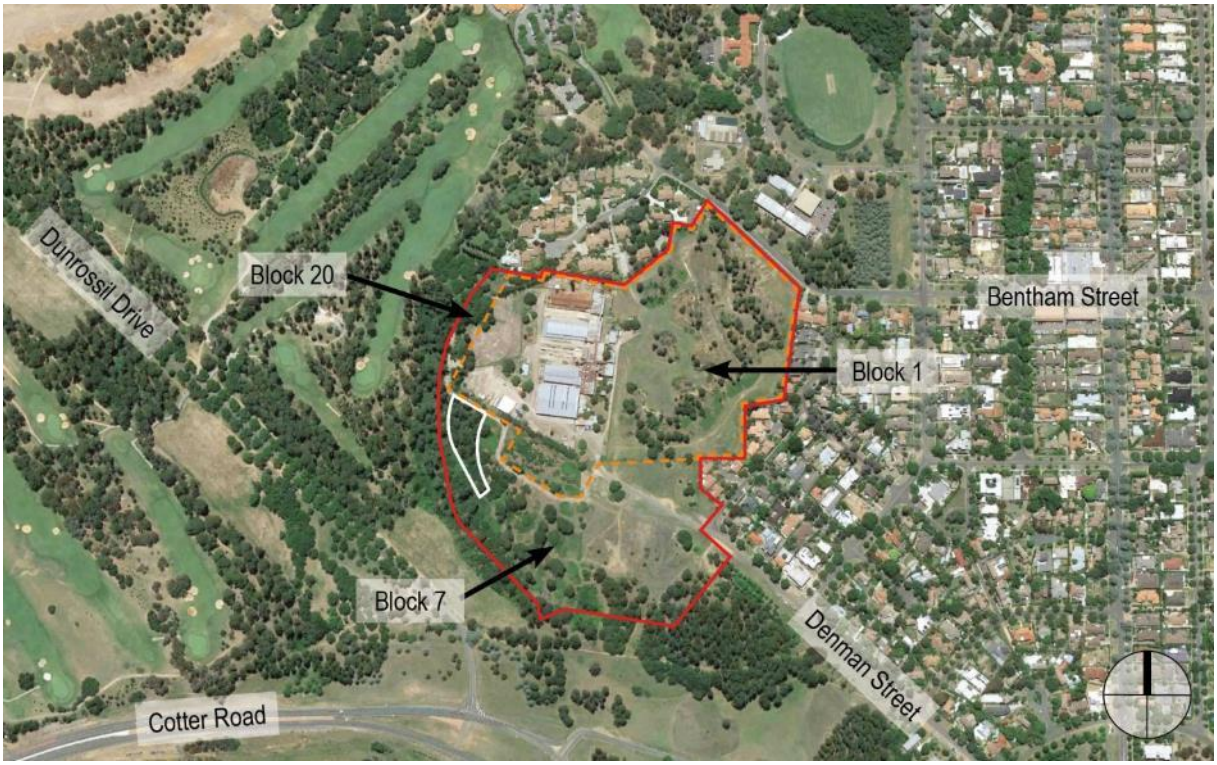


Figure 1.2 CMP study area—Canberra Brickworks Precinct is shown in the red boundary. The study area consists of Blocks 1, 7 and 20, Section 102 and includes the ACT heritage listed boundaries for the 'Yarralumla Brickworks' (Block 1) (orange dashed line) and the 'Yarralumla Brickworks Railway Remnants' (part Block 7) (white boundary). (Source: Google Earth with GML overlay, 2017)

1.3 Heritage Status

1.3.1 ACT Heritage Register

The *Heritage Act 2004* (ACT) (Heritage Act) aims to represent and protect the rich natural and cultural heritage of the ACT. The legislation establishes a system for the recognition, registration and conservation of natural and cultural heritage places and objects, including Aboriginal places and objects.

The 'Yarralumla Brickworks' (Block 1, Section 102 Yarralumla) and the 'Yarralumla Brickworks Railway Remnants' (Part Block 7, Section 102 Yarralumla) are recognised as having heritage significance by their inclusion in the ACT Heritage Register.

The heritage significance of the site is explained further in Section 4.0 of this report.

1.3.2 Non-Statutory Listings

The 'Yarralumla Brickworks' is listed on the Australian Institute of Architects (AIA) ACT Chapter Register of Significant Twentieth Century Architecture (RSTCA), item No. R063.

The 'Canberra Brickworks' was identified as a 'Classified' place by the National Trust of Australia (ACT) on 20 July 1981.

1.3.3 Heritage Places in the Vicinity

The site is also within close proximity to four heritage places that are included on the ACT Heritage Register and the Commonwealth Heritage List (CHL):

- Government House and Surrounds (CHL Place ID: 105381);
- the CSIRO Forestry Precinct (CHL Place ID: 105595);
- Westbourne Woods (ACT Heritage ID: 444); and
- Early Canberra Brickworks Housing Precinct (ACT Heritage ID: 1002).

1.4 Proposed Works

The proposed works involve the redevelopment of the study area into a residential area with associated infrastructure and retail and office spaces (Figure 1.1). Several of the remnant historical structures will be retained and utilised as infrastructure for the residents, and as retail and office spaces for the public. The site will be landscaped, and services and utilities will be installed. Structures are proposed to be constructed within areas found to have archaeological potential including BRW1, BRW2, BRW3, BRW4, BRW5, BRW6, BRW7, BRW8, BRW10 and BRW11. No structures are currently proposed for the BRW9 area. The quarry area will be landscaped, and a pool is proposed to be installed in the existing dam area. Several structures are proposed along the eastern boundary of the site, above the former quarry area.



Figure 1.3 Preliminary proposed development design over a current aerial. (Source: Google Earth with GML overlay)

1.5 Purpose of Report

This ARD has been prepared to guide the historical archaeological investigations required to manage and mitigate construction related impacts. It includes:

- a summary historical background based on the AA and CMP;
- an archaeological assessment of potential significance;
- an assessment of potential impacts of the proposed works; and
- an archaeological research design and excavation methodology to manage and mitigate impacts.

This ARD report will be submitted to the ACT Heritage Council to support an Excavation Permit application.

1.6 Authorship and Acknowledgements

This report has been prepared by Janene May (GML Heritage Consultant) and reviewed by Martin Rowney (GML Partner). GML wishes to acknowledge the assistance of personnel from Doma Group and the ACT Heritage Unit.

1.7 Limitations

This report presents the research design and methodology for historical archaeology. The methodology includes an initial testing stage to determine the nature and extent of the potential archaeological resource.

2.0 Historical Background

2.1 Introduction

This section provides a summary of the historical development of the Canberra Brickworks Precinct including a background history of Canberra, a contextual history of the Brickworks, and a comparative analysis of other Australian brickworks.

The history and comparative analysis has been drawn predominantly from the 2019 CMP, and revised and updated where necessary.

2.2 Background History of Canberra

2.2.1 Ngunnawal Country

The Brickworks is located on traditional lands held by the Indigenous people of the Ngunnawal group. The Ngunnawal people have occupied the land for thousands of years and their descendants continue to live in Canberra and the surrounding region. Several Indigenous groups, including the Ngunnawal and Ngambri, were recorded to have settled along the sandy banks of the Molonglo River. As an important resource, the Molonglo River corridor attracted a hunter-gatherer lifestyle and Aboriginal people set up shelter and camps throughout the area as they travelled in response to the availability of natural resources.[1]

The Aboriginal people were displaced from their land following European settlement of the area and their numbers dwindled dramatically, possibly associated with a smallpox epidemic in 1830, influenza and a measles epidemic in the 1860s.[2] There are few records of Aboriginal people on the Limestone Plains after it was settled by pastoralists, perhaps because of Indigenous seasonal lifestyles, or because they retreated from settlers and their horses, and moved to the hills.[3] The new settlers may also have simply failed to record their ongoing presence in any detail.

2.2.2 Colonial History

European colonisation of the area commenced in the 1820s with small and large estates for farming and grazing. The Brickworks site was established on part of a large sheep grazing property held by Frederick Campbell, a descendant of Robert Campbell who owned the early Canberra pastoral estate Duntroon.

During the late 1890s, there was much debate over the location of the seat of government for the new Commonwealth of Australia. It was eventually decided that the future capital's location would be selected by the new Parliament following Federation in 1901.[4] On the recommendation of Commonwealth surveyor Charles Scrivener, the district of Yass–Canberra was chosen in 1908. Scrivener's specific choice was an elevated site straddling the Molonglo River with mountains and hills to the northwest, northeast and south.

2.2.3 Planning the National Capital

The Griffin Plan

In 1911, an international competition to design the new city was launched and 137 entries were received. After considerable debate, Chicago architect Walter Burley Griffin was announced as the winner of the competition in May 1912.

Griffin's 1911 plan for the national capital was based on a geometry dictated by the landscape rather than the principal points of the compass, with a water axis formed from the flow of the Molonglo River at right angles to a land axis between two hill summits. A municipal axis lay just to the north of, and parallel to, the water axis. The central land axis ran from Mount Ainslie through Camp Hill (the site of Old Parliament House) to Capital Hill (the site of New Parliament House) and then nearly 50 kilometres further inland to Mount Bimberi.[5]

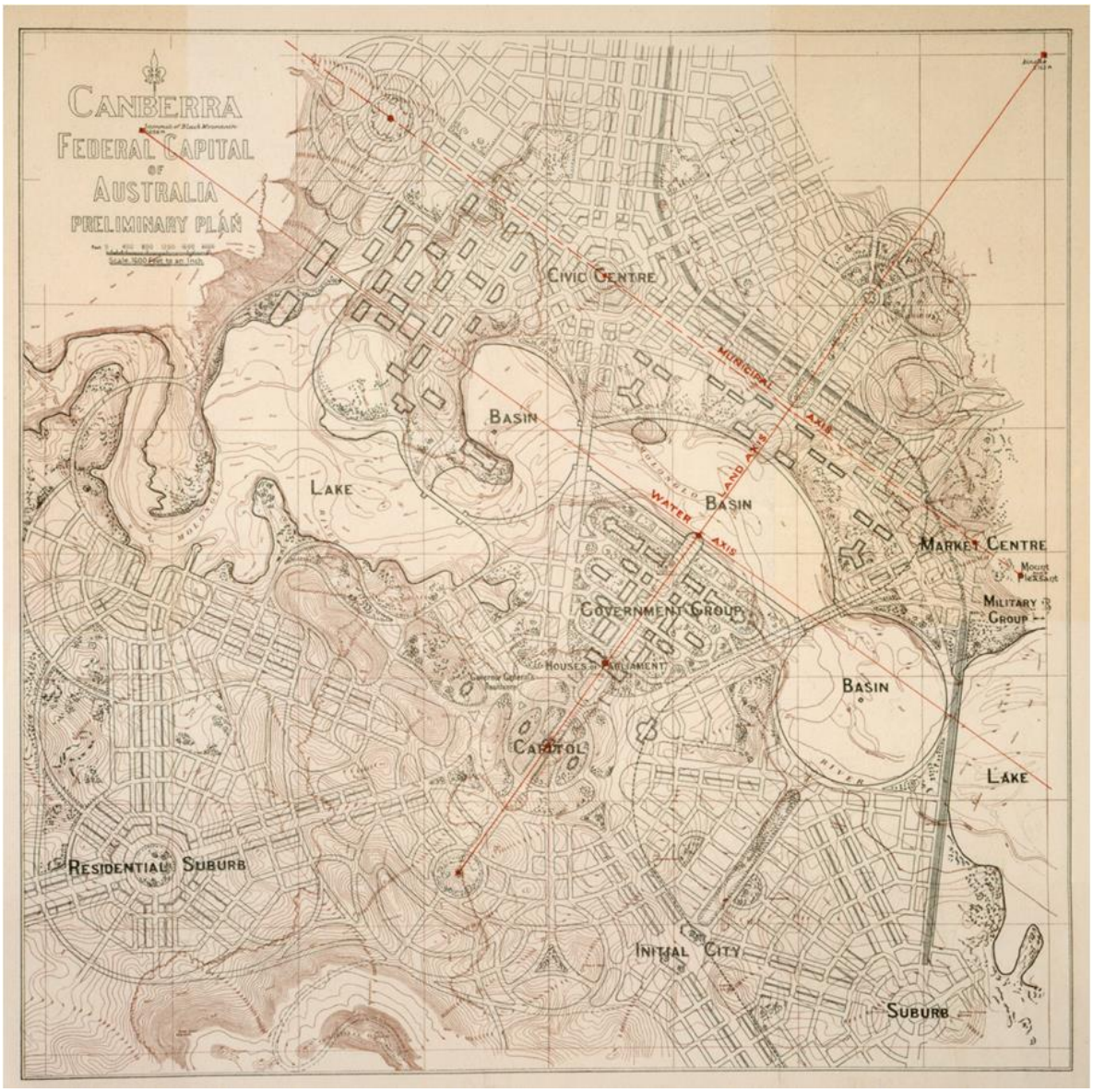


Figure 2.1 The Griffin Plan of Design for the federal capital showing the land, water and municipal axes, 1911. (Source: National Archives of Australia [NAA] A1, 1917/7242)

The Departmental Plan

Following the announcement of the top four winning entrants to the design competition, the Minister for Home Affairs, King O'Malley, appointed a Department Board to evaluate the winning proposals and create a plan for their practical implementation.

The Departmental Plan was completed by November 1912 and officially endorsed by King O'Malley in January 1913. Hearing of the Departmental Plan, Walter Burley Griffin visited Australia in an

attempt to view the site, understand the proposed amendments and deter the government from changing his vision. Of note in the Departmental Plan was the allocation of a brickworks site, which had not been included in Griffin's plan. A compromise between Griffin and the Board could not be reached and in October 1913 the incoming Minister for Home Affairs, William Kelly, dismissed the Board. Griffin was appointed as Federal Capital Director of Design and Construction to implement his original plan.[6]

By 1918 Griffin had developed his scheme into a practical plan that could be implemented. In 1920, the Commonwealth Government established a Federal Capital Advisory Committee (FCAC) to ensure the plan's timely execution. Griffin did not approve of the Advisory Committee's appointment and this, along with other ongoing unease and tension between Griffin and other staff and governmental departments, led to him to leaving Canberra in 1920 on the completion of his contract.[7]

While Griffin was no longer involved in the process, the 'Griffin Plan' for Canberra of 1925 (called the 'Statutory Plan for Canberra') was gazetted as a result of *Seat of Government (Administration) Act 1910* (Cwlth). This plan effectively set the agenda for city planning until the 1950s.

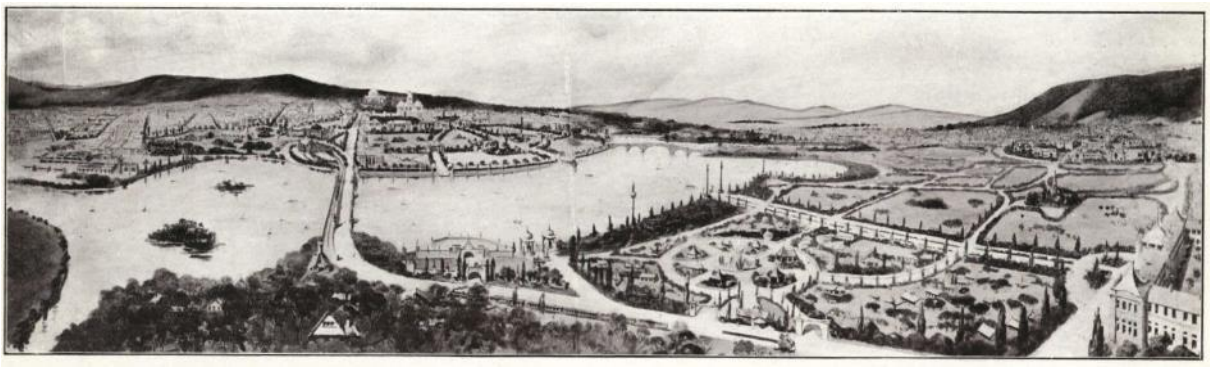


Figure 2.2 An artist's impression of the city's layout according to the Departmental Plan in Figure 2.3. (Source: NAA: M4071, 48, 1913, p 70)



Figure 2.3 The 1913 Departmental Plan, of the Federal Capital Commission, was a combination of two of the winning designs and lacked the clarity and structured form of the Griffin Plan. (Source: NAA: M4071, 48, 1913, p 68)

2.3 Overview History of the Brickworks

2.3.1 Phases of Development

The Brickworks site contains evidence from each of its main phases of development: establishment, expansion, postwar, and post closure, when the site was permanently closed as a brick manufacturing facility.

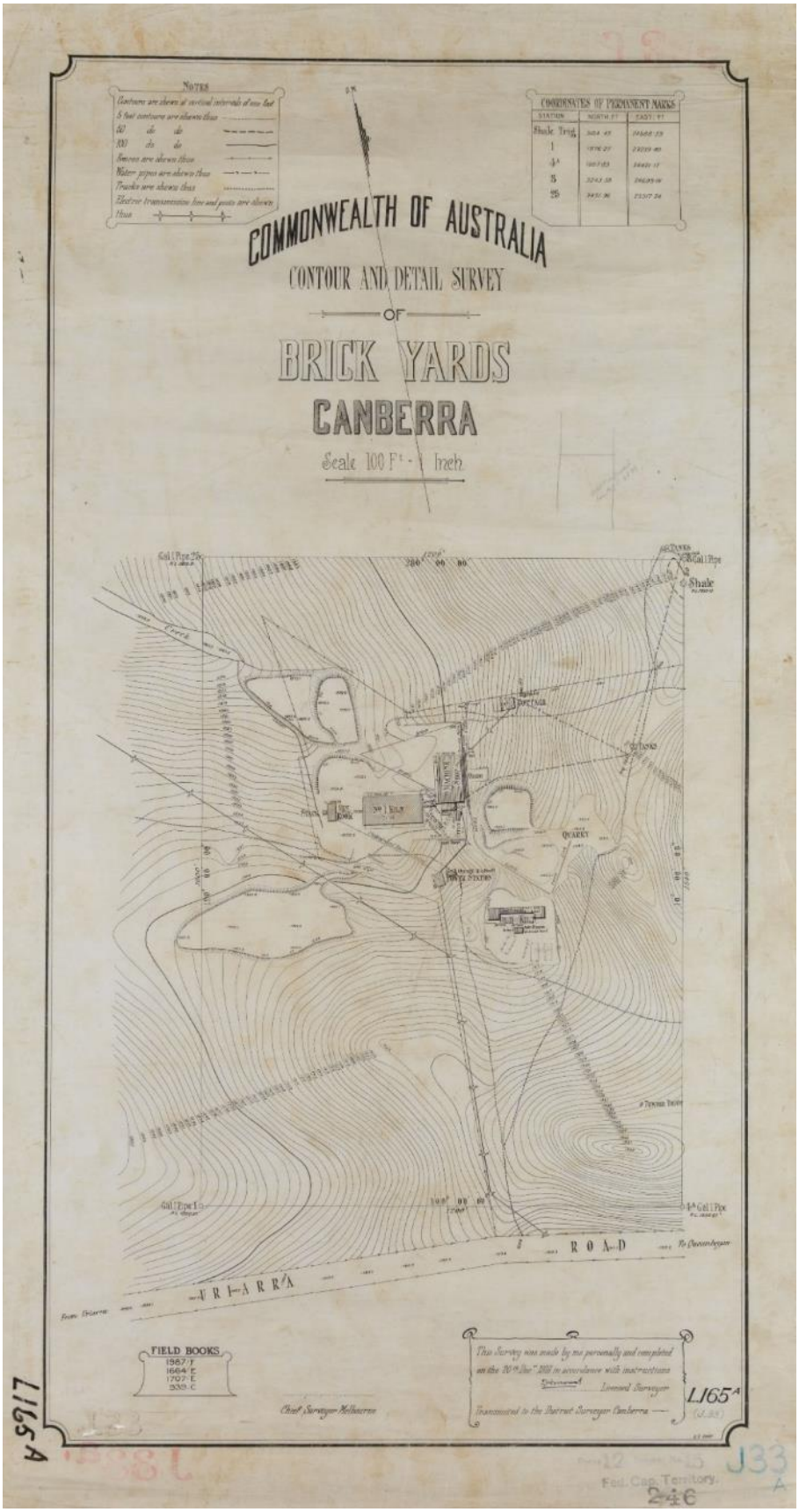


Figure 2.4 1916 contour and detail survey of the Brick Yards Canberra. (Source: NAA: A6664, L165A, 1916)



Figure 2.5 Staffordshire kiln construction at the Brickworks, c1915. (Source: Canberra District Historical Society, ID15652)



Figure 2.6 Chimney stack under construction, c1926. (Source: NAA, A3560, 2455)



Figure 2.7 Scotch kilns were in operation at the Brickworks until the mid-1920s. (Source: NAA, A3560, 1968)



Figure 2.8 Hardy patent kiln 1 under construction, c1926. (Source: NAA, A3560, 2111)

2.3.2 Establishment Phase, 1911–1920

The Brickworks was established by the Commonwealth Government in the early days of Canberra's development as the federal capital. Due to the costs associated with transporting bricks outside of the Territory, it was decided that a local quarry and brickworks be established to support the construction of houses and government buildings, and the population growth in the new town. Of the two sites investigated, 38 acres of sheep grazing land on Frederick Campbell's property Yarralumla Station was selected for its potential to produce bricks of an excellent quality, equal to the best commercially produced bricks for hardness and porosity.[8]

Development of the Brickworks began in 1913 with initial infrastructure comprising a grinding pan, brick making machine and elevator, portable steam engine, and four open kilns. It was expected that much of this equipment would be temporary and that more permanent infrastructure would be established in 1914. A single 20-chamber Staffordshire kiln, the first to be built in Australia, was completed in 1915. The arrival of World War I led to a shift in government priorities and commitments, and resulted in restrictions on the works program for Canberra. This shift, together with a coal strike, caused the first closure of the Brickworks in December 1916. A 1916 contour and detail survey identified early Brickworks infrastructure including: a 'Machine Shop', 'No.1 Kiln', 'Fan Room', 'Stack', 'Office', and 'Power Station' (see Figure 2.4).

Many workers from the Brickworks were housed in two tent camps (single and married quarters) in an area popularly known as 'Westridge', part of Griffin's planned suburb of Westlake (now part of the contemporary suburb of Yarralumla). The first permanent dwellings for workers were constructed in the 1920s.

2.3.3 Expansion Phase, 1921–1942

With the end of World War I, the government proceeded with the construction of Canberra and formally reopened the Brickworks in 1921, which had undergone machinery repairs the previous year. A tile making plant was constructed in 1922 but it was reported in 1925 that the tiles were of a poor quality and the government invested £2000 into improving the product. The 1920s saw an increase in residential construction and major civic construction projects throughout Canberra in response to government plans to move public servants from Melbourne and the completion of the Provisional Parliament House in 1927 was a significant achievement for the fledgling capital. To cope with the increased demand, a Hardy patent kiln and two 'temporary' Downdraught kilns and associated stack were constructed, and the brick manufacturing Machine Shop established in c1916 near the quarry

was expanded by two bays to accommodate brick machines and grinding pans.

During the 1920s, more permanent workers' accommodation was established in the form of timber tenements and brick cottages adjacent to the earlier accommodation camps. In 1927, additional married quarters and a single men's camp were constructed in response to the growing workforce.

To assist in the accelerated residential and civic construction of Canberra, a steam powered narrow-gauge railway was built in 1923 to improve the mass transportation of bricks. The bricks had previously been transported by steam traction engines, but this was a slow process unsuited to the capital's rapid growth and underdeveloped roads. A track leading from the Brickworks was constructed and branched out to the site of the new Hotel Canberra (now the Hyatt Hotel), the Provisional Parliament House, and the Kingston Powerhouse. A track was originally proposed to extend over the Molonglo River into Civic but the 1922 floods destroyed the connecting bridge. Eventually the Civic branch was established by narrowing an existing abandoned standard gauge track.[9] From 1927 the railway infrastructure was gradually removed and transportation continued by motor lorry.[10]

The Depression curtailed production at the Brickworks and timber was used instead of the more expensive coal to operate the kilns. With significant reduction in demand, the Brickworks closed for a second time in 1931. It reopened in 1935, but this proved to be short-lived due to the arrival of World War II. The Brickworks closed for a third time in 1942 and staff were laid off with a caretaker instituted to issue bricks for essential works only.

2.3.4 Post-World War II Phase, 1944–1976

In 1944 the Brickworks reopened on a limited scale. This soon increased to respond to the postwar housing shortage, which led to major expansion and redevelopment works at the Brickworks. Efforts were made to seek out experienced and qualified workers to meet the increased demand on the Brickworks. However, recruitment proved challenging and in an effort to attract workers, a new amenities block was constructed, as was the 'Brickworks Hostel' which was positioned south of the site and completed in 1945.

In 1952, plans and equipment for a new 'Tunnel' kiln were purchased and foundations laid, but the project was soon abandoned amid spiralling costs. A second Hardy patent 20-chamber kiln was constructed c1954 on the foundations of the abandoned Tunnel kiln. It utilised natural draught for firing, as opposed to being fan-induced, which required a tall chimney stack.



Figure 2.9 The Brickworks quarry face with workers, c1920–30. (Source: NAA, A3650, 3315)



Figure 2.10 The Brickworks quarry and narrow gauge railway track, c1920–30. (Source: NAA, A3650, 3314)



Figure 2.11 View from Old Parliament House roof with the railway and carts that delivered the bricks in the top right. (Source: NAA, A3560, 1398)

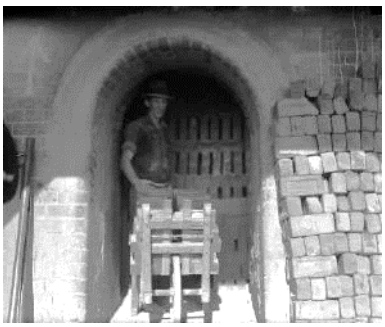


Figure 2.12 Man loading a kiln, c1926. (Source: NAA, A3560, 1973)



Figure 2.13 Canberra Brickworks, c1927. (Source: NAA, A3560, 2696)



Figure 2.14 Brick kilns and brick stacks, c1926. (Source: NAA, A3560, 167)



Figure 2.15 View to the kilns, c1928. (Source: NAA, A3560, 4557)



Figure 2.16 Stone crushing and screening plant. (Source: NAA, A3560)

The 1950s saw a change in the brick making process and a series of new crushers and hoppers was introduced, as well as an elevator and a series of conveyor belts. New brick press buildings and a workshop replaced the early machine shop adjacent the Staffordshire kiln. Despite extensive upgrades and works, a 1959 report on the operations, management, equipment, and economics of the Brickworks addressed concerns over low productivity at the site and the quality of bricks being produced.

In 1958, the two 1925 Downdraught kilns were demolished to allow for the construction of three new Downdraught kilns from 1960–1963. The new kilns had the capacity to hold 120,000 bricks and were reputed to be the longest in Australia. At this time, oil replaced coal as the fuel for firing the kilns.

By 1973, the Brickworks was considered in need of extensive modernisation and proposals were prepared by Commonwealth Brickworks Pty Ltd for upgrade works. These proposals were rejected by the National Capital Development Commission (NCDC) on environmental grounds and a new brickworks site was released at Mitchell in Canberra's north. The allocation of a new brickworks led to the final closure of the Brickworks and the kilns were unloaded for the last time in August 1976.

2.3.5 Post Closure Phase, 1976–2017

In 1976, local developer and businessman Alan Marr (A R Marr Pty Ltd) put forward a proposal to develop the Brickworks as an integrated tourist, recreation, and retail centre with medium density housing to the east and north of the site. Marr succeeded in having the land rezoned to accommodate his vision and carried out maintenance and reconstruction works to the kilns. Landscaping of the quarry, involving land fill and the creation of the reflection lake, proceeded in 1978. The redeveloped Brickworks was opened to the public as a tourist attraction in July 1979. However, limited income opportunities and high capital costs forced Marr's business into provisional liquidation. In the early 1980s, Marr was seriously injured in a fall at the site and later died of complications. The Commonwealth accepted the surrender of Marr's company's lease in 1984 and management of the site was transferred to caretaker Bruce McDonald. While many of Marr's tenants remained at the Brickworks, concerns about the safety of some of the buildings and potential redevelopment of the site led to the tenants being asked to leave and the caretaker role being abolished.

The 1988 *Canberra Brickworks South Canberra Policy Plan* suggested a range of potential uses for the site such as housing, commercial accommodation, and office and retail space. The

government adopted the plan, despite it being poorly received by the community. Hooker Projects submitted the preferred EOI, which proposed a development that adapted the kilns and machine bays, and contained a sports precinct, museum, restaurant, hotel, and visitor attractions. A depressed economy led to Hooker Projects being placed in provisional liquidation and by 1992 their proposal was defunct. It is around this time that the Commonwealth handed the Brickworks site over to the ACT Government.

Further development proposals were investigated but none proceeded and during this phase the Brickworks continued to accommodate a range of tenants, including artists, designers, and manufacturers. In 1994 a timber recycling business, Thor's Hammer, was established at the site, and operated until 2019.

In 2001 the Brickworks was included on the ACT Heritage Register as the 'Yarralumla Brickworks'. In 2013, the remnants of the former 1920s narrow-gauge railway were individually listed as the 'Yarralumla Brickworks Railway Remnants'.

In September 2013, the ACT Government's Land Development Agency (LDA) (now the Suburban Land Agency) released the *Canberra Brickworks and Environs Planning and Development Strategy*, which sought to promote the adaptive re-use of the site and its surrounds with respect to its heritage significance. Following revision of the strategy in 2015, the LDA called for development proposals to be submitted and in 2017 it was announced that the preferred tenderer was local Canberra developer Doma Group with its submission for a mixed-use residential, commercial, and retail development that utilised much of the historic Brickworks infrastructure.

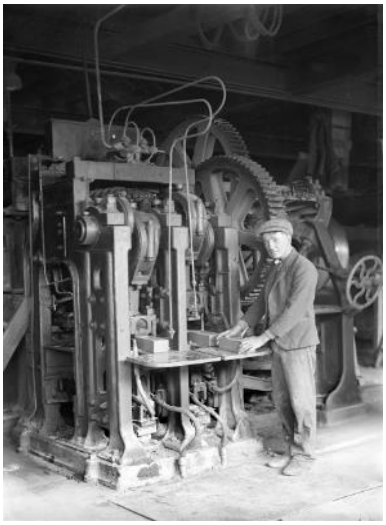


Figure 2.17 Brick pressing machine and operator, c1926. (Source: NAA, A3560, 1920)



Figure 2.18 Brick pressing machinery being installed at the Brickworks, c1925. (Source: NAA, A3560, 1210)

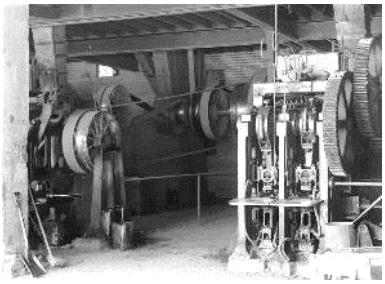


Figure 2.19 Brick presses for pressing clay bricks before firing, c1926. (Source: NAA, A3560, 159)

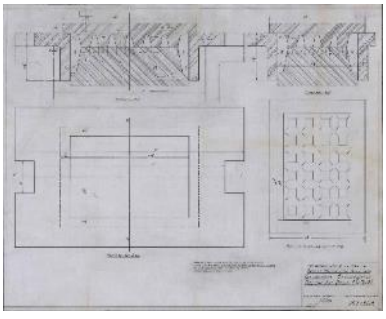


Figure 2.20 Dies for Air Brick, c1922. (Source: NAA, A2445, M2156B)

2.3.6 Chronology

The following table outlines the development phases and the construction dates of the remnant elements at the Canberra Brickworks Precinct.

Table 2.1 Chronology of the Development of the Remnant Elements On Site at the Canberra Brickworks Precinct.

Number	Element	Date
Establishment Phase: 1911–1920		
01	Quarry	1913–1940
02	Concrete Retaining Wall	c1913
03	Power House	1915–16
04	Staffordshire Kiln	1914–15
05	Fan House for Staffordshire Kiln	1914–15
06	Chimney Stack for Staffordshire Kiln	1914–15
36	Original brickyard area between Staffordshire Kiln, Hardy Patent Kiln 1, and fan houses	c1915, c1926
Expansion Phase: 1921–1942		
35	Narrow Gauge Railway (remnants)	1923
07	Offices	c1925
08	Hardy Patent Kiln 1	c1926–27 (rebuilt 1955)
09	Fan House for Hardy Patent Kiln 1	c1927 (second structure c1955)
10	Chimney Stack for Hardy Patent Kiln 1	c1926–27
Post World War II Phase: 1944–1976		
11	Amenities Block	c1950, c1977
12	Hardy Patent Kiln 2	c1954
13	Chimney Stack for Hardy Patent Kiln 2	c1953, c2005
14	Machine Bay 1 for Staffordshire Kiln and Downdraught Kilns	c1955
15	Machine Bay 2 for Hardy Patent Kiln 1	c1955
16	Machine Bay 3 for Hardy Patent Kiln 2	c1955
17	Workshop	c1955
18	Small Crusher House (Crusher House I)	c1958
19	White Pan Room (Large Crusher House/Crusher House II)	c1955
20	Primary Crusher House (Crusher House III)	c1955
21	Elevator/Conveyor	c1955
22	Downdraught Kilns	c1960–63

Number	Element	Date
23	Downdraught Kilns Control Room	c1961
24	Chimney Stack for Downdraught Kilns	c1961
Post Closure Phase: 1976–2017		
33	Model Railway Workshop	c1979
34	Model Railway Storage Shed	c1979



Figure 2.21 Site plan showing the location and development phase of individual elements within the Canberra Brickworks Precinct. (Source: Google Earth with GML overlay, 2017)

3.0 Historical Archaeological Resources

Twelve areas of potential archaeological sensitivity were identified in the AA, with varying levels of archaeological potential (low, moderate, high) and potential significance. These areas have been previously surveyed and are described in the AA. GML undertook an inspection of the site on 15 January 2020 to re-inspect these features and identify any other areas of archaeological sensitivity, if present.

3.1 Site Inspection

An inspection of the site was undertaken by GML Principal Martin Rowney, GML Heritage Consultant Janene May and GML Intern Caitlin Harvey on 15 January 2020. This aimed to examine the presence and extent of physical features at the site and review areas of archaeological sensitivity previously identified in the AA. The inspection also aimed to examine each of the areas of archaeological sensitivity to determine appropriate investigation strategies. Results of this site inspection are provided in Section 3.2 below. The site inspection confirmed the results of the AA and has informed the methodology provided in Section 4 of this report.

3.2 Archaeological Resources

The 12 areas of archaeological sensitivity (BRW1-12) at the site which were identified in the AA were assigned varying levels of potential, as shown in Figure 3.1 below. These areas are discussed below, with more detailed descriptions for some of the areas provided in the AA at Appendix A of this report.



Figure 3.1 Areas of archaeological potential in the study area. (Source: Navin Officer, 2016)

BRW1: Possible Building Platform and Concrete Features

This archaeological site consists of several surface features and potential subsurface features including a square concrete feature and a visible line of grass die back. The AA report suggested that this feature had a function with water, either for storage or drainage (refer to Appendix A). Some disturbance from erosion was noted. Preliminary investigations in this area may reveal the function of features in this area and their relationship to the wider Canberra Brickworks site.

The site inspection undertaken by GML confirmed the moderate potential of this area. If intact archaeological features are identified they may provide some information on the running of the brickworks; however, the significance of these features would likely be low. A review of historical imagery shows that the area remained largely cleared without structures present. Some roads appear to have potentially intersected the area during the twentieth century. One structure in the eastern portion of the site is visible on a 1972 aerial.

The description for the BRW1 area provided in the AA is included in Appendix A.



Figure 3.2 View towards BRW1. (Source: GML 2020)



Figure 3.3 Modern services at BRW1. (Source: GML 2020)

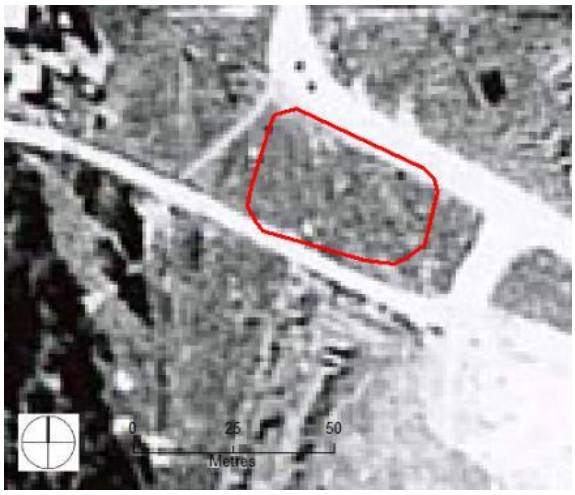


Figure 3.4 Site BRW1 overlaying a 1958 aerial. (Source: ACT Planning & Land Authority [ACTPLA] Plan Room 1958-5-21, Run 7, Print 5061)



Figure 3.5 Site BRW1 overlaying a 1972 aerial. (Source: ACTPLA Plan Room 24-2-1972, Run 9, Print 047)

BRW2: Married Quarters and Brickworks Hostel

The AA describes this archaeological site as consisting of the brickworks accommodation village, which contains a complex of structural features including a brick feature and mound (BRW2-A), a metal spoil heap (BRW2-B), a concrete slab (BRW2-C) and a brick mound (BRW2-D). The AA report indicates that the area would have previously supported the former married quarters including a mess hall and smaller sleeping quarters which were built in the 1920s. The site would have also contained the Brickworks Hostel which appears to have been built on the site of the married quarters in the 1940s. This hostel was demolished in the 1970s and the area has remained relatively undisturbed since then.

Historical aerials from 1958 show several structures present at the site during this time. As indicated by the AA, historical aerials suggest that these structures were demolished by 1980.

The site inspection undertaken by GML confirmed the high potential of this area. The area is currently covered with dense grass and shrubs which limited the visibility. Archaeological deposits at this location may provide information about the nature and configuration of the structures, as well as the daily lives and living conditions of the workers who were employed at the brickworks.

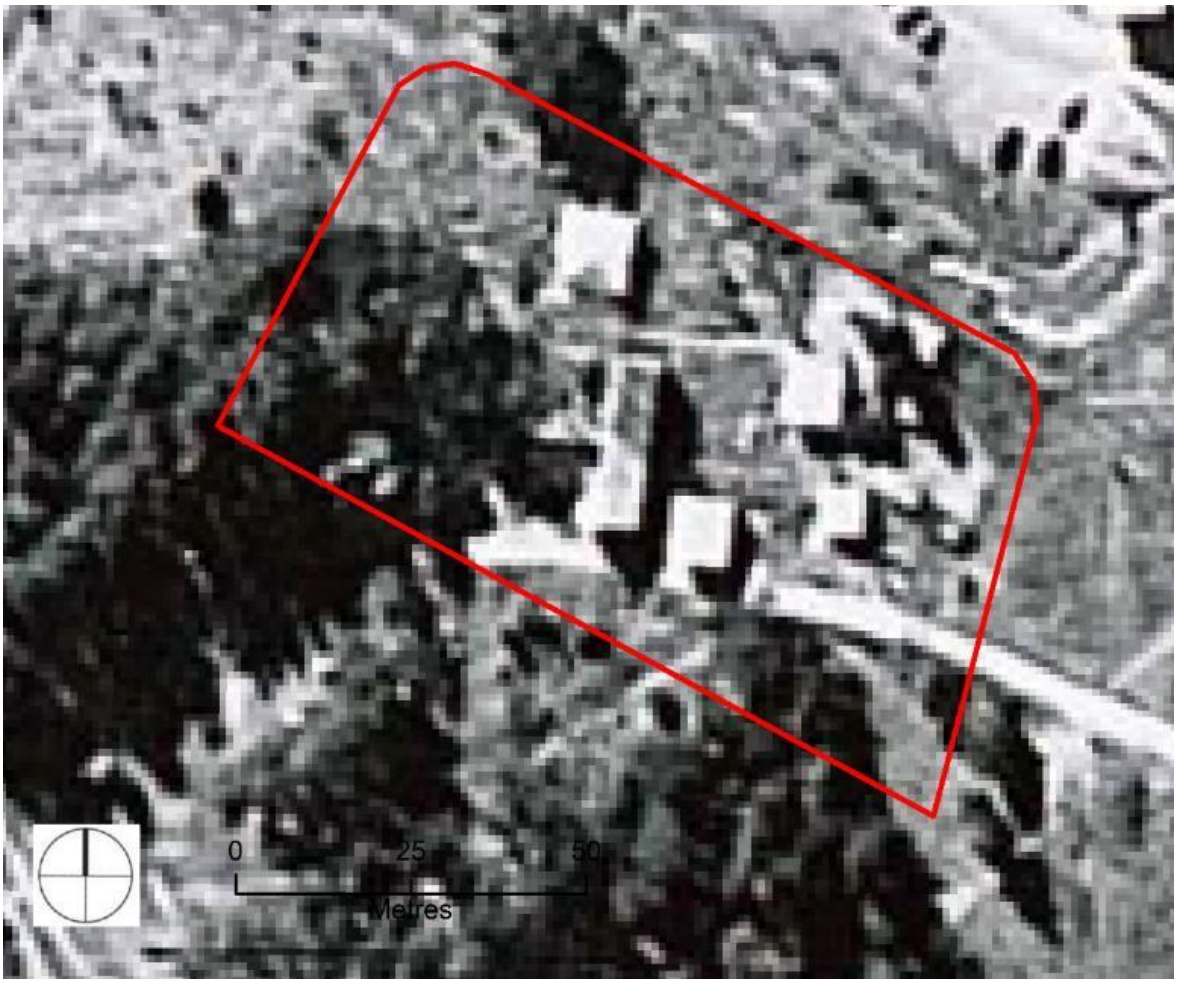


Figure 3.6 Site BRW2 overlaying a 1958 historical aerial. (Source: ACTPLA Plan Room 1958-5-21, Run 7, Print 5061)

BRW3: Area of Postholes and Other Remains

This archaeological site consists of a complex of features relating to various structures and infrastructure to the south of BRW2. The AA describes this site as containing evidence of a modern fringe dweller's camp including a hearth made of brick and concrete which appears to be recently used. Evidence of a camp or rough shelter has also been observed here with features including planks nailed to trees, pallets used for flooring, tin sheets and nylon rope tied around trees. A circular feature defined by postholes was also identified. Early plans indicate that this area was used as an ephemeral brickworks camp. Other features found here include brick and concrete spoil mounds, a rectangular clearing, a drainage line and a slab timber fence or yard post.

Historical aerials from 1950 show two large rectangular structures present in BRW3, south of the brickworks accommodation village identified as BRW2 in the AA. These structures appear to have been demolished by 1958. It is likely that these structures are the Brickworks Hostel built in the 1940s, which were included as BRW2 in the AA, but appear to be situated within BRW3.

The site inspection undertaken by GML confirmed the high potential of this area. Archaeological deposits at this location may provide information about the nature and extent of any structural features in this area, the nature of the various postholes, along with the daily lives and living conditions of the workers who were employed at the brickworks.

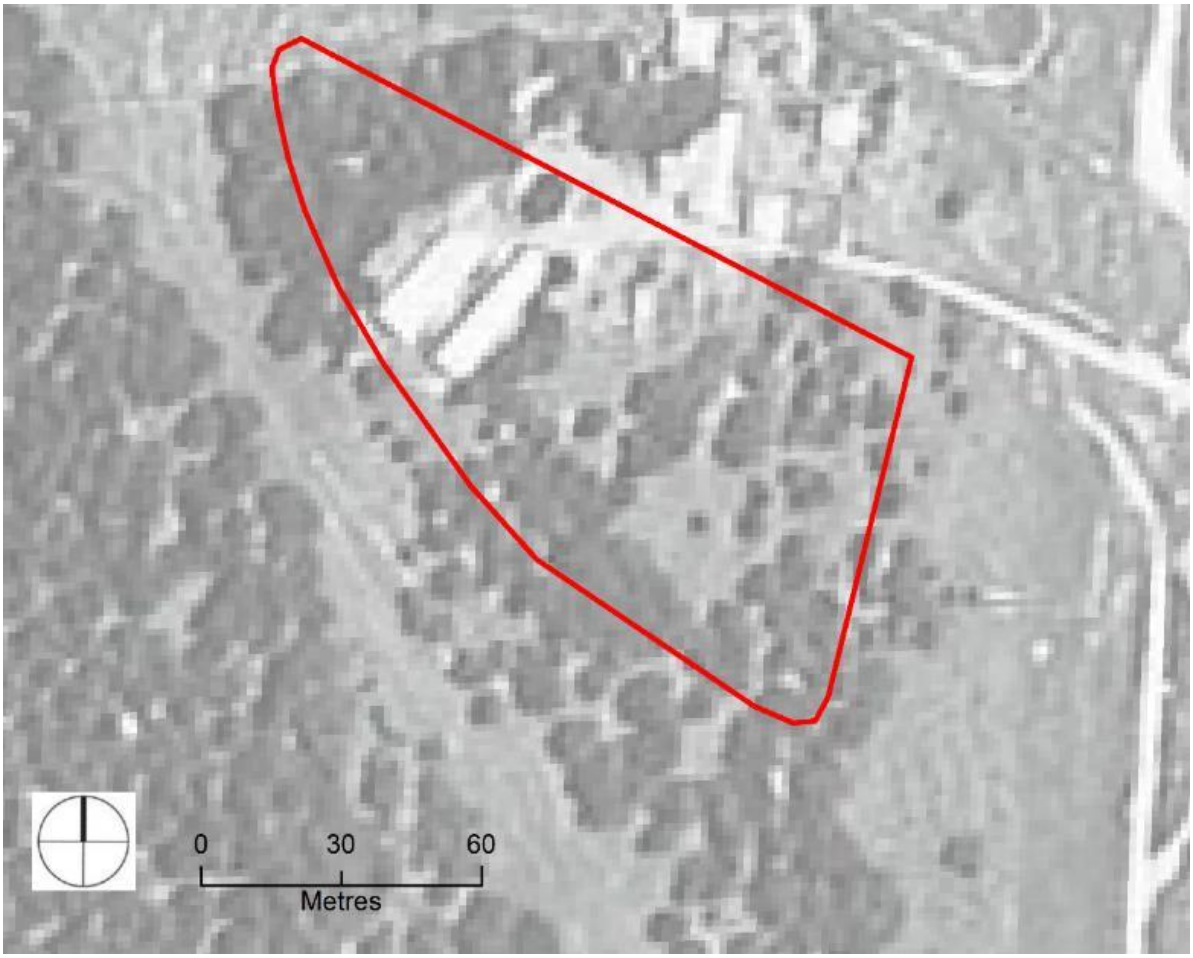


Figure 3.7 Site BRW23 overlaying a 1950 historical aerial. (Source: ACTPLA Plan Room 29-11-1950, Run 2, Print 5101)



Figure 3.8 A 1952 aerial showing the location of the Brickworks Hostel. (Source: ACT Heritage Library)

BRW4: Single Men's Quarters

This site was identified in the AA as the location of the former single men's quarters. The AA described the area as consisting of a fenced yard covering an area of about 80m x 80m. A layer of bitumen was found to cover a good portion of the site, and sits directly above a layer of bedrock. Only a thin layer of topsoil was present in patches throughout the yard. No other structural features were identified; however, fragments of window glass were found in the northern section of the site. The AA speculates that the single men's quarters was likely located within the area where a large square feature appears in 1961–1980 aerials (Figure 3.9). The AA concluded that the area has likely been subjected to significant disturbance, and potential for archaeological remnants is low.

GML inspected the area and concurred with the findings of the AA which found the area to have a low level of archaeological potential. No further investigation in the area is proposed; however, protections for any archaeological finds during works should be developed at later stages in the project.



Figure 3.9 A 1972 aerial showing a large square feature. (Source: ACTPLA Plan Room 24-2-1972, Run 9, Print 047)

BRW5: Clay Feature and Rubble

This site was identiifed in the AA as having a low level of archaeological potential. The AA identified two features at the location of BRW5 and found that these may have been associated with former structures. These features included a clay feature and some brick and concrete rubble. The clay feature consists of a silty clay feature up to 50m in diameter, and 1m to 2m in height. It appears to be a flat topped mound or stockpile of this resource.

The rubble feature is described as a series of depressions scattered throughout the area with brick and concrete rubble. The AA suggests that this feature could be associated with a former structure which has been dumped from another location. GML concurs with the low level of archaeological potential assigned to this site in the AA. No further investigation in the area is proposed; however, protections for any archaeological finds during works should be developed at later stages in the project.

BRW6: Rubble Heap/Refuse Dump

This site was identified in the AA as an area that was used as a quarry prior to being converted into a rubble heap/refuse dump by the 1940s. The AA states that there is some potential for refuse of an industrial nature to remain subsurface in this area. The area was overlaid with concrete by the 1970s, which has since been removed. The AA notes that this may have disturbed any subsurface remains at this location.

GML concurs with the findings of the AA which found the area to have a low level of archaeological potential. No further investigation in the area is proposed; however, protections for any archaeological finds during works should be developed at later stages in the project.

BRW7: Quarry

The former quarry area is designated in the AA as having high archaeological potential; however, following review of previous documents and an inspection of the site, GML considered the archaeological potential of this area to be moderate to low. There were minimal structures present in the quarry area, and the area has been subjected to significant disturbance. The former quarry is a significant landscape in its own right with a number of documented significant geological features. Further investigation should include selective subsurface testing, along with a detailed recording of the landscape.

The AA identified two specific features at the southern end of the quarry—a bricked-over water tank (Figures 3.11–3.13) and a series of circular depressions. While the bricked-over water tank was found during the site inspection, there was no clear evidence of the circular depressions. In addition to those features, GML observed a small rise in the centre of the quarry area which may represent a structure visible in 1972 historical aerials (Figure 3.14).

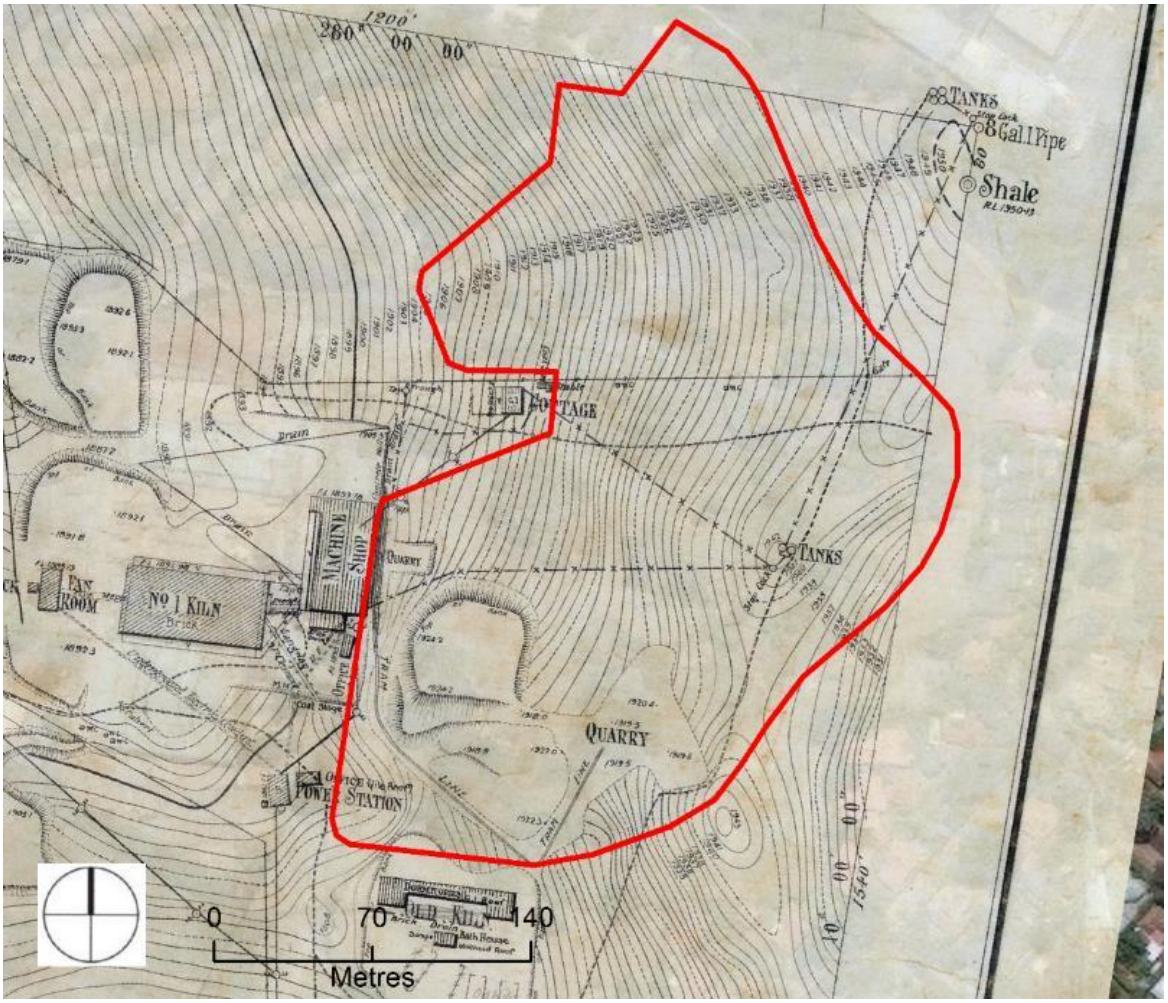


Figure 3.10 A 1916 site plan showing the BRW7 site. (Source: NAA: A6664, L165A, 1916)



Figure 3.11 Detail of the 1916 site plan showing the former tanks at the quarry. (Source: NAA: A6664, L165A, 1916)



Figure 3.12 Bricked-over water tank from AA report. (Source: GML)



Figure 3.13 Water tank during 2020 inspection of the site by GML. (Source: GML)



Figure 3.14 A 1972 aerial showing the location of BRW7 and the former structure. (Source: ACTPLA Plan Room 24-2-1972, Run 9, Print 047)

BRW8: Old Kiln and Dormitories

The BRW8 site was described in the AA as the site of the old kiln complex and dormitories, established in 1913. The dormitory building had been constructed directly to the north of the kilns. The AA states that these structures were likely demolished by the mid-1920s, and the area has undergone further disturbance since the demolition including the construction of a carpark in the area in the 1960s–1970s which involved the laying of concrete. This was removed by 1980.

The AA determined that the likelihood of subsurface features relating to the early kilns and dormitories would be low, and therefore the area of BRW8 was assessed to have low archaeological potential.

GML inspected this area on 15 January 2020 and confirmed that disturbances had occurred to the BRW8 site. A review of historical aerials and maps suggests that to the south of the old kiln and dormitories building was also a brick drain and bath house. While disturbance has occurred to this area, and the AA determined this area to have a low potential for archaeological remains, GML has found that, if present, archaeological features and artefacts could be of high significance. This area is therefore proposed to be tested as part of the methodology outlined in Sections 4 and 5 of this report.



Figure 3.15 A 1916 site plan aerial showing the location of BRW8 and former structures. (Source: NAA: A6664, L165A, 1916)



Figure 3.16 A 1958 aerial showing the location of BRW8. (Source: ACTPLA Plan Room 1958-5-21, Run 7, Print 5061)



Figure 3.17 A 1972 aerial showing the location of BRW8. (Source: ACTPLA Plan Room 24-2-1972, Run 9, Print 047)

BRW9: Cottage, Stables, Coal Store

This site represents a cottage, stables and coal store which were built in 1913 to the northeast of the Brickworks site as part of the first stage of construction of the permanent brickworks. This cottage was demolished by 1947 and the location has likely been heavily disturbed by the introduction of roadways to the east of the kiln and the construction of machinery shops. The AA notes that this area has been heavily trafficked over time. Material discard in this area, if present, may be of a domestic and/or industrial nature. GML inspected the area and concurred with the findings of the AA which found the area to have a low level of archaeological potential. No further investigation in the area is proposed; however, protections for any archaeological finds during works should be developed at later stages in the project.

BRW10: Railway Remnants

The AA described the BRW10 site as consisting of evidence of the brickworks railway, which was constructed in 1923 and largely removed by 1929. Remnants of this railway are largely manifest in the evidence of the railway siding which is still present in the form of cuttings in the landscape.

The AA stated that, while all remnants of the track were removed in the 1920s, there is some limited potential for archaeological evidence that would enhance an understanding of the railway and its operation. Features still present (though unlikely) may include the timber sleepers, iron bolts and metal rails. The AA also notes a low potential for other remains relating to the railway including drainage channels. It was therefore described in the AA as an area of moderate archaeological potential.

GML observed these cuttings during the site inspection undertaken on 15 January 2020; however, based on the known history of the removal of this feature, consider that there is relatively low potential for archaeological material to be located here. That noted, if archaeological features are present, these would likely be of high significance. On that basis, further limited investigation is proposed for this area.

These remnants also constitute a landscape feature that warrant recording.



Figure 3.18 A 1958 aerial showing the location of BRW10. (Source: ACTPLA Plan Room 1958-5-21, Run 7, Print 5061)



Figure 3.19 A 1972 aerial showing the location of BRW10. (Source: ACTPLA Plan Room 24-2-1972, Run 9, Print 047)

BRW11: Railway Siding Extension

The AA describes this site as the former railway siding which extended into the Brickworks site and terminated to the north and south of the original Staffordshire kiln. The area was later covered by a concrete slab for the extrusion plant, but the AA notes that there is still some archaeological potential for remnants of the railway siding to exist. The potential archaeological features may include the railway cutting, timber sleepers, iron bolts and metal rails.

GML inspected the area and noted that the area currently consists of a concrete slab, as well as the remaining fan room structure to the east. GML concurs that there may be potential for archaeological remnants of the former railway siding extension below the existing concrete slab. Further investigation is warranted in this area. Historical aerials demonstrate several changes to the area—including the construction of a large square structure to the south of the fan room by 1972 (since demolished). The area has been largely paved by 1972 and the fan room is the only building present in the area in current aerial photographs.

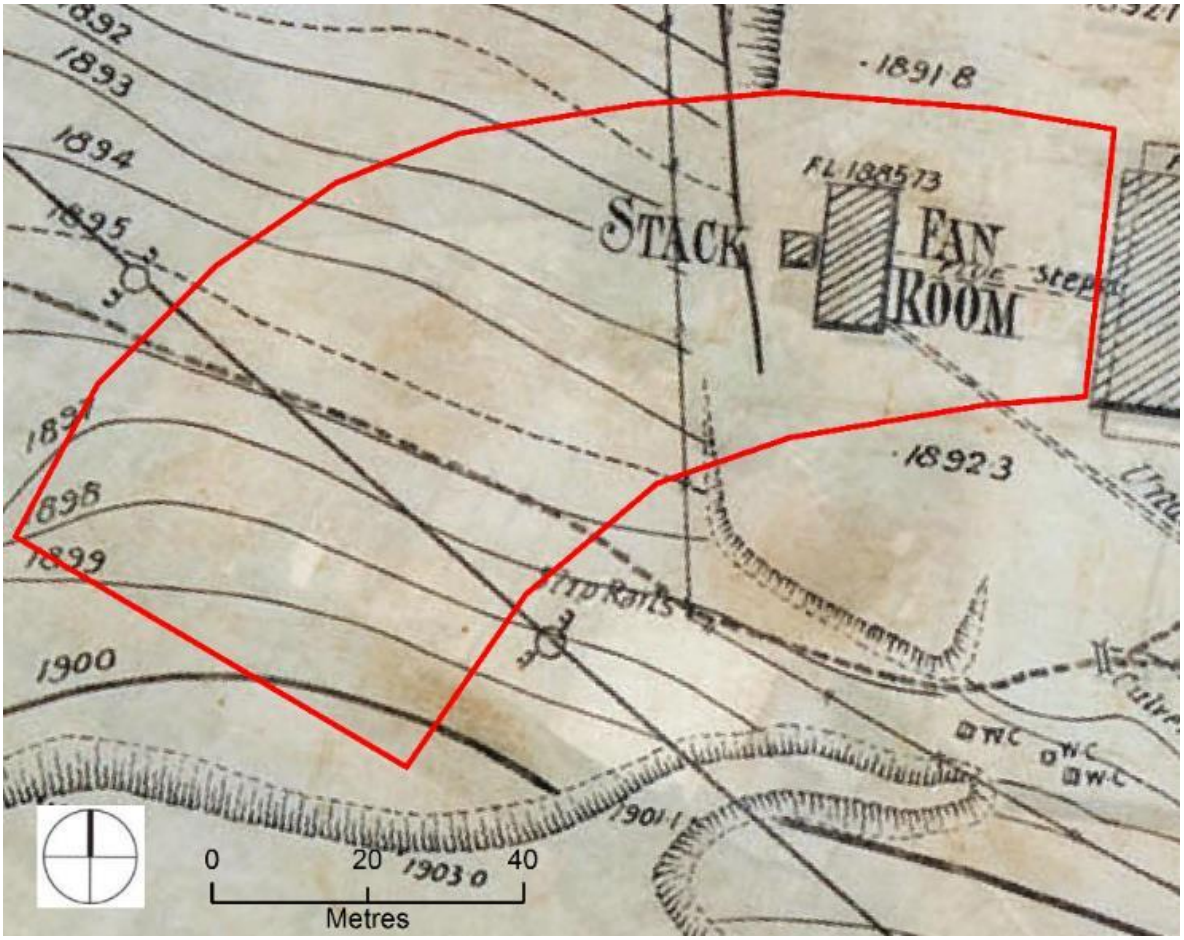


Figure 3.20 A 1916 site map showing the location of BRW11. (Source: NAA: A6664, L165A, 1916)

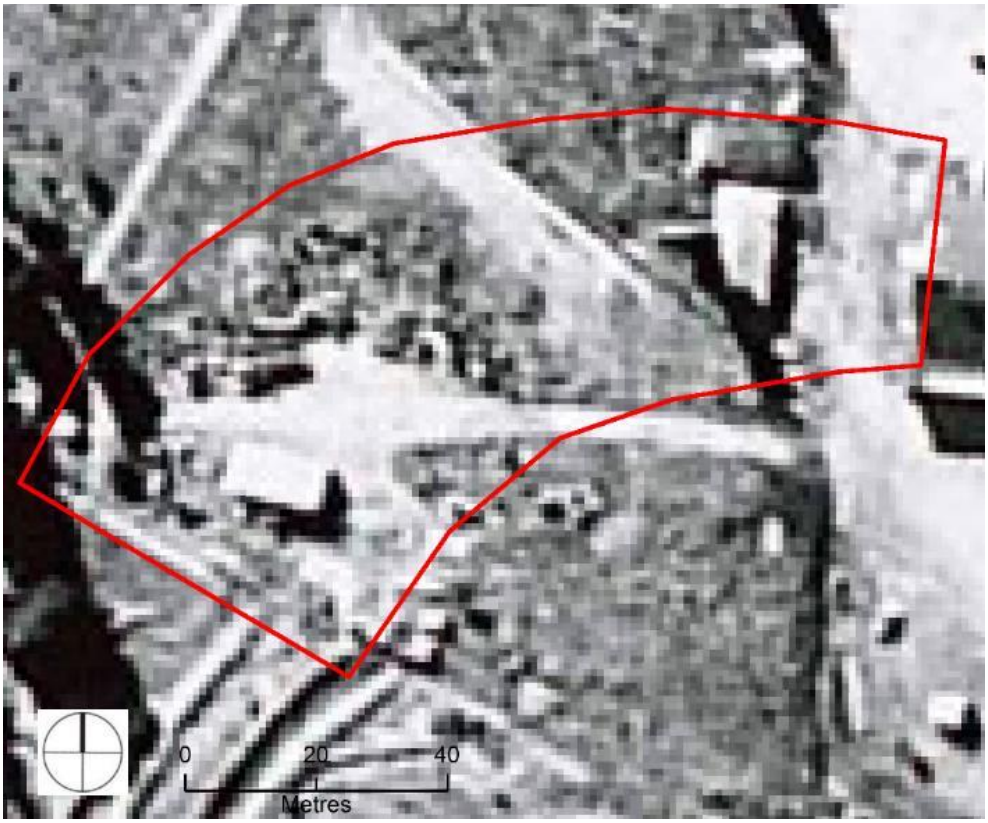


Figure 3.21 A 1958 aerial showing the location of BRW11. (Source: ACT Planning & Land Authority [ACTPLA] Plan Room 1958-5-21, Run 7, Print 5061)



Figure 3.22 A 1972 aerial showing the location of BRW11. (Source: ACTPLA Plan Room 24-2-1972, Run 9, Print 047)



Figure 3.23 A 1980 aerial showing the location of BRW11. (Source: ACTPLA Plan Room 9-2-1980, Run 15, Print 188)



Figure 3.24 A current aerial showing the location of BRW10. (Source: ESRI Basemaps and GML Overlay)

BRW12: Flues/Subsurface Workings

The AA describes this site as consisting of underground flues and workings which connected the kilns to their associated fan stacks. These features were understood at that time to still remain in situ and were unlikely to have been disturbed.

GML observed some evidence of these features during the site inspection undertaken on 15 January 2020. Further investigation to refine the understanding of these features, their depths, extent and nature is warranted.

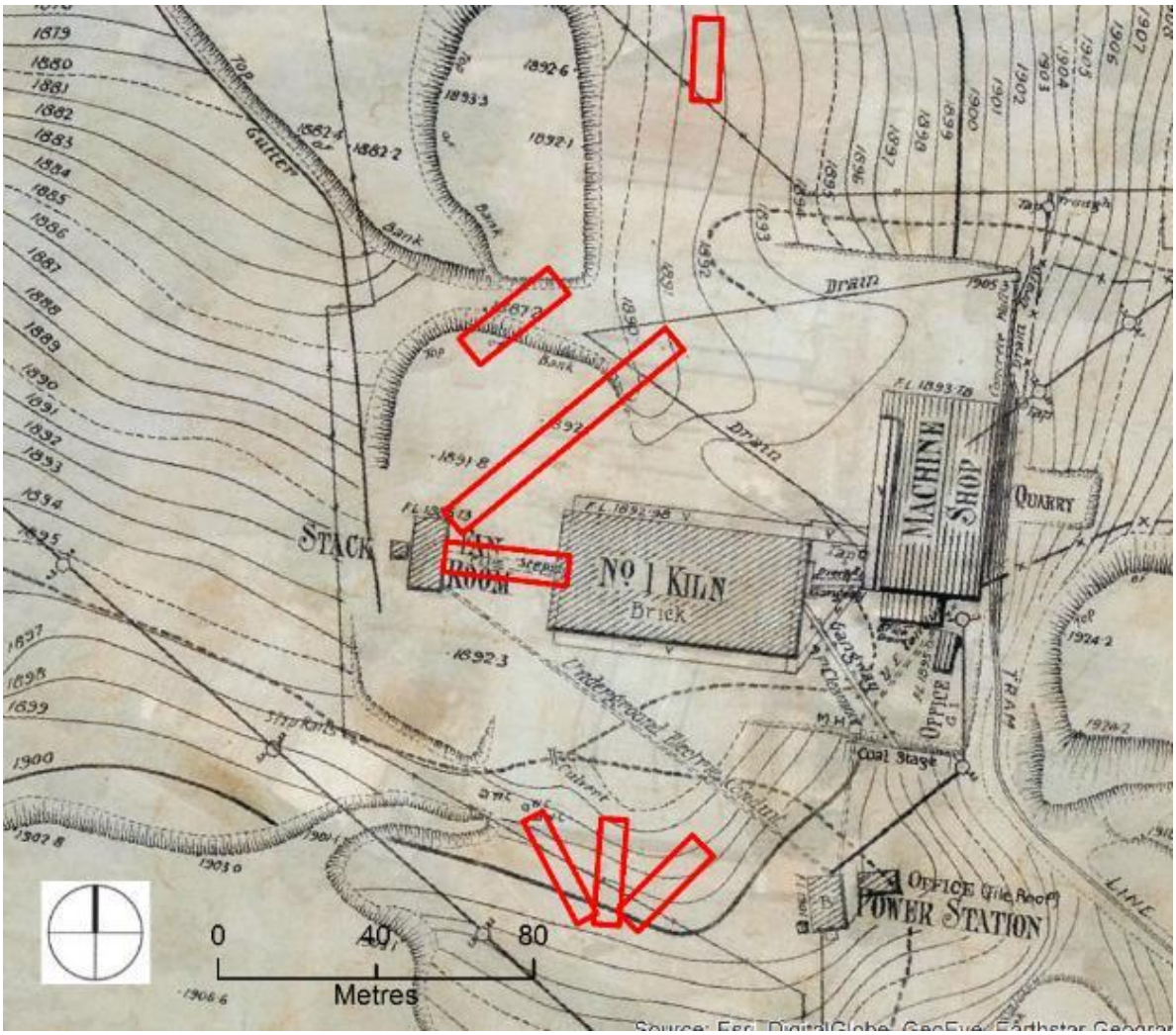


Figure 3.25 A 1916 site plan showing the location of BRW12. (Source: NAA: A6664, L165A, 1916)



Figure 3.26 A current aerial showing the location of BRW12. (Source: ESRI Basemaps and GML Overlay)

3.3 Summary of Archaeological Resources

Table 3.1 provides a summary of archaeological resources identified at the Canberra Brickworks site, including the level of archaeological potential identified at each area of sensitivity identified in the AA, the potential archaeological significance and whether further investigation is required.

Table 3.1 Summary of Archaeological Resources at Canberra Brickworks.

Area ID	Level of Archaeological Potential (AA)	Level of Archaeological Potential (GML)	Potential Significance	Further Investigation Required?
BRW1	Moderate	Moderate	Low	Yes
BRW2	High	High	High	Yes
BRW3	High	High	High	Yes
BRW4	Low	Low	Moderate	No
BRW5	Low	Low	Low	No
BRW6	Low	Low	Low	No

Area ID	Level of Archaeological Potential (AA)	Level of Archaeological Potential (GML)	Potential Significance	Further Investigation Required?
BRW7	High	Low–moderate	High	Yes
BRW8	Low	Low	High	Yes
BRW9	Low	Low	Low	No
BRW10	Moderate	Moderate	High	Yes
BRW11	Moderate	Moderate	High	Yes
BRW12	High	High	High	Yes

4.0 Research Design

4.1 Overview

The development of a research framework assists in understanding an archaeological site's significance and informs how it should be investigated and managed. The questions that archaeological investigations could address are framed in the context of the site history, physical condition and significance.

The study area's historical archaeology has the potential to answer site specific questions and contribute to a range of broader historical and archaeological research. The development program provides an opportunity to undertake archaeological investigations. The ability to answer the research questions will vary as the scale of archaeological excavation is linked to managing the construction impacts.

4.2 Research Themes

Historical themes assist in linking heritage places to broader patterns and subjects in our national and state histories. Themes provide an organising framework for understanding the connections and relationships between places that may be geographically dispersed. Historical thematic frameworks have been developed at national, state and territory levels for use in heritage assessment and management.

The ACT Heritage Council's *Heritage Assessment Policy*[11] outlines a number of overarching themes relating to the broad historical patterns and evolution of the ACT. These are outlined in Table 4.1 below.

Table 4.1 Themes from the *Heritage Assessment Policy*.

Themes	Sub-themes
The evolution of the natural environment	
Aboriginal life in the area	
Aboriginal associations with place	
European settlement pre-Federal Capital Territory (FCT) (1911)	• Exploration. • Rural settlement.
Canberra as the nation's capital	• Exploring, surveying and mapping. • The transfer of the seat of government. • Feeding and farming the region post 1911. • Developing ACT and regional economies.

Themes	Sub-themes
Canberra as a planned environment	• Griffin's Canberra. • Early federal government landscape and urban planning: – Garden City and City Beautiful; and – notions of the bush capital. • National Capital Development Commission (NCDC) and the Y-Plan. • Self-government and post-NCDC Commonwealth Government landscape and urban planning.
Lodging and educating people and the provision of government housing and schools	

In 2001, the then Australian Heritage Commission developed the Australian Historic Themes Framework. This set of themes is more broadly encompassing but includes themes relating to developing local, regional and national economies, building settlements, towns and cities, working and labour, and developing Australia's cultural life, among many others.

The research framework for excavation at the Canberra Brickworks can be formulated with regard to both of these thematic frameworks.

As the Brickworks site is a historic place that was established after the declaration of the federal capital territory in 1911, and it has previously been assessed having no Aboriginal cultural values, the following themes are central to the framing of the research direction for any historical investigation of the site.

Table 4.2 Themes from the Australian Historic Themes Framework and GML Comment.

ACT Theme	GML Comment
Canberra as the nation's capital: • exploring, surveying and mapping [building / developing]; and • developing ACT and regional economies	The history of the Brickworks is integral to the establishment and building of Canberra. The Brickworks was a key material resource for the construction of public institutions and private houses. It contributed to the economy through reducing more expensive imported materials and provided employment for local people. It was an early example of disagreement over Griffin's plans and contributed the materials for the shaping of Canberra's landscape. Archaeological evidence on site has the potential to shed further light on the processes of the physical development of early Canberra, on the way bricks were manufactured, stored and transported, and about the lifestyles of the people who lived on, and worked at the site.
Canberra as a planned environment: • Griffin's Canberra; and • early federal government landscape and urban planning.	

Australian Theme	Sub Theme	Notes	GML Comment
3 Developing local, regional and national economies	Industry, Mining and Transport	Activities associated with the manufacture, production and distribution of goods. As well as the identification, extraction, processing and distribution of mineral ores. Activities also associated with the moving of goods from one place to another, and systems for the provision of such movements	The study area has the potential for archaeological deposits associated with the manufacture of bricks, such as industrial equipment and quarrying activities. Evidence of the former rail network connecting the Brickworks to the remainder of Canberra may also be present and provide information into the distribution of bricks to the city. Evidence associated with quarrying activities at the Canberra Brickworks site is present, and further information relating to the extraction of materials to produce bricks may be provided through archaeological deposits at the site.
4 Building settlements, towns and cities	Accommodation	Activities associated with the provision of accommodation, and particular types of accommodation—does not include architectural styles (use the theme of Creative Endeavour for such activities)	There were several accommodation phases at the Canberra Brickworks site, such as the married quarters and the Brickworks hostel. Evidence of activities associated with these accommodations may be present in archaeological features and artefacts at the site.
5 Working	Labour	Activities associated with work practices and organised and unorganised labour	The Canberra Brickworks site included accommodations for people working at the site. It employed people who worked at the site manufacturing, producing and distributing bricks. Evidence associated with these labour activities may be present at the site.
8 Developing Australia's cultural life	Domestic life	Activities associated with creating, maintaining, living in and working around houses and institutions	The Canberra Brickworks site included accommodation areas for its workers, such as a married quarters and a later hostel. Earlier dormitories were also present near the 'old kiln' from the earliest phase of the site. These areas may contain evidence of domestic life of people working and living at the Brickworks site.

4.3 Research Questions

The following research questions could be asked of the potential archaeological resources within the study area.

- What is the nature and extent of the archaeological resources within each of the nominated zones of sensitivity (all BRW zones)?
- Is there any remaining archaeological evidence of the early phase operation of the site (BRW1 and 8)? What light can be shed on the operation of the site in its early years from those

remains? Can technological change be determined / mapped / investigated further through those remains?

- Is there any remaining archaeological evidence of the extraction processes used in the quarry? Can we see phases of change in those processes? How likely is the survival of clay extraction processes in this quarry and other quarries?
- What evidence remains of the accommodation structures on site? What was their nature and configuration (BRW2, 3 and 8)?
- Can we find out anything about the people who worked at the site and how they lived (BRW2, 3 and 8)? Is there a material culture difference apparent in the artefacts that show status/living conditions between living quarters? Can phases of occupation be found in the archaeological remains?
- Is there any remaining archaeological evidence of the railway system used to connect the brickworks to Canberra? What can we deduce about its nature and function? Can this information be used to build a picture of the railway and similar railway remains for elsewhere in Canberra such as Old Parliament House (BRW10 and 11)?
- Do the underground flues show evidence of change over time and modification? Do they exhibit signs of 'usewear'—vitrification of the brick surfaces from hot gases? Can they tell us more about the operation of the place than is apparent from the surface remains?

5.0 Methodology

5.1 Overview

The following methodology will guide the archaeological program for preliminary investigations at the Canberra Brickworks site. The aim of the preliminary archaeological investigations is to determine the nature and extent of archaeological deposits present and identify their significance. These investigations will inform a Statement of Heritage Effects (SHE) report in accordance with the ACT Heritage Council's Cultural Heritage Reporting Policy. This SHE will provide an assessment of potential impacts of the proposed works to the archaeological resources identified. It will also provide mitigation strategies to reduce the risk of diminishing the heritage significance of the Canberra Brickworks site and provide recommendations for any future work and/or reporting that will be required. This may include salvage excavation or monitoring of construction works, for example.

5.2 Archaeological Team

Key members of the archaeological team include the GML personnel listed below.

- Martin Rowney (Principal)—responsible for the overall archaeological program and the nominated excavation director;
- Janene May (Heritage Consultant, Archaeologist)—archaeological excavation team; and
- Lara Tooby (Heritage Consultant, Archaeologist)—archaeological excavation team.

5.3 Overall Methodology

This ARD provides a methodology for the preliminary investigation of archaeological resources at the site. A SHE report will be prepared based on results of the preliminary investigation to assess potential impacts to significant archaeological resources at the site. The SHE report may recommend further works, such as salvage excavation of significant archaeological resources or monitoring of works in areas found to have low archaeological potential or low significance. This ARD is limited to presenting the methodology and research design for preliminary testing of archaeological resources at the site.

Various methods will be utilised to confirm the nature, extent and significance of archaeological resources in the study area. These methods have been developed to respond to the varied nature of archaeological features at the site and attempt to further define these with as little impact as possible. These methods will include archaeological survey, detailed contour survey, subsurface survey of flues using remote camera and archaeological test excavation.

A total of eight of the 12 areas of archaeological potential identified in the AA will be subjected to preliminary investigation, as described in Table 5.1 below. The methodologies for investigation are further described by each area of sensitivity below. The areas selected for investigation are based on levels of archaeological potential identified in the AA, results of the site inspection undertaken by GML in January 2020, and the initial development design documentation.

Table 5.1 Summary of Preliminary Investigation Methods for Archaeological Resources.

Feature ID	Will it be Subject to Preliminary Investigations?	What Type of Preliminary Investigation Will Be Undertaken?
BRW1	Yes	• Detailed archaeological survey and plan of features. • Two archaeological test trenches.
BRW2	Yes	• Vegetation clearance of trees and grasses (may be targeted around proposed test trenches and identified features). • Detailed archaeological survey and plan of remnant visible features. • Archaeological test trenches using machine and hand excavation to reveal structures and deposits.
BRW3	Yes	• Vegetation clearance of trees and grasses (may be targeted around proposed test trenches and identified features). • Detailed archaeological survey and plan of remnant visible features. • Archaeological test trenches using machine and hand excavation to reveal structures and deposits.
BRW4	No	The AA described this area as having low archaeological potential. The recent site inspection undertaken by GML confirmed this finding. No further investigation is required; however, an unanticipated finds protocol will be required for future works within this area.
BRW5	No	This area has been found to have a low potential for archaeological deposits. If deposits are present, it is not likely that they will be of high significance or yield meaningful information.
BRW6	No	This area has been found to have a low potential for archaeological deposits. If deposits are present, it is not likely that they will be of high significance or yield meaningful information.
BRW7	Yes	• Updated detailed targeted archaeological survey and plan of remnant visible features. • Archaeological testing combining machine and hand excavation to reveal tank feature, and other features identified during the updated survey.
BRW8	Yes	• Archaeological test trenches using machine and hand excavation to reveal structures and deposits.
BRW9	No	The AA described this area as having low archaeological potential. The recent site inspection undertaken by GML confirmed this finding. No further investigation is required; however, an unanticipated finds protocol will be required for future works within this area.

Feature ID	Will it be Subject to Preliminary Investigations?	What Type of Preliminary Investigation Will Be Undertaken?
BRW10	Yes	• Vegetation clearance. • A detailed contour survey with a surveyor. • Three archaeological 'test trenches' which will be limited to manual clean-up to identify remnant features. • Potential additional machine trench, if possible, and if deemed necessary. • Further historical research into any features identified and geo-referencing of historical images with the location of any features identified.
BRW11	Yes	• Archaeological test trenches if required to determine the nature and extent of the deposits.
BRW12	Yes	• Subsurface survey with surveyor and/or plumber using GPS and camera within flues to map depth, extent and nature of features. • Archaeological test trenches if required to determine the nature and extent of the deposits.

5.4 Detailed Methodologies for Archaeological Resources

A detailed description of the methodologies for archaeological investigations at BRW1, BRW2, BRW3, BRW7, BRW8, BRW10, BRW11 and BRW12 is provided below. Where test trenches are nominated for features and areas, all trenches will be excavated in accordance with the methodology provided in Section 5.5 of this report.

BRW1: Building Platform and Concrete Features

This archaeological site consists of several surface features and potential subsurface features including a square concrete feature and a visible line of grass die back. The AA report suggested that this feature had a function with water, either for storage or drainage. Some disturbance from erosion was noted. Preliminary investigations in this area may reveal the function of features in this area and their relationship to the wider Canberra Brickworks site. At present, the development designs propose to construct several new structures in this area. This would likely result in heavy disturbance to any archaeological features which are present.

Preliminary investigations in this area will involve the steps listed below.

- A detailed archaeological survey and plan of the features. Key points will be located with GPS, and a plan of any features identified will be prepared.
- Following the detailed archaeological survey, two machine test trenches will be excavated to determine the nature and extent of any deposits present in this area. The location and size of the trenches will be determined following the archaeological survey.

BRW2: Married Quarters and Brickworks Hostel

This archaeological site consists of the brickworks accommodation village which contains a complex of structural features including a brick feature and mound (BRW2-A), a metal spoil heap (BRW2-B), a concrete slab (BRW2-C) and a brick mound (BRW2-D). The AA report indicates that the area would have previously supported the former married quarters including a mess hall and smaller sleeping quarters which were built in the 1920s. The site would have also contained the Brickworks Hostel which appears to have been built on the site of the married quarters in the 1940s. This hostel was demolished in the 1970s and the area has remained relatively undisturbed since then. Archaeological deposits at this location may provide information about the nature and configuration of the structures, the daily lives and living conditions of the workers who were employed at the brickworks. At present, the development designs propose to construct several new structures in this area. This would likely result in heavy disturbance to any archaeological features which are present.

Preliminary investigations in this area will involve the steps outlined below.

- Vegetation clearance of shrubs and grasses. This area is substantially overgrown so vegetation clearance will need to be the first step taken. Clearance could be targeted to areas of proposed test trenches.
- A detailed archaeological survey and plan of visible features. This will include undertaking systematic transects across the area and recording all features identified using GPS. A plan of any features identified will then be prepared.
- Following the detailed archaeological survey, five archaeological test trenches will be excavated to determine the nature and extent of any deposits present in this area. Trenches will be located to target known features from aerial photography but also to test areas of unknown archaeological potential to the southeast. The proposed location of the trenches is shown in Figures 5.1 and 5.2; however, these may be refined following the detailed archaeological survey and planning.



Figure 5.1 View of proposed test unit locations at BRW2 overlaid on a 1958 aerial. (Source: ACTPLA Plan Room 1958-5-21, Run 7, Print 5061)



Figure 5.2 View of proposed test unit locations at BRW2 overlaid on a current aerial. (Source: ESRI Basemaps with GML Overlay)

BRW3: Area of Postholes and Other Remains

This archaeological site consists of a complex of features relating to various structures and infrastructure to the south of BRW2. The site contains evidence of a modern fringe dweller's camp including a hearth made of brick and concrete which appears to be recently used. Evidence of a camp or rough shelter has also been observed here with features including planks nailed to trees, pallets used for flooring, tin sheets and nylon rope tied around trees. A circular feature defined by postholes was also identified. Early plans indicate that this area was used as an ephemeral brickworks camp. Other features found here include brick and concrete spoil mounds, a rectangular clearing, a drainage line and a slab timber fence or yard post.

Historical aerials from 1950 show two large rectangular structures present in BRW3, south of the brickworks accommodation village identified as BRW2 in the AA. These structures appear to have been demolished by 1958. It is likely that these structures are the Brickworks Hostel built in the 1940s, which were included as BRW2 in the AA, but appear to be situated within BRW3.

Archaeological deposits at this location may provide insight into the daily lives and living conditions of workers who were employed at the brickworks. At present, the development designs propose to construct several new structures in this area. This would likely result in heavy disturbance to any archaeological features which are present.

Preliminary investigations in this area will involve the steps outlined below.

- Vegetation clearance of shrubs and grasses. This area is substantially overgrown so vegetation clearance will need to be the first step taken. Clearance could be targeted to areas of proposed test trenches.
- A detailed archaeological survey and plan of visible features. This will include undertaking systematic transects across the area and recording all features identified using GPS. A plan of any features identified will then be prepared.
- Following the detailed archaeological survey, five machine test trenches will be excavated to determine the nature and extent of any deposits present in this area, targeting locations from aerial photographs and early site plans. The location and size of the proposed trenches are shown in Figure 5.3 and 5.4; however, these may be refined following the detailed archaeological survey and planning.



Figure 5.3 View of proposed test unit locations at BRW3 overlaid on a 1950 aerial. (Source: ACTPLA Plan Room 29-11-1950, Run 2, Print 5101)



Figure 5.4 View of proposed test unit locations at BRW3 overlaid on a current aerial. (Source: ESRI Basemaps with GML Overlay)

BRW7: Quarry

As described in Section 3.2, the former quarry area is designated in the AA as having high archaeological potential, yet following review of previous documents and an inspection of the site GML considered the archaeological potential of this area to be low. The main point of interest at BRW7 was the bricked-over water tank as shown in the AA. The circular depressions discussed in the AA did not appear to be of high archaeological potential. At present, the development designs propose to undertake landscaping in the former quarry area. Several structures are proposed to be constructed in the eastern and southeast portion of the area. These would likely result in heavy disturbance to areas where the structures are built, and moderate disturbance to the remainder of the area.

Preliminary investigations in this area will involve the steps outlined below.

- Updated archaeological survey of areas proposed for landscaping works in the new development. Newly identified features will be recorded, as will areas considered for targeted test excavation.
- Planning targeted test excavation will be undertaken at:
  - the location of the tank identified during the site inspection, and previously in the AA; and

- the location of the low relief mound in the centre of the quarry area.

The location of these excavations will be refined on site.

BRW8: Old Kiln and Dormitories

While the AA and GML have designated this area as being of low archaeological potential, it is important to confirm this. If any archaeological deposits are present, they would likely be of high significance. Historical site plans indicate that the old kiln was located in this area, as well as a dormitory building, a brick drain and a bath house building. While there has been disturbance to this area, GML proposes to excavate four test trenches to confirm the low potential of the site. At present, the development designs propose to construct several new structures in this area. This would likely result in heavy disturbance to any archaeological features which are present.

Preliminary investigations in this area will involve the following steps.

- Archaeological test excavation at the location of the former old kiln, dormitory, brick drain and bath house. The location of this excavation will be refined following the detailed archaeological survey and plan of the site.



Figure 5.5 View of proposed test unit locations at BRW8. (Source: NAA: A6664, L165A, 1916)

BRW10: Railway Remnants

GML has formulated the view that there is relatively low potential for archaeological material to be located in the area of the railway remnants. However, if archaeological features are present, they would likely be of high significance, and therefore confirmation of the archaeological potential of this area is warranted.

The railway remnants survive as a landscape feature that warrants recording.

Preliminary investigations in this area will involve the steps outlined below.

- Vegetation clearance.
- A detailed contour survey undertaken with a qualified surveyor.
- Between two and four archaeological test trenches, which will be limited to manual clean-up to identify remnant features.
- Limited additional machine trenches, if possible, and if considered necessary. The location of this trench will be determined following the detailed contour survey and excavation of manual trenches.



Figure 5.6 View of proposed manual test excavation locations at BRW10 overlying a 1958 aerial. (Source: ACTPLA Plan Room 1958-5-21, Run 7, Print 5061)



Figure 5.7 View of proposed manual test excavation locations at BRW10 overlying a current aerial. (Source: ESRI Basemaps with GML Overlay)

BRW11: Railway Siding Extension (To North)

The AA describes this site as the former railway siding which extended into the Brickworks site and terminated to the north and south of the original Staffordshire kiln. The AA notes that potential archaeological features may include the railway cutting, timber sleepers, iron bolts and metal rails.

Archaeological test excavation will be undertaken at the location of the former railway lines and sidings within the existing concrete pad location. Between two and four archaeological test trenches are proposed to be excavated to identify potential archaeological deposits. The concrete slab surface will be cut in the specific areas of the test excavations to facilitate access without the demolition and removal of large areas of the slab.

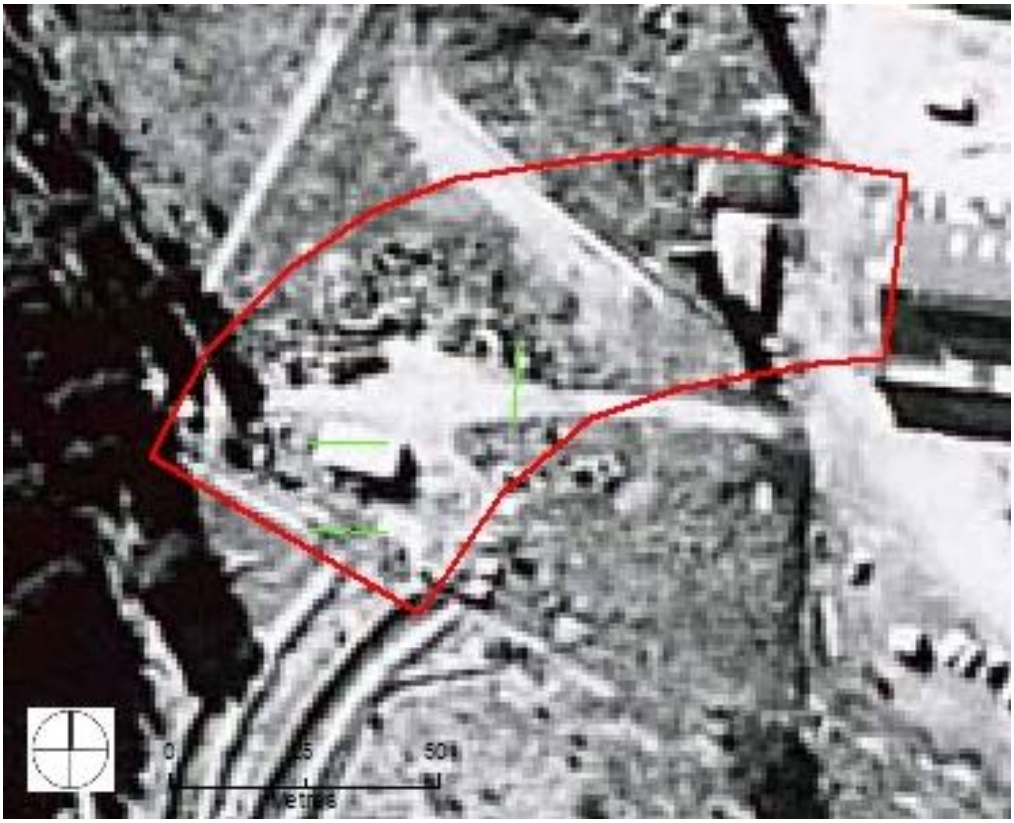


Figure 5.8 View of proposed manual test excavation locations at BRW11 overlying a 1958 aerial. (Source: ACTPLA Plan Room 1958-5-21, Run 7, Print 5061)



Figure 5.9 View of proposed test excavation locations at BRW11 overlying a current aerial. (Source: ESRI Basemaps with GML Overlay)

BRW12: Flues/Subsurface Workings

Preliminary archaeological investigations will aim to confirm the depths and nature of these features. Initial exploratory investigation utilising underground surveys with cameras and GPS units are proposed to determine the depths and nature of these features. This task will involve working with a surveyor to move a GPS and camera unit through the remnant flue structures.

If the depths and nature of these features cannot be confirmed using these less invasive methods, small machine trenches will be excavated at several of the flue structures to determine their depth, nature and extent. The location of these trenches will be determined following results of the initial exploratory investigation.

5.5 Archaeological Test Excavation Methodology

The methodology for undertaking archaeological test excavation is outlined in the steps below.

- Test trench locations will be established based on the investigation objectives for each area, and with respect to dial-before-you-dig results and other safety or logistical factors.
- Vegetation clearance will be undertaken as required and will be specified to avoid ground surface disturbance, while affording adequate access for both manual and machine excavations.
- Testing will be undertaken using a combination of mechanical and hand excavation. Modern surface material and fills will be mechanically removed to the top of archaeological layers.
- Mechanical investigation will use a flat-edged bucket and will aim only to reveal features and deposits.
- The team will clean and investigate the archaeological remains by hand.
- Significant archaeology within trenches will not be removed during the testing program. Small sondages and localised areas may be hand excavated to confirm the nature of the archaeology, to determine if there are multiple phases and verify archaeological significance.
- Recording will be undertaken in accordance with the methodology outlined in Section 5.6. Artefacts recovered will be managed in accordance with the strategy set out in Section 5.7. Samples will be taken in accordance with the strategy set out in Section 5.8.
- Test excavation locations and archaeological features will be surveyed by a surveyor.
- Excavated fills will be sample sieved to test for artefacts associated with the running of the Canberra Brickworks and domestic life. More extensive sieving will be undertaken if significant artefacts are found.
- Test trenches will be backfilled on completion of the testing program. Any archaeological remains will be protected with geofabric prior to backfilling.

5.6 Recording

The recording of archaeological data will be based on the single context recording system. Phasing and interpretation of the archaeological features in relation to the entire site will also be included in the record sheets and survey.

The following outlines the recording process:

- Test excavation locations, and main findings (features and deposits) will be archaeologically recorded and surveyed.
- Archaeological layers, structural remains, features, deposits and fills will be recorded on context sheets.
- A digital (JPEG file) photographic record of the archaeological program will be made. Significant archaeological remains will be recorded using both JPEG and RAW digital captures. All photographs will include a scale and north arrow.
- Measured drawings detailing the archaeological remains and stratigraphic relationships will be prepared. These will include the location of significant archaeological remains within the overall site.
- A surveyor will take georeferenced survey data to prepare survey drawings and orthophotographs of the archaeological remains.
- Registers of contexts, photographs, building material, environmental samples and drawings will be kept.

5.7 Artefact Retrieval Strategy

Artefacts are likely to be retrieved from archaeological test excavations. Artefacts may consist of representations of both domestic life at the site and the running of the brickworks. They may consist of machinery parts, bricks and brick fragments, ceramic and glass sherds or vessels, leather scraps or shoes, buttons, coins, nails and metal objects, animal bone and shell. Artefacts are an important part of the archaeological resource and will inform post-excavation analysis, research and interpretation.

The following general principles apply to the artefact retrieval strategy:

- Artefacts recovered will be collected according to their context. They will be cleaned, dried, bagged by context and temporarily stored on site. Significant metal and organic artefacts will be kept in appropriate storage conditions.
- All artefacts will be collected from sondages and selected surface areas such that the research potential and significance of the specific archaeological deposits can be determined.
- Context and deposit ‘types’ will be designated as having high, moderate or low research potential based on analyses of artefacts sampled from the testing program.

5.8 Sample Collection Strategy

Samples will be selectively collected from significant archaeological features and deposits for further analysis, to inform the response to the research questions. Samples will be collected by context and included in the sample register, then bagged and temporarily stored until needed for the post-excavation analysis.

Samples of the following archaeological material may be collected as deemed appropriate to the research objectives for each area:

- Building material samples such as brick, structural timber and mortar. Photographs of dimension stone examples will be taken but physical samples will not be kept.
- Organic material such as wood, seeds or pips and shell. Animal bone may also be sampled depending on the nature or significance of its context.
- Environmental material such as soil with potential for fossil pollens.

5.9 Post-Excavation Analysis

The post-excavation analysis will commence on completion of the fieldwork. It will include:

- All paper archive, digital photographs, survey data, artefacts and samples will be moved and temporarily stored at the GML office for the post-excavation analysis phase.
- Site registers and context sheets will be collated and digitised for analysis, and inclusion in the final report.
- Artefacts will be photographed by context and then sorted into type—ceramic, glass, metal, animal bone, shell, organics, miscellaneous small finds—in preparation for specialist artefact cataloguing and analysis.
- Building material and environmental samples will be selected for analysis. Samples will be selected based on the potential to contribute to further archaeological analysis and research.
- Artefacts will be identified and catalogued by type—ceramic, glass, metal, organics, animal bone and shell, building materials and miscellaneous small finds.
- The data will be entered in a database that reflects current methods for archaeological data recording.
- The artefact assemblage will be analysed, and a succinct artefact analysis will be included in the final report.
- Technical information with detailed descriptions and photographs of archaeological features, deposits and fills, and stratigraphic analysis will be prepared for the final report.
- Detailed site plans and illustrations based on the measured drawings prepared during the fieldwork will be prepared. The plans will be prepared in conjunction with the technical reports and include key context identification, stratigraphic relationships and archaeological phasing.

- Survey data and orthophotographs will be collated to inform the technical reporting and detailed plan preparation.

5.10 Final Report

Following the preliminary investigation, a SHE report will be prepared that will:

- provide a description of the place (including results of the preliminary investigation);
- provide a description of the proposed activity;
- discuss the potential impacts on the heritage significance of the site by the proposed works;
- present a consideration of alternatives if available;
- present mitigation strategies to reduce potential impacts to the heritage significance of the site; and
- provide recommendations for any future works and/or reporting requirements, including (as appropriate):
  - salvage excavations;
  - on-site interpretation of the results;
  - presentation, curation and storage of artefacts.

6.0 Conclusions and Recommendations

6.1 Conclusions

- Doma Group is undertaking a project to redevelop the Canberra Brickworks Precinct site. The proposed redevelopment includes new residential areas and associated infrastructure, as well as retail and office spaces which will be accessible to the public. Several historical structures at the site will be retained and adapted into these new facilities.
- An AA of the site was previously prepared by Navin Officer in 2016. This report identified 12 areas of archaeological sensitivity and recommended that areas of moderate and high archaeological potential be subjected to an archaeological testing program prior to any works or development in these areas (BRW1–BRW12).
- Based on a review of the AA and an inspection of the site, GML determined that eight of the 12 areas of archaeological potential identified in the AA should be subjected to further archaeological testing (BRW1, BRW2, BRW3, BRW7, BRW8, BRW10, BRW11 and BRW12). These are all areas of moderate and high archaeological potential, as outlined in the AA, with the addition of BRW8 which GML proposed to test due to the potential significance of deposits in this location.
- Following preliminary investigations, a SHE report will be prepared and will assess the potential impacts of the proposed development to archaeological resources. The SHE report will include mitigation measures to reduce potential impacts to archaeological resources and recommendations for any further works or reporting requirements.
- Impacts to historical archaeological remains require appropriate approval under the ACT *Heritage Act 2004*.
- This research design and methodology provides the framework for preliminary archaeological investigations of the study area. It will support the application for an Excavation Permit under Section 61E of the *Heritage Act 2004*.

6.2 Recommendations

- This ARD should be submitted with an Excavation Permit application under Section 61E of the *Heritage Act 2004*.
- The preliminary archaeological excavations should be undertaken in accordance with the research design and methodology presented in this report and any conditions imposed by the ACT Heritage Council.
- Post-excavation analysis and reporting should be undertaken on completion of the fieldwork. A SHE report should be prepared and submitted to the ACT Heritage Council.

7.0 Endnotes

1 Wright, WD 1923, *Canberra*, John Andrew & Co, Sydney, p 58.

2 CAB Consulting Pty Ltd, Context Pty Ltd, University of NSW and Rowell A, *Parliament House Vista Area Heritage Management Plan, Volume 1*, prepared for the National Capital Authority, 2010, p 47.

3 Gillespie, L 1984, *Aborigines of the Canberra Region*, L Gillespie, Campbell, ACT, p 29.

4 The National Capital Development Commission, *Tomorrow's Canberra: Planning for Growth and Change*, Australian National University Press, Canberra, 1970, pp 3–7; and Lovell Chen, *Nomination of Canberra to the National Heritage List: An examination of the merits*, prepared for the National Capital Authority, April 2008, pp 42–43.

5 Griffin, WB 1955 [1912], 'Original Report', reprinted with corrections in 'Parliament of the Commonwealth of Australia, Senate, Report from the Select Committee appointed to inquire into and report upon the development of Canberra, September 1955, Appendix B', cited in Marshall, D, Butler, G, Context Pty Ltd, Firth, D and Ross, M, Parkes Place and the National Rose Garden Heritage Management Plan, Volume 1, prepared for the National Capital Authority, 2011, p 52.

6 Rowe, DJ 1997, *Building a national image: the architecture of John Smith Murdoch, Australia's first Commonwealth Government architect*, Ph.D. (Arch) thesis, School of Architecture and Building, Deakin University, pp 139–140.

7 Rowe, DJ 1997, *Building a national image: the architecture of John Smith Murdoch, Australia's first Commonwealth Government architect*, Ph.D. (Arch) thesis, School of Architecture and Building, Deakin University, p 157.

8 National Archives of Australia, Series A110/FC 1913/1055, in Ian Carnell, 'Canberra's Cornerstone', *Canberra Historical Journal*, No. 5, March 1990, cited by Lester Firth Associates, 1986, Section 2.2.1.

9 ACT Heritage Council 2013, Yarralumla Brickworks Railway Remnants', pp 6–7.

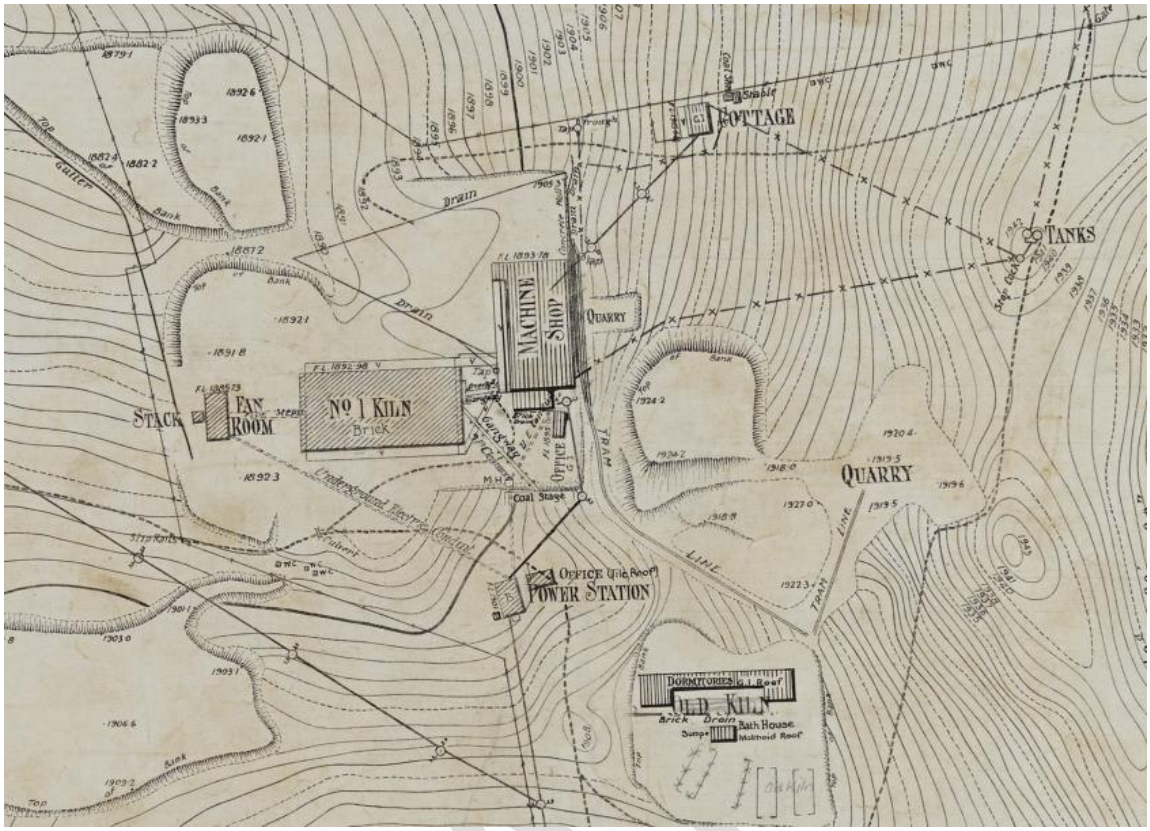
10 ACT Heritage Council 2013, 'Yarralumla Brickworks Railway Remnants', viewed 4 July 2017 <http://www.environment.act.gov.au/__data/assets/pdf_file/0011/348680/249.pdf>, p 7.

11 ACT Government, *Heritage Assessment Policy*, February 2015, pp 5–6.

8.0 Appendices

Appendix A

Archaeological Assessment



ARCHAEOLOGICAL ASSESSMENT

CANBERRA BRICKWORKS & ENVIRONS

Denman Street, Yarralumla,

South Canberra

Prepared for

Land Development Agency

September 2016

Navin Officer Heritage Consultants Pty Ltd

with

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1.0 EXECUTIVE SUMMARY

This archaeological assessment for the former Canberra Brickworks (Block 1, Section 102) and its environs (Blocks 7 and 20, Section 102) has been prepared for the Land Development Agency (LDA) to inform any future works within the three blocks in Yarralumla. The Canberra Brickworks site is not designated land (areas specified in the National Capital Plan as having 'special characteristics of the National Capital') and is subject to the provisions of the Territory Plan. The Canberra Brickworks and associated Railway Remnants are also included in the ACT Heritage Register and are protected under the *Heritage Act* 2004.

The Commonwealth Government established the Canberra Brickworks in order to support the development of Canberra as the new Federal Capital. The project was announced in 1910 and work began on the development of the complex in 1913. The brickworks supplied materials for the construction of buildings in Canberra in the early period of the capital's development. Bricks and other specialty lines were produced at the site from this time until the closure of the complex in 1976. Production capacity at the site varied in response to fluctuations in demand for bricks and the brickworks was expanded in a number of key phases, notably in the 1920s and the 1950s.

Following closure of the plant, the site was adapted for a range of uses (of varying duration) but other than for the subdivision of land and associated residential development on the perimeter of the site, relatively little physical change has occurred since this time. The surviving complex includes brick manufacturing infrastructure including kilns, stacks and ancillary buildings, with a quarry to the east. Part of the complex is occupied by a timber recycling company.

This Archaeological Assessment has been prepared in response to Policy 15 of the Canberra Brickworks Conservation Management Plan by Lovell Chen, dated April 2010, which states that:

> A predictive archaeological assessment should be undertaken for the study area and abutting sites. This study should identify the relative potential for sub-surface remains on the site and their likely nature and significance. Depending on the outcome of such a study, an Archaeological Management Plan should be prepared prior to any development or disturbance of the site.

As such, the purpose of this document has been to:

- Identify areas of historical archaeological sensitivity at the study area with potential sub-surface features
- consider the likely nature and potential of the sub-surface remains
- provide guidance on the management of any archaeological remains

Areas of potential archaeological sensitivity

Twelve sites of potential archaeological significance were identified during the preparation of this report, with varying levels of potential (low, moderate, high).

The principal areas of archaeological potential include:

BRW1: Building platform and concrete features

BRW2: Married quarters and Brickworks Hostel

BRW3: Area of postholes and other remains

BRW4: Single men's quarters

BRW5: Clay feature and rubble

BRW6: Rubble heap/refuse dump

BRW7: Quarry

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BRW8: Old kiln and dormitories

BRW9: Cottage, stables, coal store

BRW10: Railway remnants

BRW11: Railway siding extension (to north)

BRW12: Flues/subsurface workings

Other works

Prior to the completion of this report, a Statement of Heritage Effects (SHE) was granted by ACT Heritage for Phase 2 contamination and geotechnical testing. The LDA undertook sub-surface testing, which was overseen by NOHC. This work took place within the identified areas of high, medium and low archaeological potential. A summary of results is included at Appendix B.

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2.0 Introduction

This Archaeological Assessment for the former Canberra Brickworks (Block 1, Section 102) and its environs (Blocks 7 and 20, Section 102) has been prepared for the Land Development Agency (LDA). The purpose of the document is to:

- Identify areas of historical archaeological sensitivity at the study area with potential sub-surface features
- consider the likely nature and potential of the sub-surface remains
- provide guidance on the management of any archaeological remains

The Cultural Heritage Reporting Policy prepared by the ACT Heritage Council (dated 1 July 2015) has been referenced in the preparation of this document.[1] An assessment of significance and assessment of potential impacts are included as an appendix to this report (Appendix A).

This report does not address Aboriginal archaeology. The Aboriginal archaeological potential of the study area was considered as part of an Aboriginal Cultural Heritage Assessment (Stage 1) in August 2014. The assessment, prepared by Navin Officer Heritage Consultants Pty Ltd (NOHC), concludes that the brickworks and its environs contain no known Aboriginal places or objects and is of low Aboriginal archaeological potential. Further, any archaeological deposits would have been disturbed as a consequence of past land use practices.[2] As an outcome of the Cultural Heritage Assessment, no statutory implications regarding cultural heritage apply to the study area. The Cultural Heritage Assessment was approved by the ACT Heritage Council on 11 September 2014.[3]

Canberra Brickworks CMP

This Assessment has been prepared in response to Policy 15 of the Canberra Brickworks Conservation Management Plan by Lovell Chen, dated April 2010. The policy is as follows:

> A predictive archaeological assessment should be undertaken for the study area and abutting sites. This study should identify the relative potential for sub-surface remains on the site and their likely nature and significance. Depending on the outcome of such a study, an Archaeological Management Plan should be prepared prior to any development or disturbance of the site.

The CMP provides an assessment of the site's heritage values, and sets out policies to guide the conservation and management of those values. It was endorsed by the ACT Heritage Council on 20 May 2010. The CMP notes that archaeological remnants are likely to survive at the site and comments that, '[these artefacts are unlikely] to be of a level of significance that … would warrant retention in situ, or … preclude development on the site'.[4] Subsurface artefacts located at the site would however have the potential to enhance an understanding of the history and operation of the site.

Canberra Brickworks Railway Remnants

While the Canberra Brickworks CMP has regard for issues of setting and curtilage, it does not provide a detailed analysis of land adjacent to the former brickworks, including the Canberra Brickworks Railway Remnants, which is the subject of a separate entry in the ACT Heritage Register. The registered area for the railway remnants extends south from the brickworks and forms part of Block 7, Section 102, Yarralumla (Figure 1).

2.1 Study area

The study area for this archaeological assessment includes Blocks 1, 7 and 20 Section 102 in Yarralumla. The total area is approximately 16ha. There is an elevated ridge to the south and east of the study area, and lower ground to the north and west. A water course originally ran to the north-west of the site. The study site is located approximately 5km west of the Parliamentary Triangle. It is bounded to the north and east by low density residential development (Woolls, Schomburgk and Bentham streets, and

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Lane-Poole Place). To the west, the site is bordered by Territory land (Block 1, Section 127), and to the south by Block 3 Section 94 (Figure 1). Access to the study area is from Denman Street only.

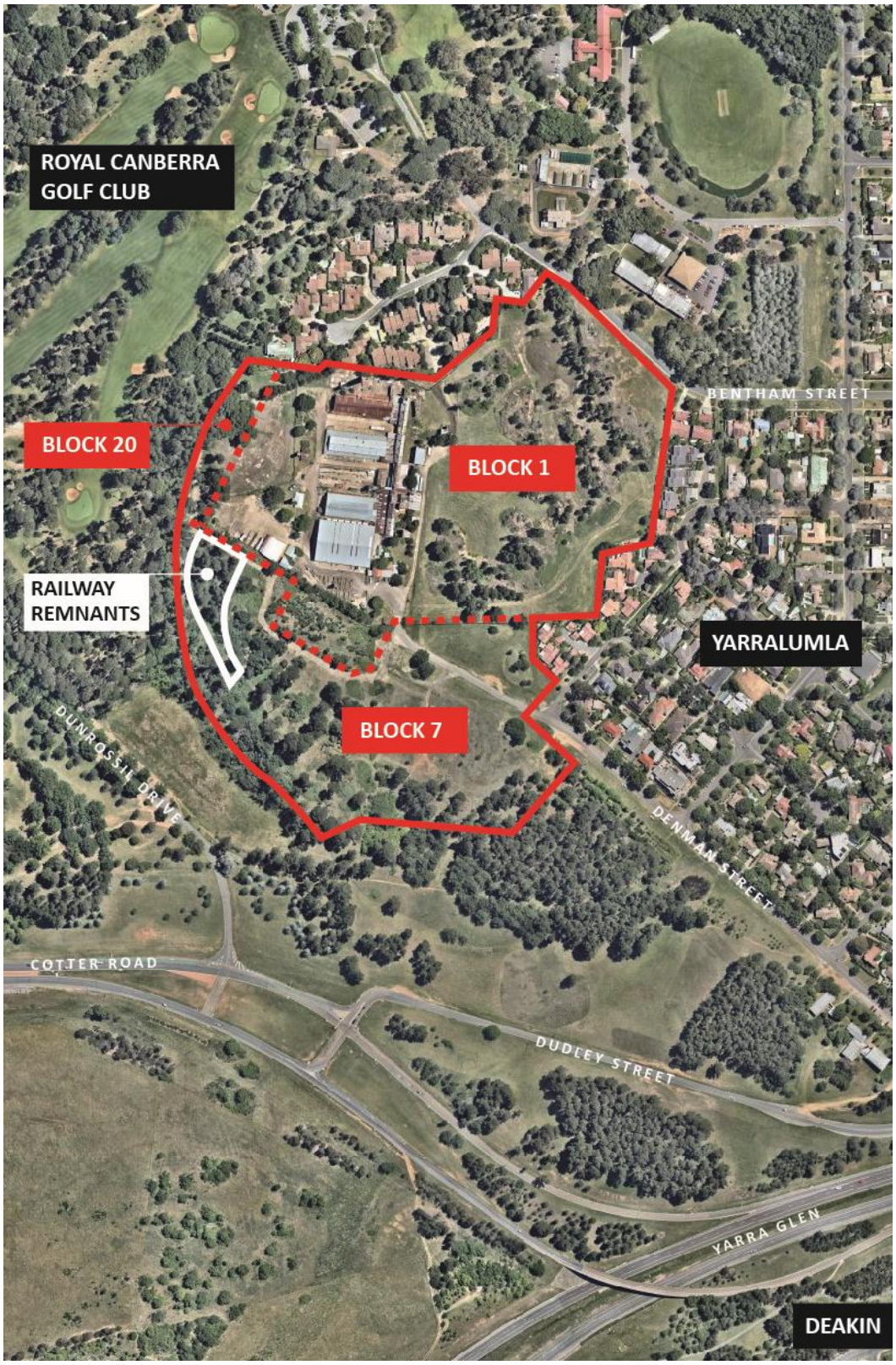


Figure 1 Aerial photograph of the study area (solid red line) and environs, 20 November 2015: Block 1 is the registered extent of the Canberra Brickworks
Source: www.nearmap.com (base photograph), accessed 16 December 2015

3.0 Project description

The nature of future works within the study area is yet to be determined. Based on criteria and land uses defined in the current Territorry Plan and Yarralumla Precinct Map and Code, the study area could be subject to future commercial and/or residential development..

4.0 Statutory context

The *Australian Capital Territory (Planning and Land Management) Act* 1988 established the National Capital Planning Authority, which was required to prepare a National Capital Plan (NCP). The Act also required the preparation of a Territory Plan, which was not to be inconsistent with the NCP. The Territory Plan is the document that informs and guides planning and development in the ACT, with the exception of 'Designated Areas' (an area specified in the NCP as having 'the special characteristics of the National Capital'). The study area is not designated land and as such is subject to the provisions of the Territory Plan. However, land to the south, north and west (Sections 103, 113, 119 and 123) is designated, and forms part of the National Capital Open Space system.

Development approval processes within the ACT can be summarised as follows:

- Work carried out on National Land in Designated Areas is subject to the approval of the National Capital Authority (NCA);
- Work carried out on Territory Land in Designated Areas is generally subject to approval by the NCA but Territory requirements may also apply to development where the Territory is the approving Authority;
- Work carried out on National Land outside of Designated Areas must be in accordance with a Development Control Plan (if applicable) agreed by the NCA that reflects the requirements of the Territory Plan; and
- Work carried out on Territory Land outside Designated Areas is subject to the Territory Plan and Territory Approval processes.

4.1 *Heritage Act 2004* (ACT)

The Canberra Brickworks (Section 102, Block 1) and the Brickworks Railway Remnants (Section 102, Block 7 – part) are included in the ACT Heritage Register and are protected under the *Heritage Act* 2004. This Act provides for the protection, management and conservation of heritage places and objects in the ACT. Under the Act, the ACT Heritage Council is to be responsible for the Heritage Register and the heritage registration process.

Under s.74 of the *Heritage Act*, it is an offence to engage in conduct that diminishes the heritage significance of a place or object. An object is defined as 'a natural or manufactured object, but does not include a building or any other man-made structure' and a place is defined as 'a site, precinct or parcel of land; a building or structure; or part of a building or structure; the curtilage, or setting, of a building or structure, or part of a building or structure; an object or feature historically associated with, and located at, the place'.[5]

Under the Act, penalties apply where other works diminish the heritage significance of a registered or nominated place or object or damages an Aboriginal place or object. The reporting and offence provisions of the Act apply irrespective of land status, or whether the site is listed in the Heritage Register or not.

The only provisions for legally sanctioned disturbance to a place or object, or the diminution of the heritage value of a Heritage Place or Object is to conform to one of the exceptions listed in s76 of the Act (see also Section 13.0).[6] According to this section, the offence provisions of the Act (s74 and s75) do not apply if conduct is engaged in accordance with the following:

(i) a heritage guideline;

(ii) a heritage direction;

(iii) a heritage agreement;

(iv) a conservation management plan approved by the council;

(v) development approval under the Planning and Development Act 2007, chapter 7;

(vi) an excavation permit;

(vii) a statement of heritage effect approved by the council.

4.2 Elements of significance

The features associated with the brickworks are divided between two schedules – elements of exceptional significance, and elements of moderate significance (ACT Heritage Register Item 20068, Figure 2).

Schedule 1 Elements of Exceptional Significance

1) Kiln - Staffordshire (1915)
2) Fan House for Staffordshire Kiln (1915)
3) Kiln - Hardy-Patent (1927)
4) Fan House for Hardy Patent Kiln (1953)
5) Kiln - Hardy-Patent (1953)
6) Kilns - Downdraft a, b, c (1963)
7) Chimney Stacks for Staffordshire Kiln (1915)
8) Chimney Stack for Hardy Patent Kiln (1927)
9) Chimney Stack for Hardy Patent Kiln (1953)
10) Chimney Stack for Downdraft Kiln (1963)
11) Quarry
12) Geological features A, B, C, D

Schedule 2 Elements of Moderate Significance

13) Office (1916)
14) Power House (1915)
15) Machine Bay for Staffordshire and Downdraft Kilns (1955)
16) Machine Bay for Hardy-Patent (1955)
17) Machine Bay for Hardy-Patent (1955)
18) Workshop (1955)
19) Large Crusher House (1955)
20) Primary Crusher House (1955)
21) Small Crusher House

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22) Elevator Conveyor (1955)

23) Remains of the Brickworks Accommodation Village

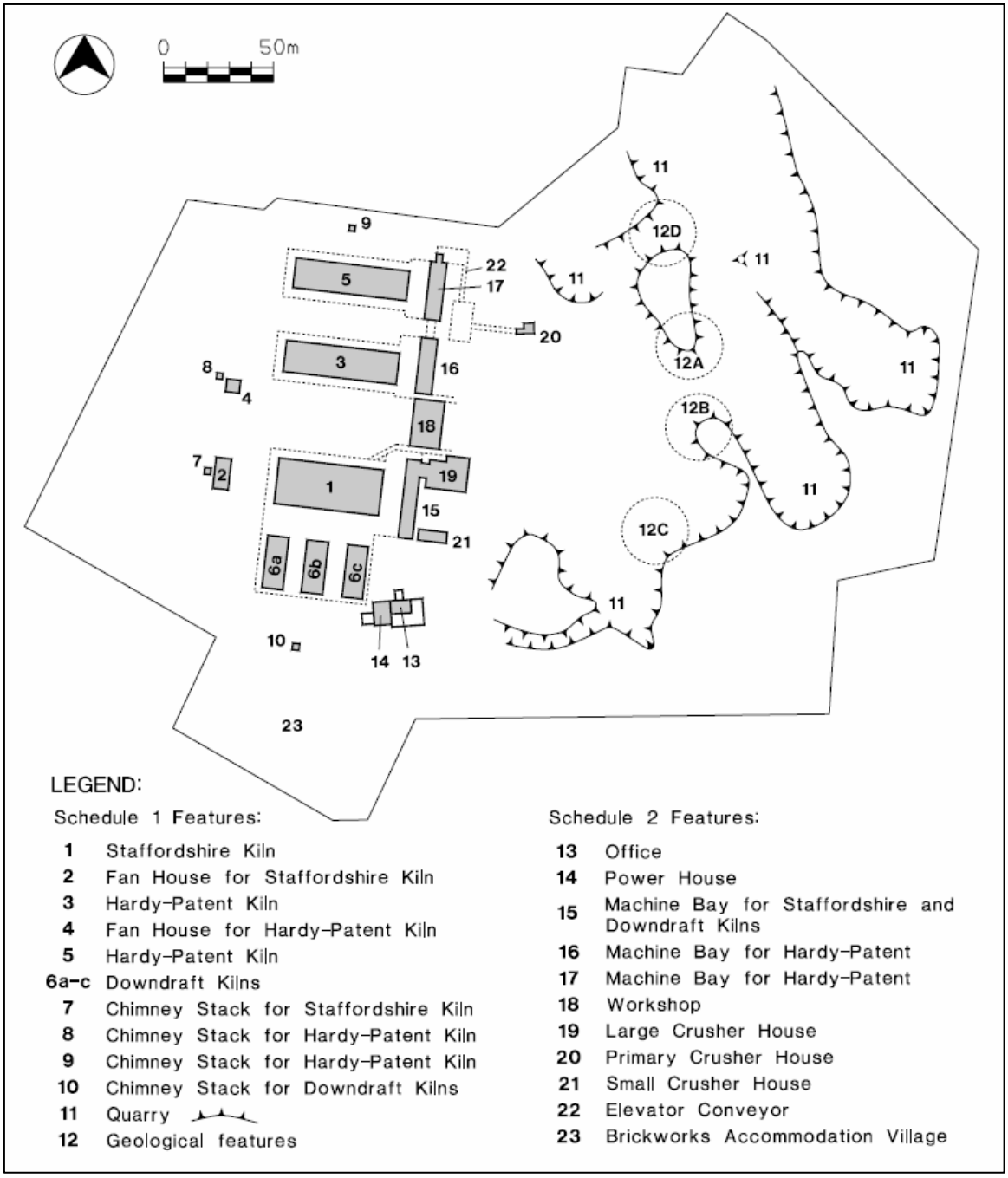


Figure 2 Canberra Brickworks significant features
Source: ACT Heritage Register

5.0 Environmental context

The Canberra brickworks is located within two distinct geological regions: the Deakin Volcanics, which consists of Rhyodacitic ignimbrite and minor volcaniclastic and argillacrous sediments; and the Yarralumla Formation, which consists of calcareous and tuffaceous mudstone and siltstone with minor limestone, calc-silicate hornfels and quartz sandstone.[7]

The area is situated on the Williamsdale soil landscape, characterised by undulating rises with elevation between the highest and lowest points locally being below 10% in natural terrain. The soil landscape consists of moderately deep, moderately well-drained Yellow Chromosols, Red Kandosols and Brown Kandosols. There are elevated ridges to the south and east of the study area, and lower ground to the north and west. A former watercourse ran through the brickworks site in the north-west, at which point alluvial soils are present. The brickworks is located on a minor local topographic high, with a sloping ground surface outside the study area to the south and south-west heading towards Yarralumla Creek, a tributary of the Molonglo River. Topography and drainage in some areas of the study area have been significantly modified due to the brickworks itself, the associated quarry and road infrastructure.[8]

The study area is largely dominated by exotic vegetation. The areas of tree plantings contain an exotic understorey. The areas of exotic pasture surrounding the entrance road to the study area are dominated by Chilean needlegrass, a noxious weed. The predominant tree species within the study area is *Pinus radiata* (weed species), *Pinus ponderosa*, *Pinus sylvestris* and *Ulmus procera* and various tree and shrub weed species. A number of planted trees are located along the eastern boundary and a copse of oak trees is located on the south-east corner of Block 7. Generally the landscape is unmanaged, and weed species (trees, blackberry shrubs and grasses) are prevalent.[9]

6.0 Social context

Investigation of the social context of the brickworks site has not been undertaken for this current assessment. However, a study was undertaken in late 2010 with past employees or their family members to explore their memories and experience of the Brickworks. This study revealed an attachment for people who have worked at the site during its operational life as a brickworks.

Unsurprisingly, given its scale, heritage values and location, the brickworks is a place which has been the focus of major interest for the local community concentrating largely on the issue of potential future development. Significant community sentiment and interest and consultation workshops have taken place with the LDA to provide an opportunity for residents to express opinions regarding the future use and development of the site.

7.0 Archaeological context

The Aboriginal archaeological potential of the study area was considered as part of a Cultural Heritage Assessment undertaken by Navin Officer Heritage Consultants (NOHC) in August 2014. As noted, this report concluded that the brickworks and its environs contained no known Aboriginal places or objects, and any potential deposits would have been disturbed as a consequence of the extensive land use.

No previous historical archaeological assessments of the study area came to light during the preparation of this report.

Site visits undertaken for this Archaeological Assessment, and previously, suggest that there is some above-ground evidence of archaeological features within the study area. This is described in detail in Section 11.3. Some evidence for potential archaeological features is also visible in the form of the landscape. The quarry itself is a highly intact feature and the brickworks railway, which operated between 1923 and 1927, remains partly evident in the form of cuttings in the landscape that follow the original alignment of the siding. Self-seeded vegetation has reclaimed much of this area in recent years. Evidence of man-made intervention is also apparent in the refuse dump to the west of the brickworks.

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8.0 Research design and methodology

Historical research

Historical research using primary and secondary sources formed a significant component of this assessment of archaeological potential. The principal objective of this research was to establish and document the historic development of built form at the study area.

The 2010 CMP prepared by Lovell Chen was a key reference. It is based upon a range of sources, including survey and site plans and historic photography. This report is also informed by the following primary sources:

- Photographic collection, National Library of Australia
- Photographic collection, ACT Heritage Library
- Aerial photography, ACT Planning and Land Authority

Additional research was also undertaken using secondary sources and online databases including published histories, the Canberra Heritage Register, and Nearmap aerial photography.

The historical development of the Canberra Brickworks is presented in this report in four key phases:

- Establishment (1913-1920)
- Reactivation (1920s-1930s)
- Expansion (1940-1970s)
- Closure and Redevelopment (1970s – current)

Archaeological fieldwork

Archaeological fieldwork was conducted to examine the presence and extent of physical features at the site, including their location and potential purpose; confirm the location and archaeological potential of any previously identified features; identify any areas of archaeological potential not recognised through historical research; and where possible, use the results of the above examinations and analyses to identify the potential for these areas to yield further information.

Research questions which were posed included:

- Are there identifiable remains and features that would provide information on the course of the development and use of the study area; and
- Are there areas of archaeological potential, with no surface remains, within the study area that may be able to provide information on its development and use?

A predictive archaeological model was also developed to indicate the types of potential archaeological features, and likely areas of subsurface remains. This model is outlined in Section 11.1.

Site visit

Three site visits were undertaken throughout the duration of this study.

Lovell Chen undertook an inspection on 24 November 2015, to 'ground truth' the outcomes of the historical research and identify any archaeological evidence relating to historic land use. The site visit was undertaken by Adam Mornement, Senior Associate, and he was accompanied by a staff member from the Land Development Agency. The survey covered the quarry, and land to the west and south of the kilns including remnants of the railway siding extending into Block 7.

The focus of this visit was on six locations which had been identified as being of archaeological potential during the review of historical documentary material. Lovell Chen established that one of the locations had been developed, and confirmed that archaeological evidence of previous land use remained

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possible at the other five locations. Underground flues linking the kilns to their respective fan houses and chimney stacks were not inspected during this visit. However, documentary and above-ground evidence (in the form of the kilns, stacks and fan houses) suggests that these flues survive.

A second investigation was undertaken by Travis Gottschutzke and Dr Rebecca Parkes of NOHC in the afternoon of 20 May 2016. This involved a walk over of the area to the south of the brickworks itself, and the quarry. Staff were accompanied by three officers from the Land Development Agency (LDA). The inspection was an opportunity to familiarise NOHC staff with the nature of the brickworks site.

Following this investigation, a detailed survey of sites within the brickworks area was undertaken by Travis Gottschutzke and Julia Maskell (NOHC) on 9 June 2016. Over the course of the survey, contributions were sought from other NOHC staff (Dr. Rebecca Parkes and Dr. Antony Barham).

8.1 Limitations

Access to the entire study area was limited due to a number of factors. The centre of the precinct, the brickworks, is a partially active environment, licensed by the Territory to a joinery business involving processing and recycling of reclaimed timber. Access to this zone was therefore restricted to short windows of time during staff breaks. Fortunately, the built environment of this part of the precinct has been sufficiently analysed in the 2010 CMP, and visible archaeological remains were predicted to be minimal in these areas.

Historical research has largely relied on material in the 2010 CMP, which in turn relied in part on material from the 1986 Lester Firth Associates' *Conservation Management Plan*, with additional research undertaken by Lovell Chen where required. While there is clearly scope to undertake further historical research in relation to the study area, it was considered that sufficient research had been undertaken to inform the analysis and assessment of this report.

9.0 Related reports

The Canberra brickworks site, as well as the surrounding environs, has been the subject of a number of previous studies. These include:

- Lester Firth Associates Pty Ltd, *Old Canberra Brickworks Conservation Plan,* 1986
- National Capital Development Commission, *Canberra Brickworks, South Canberra, Policy Plan*, October 1988
- Connell Wagner Pty Ltd, *The Old Canberra Brickworks and Environs Development Control Plan*, February 2001
- Susan Conroy & Munns Sly Architects, *The Yarralumla Brickworks & Environs Planning Review*, March 2005
- Lovell Chen, *Canberra Brickworks Conservation Management Plan*, April 2010
- Navin Officer Heritage Consultants, *Canberra Brickworks, Yarralumla ACT Aboriginal Cultural Heritage Assessment (Stage 1)*, August 2014

10.0 Historical background and analysis

The following historical overview of the former Canberra Brickworks is derived largely from the CMP prepared by Lovell Chen in 2010. Full reference details are contained in the CMP. The results of any additional research are referenced below.

10.1 Pre-brickworks

In 1910, King O'Malley announced Government plans for the construction of a brickworks to serve the Federal Capital. Various experiments on shale in the region were carried out in early 1911. One potential site was Frederick Campbell's Yarralumla property. Samples from the site were sent for testing and reports concluded that samples from Yarralumla produced bricks of excellent quality. Yarralumla was thus chosen and Frederick Campbell agreed to the acquisition of approximately 38 acres (15ha) of his land holding. The area was gazetted on 27 July 1912, and development of the site began in 1913.

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The map at Figure 3 shows the location of the study area prior to the development of the Federal Capital.

10.1.1 Analysis and conclusion

There is unlikely to be any archaeological features or deposits relating to this period.

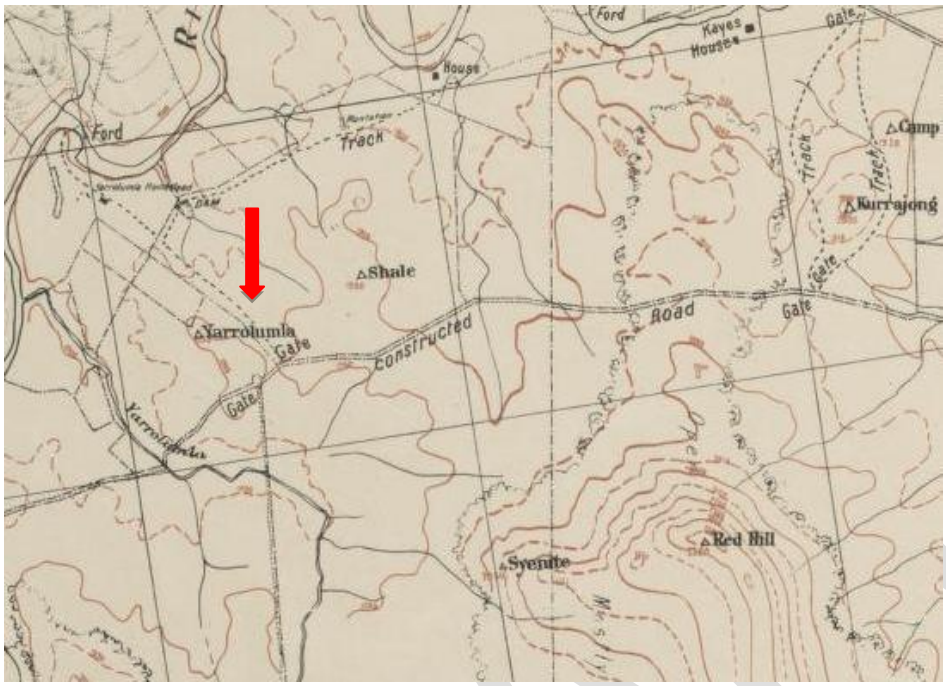


Figure 3 Map of Federal Capital, 1912: the approximate location of the former Canberra Brickworks is indicated
Source: National Library of Australia

10.2 Establishment (1913-1920)

A temporary brick making plant was operational by 19 June 1913. This comprised a grinding pan, brick making machine and elevator made by Geo. Foster and Sons, Sydney, and a portable steam engine. By August 1913, four open kilns were in use at the temporary plant, with plans for a fifth. During this period, workers were accommodated in two camps of tents – one for married couples, the other for single men. The camps were located on Banks Street, near the present Forestry School. This area has been developed for housing.

The first stage of the permanent brickworks, which included a Staffordshire kiln, was approved on 1 December 1913 by P T Owen, the Director-General of Works. It was proposed to use this kiln to produce bricks for the construction of two further kilns. In September 1915, the brickwork for a 20-chamber Staffordshire kiln was nearing completion. This kiln, together with crushing, processing equipment and brick presses was ready for production by early 1916.

A Survey Plan of the site (Figure 4), dated 20 December 1916, shows the layout of the permanent brickworks. A small galvanised iron office building is located close to the 'Machine Shop', and a galvanised iron 'Cottage' with associated coal store and stable is located to the north-east of the site. Other features include a coal stage, a concrete retaining wall separating the quarry pit and the working areas, water storage tanks on a high knoll, a remote powder depot, three detached WCs south of the kiln, an elevated gangway connecting the coal stage to the kiln and overhead electrical connections linking the power station to the fan room, machine shop and the cottage. The Staffordshire kiln was connected to the fan house and stack by means of flues and underground workings. A tram line is indicated linking the quarry to the machine shop – these tram lines could be relocated as the quarry face advanced.

The plan also provides details about the temporary brickworks. The temporary 'Old Kiln' area, shown in outline on the plan, comprises four kilns located to the south-east of the permanent brickworks. There is also a 'Dormitories' building located to the immediate north.

The plan indicates that the land to the immediate north of the Staffordshire kiln and associated fan room was on a rise, and a gutter was developed to the west of this to allow water to flow from the nearby creek to the site. This land later became a rubble heap and refuse dump.

The land to the north-west, west and south of the brickworks was established in 1914 as a designed landscape 'Westbourne Woods' (Figure 5). This land, together with Weston Park and the Yarralumla Nursery, was nursery and arboretum to test the suitability of plantings throughout Canberra.

The commitments of World War I, and consequent restrictions on the works program for Canberra, together with a coal strike, saw the brickworks close in December 1916.

10.2.1 Analysis and conclusion

All structures relating to the temporary brickworks have been demolished.

Elements of the permanent brickworks, as indicated on the 1916 survey plan, that survive include the power station, Staffordshire kiln, the fan room, stack and the concrete retaining wall. It is assumed that the underground workings connecting the kiln to the fan house and stack also survive as intact subsurface remains. Other elements from this period have been demolished. As was the case for the cottage, associated coal store and the office building close to the machine shop, the majority of the demolished buildings are likely to have been constructed of sheet metal.

Archaeological deposits pertaining to built form from this era are expected to comprise footings and machinery remnants. The material discard is expected to be items of an industrial nature. As can be seen from the survey plan (1916), most of the development in this period was located on the flat land to the west of the quarry pit. This area has been heavily disturbed as a result of the expansion of the brickworks, and it is unlikely that archaeological remains will be uncovered here.

The site of the temporary kilns to the south-east of the power station is the most likely location for archaeological deposits dating to this era. This area has not subsequently been developed, although part of it was covered with a concrete slab (see Section 10.4).

The cottage to the north-east may also yield some archaeological remains, although this site is likely to have been disturbed by quarrying activities. The location of the cottage and outbuildings has been heavily trafficked over time, being located on a key route between the quarry pit and kilns and in close proximity to the primary crusher house and the elevator/conveyor. Archaeological deposits or features relating to this area may include timber post holes and/or domestic discard.

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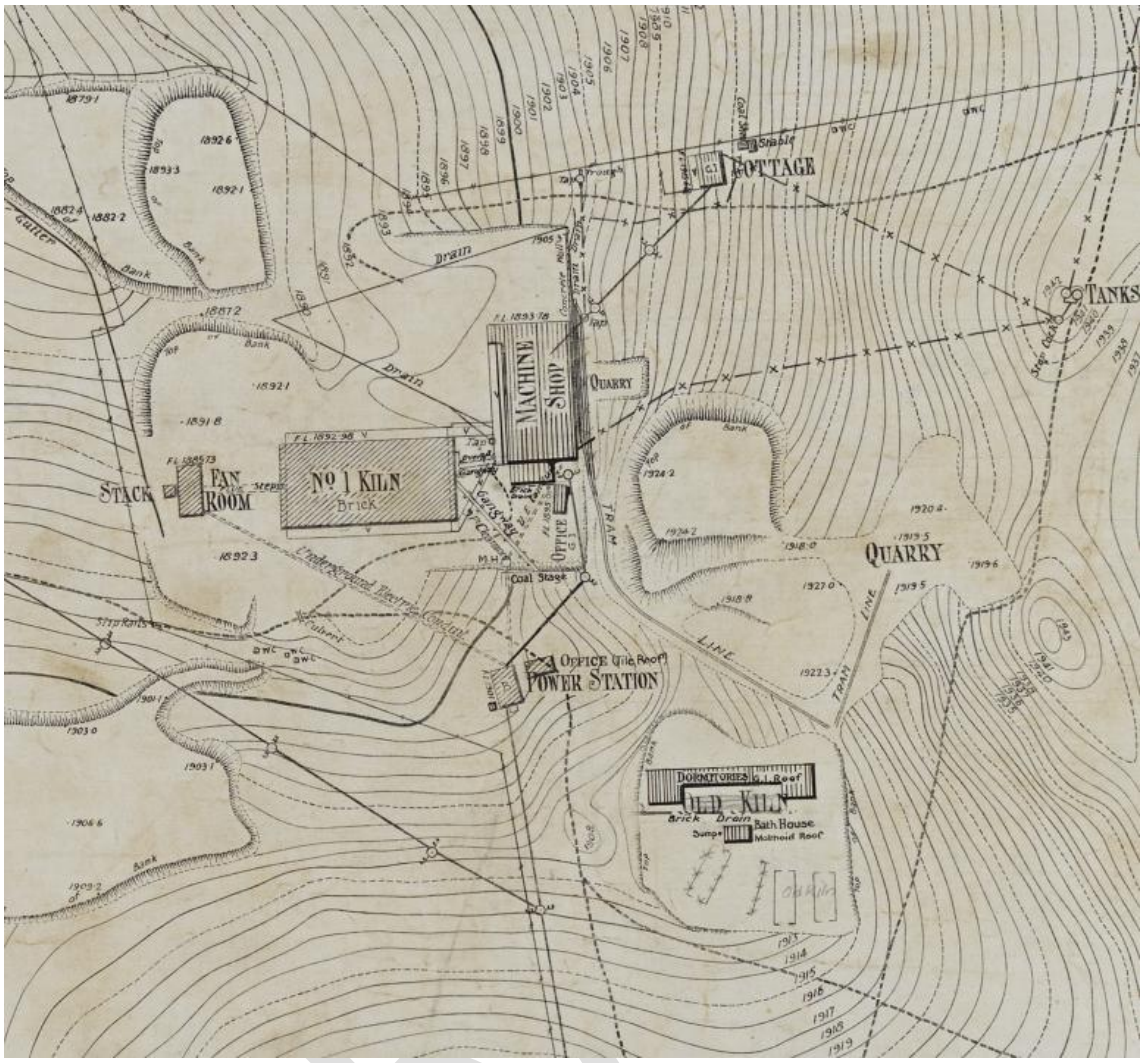


Figure 4 Contour and detail survey of Brick Yards, Canberra, 1916. North is at top
Source: National Archives of Canberra

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Figure 5 Detail of Plan of City and Environs, 1918 showing the Brickworks (indicated) in relation to Westbourne Woods
Source: National Library of Australia

10.3 Reactivation (1920s – 1930s)

The Canberra Brickworks re-opened in 1921 to meet the demands of a developing city. By the end of 1923, 5,000,000 bricks and 50,000 tiles had been produced at the plant.

Bricks were initially transported from the brickworks to construction sites in the emerging city centre by traction engine. However, the machines were able to make only two daily round trips. To speed the process a light railway was constructed. This led from the south-west of the brickworks site, before aligning with the present Denman Street and heading east to the construction sites. The 'branch lines' of the light railway were removed prior to the opening of the Provisional Parliament Building in May 1927 and the remaining sections of the railway were removed in 1929. From the late 1920s, bricks were transported by truck. The only remaining evidence of the light rail network is the formation between Denman Street and the west side of the brickworks (the Canberra Brickworks Railway Remnants).

To cope with increased demand during the 1920s, two 'temporary' downdraught kilns and an associated stack were constructed at the brickworks in October 1925. These were oriented east-west and located to the south of the Staffordshire kiln. They were replaced in the 1960s by three kilns that survive today. In 1926 the existing machine shed was also expanded by two bays.

A 1926 site plan of the brickworks (Figure 6) indicates the changes that occurred following the re-opening of the site after World War I. The old dormitory block and iron cottage with associated stable are still present, but the temporary kilns have been demolished by this stage. The machine shop has

been expanded to the north and a new kiln constructed to the north of the Staffordshire kiln. The location of the two downdraught kilns is also outlined. There was an amusement hall, possibly associated with the Brickworks Camp, to the east of the quarry pit. The quarry itself has altered in shape significantly from the earlier 1916 plan and the tramways follow a different alignment. The plan also provides an indication of the arrangement of the railway siding, just prior to its closure the following year.

Further development took place in 1927. A Hardy patent kiln was built, located to the north of and parallel to the Staffordshire kiln. Today, this kiln has its own fan house and stack, presumably with underground flues, but a 1927 site plan showing the proposed location of this kiln, suggests that it may originally have been supported by the fan house and stack of the Staffordshire kiln. This kiln remains today, albeit in extensively modified form. A 'Scotch' kiln was also in operation to the north of the Staffordshire kiln, and the original section of the present office building was constructed. Single men's quarters were constructed on the south side of Denman Street, close to the entrance to the study area – the location of these quarters is not recorded in historic plans or photographs – and new married quarters were located to the south of the brickworks in the same year. These married quarters can be seen in Figure 7 and Figure 8. They comprised a large two storey building (mess hall) and a number of simple single storey sleeping quarters. The photographs suggest that they were of timber construction.

By the end of the 1920s, the brickworks comprised:

- Staffordshire kiln, fan house and stack
- Hardy patent kiln, fan house and stack
- Two downdraught kilns
- Machine shed
- Amusement hall
- Cottage and associated stables/coal store
- Power house (brick)
- Office (brick)
- Accommodation units to south west and south
- Railway siding remnants

The works closed in February 1931 as a result of the 1929 Depression before reopening again in 1935. However, World War II diverted peace time activity to works associated with the war effort, and the brickworks closed once again. In April 1942 staff were laid off and a caretaker retained to issue bricks for essential works.

10.3.1 Analysis and conclusion

The reactivation phase saw the expansion of the brickworks to something close to its present dimensions. The industrial buildings built during this period were generally constructed of brick with corrugated sheet metal roofs. It is anticipated that accommodation buildings of this era were constructed of timber.

The only buildings that survive from this period were those associated with the industrial workings of the brickworks itself. All accommodation, including the sheet metal cottage, the original dormitories, the single men's camp and the married quarters have been demolished, as has the amusement hall.

The form and location of the single men's quarters constructed to the south of Denman Street, close to the site entrance, is not known. As noted, it is probable that the building (or buildings) were of timber construction. The land to the south of Denman Street, close to the entrance, has not subsequently been

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developed. Archaeological deposits relating to these quarters may include post holes and underfloor refuse deposits. Any material discard is expected to be of a domestic nature.

The married quarters, south of the brickworks, were replaced with a hostel in 1945. As a result, there is limited potential for archaeological deposits relating to the 1920s married quarters. Any deposits are likely to be of a domestic nature.

There are unlikely to be any remains of the quarry pit tramways. These were of an ephemeral nature, being readily relocatable. The floor of the quarry pit has also been modified through quarrying operations, and (in the 1970s) through the adaptation of the pit to a landscaped park and model railway.

Evidence of the railway siding remains in the form of cuttings in the landscape that follow the original alignment of the siding. The potential for subsurface remains relating to the railway, including drainage channels, is low, but cannot be discounted. The railway siding extended right to the brickworks and, although part of this area was later covered with the slab of the extrusion plant, there is potential for the evidence of tracks extending to the north and south of the Staffordshire kiln. Potential archaeological features related to the railway may include timber sleepers, iron bolts and metal rails.

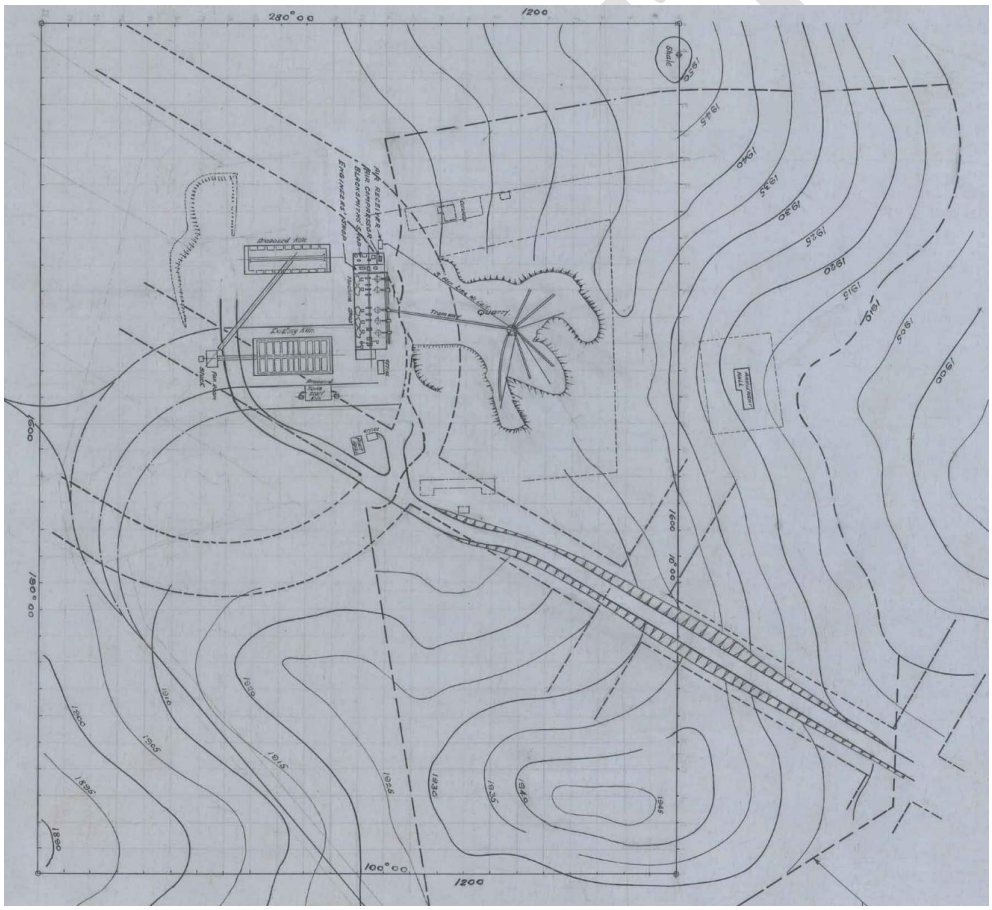


Figure 6 Canberra Brickworks site plan, 1926. North is at top
Source: National Archives of Australia



Figure 7 View of Brickworks, 1929 with married quarters to the left of the image
Source: National Archives of Australia



Figure 8 Brickworks looking south to married quarters buildings, 1929
Source: National Archives of Australia

10.4 Expansion (1940s – 1960s)

With the end of World War II in sight, the Canberra Brickworks reopened in September 1944, with production on a limited scale. From the late-1940s and into the 1950s output was stepped up to provide material to address the post-war housing shortage, resulting in a major expansion and redevelopment of the brickworks.

Among the first post-war construction projects was the replacement of the married quarters at the south-west of the site, built during the 1920s. The new 'Brickworks Hostel' was ready for occupation in 1945 and was located on the site of, and in close proximity, to the former married quarters. The hostel was demolished c.1970.

The expansion of the brickworks in the 1950s saw a change in the process of brick making and in the machinery required for production. While the major brick kilns on the site were retained, other early plant and buildings were replaced. The early machine shop, adjacent to the Staffordshire kiln, was replaced with a series of brick press buildings and a workshop. The brickworks was also equipped with a series of new crushers and hoppers, an elevator and a 'Pan Building'; and a sequence of conveyor belts. The two 'temporary' downdraught kilns that had been built c. 1925 were demolished to make way for three new downdraught kilns. These were constructed on the site of the former 'temporary' kilns in 1960-63.

Westbourne Woods, which surrounded the Brickworks also witnessed change during this period. To solve problems of tree damage as a result of drought, a golf course within the Woods was proposed in 1945. From 1949-1954, fairways were cleared and grassed and in 1962 the Royal Canberra Golf Club was granted a lease that included most of Westbourne Woods.[10] The land to the north-west and west of the brickworks has thus retained a designed landscape character since 1914, with no evidence of development.

This phase of development of the brickworks is reasonably well documented. A site plan dated 1947 (Figure 9) shows the layout of the site at the time, which is substantiated by a 1950 aerial photograph (Figure 10). A 1961 aerial shows further development that took place during this period (Figure 12).

The cottage to the north-west of the quarry pit had been demolished by 1947, with the introduction of roadways to the east side of the machinery shops and kilns likely to have disturbed any material related to the building. A new house had been constructed directly to the north of the brickworks, with an associated garage. As noted above, the Brickworks Hostel replaced the former married quarters in 1945. This new accommodation comprised two buildings with rectangular footprints to the south-west of this area, and a number of smaller buildings to the north and north-east (Figure 11). The amusement hall was extant in 1950 and an explosives store had been erected to the west of the railway siding.

The 1961 aerial shows development to the east and south-east of the brickworks. Residential development to the north-east was also progressing at this stage.

The 1961 aerial also demonstrates the extensive remodelling of the brickworks during the 1950s. A new kiln, constructed c.1953, is located to the north of the older kilns and in close proximity to the residence, presumably with its own sub-surface flue connections; a clay storage shed had been erected to the east of the brickworks; and the machine shop had been remodelled into a series of smaller buildings. The Brickworks Hostel was extant, although it appears to have been modified by this time. A large square expanse is also evident to the south of Denman Street. It is possible this was used as a brick stacking or storage area for the brickworks.

10.4.1 Analysis and conclusion

This period saw the major expansion and redevelopment of the Brickworks, with a mix of residential and industrial buildings being constructed, which generally replaced earlier structures.

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The residence to the north of the brickworks was demolished by the 1970s, with the area later incorporated into the Lane Poole Place development (see Section 10.5). This site now lies outside the study area.

The principal site of archaeological potential relating to this era is the former Brickworks Hostel (built 1945, demolished c. 1970). Footings and concrete slabs were not visible during the first study area visit (due to the extent of vegetation). However, above-ground evidence of built form in this location was visible during the survey conducted by NOHC in June 2016 (Figure 13). Any material discard in proximity to the former hostel is likely to be of a domestic nature.

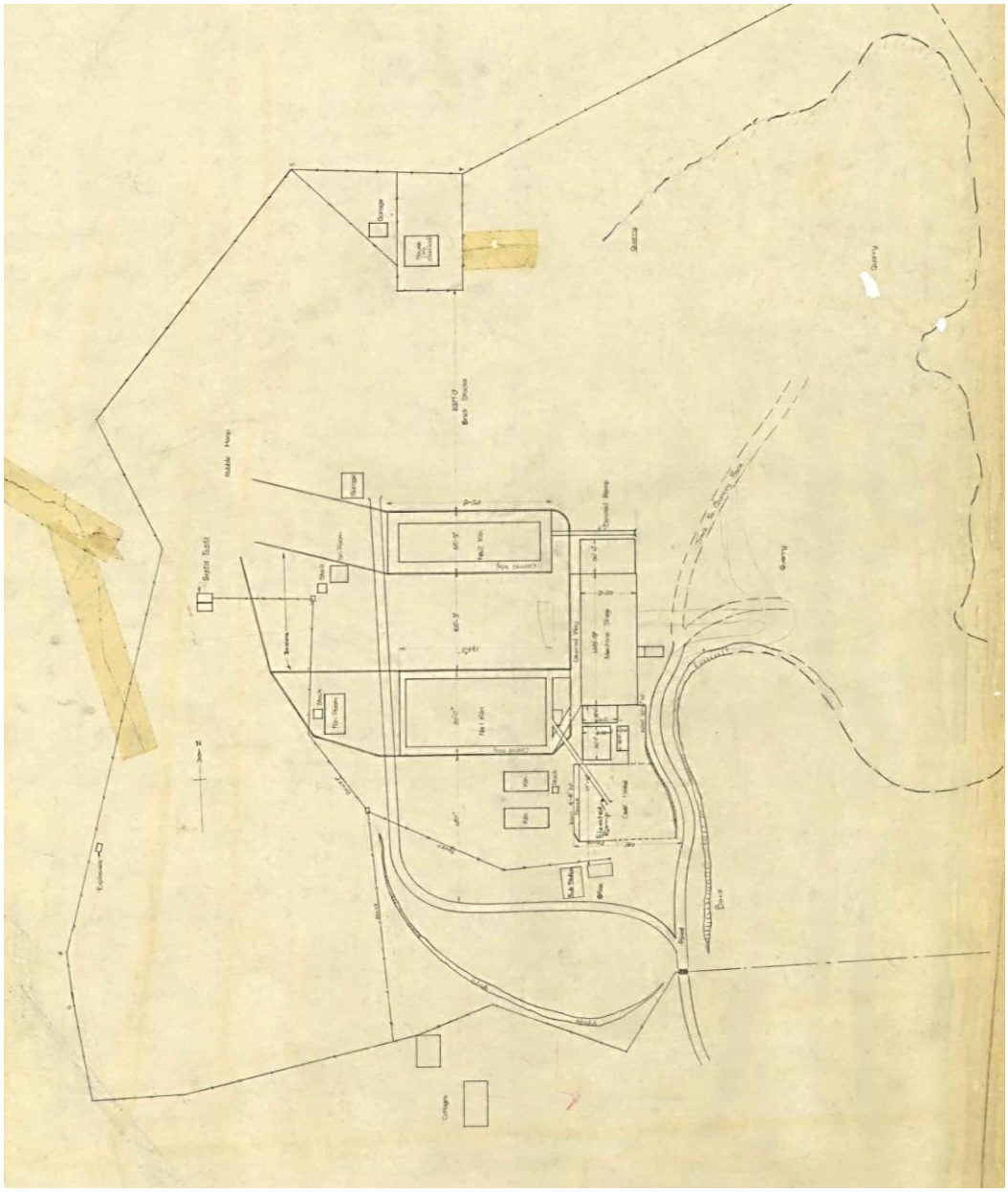


Figure 9 Brickworks site plan, 1947. North is at top
Source: National Archives of Australia



Figure 10 Aerial view of the Brickworks site, 1950
Source: ACTPLA



Figure 11 Aerial view of Yarralumla looking east, with the Brickworks at the lower left showing the Brickworks Hostel (indicated), 1952
Source: ACT Library

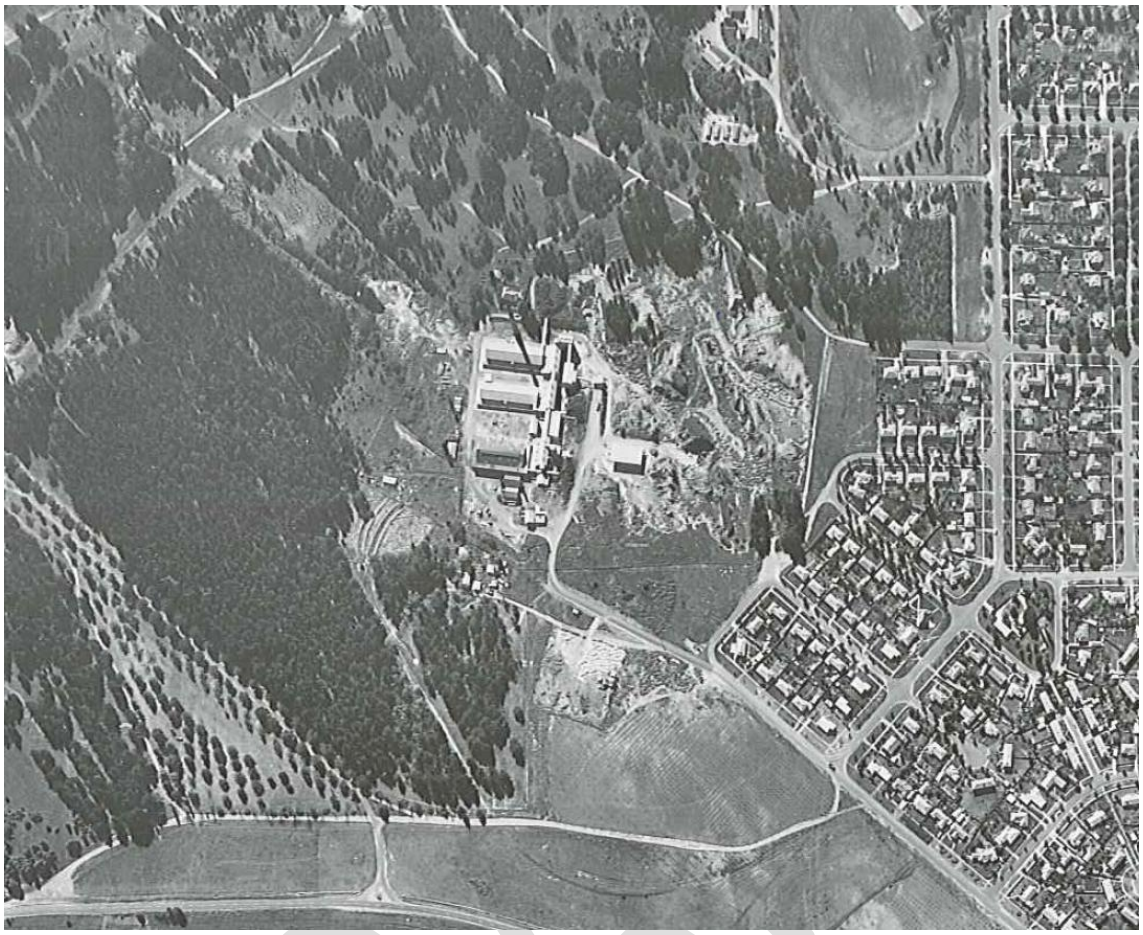


Figure 12 Aerial view of the brickworks site, 1961: note the square fenced area to the south of Denman Street
Source: ACTPLA



Figure 13 Walls/footings of the former Brickworks Hostel, 2010

10.5 Closure and redevelopment (1970s – current)

In 1967, the ACT Health Services Branch inspected the Brickworks Hostel and reported that the buildings were in a state of disrepair. Late in 1970 it was reported that the hostel was to be demolished. The 1972 aerial photograph (Figure 14) shows the site of the hostel as cleared land. The amusement hall had also been demolished by this time, although the associated landscaping (trees) survived. Further residential development had occurred to the north-east and east of the study area and to the north, the Royal Canberra Golf Course had been established.

The three downdraught kilns built in the 1960s can be seen to the south of the Staffordshire kiln, with a large square extrusion plant to its west – part of this large concrete slab was located on top of the rail sidings that extended to the north and south of the Staffordshire kiln. A comparison of the 1960s and 1970s aerial shows that new structures were constructed to the immediate east of the kilns, the latest iteration of development in this location. The c. 1940s residence to the north of the brickworks had been demolished by this time. This area has since been developed as part of the Lane Poole Place housing complex. The area of the old kilns and dormitories had been partly covered by a concrete slab for a car park by the 1970s.

By 1973, the Canberra Brickworks was considered to be in need of extensive modernisation and proposals were prepared by Commonwealth Brickworks Pty Ltd for upgrading. These proposals were rejected on environmental grounds and a new site for a brickworks was released at Mitchell, north of Canberra. The kilns at the Canberra Brickworks were unloaded for the last time in August 1976.

Also in 1976, local developer and businessman Alan Marr (A R Marr Pty Ltd) made a proposal to the NCDC to develop the brickworks and adjacent land as a tourist, recreation and retail destination, with associated housing to the east and north of the study area. Under Marr's scheme, the quarry was to be landscaped to include picnic areas, walking trails and a miniature railway (Figure 15). Marr succeeded in having the land re-zoned, and redevelopment works on the quarry commenced towards the end of 1978. This involved land fill and the creation of a reflection lake. The redeveloped brickworks was opened to the public as a tourist attraction in July 1979. A 1980 aerial photograph shows the study area at this time (Figure 16).

Marr also held an option to develop up to 212 townhouses on parts of the brickworks site. In 1980 the first stage, comprising 20 houses on the eastern side of the study area (along Woolls and Schomburgk Street), was commenced. Work on 45 houses to the north-west of the study area (now Lane Poole Place) began the following year. At this time, the railway remnants were not recognised or registered as a heritage site.

A R Marr Pty Ltd was placed in provisional liquidation in January 1980, and in 1984 the Commonwealth Government accepted the surrender of the lease for the brickworks from the lessee, A R Marr Pty, and paid $1.1 million for its interests.[11]

10.5.1 Analysis

This phase relates to the use of the study area after it ceased operations as a brickworks. The post-operational phase of the Canberra Brickworks makes a limited contribution to the identified values of the place. There are no sites of archaeological potential related to this phase.

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Figure 14 Aerial view of the Brickworks site, 1972: note the demolition of the Brickworks Hostel (indicated)
Source: ACTPLA

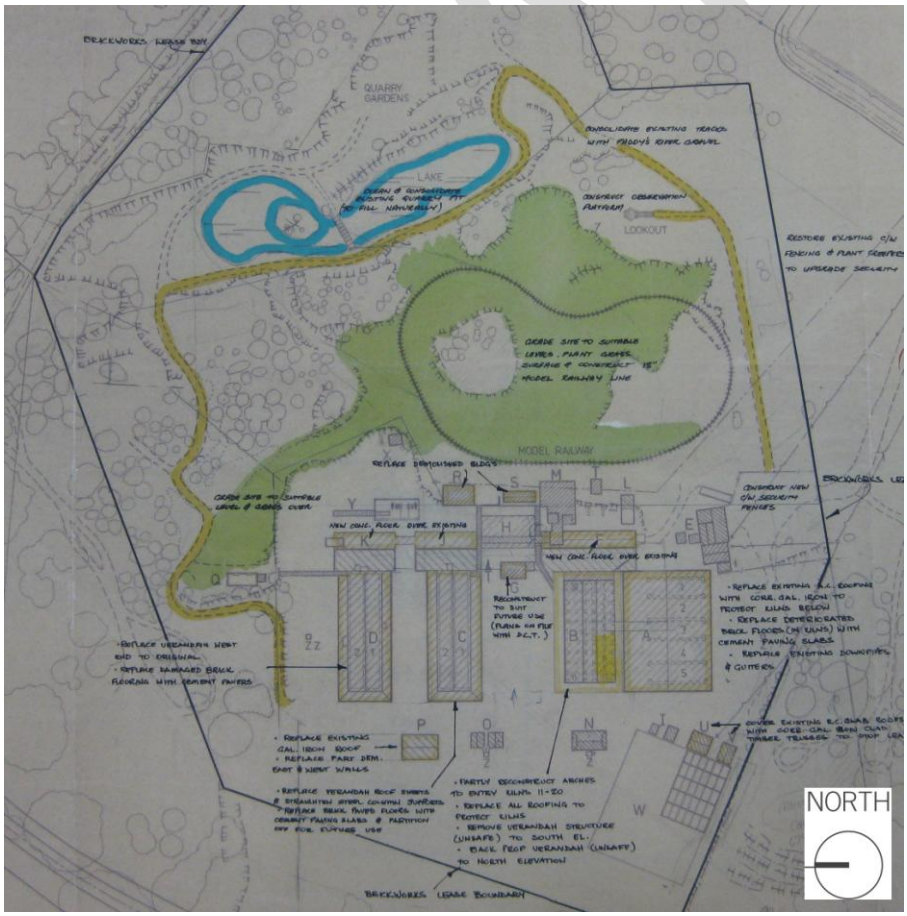


Figure 15 The A R Marr proposal for the Canberra Brickworks, c. 1977
Source: ACT Heritage Library



Figure 16 Aerial view of the brickworks site, 1980

11.0 Physical investigations

The historical analysis identified five areas of potential archaeological sensitivity within the study area. Physical investigations undertaken by NOHC confirmed these areas and also identified a further seven archaeological sites. All twelve sites are discussed below.

11.1 Predictive archaeological model

The core function of brick making in an industrial complex such as the Canberra Brickworks requires a network of interrelated sites and features that include domestic as well as industrial elements. Working from the core to the periphery, archaeological sites and features of heritage significance that may occur within the study area were predicted to include:

- Remains of the brickwork making process including kilns, flues, chimney stacks, conveyors, fan houses and raw material stockpiles;
- Remains of former dwellings including worker's camps, dormitories, houses and huts and associated infrastructure such as drainage;
- Remains of other buildings and structures such as stores, tanks for liquid storage (both above and underground), offices and workshops;
- Old fence lines, such as post and rail fencing; these may occur along inter- and outer-site boundaries;
- Transport infrastructure such as road and railway sites and features;

- Vegetation defining location of sites and features either as introduced plantings or clearings with vegetated borders

Structures of historical interest and heritage significance may be standing, ruined, buried, abandoned or still in use.

11.2 Survey coverage and visibility variables

The effectiveness of archaeological field survey is, to a large degree, related to the obtrusiveness of the sites being looked for and the quality of ground surface visibility. Ground surface visibility is a measure of the bare ground visible to the archaeologist during the survey. There are two main variables used to assess ground surface visibility - the frequency of exposure encountered by the surveyor, and the quality of visibility within those exposures. The predominant factors affecting the quality of ground surface visibility within an exposure are the extent of vegetation and ground litter, the depth and origin of exposure, the extent of recent sedimentary deposition, and the level of visual interference from surface gravels.

Visibility variables were estimated for all areas of survey within the study area. These estimates provide a measure with which to gauge the effectiveness of the survey and level of sampling conducted. They can also be used to gauge the number and type of sites that may not have been detected by the survey.

Visibility across the Canberra Brickworks site was of mixed quality. Vegetation growth and leaf litter across sites was the single largest contributing factor to poor visibility. Growth was either in the form of high growing grasses and weeds, or clusters of bushes and young trees, which at times impeded access as well as visibility. Visibility was low at those sites which have not been maintained (e.g. BRW6 and BRW2), and high at those which have been manicured (e.g. quarry and BRW1).

The built environment which forms the core of the complex was also a key contributor to poor visibility. It is assumed that any archaeology that may have survived the later construction of kilns and other structures in the precinct has been disturbed.

Overall, visibility was moderate, and the survey was able to obtain a comprehensive recording of archaeological sites and features. The individual sites have been described below.

11.3 Surface features

Twelve archaeological sites were identified within the brickworks site during the archaeological investigations. These sites comprised surface features and are described in detail below.

11.3.1 BRW1: Possible building platform and concrete features

A platform and a number of features including concrete and spoil are located on the south side of Denman Street, approximately 25m from the entrance to the brickworks. A vehicular track runs north-east to south-west on the western extremity of the site, and a fence line consisting of star pickets/pine posts and wire netting combined with barbed wire delineates the southern extremity. A small grove of trees are situated at the eastern end of the site. The site measures approximately 20m x 15m.

At the western end of the site there is a square concrete feature, approximately 1m x 1m, with an exposed top (Figure 17). This feature suggests a function associated with water, either for storage or drainage. Approximately 5m to the east of this square concrete feature is a visible line of grass die back, which suggests the presence of subsurface features. This line extends from north to south across the building platform that comprises the bulk of this site (Figure 18).

Site conditions are poor to fair. Two depressions identified within the platform suggest erosion or disturbance has occurred, while the in situ concrete features suggest a level of intactness. Visibility of this area was good, with only some low grass.

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Figure 17 View of BRW1 concrete feature, looking north
Source: NOHC



Figure 18 View looking north across BRW1, showing line of grass die off (centre left)
Source: NOHC

11.3.2 BRW2: Married quarters and Brickworks Hostel

This site is within an area that has been designated through historical records as the brickworks accommodation village.

A complex of structural features is located south of the brickworks fence line, and approximately 40m west of BRW1. The area is approximately 80m x 35m and extends southwards up a gentle slope to a road cutting that transects the southern portion of the site on an east-west alignment. A less formal vehicular track is situated along the same alignment as the more formal road, immediately to the south.

Site visibility was generally poor in this area with thick groves of blackberry bushes to the east, which also spread intermittently towards the west. This was interspersed with moderately dense patches of small saplings/trees, with dense grass throughout. A limited area had enhanced visibility due to a cleared path which ran through parts of the site and around a number of features. Occasional sawn off medium sized tree stumps were visible throughout the site.

The site is defined by a number of highly visible mounds of spoil and a platform. These mounds of spoil, if related to former structures on the site, suggest heavy disturbance and a poor to fair condition across the site generally. Various items of artefactual material are scattered throughout the area, such as sheets of tin, brick and tile fragments, concrete and bottle fragments. Some of the material is relatively modern, including old car parts and even a bicycle frame, suggesting dumping of rubbish not necessarily associated with the site.

Descriptions of identified individual features are provided below:

BRW2-A: Brick Feature and Mound

Situated at the western end of BRW2 and approximately 15m north of the road cutting, is a large mound of brick and concrete rubble covered in grassed topsoil atop a large rectangular brick feature. It measures approximately 6m x 2m, and up to 1 metre in height.

This brick feature is a substantial structural element of a former building and remains in situ unlike many of the other elements at this site. At the northern end of this structural feature is a large concrete lined drain or water trap, with remains of an iron grate (Figure 19). Brickwork around this feature, particularly the southern portion, shows signs of having been covered in tar or bitumen. Along the western side of the feature is a rectangular stall that is reminiscent of a fireplace or hearth recess (Figure 19). A piece of iron flue or furnace was identified as part of the spoil on this site, along with what appears to be a crumpled washtub (Figure 21). The bricks show a combination of different stamps and frog marks on their surface, including the early “CANBERRA C’WEALTH” stamp.

Slabs of brick and concrete are located around the feature, which are suggestive of walls or flooring remains, sheets of tin, iron girders and rods. A linear mound of rubble extends easterly from this main structural feature and is made up of cemented brick segments and other structural detritus.

This feature appears to correspond with the brickworks mess hall which was depicted in images from at least 1929.

BRW2-B: Metal spoil heap

A spoil made up largely of metal remains including tin, iron girders and rods, galvanized and non-galvanized pipes is situated approximately 15m east of BRW2-A (Figure 22). There is some brick material within this spoil, including what appears to be an in situ brick footing. There is also the occasional plank of milled timber. The northern side of this mound is bordered by a blackberry bush cluster.

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Figure 19 Detail of drain at northern end of BRW2-A
Source: NOHC



Figure 20 Detail of brick stall at BRW2-A
Source: NOHC



Figure 21 View looking wast across BRW2; note the washtub and brick stall to the west and rubble to the north
Source: NOHC



Figure 22 View looking east across BRW2-B
Source: NOHC

BRW2-C: Concrete slab

A concrete slab approximately 4m x 6m is located just south of the southern fence line of the brickworks at the western end of the site (Figure 23). The rendering is coloured red and has the remains of four toilet fittings running down the centre of the slab. The toilet bowls have been removed from the platform, although fragments of broken bowl and earthenware plumbing pipe exist around the slab (Figure 24). The alignment of the toilets suggest that the stalls were accessible from the northern side of the slab. A possible step or entrance way extends from the northern part of the slab in the centre. A stamped feature is evident in the north east corner of the slab suggesting a small closet, room or feature for what appears to be an ablutions block. The slab appears to be on the same alignment as BRW2-A, which is just further south. This structural feature appears to correspond with the brickworks ablution block which is depicted in images of this area from at least 1929. The ablution block suggests that it was more to do with the brickworks than it was to do with the accommodation of employees.

BRW2-D: Brick mound

Positioned just east of BRW2-C is a small mound made up largely of brick and brick fragments, along with rendered red brick (Figure 25). There are also segments or clusters of concrete blocks with broken red tile as aggregate. There is also the occasional piece of tin sheeting. It is possible, due to the red rendered brick, that this mound is a spoil heap for structural remains from BRW2-C.

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Figure 23 The concrete slab at
Source: NOHC



Figure 24 Remnant of one of the toilet fitting
Source: NOHC



Figure 25 Looking south-west towards BRW2-D
Source: NOHC

11.3.3 BRW3: Area of postholes and other remains

A complex of features that relate to various structures and infrastructure are located to the south of BRW2. This site covers approximately 100m x 50m. Visibility was fair to good due to patchiness of vegetation ranging from dense to light.

At the western extremity of the site is evidence of a modern "fringe dwellers" camp, with a hearth constructed of brick and concrete remains from structural features such as those encountered at BRW2. The hearth had been in recent use as evidenced by the condition of the fire remains within and the rubbish surrounding this feature. Evidence for a camp or rough shelter was also observed, with various planks nailed to trees and pallets repurposed for flooring or other means amongst a grove of young trees. Sheets of tin were also present and nylon rope tied around trunks in strategic places possibly for the use of attaching a tarpaulin or other such item for shelter purposes. Within the grove of saplings a circular feature with a diameter of approximately 10m was defined by postholes surrounding a large pallet like item in the centre (Figure 26). It is unclear whether the postholes predate the modern fringe camp. Early maps and plans suggest that this area to the west was originally a more ephemeral brickworks camp and then later into the twentieth century the location for dormitories or hostel like accommodation.

In proximity to the hearth and camp are mounds of structural spoil, consisting of brick and concrete, iron rods and metal sheeting, bottles and tin cans. To the east of the modern camp, and almost directly south from BRW2, a rectangular clearing was encountered. At the top of the slope to the south of the clearing a drainage line has been excavated, which runs approximately on an east-west alignment (Figure 27). No other structural features or remains were identified within this clearing between the drainage line and the northern border of the site. However, a slab timber fence or yard post is located at the northern end. The post itself appears to be early in origin, but has had modifications made to it by the addition of another slab bolted to the upright, and use of galvanized wire and nails, as opposed to non-galvanized iron nuts and bolts for other modifications (Figure 28). No other posts or holes were

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identified in the immediate vicinity. This clearing could have been the location of one of the hostels or dormitories.



Figure 26 Circle of post holes (indicated by pink flags), looking north
Source: NOHC



Figure 27 Drainage line at BRW3, looking west
Source: NOHC



Figure 28 Detail of slab post at BRW3
Source: NOHC

11.3.4 BRW4: Single men's quarters

A fenced yard area measuring approximately 80m x 80m is located to the south of BRW1. Defined by a star picket fence line with wire netting along the bottom portion and barbed wire on the upper portion, the yard is accessed by gates at the northern end from Denman Street and a gate in the south-west corner. Visibility was very good as the area is relatively clear of vegetation, with the exception of a light covering of low growing grass across parts, and the occasional low growing shrub and small tree. The yard rises up a gentle slope to the south. A layer of bitumen such as that used for road surfaces covers a good portion of the site (Figure 29) and this sits directly above a layer of bedrock, with only a thin layer of topsoil present in patches throughout the yard. No structural features were identified, although fragments of window glass were found near the northern entrance to the site (Figure 30). The condition of this area is good.

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Figure 29 Asphalted area at BRW4, looking east
Source: NOHC



Figure 30 Window glass at BRW4
Source: NOHC

11.3.5 BRW5: Clay feature and rubble

To the immediate west of the brickworks kilns is a silty clay feature up to 50m in diameter and 1 to 2m high, which appears to be a flat topped mound or stockpile of this resource (Figure 31). It is possible that it is a feature that has been created from earthworks in this area, however it does not sit on the same horizon as other surrounding features, such as the brickworks kilns. The location of this site is close to the former creek that fed into the precinct from its north-west corner. The silty clay material is different to any of the top soils and sediments around the rest of the precinct. Visibility of this area was good and the condition of this feature is good.

To the west of the mound is a series of depressions scattered throughout with brick and concrete rubble (Figure 32). These depressions are located between the mound to the east, and the railway remnants to the west. They could be associated with a former structure in the vicinity or rubble that has been

dumped from another location. An aerial image from 1950 (Figure 33) shows that a rectangular structure was once located in this vicinity. The overall condition of this element is generally fair and visibility is good.



Figure 31 Clay mound feature at BRW5, looking west
Source: NOHC

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Figure 32 Rubble and depressions at BRW5
Source: NOHC

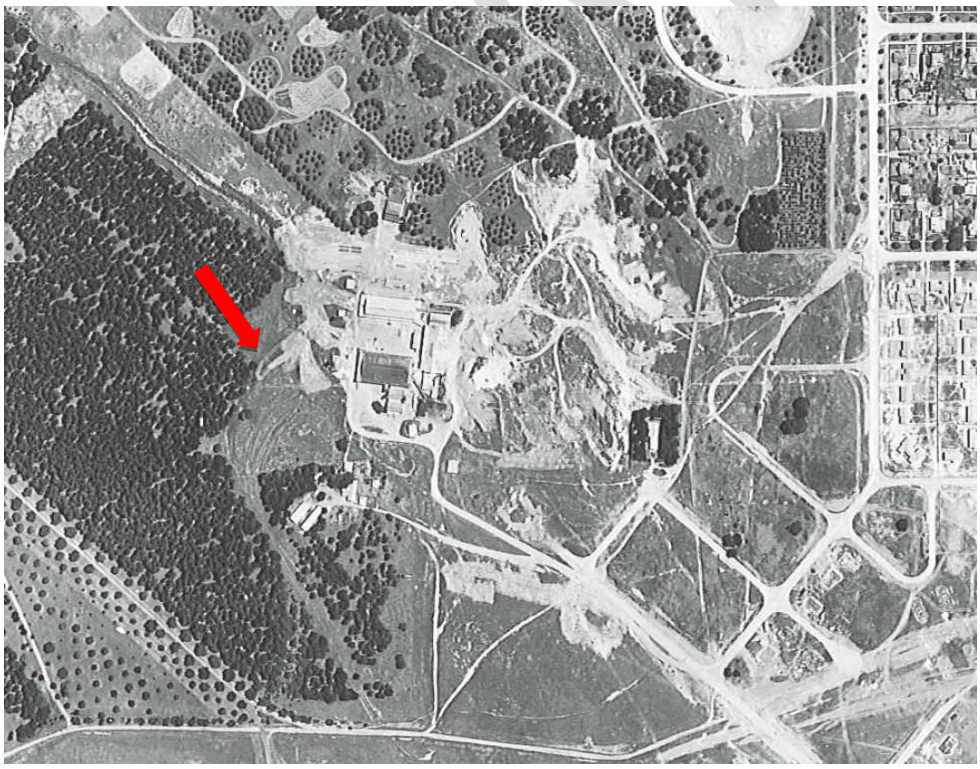


Figure 33 Aerial photograph of the Brickworks, 1950; the rectangular feature is indicated
Source: ACTPLA

11.3.6 BRW6: Rubble heap/refuse dump

This site is located at the north-west section of the precinct and consists of a mix of brick and concrete rubble located within a depression at the base of trees (Figure 34). The remains could be associated with a former structure in the vicinity or rubble that has been dumped from another location. An aerial photograph from the 1960s shows that a rectangular structure was once located in this vicinity. Visibility was poor in this area due to high growing vegetation in the form of grasses and weeds. Condition is fair.



Figure 34 Brick and concrete rubble surrounding trees at BRW6, looking north
Source: NOHC

11.3.7 BRW7: Quarry

The brickworks quarry is a large site located to the east of the brickworks buildings. Visibility is generally good across the quarry zone with features and elements able to be clearly identified through the low growing and manicured grass coverage.

Further east and up an incline, there are a number of depressions amongst a grove of pines along the edge of the quarry cliff (Figure 35). These depressions are uniform in size, approximately 1m in diameter and appear to be in a sequence. The historic aerial dating to 1950 (Figure 33) shows a series of circular features similar to these depressions extending west to east up the slope in a double row. The function or purpose of these depressions is unknown. On the eastern side of the quarry zone to the north is an example of an in ground circular tank that has been back filled with brick rubble, approximately 3 metres in diameter (Figure 36). This tank does not resemble the depressions in the south of the quarry in scale and known purpose.

At various locations along the quarry wall, particularly the eastern side, brick rubble has been back-filled against the face (Figure 37). This is either an example of disposing of seconds and damaged bricks, or to provide something of a retaining wall for the cliff face. The exactness of the placement suggests the latter.

A number of features and elements exist within the quarry floor itself. Starting at the south end of the quarry floor, a raised embankment of earth runs along the eastern contour of the quarry wall. This

feature belongs to a much later use of the brickworks as a tourist destination in the form of a model railway.

In the middle of the quarry floor are two mounds that have been covered with topsoil and grassy vegetation. Aerial imagery from the 1960s (Figure 38) shows a structure in the form of a large shelter or shed in the same location. These mounds could be evidence of this structure and its contents. This also confirms that there is likely to be intact subsurface material beneath these mounds dating to the original quarrying.

Along the north eastern edge of the quarry, the floor has been further excavated to create a pond or lake. This excavation dates to the time the brickworks precinct was a tourism facility. The quarry face to the west of this pond or lake in the north, shows stratigraphy that depicts a disposal event that has subsequently been capped by spoil from either the excavation of the pond/lake or from other areas. A layer of brick, concrete, glass, and iron exists along with a line of charcoal and burnt material approximately a metre below the surface (Figure 39).

The condition of the quarry is very good and its level of intactness is the highest standard when compared with other archaeological sites within the precinct.



Figure 35 Depression on south side of quarry edge
Source: NOHC



Figure 36 Tank at north-eastern edge of quarry, looking south
Source: NOHC



Figure 37 Rubble backfill along north-eastern edge of quarry face, looking east
Source: NOHC

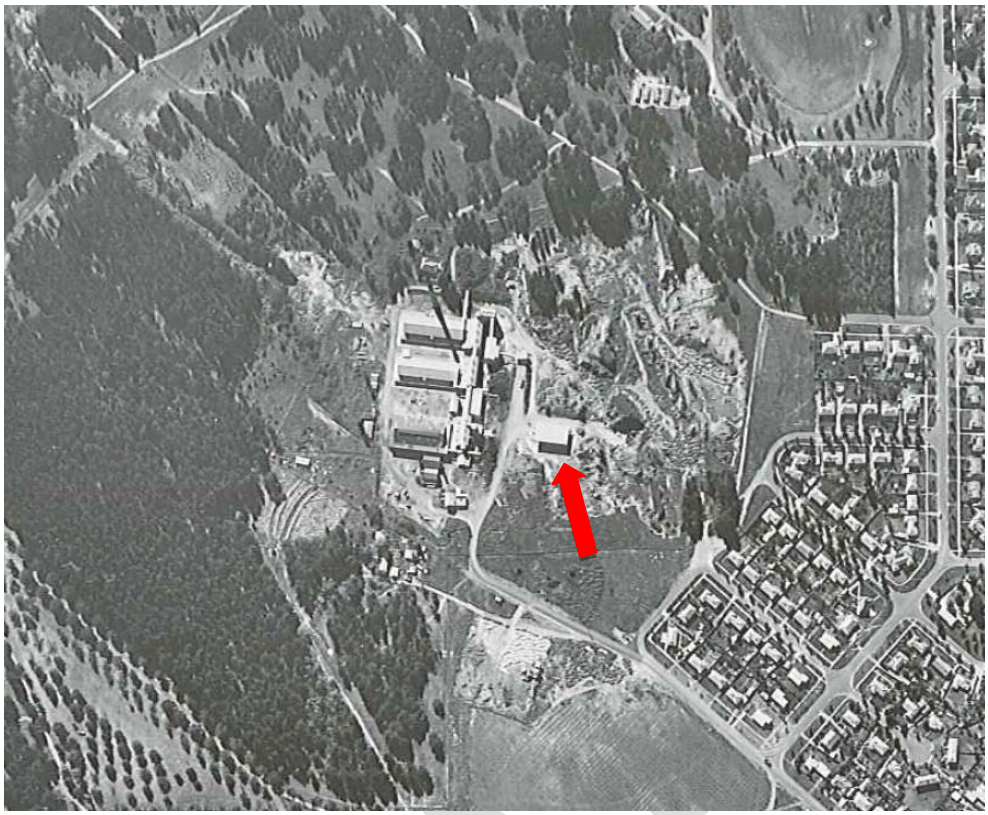


Figure 38 Aerial photograph of the Brickworks, 1961; the shelter is indicated
Source: ACTPLA



Figure 39 Quarry face showing layer of rubble and charcoal at northern end of quarry
Source: NOHC

11.3.8 BRW8: Old kiln and dormitories

The temporary brickworks was established in 1913. By August of that year, four open kilns were in use. This 'Old Kiln' area was located to the south-east of the permanent brickworks and a dormitories building was also located to the immediate north of the temporary kilns. These structures are likely to have been demolished by the mid-1920s.

Analysis of site plans and aerial photography demonstrates that this area has undergone some disturbance since the demolition of the temporary kilns and dormitory. Buildings can be seen in aerial images from the 1950s and car parking was introduced in the vicinity in the 1960s-70s, which involved the laying of concrete. This was removed by 1980. Along with the vehicular track that exists now, there are also occasional fragments of in situ concrete slab that are possibly associated with structures postdating the early kilns. The condition is assessed as poor to fair and likelihood of subsurface features for early kilns is low.

Archaeological deposits pertaining to built form from this era would be expected to comprise footings and machinery remnants. Material discard would be expected to be items of an industrial nature with the potential for some domestic material related to the dormitories (Figure 40).

11.3.9 BRW9: Cottage, stables, coal store

A cottage, with associated stable and coal store, was built c. 1913 to the north-east of the brickworks as part of the first stage of construction of the permanent brickworks. This cottage was demolished by 1947. The location of the cottage and outbuildings has been heavily trafficked over time, being located on a key route between the quarry pit and kilns and in close proximity to the primary crusher house and the elevator/conveyor. The site of the cottage and its outbuildings is therefore likely to have been disturbed by the introduction of roadways to the east of the kiln and machinery shops as a result of successive remodelling of the brickworks.

Material discard would generally be expected to be of a domestic nature, though there may be some industrial materials related to the stables and coal store. There may also be evidence of timber post holes or footings.



Figure 40 Location of the old kiln and dormitories looking east
Source: Lovell Chen

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11.3.10 BRW10: Railway remnants

The brickworks railway operated between 1923 and 1927, and all tracks had been removed by 1929. Evidence of the railway siding, in the form of cuttings in the landscape located to the south-west of the brickworks, could be seen in aerial views of the site well into the 1970s and are still evident (Figure 41 and Figure 42). Self-seeded vegetation has since reclaimed much of the area. Although all remnants of the track were removed in the 1920s, and a period of 90 years has elapsed since then, there is some limited potential for archaeological evidence that would enhance an understanding of the railway and its operation.

The potential for subsurface remains relating to the railway, including drainage channels, is low, but cannot be discounted. Potential archaeological features related to the railway may include the railway cutting, timber sleepers, iron bolts and metal rails.



Figure 41 Cutting in landscape showing the original alignment of the brickworks railway
Source: Lovell Chen



Figure 42 Cutting in landscape showing the original alignment of the brickworks railway
Source: Lovell Chen

11.3.11 BRW11: Railway siding (extension to the north)

The railway siding extended into the brickworks site and terminated to the north and south of the original Staffordshire kiln. Aerials indicate that part of this land was later covered by the concrete slab for the extrusion plant, however there is some potential for archaeological evidence.

There is some potential for the evidence of tracks extending to the north and south of the Staffordshire kiln. Potential archaeological features related to the railway may include the railway cutting, timber sleepers, iron bolts and metal rails.

11.3.12 BRW12: Flues/subsurface workings

Underground flues and workings connected the kilns to their associated fan stacks. These are understood to still remain in situ and are unlikely to have been disturbed.



Figure 43 View looking east over the extrusion plant, part of the northern extension to the railway reserve
Source: Lovell Chen

12.0 Findings

Based on the research and archaeological investigations conducted for this report, 12 areas of archaeological potential have been identified (Figure 44):

BRW1: Building platform and concrete features

BRW2: Married quarters and Brickworks Hostel

BRW3: Area of postholes and other remains

BRW4: Single men's quarters

BRW5: Clay feature and rubble

BRW6: Rubble heap/refuse dump

BRW7: Quarry

BRW8: Old kiln and dormitories

BRW9: Cottage, stables, coal store

BRW10: Railway remnants

BRW11: Railway siding extension (to north)

BRW12: Flues/subsurface workings

The archaeological potential of each area is discussed below.

Area	Comment	Archaeological potential
BRW1 Building platform and concrete features	This feature suggests a function associated with water, either for storage or drainage. The bulk of the feature remains below ground. Site condition is poor to fair, with two depressions within the platform suggesting a level of erosion or disturbance. Even so, the in situ features of concrete, including the square feature and the platform remnants, suggest a level of intactness.	Moderate archaeological potential
BRW2 Married quarters and Brickworks Hostel	The married quarters, comprising a mess hall and a number of smaller sleeping quarters, was built to the south-west of the brickworks in the 1920s. This was replaced in the 1940s by the Brickworks Hostel, at least part of which appears to have been built on the site of the married quarters. The hostel was demolished in the 1970s. This area has remained undisturbed since the demolition of the hostel, and above-ground footings/physical evidence were located at the site in 2010 and 2016. Finds have the potential to inform an understanding of the daily lives and living conditions of the workers who were employed at the brickworks.	High archaeological potential.
BRW3 Area of postholes and other remains	Early maps and plans suggest that this area to the west was originally a more ephemeral brickworks camp and then later into the twentieth century the location for dormitories or hostel like accommodation. Condition of site is good.	High archaeological potential

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Area	Comment	Archaeological potential
BRW4 Single men's quarters	The single men's quarters was located on the south side of Denman Street in close proximity to the entrance of the brickworks site. While the exact location has not been determined, it is possible that it was in the same location as the square expanse identified in the 1961 - 1980 aerials. If so, there is limited potential for archaeological remains as the site has been relatively disturbed.	Low archaeological potential
BRW5 Clay feature and rubble	Clay feature: It is possible that it has been a feature created from earthworks in this area, however, it does not sit on the same horizon as other features surrounding, such as the Brickworks kilns themselves. The condition of this feature is good. Rubble: The remains could be associated with a former structure in the vicinity or rubble that has been dumped from another location. An aerial image from 1950 shows that a rectangular structure stood in this vicinity. The overall condition of this element is generally fair	Low archaeological potential
BRW6 Rubble heap/refuse dump (including clay feature)	The land to the west of the kilns was quarried before being converted into a rubble heap/refuse dump by the 1940s. The man-made modification of this area is discernible in the aerial photography of the site. The use of this area as a rubble heap/rubbish dump means that there is potential for some refuse of an industrial nature to remain sub-surface. This area was overlaid with concrete by the 1970s, which has since been removed. It is possible that these works disturbed any sub-surface remains.	Low archaeological potential
BRW7 Quarry	In 1910, King O'Malley announced Government plans for the construction of a brickworks to serve the Federal Capital. In July 1912, the area at Yarralumla was gazetted and development of the site began in 1913. A detail survey plan of 1916 shows the early configuration of the quarry to the east of the brickworks buildings. Unsurprisingly, this area developed and changed throughout the operation of the site. The condition of the quarry site today ranges from poor to fair and comprises fragments of in situ concrete slab and a number of depressions along the edge of the quarry cliff.	High archaeological potential
BRW8 Old kiln and	The temporary brickworks was established in 1913. By August of that year, four open kilns were in use. This 'Old Kiln' area was located to the south-east of	Low archaeological potential.

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Area	Comment	Archaeological potential
dormitories	the permanent brickworks and a dormitories building was also located to the immediate north of the temporary kilns. These structures are likely to have been demolished by the mid-1920s. Analysis of site plans and aerial photography demonstrates that this area has remained relatively undisturbed since the demolition of the temporary kilns and dormitory. Some car parking was introduced in the vicinity in the 1960s-70s, which involved the laying of concrete. This was removed by 1980. The area is located in close proximity to the main access road leading to the brickworks, and as a result, there may have been some disturbance through vehicle movement. No other land disturbance appears to have occurred here.	
BRW9 Cottage, stables, coal store	A cottage, with associated stable and coal store, was built c. 1913 to the north-east of the brickworks as part of the first stage of construction of the permanent brickworks. This cottage was demolished by 1947. The site of the cottage and its outbuildings is likely to have been disturbed by the introduction of roadways to the east of the kiln and machinery shops as a result of successive remodelling of the brickworks.	Low archaeological potential
BRW10 Railway remnants	The brickworks railway operated between 1923 and 1927, and all tracks had been removed by 1929. Evidence of the railway siding, in the form of cuttings in the landscape located to the south-west of the brickworks, could be seen in aerial views of the site well into the 1970s. Self-seeded vegetation has since reclaimed much of the area. Although all remnants of the track were removed in the 1920s, and a period of 90 years has elapsed since then, there is some limited potential for archaeological evidence that would enhance an understanding of the railway and its operation.	Moderate archaeological potential
BRW11 Railway siding extension (to north)	The railway siding extended into the brickworks site and terminated to the north and south of the original Staffordshire kiln. Aerials indicate that part of this land was later covered by the concrete slab for the extrusion plant, however there is some potential for archaeological evidence.	Moderate archaeological potential
BRW12 Flues/subsurface workings	Underground flues and workings connected the kilns to their associated fan stacks. These are understood to still remain in situ and are unlikely to have been disturbed.	High archaeological potential

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AREAS OF ARCHAEOLOGICAL POTENTIAL

SITE	NAME
BRW1	Building platform and concrete features
BRW2	Married quarters and Brickworks Hostel
BRW3	Area of postholes and other remains
BRW4	Single men's quarters
BRW5	Clay feature and rubble
BRW6	Rubble heap/refuse dump
BRW7	Quarry
BRW8	Old kiln and dormitories
BRW9	Cottage, stables, coal store
BRW10	Railway remnants
BRW11	Railway siding extension (to north)
BRW12	Flues/subsurface workings

LEVELS OF ARCHAEOLOGICAL POTENTIAL

- high
- moderate
- low
- study area

Figure 44 Areas of archaeological potential at the study area: the Canberra Brickworks and environs is indicated by the solid red line

13.0 Next steps

This report has identified areas where historical archaeological remains may be present at the study area and satisfies the conditions of Policy 15, as outlined in the Canberra Brickworks Conservation Management Plan (2010).

In order to manage the potential archaeological sensitivity of the site, and the consequent possibility of archaeological remains being disturbed during future sub-surface works within the study area, archaeological management protocols are recommended. This is in accordance with the *Heritage Act 2004,* which states that, under Section 74 it is an offence to engage in conduct that diminishes the heritage significance of a place or object. Section 76 provides exceptions to Section 74 where the person engages in conduct in accordance with a number of listed processes. This includes obtaining an Excavation Permit, which must be approved by ACT Heritage. While different methods of archaeological management are proposed according to their level of archaeological potential, one Excavation Permit will be required which will cover all archaeological works, including monitoring. This Excavation Permit will set out the proposed archaeological methods (outlined below) for when the archaeological material is encountered and these methods are to be agreed by ACT Heritage.

Areas of moderate-high potential

Areas of moderate to high archaeological potential comprise those parts of the study area which have not been subject to extensive and intensive demolition, site preparation and construction works which have occurred elsewhere within the site during the development of the Brickworks. It is recommended that, prior to any works or development in these areas, a programme of subsurface archaeological testing be implemented for the purposes of determining the actual archaeological values of these areas. As well as identifying the actual level of archaeological sensitivity, testing will also assist in defining the extent of areas which may require further investigation after the completion of the testing programme. As mentioned above, an Excavation Permit will be required for these works.

There are two potential outcomes of the testing programme:

- Areas of moderate to high archaeological significance are identified which will require further investigation through controlled open area excavation
- The actual values of the zone or parts thereof of the area are determined to be of low archaeological significance

In the case of the first outcome consultation and negotiation with ACT Heritage will determine the extent of the area to be subject to detailed manual excavation.

In the second case, areas determined to be of low archaeological significance may either not be subject to further investigation or may be incorporated within the area subject to monitoring (see below).

Areas of low archaeological potential

Areas of low archaeological potential within the site have been subject to significant disturbance through the extensive development and remodelling of the Brickworks site during its operation. No archaeological testing programme is recommended for these areas. Rather a programme of monitoring is recommended for the purposes of providing an assessment of the actual archaeological values of these areas. As mentioned above, an Excavation Permit will be required for these works.

Where the monitoring programme reveals that no or a low potential for historical archaeological remains exists it is recommended that the monitoring programme be replaced by a watching brief, whereby a suitably qualified archaeologist will attend the site as and when archaeological materials are encountered for the purposes of documentation and assessment. This, or a similar, protocol will be agreed upon in consultation with ACT Heritage during the application and approval of the Excavation Permit.

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In the event that the monitoring programme identifies that the archaeological potential of these areas is greater than first predicted or where isolated pockets of relatively intact archaeological materials area present these occurrences will be dealt with as per the requirements outlined above for areas of moderate to high potential.

It is recommended that any works to the railway siding area, whether archaeological or future development, are minimal and do not alter the legibility of the modified landscape as it remains evident today. It is noted however that this area falls with a bushfire prone area, and for bushfire management reasons, removal of some vegetation may be necessary to allow for land management.

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1 ACT Heritage Council, Cultural Heritage Reporting Policy, 1 July 2015, accessed via www.environment.act.gov.au, 6 January 2016.

2 Navin Officer Heritage Consultants Pty Ltd, Canberra Brickworks, Yarralumla, ACT, Stage 1: Aboriginal Cultural Heritage Assessment, 14 August 2014, Executive Summary.

3 ACT Heritage Council, Heritage Advice to Navin Officer Heritage Consultants, 10 September 2014.

4 Lovell Chen, Canberra Brickworks Conservation Management Plan, April 2010, p. 240.

5 ACT Heritage Council, *Heritage Act 2004*, p.6.

6 ACT Heritage Council, *Cultural Heritage Reporting Policy*, July 2015, p.8.

7 SMEC, *Preliminary Geotechnical Site Investigation for the Canberra Brickworks,* prepared for Land Development Agency, 2013.

8 SMEC, *Preliminary Geotechnical Site Investigation for the Canberra Brickworks,* prepared for Land Development Agency, 2013.

9 AECOM, *Stage 1 Ste Investigation Report for Canberra Brickworks Precinct,* prepared for Land Development Agency, 2016.

10 ACT Heritage Council, *Heritage (Decision about Registration for Westbourne Woods, Yarralumla) Notice 2011*, p.5.

11 Lester Firth Associates Pty Ltd, Old Canberra Brickworks Conservation Plan, June 1986, Section 2.1.5.

Preliminary (Environmental) Site Investigation

Canberra Brickworks

For: Land Devlopment Agency

18 February 2014

Project Name:	Preliminary (Environmental) Site Investigation, Canberra Brickworks
Project Number:	3002369
Report for:	Land Development Agency

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EXECUTIVE SUMMARY

SMEC Australia Pty Ltd (SMEC) was engaged by the LDA to undertake a Preliminary Geotechnical and Environmental Site Investigation (PSI) at the Canberra Brickworks, ACT (the Site). This report presents the findings of the Environmental Investigation undertaken at the Site.

The purpose of this PSI was to provide preliminary Site contamination data for the information of the LDA regarding the contamination status of the Site. Assessment of the suitability of the site for any particular development would then be subject to the outcomes of a future Detailed Site Assessment (DSI).

The available historical data indicate the northern portion of the Site has been used as brickworks since the early 1900's. A disused quarry is located adjacent (east) and a demolished workers accommodation is located adjacent (south) to the brickworks. The reminder of the Site (southern areas) was formerly grazing land which has been developed to include road infrastructure (Cotter Road, Adelaide Avenue and Yarra Glen).

Parts of the brickworks are currently leased by Thor's Hammer a wood recycling business, the potential for contamination attributed to current land uses is considered low.

A total of 28 test pits were advanced across the Site and 42 samples submitted for laboratory analysis to evaluate contaminants of concern.

Fill material was logged at 18 of the 28 test pit locations. Dependent on the sample location the fill materials were observed to comprise:

- **Brickworks and Quarry**: brick waste, ash, quarry cuttings (shale) with traces of anthropogenic inclusions (glass, metal and bitumen) to the practical limit of excavation of 3 metres below ground level (mbgl). The nature and extent of fill beyond 3mbgl is unknown;
- **Surrounding Areas**: sandy to silty clay, probable reworked natural soils, generally encountered at shallow depths less than 1 mbgl; and
- **Adjacent Cotter Rd (TP02)**: silty cobbles to gravelly sand with traces of brick and bitumen, refusal on concrete 2 mbgl, the nature of fill is expected to be attributed to the construction of the adjacent road, however the extent of fill is unknown.

Natural soils were logged to comprise soft brown silty topsoils underlain by medium to stiff red-brown silty clays and clays. Natural soils graded to weathered red brown residual soils (silty clays and clay) and were underlain by shale, dacite, siltstone or sandstone bedrock. Strength and weathering of the bedrock material varied across the Site and was logged between depths of 0.17 and 1.9 mbgl.

All analyte concentrations in natural and fill samples submitted for analysis were less than the adopted (human health based and ecological) assessment criteria. In particular, it was noted that polycyclic aromatic hydrocarbon (PAH) concentrations in fill containing coal ash (which are often associated with PAH contamination) were below assessment criteria and typically below laboratory detection limits.

It should be noted, however, that the sampling densities adopted during this preliminary assessment were below though that would typically be adopted during a detailed site investigation (DSI) and the full depth of fill in the quarry has not been investigated.

Based on the our review of previous reports and exiting data SMEC relating to the Site a total of 32 areas of environmental concern (AEC) were identified at the site. Potential risks to human health and

the environment associated with each AEC were considered, supported by data from the limited supplemental soil sampling and analysis conducted by SMEC as part of this preliminary investigation. On this basis preliminary information reviewed to date 28 of the 32 identified AECs were qualitatively assessed be of low risk with no further investigation or limited further investigation recommended.

Generally, based on the limited soil data collected during this PSI, the site ecological and human health risks associated with brickworks, quarry and the former workers accommodation areas of the site are considered moderate to low The remainder of the Site (the Southern Areas) typically comprised of natural soils grading to weathered bedrock. Soil analytical results returned concentrations of contaminants less than the adopted assessment criteria, the potential for contamination is therefore considered low.

Although no potential source of groundwater contamination was identified during this investigation, no groundwater testing or assessment groundwater conditions at the Site have been made.

The results of this primary investigation are not sufficient to assess the suitability of the site for a specific planned land use. It is recommended that, once detailed plans indicating the proposed land use(s) across the Site have been developed that a detailed site investigation (DSI) be undertaken to assess the suitability of the site for the planned land use(s). Typically a Site Audit Report (SAR) and Site Audit Statement (SAS) regarding the suitability of the Site would be required by the approving authority and an ACT EPA accredited Site Contamination Auditor would be engaged to independently review the DSI and any subsequent remedial works as supported by the ACT EPA.

1 INTRODUCTION

1.1 General

SMEC Australia Pty Ltd (SMEC) was engaged by the LDA to undertake a Preliminary Geotechnical and Environmental Site Investigation (PSI) at the Canberra Brickworks, ACT (the Site). This report summarises the work conducted and the results of the Environmental Investigation including the findings from the historical information review, field observations and analytical data from analysis of soil samples collected between the 9th and 11th of September 2013. The results of the geotechnical investigation are presented in a separate geotechnical report.

The location of the Site is presented in Figure 1 and the Site layout and features are presented in Figure 2 and Figure 2a (**Appendix A**). Features of the Site include a former brickworks, former quarry, and former workers accommodation with open grassland to the south. A draft masterplan has been prepared by the LDA for the redevelopment of the Site. The proposed redevelopment of the Site will include medium density residential and commercial land use. A copy of the draft masterplan provided in **Appendix B,** which shows proposed building height limitations and park land areas (West Bridge Park and the Quarry Park).

At the time this report was prepared it was also understood that the former brickworks area would likely be redeveloped for commercial use, preserving some of the existing buildings. The remainder of the Site would be redeveloped to include a mix of high, medium and low density land use with park lands (West Bridge Park and the Quarry Park).

1.2 Project Objectives

The purpose of this (environmental) PSI was to provide preliminary Site contamination data for the information of the LDA regarding the contamination status of the Site. Assessment of the suitability of the site for any particular development would then be subject to the outcomes of a future Detailed (environmental) Site Assessment (DSI).

1.3 Limitations

The findings in this report are based on the desk top scope and limited soil testing. SMEC prepared this report for the exclusive use of the LDA for the purposes specified and performed services in a manner consistent with the level of care and expertise ordinarily exercised by members of the environmental consulting profession. No other warranties, expressed or implied, are made or intended.

The Conclusions in this report were based on site observations and other information obtained by SMEC, and on the assumption that these data were representative and reliable. These conclusions must be read in conjunction with the assumptions and uncertainties included in the report. Conditions may vary over time and therefore the timing of the activities of the report should be considered in the use of any information provided herein.

This report is issued on the condition that it will not be altered, amended or abbreviated, issued in part or issued incomplete without our prior approval. We accept no responsibility for any loss, damage or consequence that may arise from breaches of this condition.

1.4 Scope of Works

The following scope of work was undertaken to meet the objectives of the PSI.

- Review of available background data including:
    - Previous environmental and heritage reports;
    - Historical aerial photography;
    - Available geology and hydrogeology maps;
    - Dangerous Goods Search;
    - Groundwater Bore Search; and
    - An Environmental and Sustainable Development (ESDD) Contaminated Land Search.
- Inspection of the Site to identify potential sources and indicators of contamination;
- Completion of 28 test pit's to a maximum depth of 3mbgl across the Site and collection of soil samples to evaluate concentrations of contaminants of concern;
- Submission of collected soil samples for laboratory analysis to National Association of Testing Authorities (NATA) accredited laboratories; and
- Preparation of this PSI report, discussing the historical data, field methodologies, analytical results, identified areas of environmental concern (AECs) and preliminary findings.

SMEC notes that the scope of the PSI was prepared to identify the AECs present at the Site with limited soil sample collection undertaken in conjunction with the geotechnical investigation (presented under a separate cover). The assessment of groundwater was therefore outside the scope of the PSI.

Furthermore the sampling design and densities were not derived from the endorsed ACT EPA guidelines (**Section 1.5** below) and are not to be relied upon for the assessment of site suitability for the proposed land use.

1.5 Published Guidelines and Framework

This PSI report has been prepared in accordance with the requirements of the guidelines endorsed by the ACT Environment Protection Authority (EPA) as contained in the ACT EPA (2009) Contaminated Sites Environment Protection Policy (EPP):

- ACT Environmental Protection Authority (EPA), 2009. Contaminated Sites Environmental Protection Policy;
- Environment Protection Act, 1997;
- Environment Protection Regulation, 2005;
- National Environment Protection Council (NEPC), 1999 – National Environmental Protection (Assessment of Site Contamination) Measure (Amended 2013) – "the ASC NEPM";
- NSW EPA, 2000 (reprinted 2011), Guidelines for Consultants Reporting on Contaminated Sites; and

- Standards Australia, 2005 – AS 4482.1: Guide to the investigation and sampling of potentially contaminated soils: Part 1 – Non-volatile and semi volatile compounds.

1.6 Data Quality Objectives

The seven step Data Quality Objective (DQO) process for this PSI has been adopted in accordance with the ASC NEPM. The DQO process is a seven step process to assist the development of sampling programs that produce data of sufficient reliability to support the decision making process. The DQOs established for the PSI are presented in **Appendix C**.

1.7 Abbreviations

This section includes an alphabetical list of abbreviations used in this report:

ACT	Australian Capital Territory
ACM	Asbestos Containing Material
AST	Above Ground Storage Tank
BTEX	Benzene, toluene, ethyl benzene and xylenes
DECCEW	Department of the Environment, Climate Change, Energy, and Water
EPA	Environment Protection Authority
EPU	Environment Protection Unit (part of Territory and Municipal Services)
HM	Generally, arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc
LOR	Limit of reporting
mbgl	Metres below ground level
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection (Site Contamination) Measure
NSW	New South Wales
OCP	Organochlorine Pesticides
OPP	Organophosphorus pesticides
PSI	Preliminary Site Investigation
PAH	Polycyclic Aromatic Hydrocarbons
SMEC	SMEC Australia Pty Ltd
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
UST	Underground Storage Tank

2 SITE SETTING

2.1 Site Definition and Land Zoning

The Site definition and land zoning is summarised below in Table 2.1:

Table 2-1 Site Definition and Land Zoning

Detail	Description
Block and Section	Yarralumla Block 1, 7, and 20 Section 102, Yarralumla Block 3 Section 94, Yarralumla Block 2 Section 103, Yarralumla Block 1 Section 113 and Curtin: Block 1 Section 123
Part Block and Section	Yarralumla Block 1 Section 127, Yarralumla Block 7 Section 121, Deakin: Block 4 Section 65, and Deakin: Block 1 Section 75
Land Zoning	RZ1: Suburban CZ6: Leisure and Accommodation; PRZ2: Restricted Access Recreation Zone PRZ1: Urban Open Space Des: Designated
Area m^2 (approximate)	45,239 m

The land use zones noted above were assessed using the ACT Planning and Land Authority ACTmapi online mapping tool (http://www.actmapi.act.gov.au/).

2.2 Surrounding Land Uses

The surrounding land uses are summarised below:

- North: Low density residential, a Uniting Church is also located adjacent to Denman St in the north eastern portion of the Site. Further north is the Royal Canberra Golf Course followed by the Yarralumla Nursery (1200 m) and Lake Burley Griffin (1800m);
- South: Open urban space, followed by roads (Dudley St, Cotter Rd and Yarra Glen). Further afield Deakin offices are located to the south east and open space to the south west;
- West: Royal Canberra Golf Course. Lake Burley Griffin is located 630 m to the northwest; and
- East: Residential, Suburb of Yarralumla.

2.3 Current Land Use

The current uses of the Site are summarised below:

- Canberra Brickworks: Leased by Thor's Hammer a wood recycler (further detail provided in **Section 3.5**);
- South eastern portion of the Site used for public recreation and vehicle parking; and
- Roads (Dudley St, Cotter Rd and Yarra Glen) and tracks (pedestrian and bicycle use).

The remainder areas of the Site included open grasslands, forest and open urban space.

2.4 Site Description

The Site covers an approximate area of 45 ha, features of the Site include a former brickworks, quarry, and a workers accommodation with open grassland to the south. For ease of reporting, discussion of the Site will be divided by these features, the features are also depicted in Figure 2, **Appendix A**.

A description of the Site features is provided below:

Former Brickworks

The Canberra Brickworks is located adjacent to the suburb of Yarralumla and the Royal Canberra Golf Course. Access to the brickworks is via Denman St adjacent south. The brickworks were operational between 1913 and 1976 and are currently used by Thor's Hammer, a wood recycling business.

Remnant buildings include, 6 kilns, 4 stackhouses, office building and amenities, 3 machinery sheds, workshops, boiler house, a substation, a power house (prior to 1915 was powered by a steam donkey engine), storage sheds and other minor buildings.

Demolished features include temporary kilns (south east), two explosive stores (180 m south and 130 m west respectively), a forklift shed (west), clay storage shed (quarry) and a weatherboard house (quarry).

Former Workers Accommodation

The former Workers Accommodation is located south of the brickworks; it comprises several demolished buildings with a former railway corridor to the west and south. The extent of the former buildings unknown, inspection of this portion of the Site was limited by overgrown grass and woody weed species (blackberries).

Quarry

The quarry is a large levelled grassed area with several exposed natural limestone and shale bedrock features. The area contains an unknown amount of fill used to level the quarry and to form several large mounds located in the northern and western portions of the area. An artificial lake was also present in the northern portion of the quarry.

Southern Areas

The Southern Areas of the Site is comprised of planted tree groves (predominately pine trees) and open grasslands with several major roads (Dudley St, Cotter Rd and Yarra Glen) bisecting the Site east to west.

The area includes the Yarralumla and Deakin Open Space as shown in Figure 2, **Appendix A.**

2.5 Proposed Land Use(s)

SMEC have been provided with a draft 'Canberra Brickworks and Environs Master Plan' dated 2013 and is included in **Appendix B**. SMEC understands that the former brickworks area would likely be redeveloped for commercial use, preserving some of the existing buildings for adaptive reuse.

The remainder of the Site (the former workers accommodation, quarry and southern area) is to be redeveloped to include a mix of high, medium and low density land use with park lands (West Bridge Park and the Quarry Park).

2.6 Topography and Drainage

A traffic report prepared by SMEC entitled 'Canberra Brickworks and Environs Options & Evaluation Report Update' dated 17 December 2013 identified a total of five catchments in the Site; the catchments and anticipated surface water flow is shown in Figure 2c, **Appendix A**.

A summary of the topological and drainage characteristics of the Site in relation to the catchments is provided below:

Catchments 1, 2, 3 and 4

The Southern Areas of the Site generally slope to the southwest, south, and southeast. The topography of this area has been modified to include the Cotter Road and Yarra Glen/Adelaide Avenue. Surface water flow has been mapped to generally flow south towards Yarralumla Creek which discharges into the Molonglo River.

Catchment 3

The brickworks, located adjacent west to the former quarry, is approximately 3m lower than the quarry with the quarry (having been backfilled) to an unknown depth below the natural surface on the north eastern site boundary, as shown in Figure 2c, **Appendix A**.

It is expected that most surface water entering the quarry would either infiltrate fill material or drain towards the artificial lake. A drain located in the north western portion of the quarry suggests at least some water drains to the brickworks area.

The brickworks contain drainage infrastructure (including roof level guttering and surface open concrete lined, open stormwater drains) which are likely to receive majority of surface water in the area, possibly including the quarry and former workers accommodation.

The final discharge point is towards the Royal Canberra Golf Course, although water captured in the brickworks drainage infrastructure is likely to enter the municipal stormwater system, the discharge point is unknown.

2.7 Vegetation

The vegetation of the Site was characterised by areas of tree plantings (pine and deciduous trees) and open grassland (native and modified grassland). Areas within the former brickworks, former quarry and former workers accommodation contained dense grass and woody weed species (blackberry bush) with pine trees.

The vegetation appeared to be in good health with no obvious signs of stress.

2.8 Regional Geology

The Canberra Brickworks quarry form one of Canberra's most important and oldest geological 'monuments'. The quarry derive their geological importance from being the type locality of the Yarralumla formation, a sequence of tuffaceous siltstone, sandstone and limestone deposited in the Silurian Period, 425 Million Years ago.

The Yarralumla formation is the only fossiliferous, marine unit within the extensive volcanic marker horizon in determining the stratigraphy of the volcanic rocks, and through its fossil fauna, provides evidence of the age of these volcanics.

A significant portion of the site has been excavated to provide raw materials for brickmaking (clay). Excess raw materials from the quarry have been combined with brick offcuts to fill site areas and to create mounds around the Site. There was no specific geotechnical information for the site available for this study.

2.9 Regional Hydrogeology

In the Canberra region, groundwater occurs in fractured rock aquifers and in unconsolidated sand in thin alluvial and colluvial aquifers. Yields of bores in fractured rock aquifers are in the range 0.1-5l/s and higher yields are obtained in closely jointed rocks along fault zones.

Groundwater salinity is generally less than 2000 mg/L TDS and largely determined by complex geology and recharge conditions. The depth to groundwater in the Canberra region generally ranges from about 2 to 20m from the surface and is dependent on the underlying geology.

ACT ESDD Groundwater Bore Search

A search of the Environment and Sustainable Development Department (ESDD) Groundwater Bore database indicated that 3 registered abstraction and one investigation/monitoring groundwater were located within a 2 km radius of the Site. No groundwater bores were located within the Site, a copy of the search and a map depicting the location of the bores is presented in **Appendix D**.

Table 2-2 Groundwater Bore Search

Bore ID	Purpose	Construction Date	Total Depth (m)	Static Water Level (m)
WU36	Private (abstraction)	Unknown	43	35
WU105	Private (abstraction)	Unknown		
WU609	Private (abstraction)	Unknown		
Woden3	Investigation	Unknown		

3 SITE HISTORY AND BACKGROUND DATA

3.1 Previous Investigations

SMEC has reviewed two conservation plans (Lester Firth & Associates and Lovell Chen) and six environmental reports (Connell & Wagner and Robson's).

The plans and reports reviewed as part of the PSI are listed below:

- Lester Firth & Associates Pty Ltd (June1986), Old Canberra Brickworks, Conservation Plan, June 1986;
- Connell & Wagner (February 2001), Brickworks Contamination Report, Appendix F;
- Robson Laboratories Pty Ltd (October 2006), Environmental Investigation Audit, Yarralumla Brickworks Block 1 Section 102 Yarralumla, Canberra Central, ACT;
- Robson Laboratories Pty Ltd (March 2006), Survey to Determine the Extent and Condition of Hazardous Building Material at Yarralumla Brickworks, Yarralumla ACT;
- Lovell, Chen – Architects & Heritage Consultants (March 2010), Conservation Management Plan – Canberra Brickworks, Denman Street, Yarralumla, Canberra;
- Robson Environmental Pty Ltd (May 2010), Review of Past Site Works and Indicative Costings for Further Assessment and Remediation, Yarralumla Brickworks, Yarralumla, ACT;
- Robson Environmental Pty Ltd (October 2010), Hazardous Material Survey & Management, Denman St Yarralumla Brickworks, Yarralumla ACT; and
- Robson Environmental Pty Ltd (February 2012), Hazardous Material Survey & Management, Yarralumla Brickworks, Yarralumla ACT.

The reports generally pertain to the Canberra Brickworks located within the northern portion of the Site. A summary of the reports is provided in the following sections.

3.1.1 Lester Firth (1986)

Lester Firth Associates prepared a Conservation Plan for the Canberra Brickworks; the purpose of the plan was to outline conservation policies and management options for the brickworks.

The plan reports on the history of the Canberra Brickworks until its closure in 1976. A series of chorological layout plans are presented in the report, a review of the plans is provided below, copies of each plan can be found in **Appendix E**.

1911: Plan depicts rural character of the Canberra Brickworks. The Site is surrounded by fenced paddocks, Yarralumla creek is identified to the south and Molonglo River to the north. An unnamed road is located adjacent and south of the brickworks.

1916: The first four (4) kilns and associated workshop were located approximately 100 m southeast of the brickworks office building (refer **Appendix E**). The kilns were used sometime between 1913 and 1916 to make the initial bricks used to establish the brickworks. At this time the brickworks comprised a machine shed (with attached blacksmiths shop), office, power house, Staffordshire kiln and a fan house with a stack. A tram line is identified connecting the brickworks to the quarry.

It is noted that the power house was driven by a steam driven donkey engine (likely coal fired) until the Kingston Powerhouse was commissioned in 1915.

1920s: Hardy patent kiln and fan house with stack constructed. A tile making plant installed south of the machine shed. The plan reports that joinery shop, mechanical and electrical workshops were operated briefly for one year.

A 3'6' (1027 mm) narrow gauge steam hauled locomotive rail network installed to service Parliament House, the Kingston Powerhouse and Canberra Hotel. The railway was removed and timber was used for firing kilns due to the economic depression. Prior to the railway, bricks were likely transported in wagons pulled by a steam driven tractor.

1950s: Post war growth included the establishment of the brickworks workers accommodation, crusher/pan houses, workshops and machine bays. Two temporary downdraft and one Hardy patent kiln with stack were also constructed.

The workers accommodation comprised two sleeping quarters, kitchen and mess hall, several huts and a latrine (toilet) block.

Carpenters shed was constructed approximately 50 m south east of the office and power house.

A diagrammatic representation of the brick making process (1960) is presented in the plan (refer **Appendix E**).

1960-70s: Three downdraft kilns with stack, forklift shed, oil storage, and extrusion plant were constructed.

The carpenters shed was removed between 1963/1969, the building was replaced with a carpark.

A weighbridge also used to weigh imported material during the 1960s. A concrete pit remains but has be filled.

In 1967 the ACT Health Services found the accommodation to be in '*a state of disrepair, and the area littered with all kinds of rubbish*'. In 1970 attempts were made to dispose of the brickworks workers accommodation, although foundations and building demolition remain visible today.

The brickworks were closed in 1976. All reusable material was relocated to the new Mitchell Brickworks Site.

1976-84: The brickworks were purchased by private developer A.R Marr Pty Ltd, it was envisaged that the brickworks and surrounding area would be redeveloped as a major tourist complex with associated housing.

The quarry area was to become 'quarry gardens' works included land filling, installation of the 'reflection lake' and 'outer quarry' was levelled and grassed to install a 300 mm railway.

Several storage sheds including a Model Railway Workshop were located adjacent to the wall separating the brickworks and quarry. The Model Railway Workshop was formerly used for the storage of coal/oil.

A.R Marr Pty Ltd was put into provisional liquidation and the Commonwealth government regained the lease.

Fill was identified in the A.R Marr Pty Ltd plan as being a development constraint (Lester and Firth**, Section 3.4.3**) in the following areas:

- Western Open Space: area was used for dumping brick waste including over burnt brick, broken material, rubble and dust/other unspecified waste from the kilns. The location and volume of fill were unspecified; and
- Quarry Zone; area contains areas of reject brick fill; the location and volume of fill were unspecified.

3.1.2 Connell and Wagner (February 2001)

Connell and Wagner completed a Phase 1 assessment for the Old Canberra Brickworks which was included as an appendix to a Development Control Plan also prepared by Connell and Wagner.

The assessment included a desktop study, site inspection and an interview of personal involved with the operation of the brickworks.

The Phase 1 data identified the following Areas of Environmental Concern (AEC):

- Coal and Oil Bunkers. Location initially used for the storage of coal;
- 1000L underground storage tank (UST) in the forklift area. The status of the UST at this time was unknown;
- Model Railway Workshop. Location initially used for above ground storage for coal and later oil;
- Septic Tank;
- Blacksmiths shop; and
- Explosives Storage Area.

The Phase 1 concluded that the main sources of contamination at the site are attributed to the brickmaking activities (1913 to 1976) including the onsite storage of fuels, oils and possibly explosives. Connell and Wagner also identified the areas of fill sourced from materials within the Site.

The report concluded that the identified AEC's would require further assessment, remediation and validation (as required) in accordance with Environment ACT requirements.

3.1.3 Robson Laboratories (October 2006)

Robson Laboratories completed a report entitled, "Environmental Investigation – Audit Report" detailing the results of soil testing targeting of specific facilities within the Yarralumla Brickworks Complex, Yarralumla ACT. The purpose of the investigation was to assess the potential environmental impact arising from former uses at each facility. The facilities targeted also include AEC identified by Connell and Wagner (2001) and are summarised below:

Brickworks

- Explosive Store;
- Asbestos dump;
- Forklift Shed;
- Coal and Oil Storage Area;
- Kiln Sand; and

- General Areas.

Quarry Area (West)

- Machine and Blacksmith Shop Area;
- Quarry Tailing Dump Areas; and
- General Areas.

A contaminated land search undertaken through Environment ACT Environment Protection Unit (EPU) indicated the site is recorded on the database as potentially contaminated.

The EPU supported the recommendations of the Connell and Wagner stating '*it would oppose any change in land use from brickworks until the site is assessed and independently audited by a contaminated land auditor'*.

The key findings of the investigation are summarised below:

- Fill was identified across the site and was observed to comprise bricks, clay and slag.
- TPH exceedances were reported at a sample location proximal to the Machine Bay 3. The exceedance was attributed to temporary fuel storage at this location.
- A single lead exceedance was reported in a surface sample of sands adjacent to the kiln. The source of the impact was unclear, but was considered attributed to the glaze used in brick making.

Robson recommended that an appropriate environmental assessment be designed once the future land use is confirmed. The assessment may include further investigations and/or remedial work of the AEC's identified.

3.1.4 Robson Laboratories (March 2006)

Robson Laboratories in March 2006 completed a report entitled, "Survey to Determine the Extent and Condition of Hazardous Building Materials at Yarralumla Brickworks", this was a non–destructive survey and sampling was therefore limited to accessible materials. The objective of this report was to give a detailed list of hazardous materials that were identified and included the following:

- Friable asbestos;
- Bonded asbestos;
- Lead-paint;
- Synthetic mineral fibre; and
- PCB capacitors to fluorescent light fittings

Areas excluded from the inspection (due to access) included:

- Asbestos pipe lagging set into masonry walls;
- Wall Cavities – original asbestos sheeting, debris and insulation ;
- Areas which contain inaccessible building rubble;
- Plant equipment – asbestos gaskets;

- Subterranean areas and asbestos sheet fragment packers; and
- Hot water heaters – asbestos beneath Synthetic Mineral Fibre Insulation

Based on the site survey and analytical results, Robson recommended the following:

- Structures should be removed as soon as practicable (e.g. top level Kiln 2).
- Other structures which are in poor condition should be removed by an ACT licensed asbestos removalist as soon as practicable (e.g. external wall sheets of the building atop Kiln 3, corrugated roof sheet on building A3.
- Dumped material on the western end of the site would need to be removed prior to any further site development due to contamination.
- Lead paint identified on the windows frames of the top floor of the former canteen building is in poor condition and should be removed or encapsulated to prevent further deterioration.
- All the Synthetic mineral fibre should be removed as soon as practicable as asbestos waste.
- If it is decided to demolish or excavate the exclusion areas, care should be taken to determine the existence of asbestos. If asbestos is located, all works must cease and an ACT licensed asbestos removalist should be contacted immediately to remove this material prior to completion of the job.

3.1.5 Lovell, Chen – Architects & Heritage Consultants (March 2010)

Lovell and Chen prepared a Conservation Management Plan (CMP) for the Canberra Brickworks, the CMP built upon previously undertaken by Lester Firth (1986) and provides a more recent and detailed account of the history of the brickworks.

One of the main objectives of this Management Plan is to support a sensitive approach to potential future change and the implementation of an adaptive reuse and redevelopment strategy that is both feasible and will support the long-term conservation of the core heritage values of the place.

The Management Plan includes:

- The Process of Brickmaking;
- History and Physical Analysis;
- Assessment of Significance; and
- Conservation Policy and Management Plan.

This Plan highlights facilities, which could have environmental impact on the site:

- Quarry;
- The power house (concrete floor);
- Coal storage shed (later model railway storage shed);
- Demolished structures: (the location of some is unclear):
    - clay storage shed;
    - carpenter's shed;

- oil/fuel and coal bunkers (onsite and offsite);
- weighbridge;
- forklift shed;
- temporary kilns;
- brickworks workers accommodation (includes Hostel and Camps);
- explosives store; and
- a weatherboard cottage.

The CMP concludes with the recommendation that these sites should be investigated as part of a broader archaeological assessment of the site and abutting land.

3.1.6 Robson Laboratories (May 2010)

Robson Laboratories in May 2012 prepared a proposal entitled "Review of Past Site Works and Indicative Costing's for Further Assessment and Remediation".

The proposal refers to an environmental assessment report titled Robson (2006) *Remediation Action Plan (Draft), Asbestos Dump, Yarralumla Brickworks, Block 1 Section 102 Yarralumla, Canberra Central ACT* (Robson report reference 3144_CL_RAP_20061109, dated November 2006). The summary stated:

> *In 2006, Robson prepared an environmental assessment report titled Robson (2006) Remediation Action Plan (Draft), Asbestos Dump, Yarralumla Brickworks, Block 1 Section 102 Yarralumla, Canberra Central ACT (Robson report reference 3144_CL_RAP_20061109, dated November 2006). The Remediation Action Plan (RAP) was prepared so as to facilitate the safe and effective removal of all waste from the asbestos dump area so that the waste no longer poses a risk to human health or the natural environment.*
>
> *Three broad phases of work were proposed for the remediation of the asbestos dump including:*
>
> - *Vegetation removal, including prior organisation of work permits and preparation of a Sediment and Erosion Control Plan and a Project Health and Safety Plan;*
> - *Removal of hazardous materials and recyclable wastes, including waste classification and validation of the remediated area; and*
> - *Site reinstatement, including importing validated fill material and revegetation.*

Limited remedial works of the asbestos dump area were subsequently undertaken by Robson in June and July 2007, with approximately 50m3 of asbestos waste being removed from the site. Remedial works were ceased when:

> *A 'Prohibition Notice' was served by a delegate of the ACT Planning and Land Authority (ACTPLA) on the grounds that the excavation work was being undertaken without development approval. At the time that work ceased it was assessed that potentially 500m3 of asbestos waste remained in the dump area.*

3.1.7 Robson Environmental (October 2010)

Robson in October 2010 completed a report entitled, “Hazardous Material Survey and Management Plan”. The objective of this report was to assure the occupants of Yarralumla Brickworks the highest standards of occupational health and safety in relation to hazardous materials. The survey involved a visual inspection non-destructive and non-intrusive in nature of accessible, representative materials, therefore limited to the following areas:

- Interior and exterior of the building;
- Roof, amenities and immediate surrounding land; and
- UST filler points and breather vents (near kiln 1).

The survey did not include the inspection or assessment of the following areas:

- Subterranean areas (e.g. infill/soil);
- Concealed cavities; and
- Formwork and subterranean electrical cable ducts and water pipe ducts.

The key findings of hazardous materials were:

- Asbestos (friable, bonded);
- Lead paint;
- Synthetic mineral fibre;
- Polychlorinated Biphenyls (PCB);
- Ozone Depleting Substances (ODS); and
- Aboveground Storage Tank (near Machinery Shed 3) and Underground Storage Tank (near Kiln 1).
    - Note that, the AST and UST identified by Robsons (2010) were not sighted during the fieldwork component of the PSI.

The key recommendations of this report were:

- All Asbestos Containing Material should be removed by an ACT licensed Asbestos Removalist. Also, the area where this material was found should be cleaned by this removalist.
- All SMF, Lead Paint, PBC and ODS contaminated related material should be removed using effective control procedures and disposed in accordance with the ACT regulatory authorities.
- As access to some areas was not permitted, it should be presumed that any similar materials located in these areas could be contaminated until proven otherwise.
- In terms of the Underground Storage Tank, further investigation is required to establish whether or not is still in place and its condition.

3.1.8 Robson Environmental (February 2012)

Robson Laboratories in February 2012 completed a second report entitled, “Hazardous Material Survey and Management Plan” at the Canberra Brickworks. The objective of this report was to present the findings of a Hazardous Material Survey conducted at Canberra Brickworks, Yarralumla. Also, ensures that the safe removal of hazardous materials must be undertaken by appropriately licensed and skilled personnel prior to the demolition of the premises. The survey undertaken at Canberra Brickworks involved a visual inspection non-destructive and non-intrusive in nature of accessible, representative materials, therefore limited to the following areas:

- Interior and exterior of the building
- Roof, amenities and immediate surrounding land.
- UST filler points and breather vents.

The key findings were the same as previous reports, with a more specific report in terms of identification of the hazardous materials, location and the actions which have to be taken in order to eliminate the hazard.

3.2 Historical Aerial Photographs

Historical aerial photographs were obtained and reviewed to investigate the former land uses and development at the site. Aerial photographs dated between 1951 and 2012 were obtained and reviewed.

The historical aerial photographs are presented in Figure 3a to 3k, **Appendix A**. Remnant features still visible today are presented in Figures 2 and 2a, **Appendix A**.

Table 3-1 Historical Aerial Photography

Year	Site Description
Figure 3a 1951 Run 2 Print 5102	The Site: Quarry, Power House, Staffordshire Kiln (Kiln 1), Fan House and Chimney Stack for Kiln 1, Offices, Hardy Patent Kiln (Kiln 2), Fan House and Chimney Stack for kiln 2, Amenities Block also present. There are some visible buildings and sheds surrounded by trees east, north and south (Workers Accommodation) of the Site. The railway line and several roads are visible including Denman St. Several unnamed roads leading to the brickworks, quarry and the former workers accommodation are also visible in the imagery.
	The Surrounding Area: to the north trees/orchids associated with early arboretum works including the Westbourne Woods to the west. Development of Yarralumla suburb to the east and vacant land to the south also observed.
Figure 3b 1958 Run 7 Print 5060	The Site: presence of new buildings. A third kiln has been established on the Site (Hardy patent Kiln), Chimney stack for Kiln 3, Machine Bays (I, II and III), Workshop building, Crusher Houses and the Elevator/Conveyor. Additional structures observed at the former brickworks workers accommodation, the quarry has also been expanded. Shed like structure observed west of the brickworks and north of the railway line, possible location of the explosives store.

Year	Site Description
	Small building south and east of the brickworks, probable location of the Carpenters Shed. Exposed soils observed further south and east of this location.
	The Surrounding Area: further development of the surrounding areas.
Figure 3c 1968 Run 9 Print 8708	The Site: a large shed has been built on the west of Power House and became the Downdrafts Kilns (Kilns 4-6). The railway line is starting to be overgrown with vegetation. The quarrying activity is more evident. Appears to be some stockpiling of material west of the quarry. Clay storage shed observed in the quarry area Area of exposed soil south east of the brickworks previously noted (1968) remain, purpose is unclear however the area may have be used for the storage of materials. Cleared area 50m south east of the Power House, location of a former carpenter's workshop appears to be used as a carpark. Plantings of trees in the southern portion of the Site evident. Rows of trees also planted south adjacent to Denman St. Earthworks associated with the Cotter Road and Yarra Glen overpass observed.
	The Surrounding Area: further development of Yarralumla to the east, establishment of the Royal Canberra Golf Course to the west and the suburb Curtin to the south. Some buildings have been established north of the Site. Lake Burley Griffin has been filled.
Figure 3d 1978 Run 15 Print 49	The Site: removal of clay storage shed, workers accommodation buildings, forklift shed and several other buildings. The quarry appears to have been also been filled. Extrusion plant has been constructed. Disturbed soils observed in the north western portion of the Site, this is the location of the current asbestos dump. Cleared area south east of brickworks (noted 1958 and 1968) appears to be used for stockpiling. The vegetation around the former railway corridor and brickworks workers accommodation increased. The railway corridor is barely visible in the image.
	The Surrounding Area: Consistent with 1968. Cotter Road and Yarra Glen overpass construction completed. CSIRO School of Forestry established (NE of the site).
Figure 3e 1988 Run 15 Print 6251	The Site: roofing material of the kilns and workshops has been upgraded. Tracks observed in the quarry, the carpark (formerly the carpenter's workshop) is disused and overgrown with grass. Former workers accommodation and railway corridor completed overgrown with vegetation.
	The Surrounding Area: No significant changes, housing constructed to the northern and eastern boundary of the Site
Figure 3f 1998 Run 5 Print 0137	The Site: asbestos dump appears covered with vegetation. Quarry area grassed with the reestablishment of trees. Some minor tracks (pedestrian) appear to bisect the central areas of the Site.
	The Surrounding Area: No significant changes.
Figure 3h 2012 Aerial Imagery	No significant changes from previous years.

Year	Site Description
ACTmapi	

A review of the available aerial photographs indicates the Site has a history of industrial land use associated with the operation of the brickworks between 1913 and 1976. Some features of the brickworks have been demolished since its closure. The review did not provide any data pertaining to the depth of the quarry or the nature and/or extent of filling activities.

With the exception of the construction of road infrastructure, the southern portions of the Site remain largely unchanged.

3.3 ACT ESDD Contaminated Land Search

A search of the Environment and Sustainable Development Department (ESDD) Contaminated Land Search database indicated that following blocks were recorded on the ACT EPA contaminated sites management database:

Blocks 1, 7 and 20 Yarralumla Canberra Central (the brickworks, quarry and the former workers accommodation areas)

The search identified the presence of an abandoned commercial brickworks. The EPA have reviewed and gave their support to the recommendations made in the Phase 1 assessment report prepared by Connell and Wagner (2001). The Phase 1 recommended that further investigation, validation and remediation would be required.

The EPA stated '*it would oppose any change in land use from brickworks until the site is assessed and independently audited by a contaminated land auditor'*.

The search also indicated the block may contain fuel storage facilities and asbestos containing materials. Worksafe ACT should be contacted regarding the status of any fuel storage facilities and asbestos abatement plans.

The search indicated that a draft remediation action plan for the remediation of identified asbestos material in soil was received by the EPA in 2007. The RAP was not available at the time this PSI report was prepared, the area subject to remediation has identified as an area of environmental concern in this PSI and shown on Figure **Figure 2a, Appendix A.**

Block 4 Deakin Canberra Central (the Southern Area)

The block is not reported on the EPA's contaminated sites management database or geographic information system.

Records indicate the block is occupied by public playing field and that playing fields have (in the past) been associated with contamination due to the application of chemicals for the control of weeds and pests. The storage of herbicides/pesticides may also have occurred at the block. There is potential for uncontrolled fill to also be present at public playing fields.

Copies of the ACT ESDD Contaminated Land Search results are provided in **Appendix F**.

3.4 Dangerous Goods Records Search

A search of the Dangerous Goods Act 1975 and Dangerous Substances Act 2004 maintained by Worksafe ACT did not indicate the presence of any stored dangerous goods or underground storage tanks (USTs).

The search indicated that tanks containing diesel less than 50 000 litres were not required to be licensed with Worksafe. A copy of the search is provided in **Appendix G**.

3.5 Site Inspection

3.5.1 Visual Observations

An inspection of the Site was undertaken by SMEC during the fieldwork component of the PSI. The purpose of the inspection was to identify areas of environmental concern. Photographs taken during the Site inspection are included in **Appendix H**.

Observations made during the inspection are summarised below:

Brickworks

Large portions of the brickworks were occupied by Thor's Hammer a wood recycling business (Photo 1, **Appendix H**) and were used for the storage of bulk wood supplies, it is understood that artists also utilise some workshop spaces at the brickworks. Thor's Hammer and the artists were observed to be operating in Machine Bay 1 and the Workshop (Figure 2a, **Appendix A**), other areas of the brickworks (both sealed and unsealed) were used for wood storage as shown in Figure 2b, **Appendix A.**

An inspection of the chemical storage areas used by Thor's Hammer and artists was undertaken by SMEC on 12/2/2014. The chemicals stored at the brickworks included varnishes, wood finishes, paints, oils and hydraulic fluid (for wood working machinery). These chemicals were kept in a lockable shipping container and steel storage cabinets, good housekeeping was observed with no staining evident. These storage areas were typically located in Machine Bay 1 (Figure 2a, **Appendix A**) on a sealed concrete surface.

Remnant buildings associated with the operation of the brickworks were observed to be in various conditions ranging from good to some buildings showing signs of disrepair. (Photo 2, **Appendix H**).

A hazardous material assessment was outside the scope of this PSI; however a brief inspection generally indicated good housekeeping with no obvious staining or visible waste observed. Robson Environmental Pty Ltd has prepared several hazardous material surveys for the brickworks (March 2006, October 2010 and February 2012) a summary of these reports is provided in **Section 3.1** of this PSI.

External areas comprised gravelled vehicular tracks, grassed and concreted areas. The condition of concrete varied presumable based on the age of construction. Occasional fragments of potential ACM were observed during the Site inspection of the brickworks and quarry areas.

A network of concrete drains was observed around the building; although generally dry, some sheen was observed in drains around Machine Shed 1 (Photo 3, **Appendix H**). The source of the sheen is unknown but is likely oily wash from the nearby workshop. The drains are likely to receive wash from the former operation of the brickworks and the current use of the workshops. It is expected that the infrastructure drains to the local stormwater system.

Remnant structures of the former crusher plants were noted, some rusted oil drums (labelled *'lubrication oil'*) were observed in this area (Photo 4, **Appendix H**), no staining and/or odours were observed. Inspection of this area (and others) was limited by the presence of dense woody weed species (blackberries).

General areas around the machinery sheds were littered with empty drums, scrap metal and other waste materials (Photo 5, **Appendix H)**. No obvious signs of ACM, staining and/or odours were noted during the inspection.

A disused oil pressure/storage tank was identified at the rear of Machine Shed 3 (Photo 6, **Appendix H)**. It was located adjacent to the concrete footings of removed plant machinery. No odours or staining were observed however Robson (2006) identified TPH impact at nearby at location BH14.

Historical data indicated the presence of a 1000 L petrol UST between the former forklift shed and Fan House 2. A visual inspection did not identify any vent pipes, dispensing pumps, concrete pads or remote filling points. The base of the former building was littered bricks and demolition waste (no observed ACM) limiting the inspection.

The asbestos dump was contained within a fenced exclusion area which prevented access. The area was also observed to be overgrown with weed species which prevented inspection of surface soils. A septic tank servicing the brickworks is also located in the fenced exclusion area. It is considered likely that the septic tank is still connected to the brickworks and possibly the former workers accommodation.

Quarry

The quarry was observed to comprise levelled grassed areas, natural limestone and shale knolls, and several fill mounds. The original depth of quarry is unknown and has been backfilled to level approximately 3 m higher than the ground level within the adjacent former brickworks (Figure 2c, **Appendix A**).

The artificial lake located in the northern portion of the quarry was observed to be dry and appeared to have been formed from a shallow (approximately 1 m) depression. The base of the lake appeared to be bedrock with shale outcroppings, the walls of the lake appeared to be constructed from reworked soils.

Two large fill mounds comprising reworked natural soils, brick waste and excess quarried rock. Fragments of potential ACM were observed in the northern fill mound (Photo 7, **Appendix H)**.

It is expected that surface water in the quarry would either infiltrate fill material or drain towards the artificial lake. A surface drain was observed in the north western portion of the quarry that drained to the brickworks, Figure 2c **Appendix A**. The exact purpose of the drain is unknown but may have been constructed for the following:

- To redirect surface water (from the north and north east) away from the quarry (towards the brickworks) to protect mining activities; and/or
- To receive the overflow from the artificial lake.

Once discharged to the brickworks surface water either infiltrate sub-surface materials (probable fill material) or flow towards the brickworks drainage infrastructure.

Surface fragments of potential ACM were also observed in the southern portion of the quarry, the potential ACM appeared to be associated with gravelly fill comprising crushed brick and concrete used to construct the track.

Former Workers Accommodation

Several demolished brick buildings and footings were observed in the former workers accommodation (Photo 8, **Appendix H)**. The demolition waste generally comprised bricks, metal and concrete, occasional fragments of potential ACM were also observed.

The exact location and extent of the former building could not be established during the inspection due the presence of overgrown grass and woody weeds. The approximate location of the former buildings identified from a review of the available reports (**Section 3.1**) is provided in Figure 2b, **Appendix A**.

An interceptor type structure (Photo 9, **Appendix H**) adjacent to a demolished building (likely location of the former kitchen/mess hall) indicates that underground services/structures are still likely to be present. The interceptor likely received grease and fats from the kitchen/ mess hall operations, no odours and/or staining was observed. It is probable that the interceptor drains to the brickworks, and then subsequently the local stormwater system.

An abandoned vehicle (Photo 10, **Appendix H**), dumped materials (wood, metal and general waste), a fridge and multiple mounds were observed in the area, a detailed inspection of these features was limited by dense vegetation.

The railway corridor(s) was observed to be bare, with no remnant infrastructure (railway lines or treated wooden sleepers).

A cleared area with patches of asphalt was observed adjacent to the workers accommodation, no mounding or dumped materials were identified. The purpose of the area is unclear but may have been used for storage of materials.

Southern Areas

The Southern Areas of the Site were observed to comprise tree plantings (pine species) and open grasslands with several major roads (Dudley St, Cotter Rd and Adelaide Avenue) that bisect the Site east to west. It is considered probable that this fill was imported to meet the designed Cotter road grade.

Plantings of deciduous trees were observed north adjacent to Denham St and west near the Royal Golf Course. Slashing and mulching activities in the western portion of the area were noted during the PSI.

The available historical data (Lester and Firth, 1986) indicated that the southern areas of the Site were denoted as “Gibbes Paddock’ and was likely used for grazing as part of the larger Yarralumla property. The potential for contamination from grazing practices is considered low. A grove of trees was also observed adjacent south to Denham St in the central portion of the Site.

Since then several tree groves (predominately pine) have been planted throughout the central and southern areas of the Site, as shown in Figure 2, **Appendix A**. The trees appeared to be in good health with no obvious signs of stress.

Remnant portions of the railway corridor were observed in the western portion of the area. No ballast or other infrastructure was noted during the inspection; it is likely that the rail line and sleepers rested on the site’s soils.

Two concrete lined pits were located adjacent to remnants of an unnamed vehicle track (currently used by pedestrians and cyclists). Some broken tiles and glass bottles observed at the base of the pits, which appeared otherwise empty (Photo 11 and Photo 12, **Appendix H**). The purpose of the pits was unclear; however, it was considered likely that they were used to retain stormwater run-off from

the adjacent unnamed road. The potential exist for possible impacts from spills/leaks from vehicles (formerly using the track) and wash form the surrounding area.

A diffuse waste pile was identified in the south east portion of the Site adjacent Yarra Glen (city bound). The pile comprised mostly bricks, metal, and general waste and was estimated to be around 10 m^3 in total volume (Photo 13 **Appendix H**). Several fragments of potential ACM were also identified in and around the pile.

3.5.2 Interview with Thors Hammer

On the 12 February 2014, SMEC undertook an interview with Mr Thor Diesendorf the proprietor of the Thors Hammer since 1984 regarding his knowledge of historical or recent potentially contaminating activities. A summary of the interview is provided below:

- Mr Diesendorf was not aware of any contaminating activities to have occurred at the brickworks during the operation of Thor's Hammer, however some vandalism (spray painting) had been noted;
- It was highly unlikely that any treated woods have been stored or used as part of the business given the regulations around the reuse of these materials (arsenic (copper chrome arsenate), creosote and/or OCP treated timbers); and
- Mr Diesendorf did however indicate that small amounts of creosote treated timber and painted (potentially lead based) timber could have been reused over the years.

General woodworking chemicals were kept on the premises this included, varnishes, finishes and paints. Some oils and hydraulic fluids were kept for maintenance of the woodworking machinery (lathes, wood saws etc). These chemicals were kept in a lockable shipping container and steel storage cabinets, good housekeeping was observed with no staining evident.

3.6 History Summary

1913-1976: A review of the available site history and background data indicated that the northern portion of the Site has a history of industrial land use centred around the operation of the Canberra Brickworks from 1913 until its closure in 1976.

1976 -1984: Since its closure, there has been one attempt to redevelop the brickworks by A.R Marr Pty Ltd. It was envisaged that the brickworks and surrounding area would be redeveloped as a major tourist complex with associated housing. A artificial lake, and a model railway was constructed in the quarry at this time. Several storage sheds including a Model Railway Workshop were located adjacent to the wall separating the brickworks and quarry. The Model Railway Workshop was formerly used for the storage of coal/oil. The locations of these features are presented in Figure 2b and 2c, **Appendix A**.

1984-Current: Areas of the brickworks are currently leased by Thor's Hammer a wood recycler and local artists. Given the limited available historical data since the closure of the brickworks (1976 to Current) there is the potential for dumping (illegal or legal) and/or vandalism to have occurred.

The remainder of the Site is comprised of open grassland, forests and several major roads.

Previous Environmental Investigations: Two limited environmental investigations have been undertaken by Connell and Wagner (2001) and Robson Environmental Pty Ltd (2006). Robson completed 21 boreholes across the brickworks and quarry, as no GPS data was provided the approximate borehole locations of the investigation are provided in Figure 4, **Appendix A**.

The inclusion of the Robson (2006) data is not considered to add a significant amount of certainty/data for future assessments given:

- The lack of GPS coordinates for the boreholes (this would add uncertainty);
- The age of reported data, as the condition of the site may have changed since the publication of the report.

3.7 Contaminants of Potential Concern

The historical data review completed by SMEC has identified the following contaminants of concern (CoPC) that may be present at the Site.

Table 3-2.6 Contaminants of Concern

CoPC	Context
Asbestos Containing Material (ACM), Asbestos Fines (AF) and Fibrous Asbestos (FA)	Asbestos cement materials present (sheet, conduits, flooring tiles etc) in Site buildings. May be present in fill material containing demolition waste from former buildings. Asbestos also may have used in vehicle and locomotive (light rail and trams) brake pads used during operation of the brickworks. Asbestos is also present in the asbestos material dump area.
Benzene, toluene, ethylbenzene, xylenes (BTEX)	Volatile organic compounds (VOC) present in petroleum based fuels, oils and solvents. May be present in solvents, paint strippers and rubber cements. Potential for former use associated with the operation of the workshops and/or former carpenters shed.
Creosote	Wood –tar or coal-tar creosote used for wood preservation. It is toxic to fungi, insects, marine borers and is a water repellent and it's typically applied to pilings, telephone poles, power line poles and fence posts. Storage of creosote treated woods may have been associated with operation of Thors Hammer. Contains variable percentages of aromatic hydrocarbons (PAH and BTEX) and phenols.
Explosives	Potential for nitrogenous organic explosives (TNT etc.) to have been stored and used to advance the quarry. Given the uncertainty around the specific explosives, analysis of a broad suite of explosives compounds may be necessary. Potential for metals (e.g. mercury fulminate) to have been used as detonators.
Metals and Heavy Metals (HM)	Potential for elevated natural occurring metal concentrations in Site soils. Anthropogenic impacts may be associated workshop activities (machinery maintenance/servicing and welding), deterioration of metallic objects, pesticides, herbicides (arsenic) and general industrial practices. Elevated metal concentrations may be present in fill associated with practices described above.
Nutrients	Discharge of nutrient rich wastewater into unsaturated soil above the water

CoPC	Context
(fixed nitrogen (all forms), phosphorus, and faecal coliforms)	table. Transport of wastewater can occur via surface water flow and infiltration. Potential for nutrient impacts arising from the septic tank located at the brickworks. The septic tank is first show in the 1954 site plan (Lester and Firth 1986) with a long history of use (+50 years).
Herbicides and Pesticides including: Organochlorine Pesticides (OCP), Organophosphorus Pesticides (OPP)	OCPs are persistent and bioaccumulation in the environment formerly used as pest control to crops, livestock and buildings. OPPs used since the banning of OCP in Australia. Potentially used in building footings, rail corridor and across the Site for pest control. Can be present in uncontrolled fill.
Oil and Grease	Oil and grease present fuels, motor oils, lubricating oil, hydraulic oil, animal-derived fats and cooking oil. Human and ecological toxicity varies between types of oil and grease. Contains various hydrocarbons that can pose a range of health risks. Typically insoluble in water. Likely used to operate and maintain machinery at the brickworks, potential impacts to soils and receiving water bodies.
Phenols	Phenol is generally synthesized as a manufacturing chemical, primarily used as a resin and in the production of plastic and synthetic materials. May occur naturally as a constituent of coal tar and decomposing organic material. Potentially used in workshops, may be present in uncontrolled fill.
Polychlorinated biphenyls (PCB)	PCBs were formerly used a coolants and insulating fluids for electrical transformers, and capacitors. Robson (2006, 2010 and 2012) identified the presence of PCB containing material in the existing buildings of the brickworks.
Polycyclic aromatic hydrocarbons (PAH)	Can occur naturally in crude oil, coal and incompetently burnt carbon materials (wood, coal, diesel etc) and ash. Used in the production of bitumen and asphalt material, can be present in fill of unknown origin.
Petroleum hydrocarbons (TPH)	Present in fuels (petrol, diesel, and kerosene) solvents and oils. Potential for TPH impacts sourced from the operation of the brickworks (workshops, machinery, USTs), spills from vehicles and in uncontrolled fill.

3.8 Areas of Environmental Concern

Based on the Site history review and field observations the following AECs identified at the Site are summarised below in Table 3.3.

Table 3-3 Areas of Environmental Concern

AEC	Description	Comments

AEC	Description	Comments
1	Waste Fill (locations where fill is present)	Likely contained to the brickworks and quarry. Fill in these area was observed to comprise reworked natural soils, brick waste, ash waste, bitumen, demolition waste often with other anthropogenic inclusions (including metal, concrete, wood but not plastic). Potential for TPH, BTEX, PAH, Phenols, PCB, HM, Herbicides, Pesticides and Asbestos impacts in soil. Potential for contaminants to leach to the groundwater.
Former Brickworks		
2	Recycled Timber Storage (Thor's Hammer)	Parts of the brickworks are currently used for the storage of recycled (possibly treated) timber associated with the operation of Thor's Hammer. Potential for to metal impacts leaching from treated timbers. Potential for HM, creosote and Pesticide impacts in soils.
3	UST(s) Forklift Shed (former)	Historical data indicates a 1000 L petrol UST was located between the former forklift shed and adjacent fan house (Fan House 2). Robson (October 2010) reported the presence of UST filling points and breather vents near Kiln 1. A small empty above ground storage tank was also identified near Machinery Shed 3. These features were not identified during the PSI; further investigation is recommended to determine the presence and condition of the storage tanks discussed above. Potential for TPH, BTEX and lead impact in soils and/or groundwater. Potential for TPH, BTEX, PAH, HM and asbestos impacts in the soils at and/or near the former forklift shed.
4	Stackhouse(s)	Ash waste from combustion of wood, coal and oils. Potential for PAH impact in ash waste present in uncontrolled fill across the brickworks and quarry. Storage of coal material observed adjacent to Fan House 2. Potential PAHs impacts in and around stackhouses and coal storage areas. Potential for contaminants to leach to the groundwater.
5	Explosive Store (former)	The former explosives store (160 m west of the Power House) was assessed in this PSI and by Robson (2006). Potential for impacts from explosive compounds impacts in shallow soils. Potential for contaminants to leach to the groundwater.
6	Machinery Shed(s)	Includes blacksmith's workshop attached to Machine Shed 1. Possible spills and leaks from use of oils and solvents. Deteriorating metal waste present in and around the workshops. Leaks and spills likely to wash towards surrounding soils and/or into surrounding drainage infrastructure. Potential for TPH, BTEX, Oil, Grease, PAH, Phenols and HM impacts in soil, surface and groundwater.

AEC	Description	Comments
7	Operation of Crusher and Refinery Plant(s)	Potential for hydrocarbon impacts from spills and leaks from machinery used for crushing and transporting of raw material. A diagrammatic representation of the brick making process (1960) is presented in **Appendix E**. Robson (2006) reported elevated concentrations of TPH at sample location BH14 in this general area. Potential for TPH, Oil, Grease, BTEX and PAH impacts in soil and/or groundwater.
8	Coal/Oil Storage Facility(ies)	An aerial image in the Lovell Chen CMP (page 168) indicates the presence of 2 large above ground storage tanks at the building most recently used as the Model Railway Shed during the A.R Marr lease of the Site (1976 to 1984). It is currently an unsealed empty shed. Another former coal/storage facility was identified by Robson (2006), it was observed to be a remnant steel structure, the surrounding area was observed to be sealed (concrete) with no obvious signs of staining/and or odours. Potential for TPH, BTEX and PAH impacts in soil and/or groundwater.
9	Kiln Sand	Potential lead contamination. Historical data recorded an elevated concentration of lead (770mg/Kg) in a Kiln sand sample. Likely restricted to within the kilns but potentially deposited through fill material within the brickworks and quarry. Potential for HM impacts.
10	Asbestos Dump	ACM material and fill dumped west of the brickworks, observed to be contained within an exclusion fence and overgrown with dense woody weed species (blackberry bushes). Estimated to be 500 m^3 (Robson 2010). SMEC understands that the Robson Environmental Pty Ltd have prepared and will be implementing a Remediation Action Plan for the asbestos dump. The remedial area is show in Figure 2a, **Appendix A**. Potential for TPH, BTEX, PAH, Phenols, PCB, HM, Herbicide, Pesticide and Asbestos impacts in soil. Potential for contaminants to leach to the groundwater.
11	Septic Tank	Robson (2006) identified the septic tank as an AEC. The septic tank servicing the brickworks is located in the asbestos dump fenced exclusion area and was not inspected as part of the PSI. Nutrients, (phosphate and or nitrate / nitrite impact to groundwater), HM and faecal coliform impacts to soil and groundwater.
12	Carpenters Workshop (former)	Possible spills/leaks associated with workshop activities (use of oils, solvents and/or resins). Demolition waste may contain ACM. Potential for TPH, BTEX, PAH, Phenols and Asbestos impacts in soils.
13	Former Kiln(s)	Possible presence of demolition waste containing ash, kiln sand, and ACM. Potential for HM and Asbestos impacts in soils.

AEC	Description	Comments
14	Fill Mound(s)	Two fill mounds were identified immediately south of the quarry fence. A detailed inspection of the mounds was limited by the presence of grass. The mounds may contain demolition waste from nearby former structures (temporary kilns and the carpenters shed). Potential for TPH, BTEX, PAH, Phenols, PCB, HM, Herbicides and Pesticides and Asbestos impacts in soil. Potential for contaminants to leach to the groundwater.
15	Weighbridge (former)	Former weighbridge used to weigh imported raw materials, Lester Firth & Associates (1986) report the concrete pit as remaining and has since been filled with material of unknown origin. Potential for TPH, BTEX, PAH, Phenols, PCB, HM, Herbicide, Pesticide and Asbestos impacts in soil.
16	Power House and Underground Conduits	Constructed 1915-1916, also referred to as the Power Station (Lovell Chen 2010) was used to breakdown the high voltage supply from the Kingston Power House. The Power House distributed power across the Site via underground electrical conduits (1916 Historical Plan, **Appendix E**). PCBs and Asbestos materials potentially to have been used in the Power House, potential for impacts to nearby soils. The underground electrical conduits are also potentially constructed of Asbestos materials.
17	Boiler House and adjoining Substation (former)	Constructed in 1971 to service the adjacent brick extrusion plant increasing the brick production capacity. Only operational for 5 years. All internal infrastructures have since been removed. It is unknown if the boiler was fuel (wood, coal or oil) or electricity driven. Potential for PCB, TPH, PAH and Asbestos impacts in soil.
Former Quarry		
18	Fill Mound(s)	At least two large fill mounds within the quarry were identified; it is likely the mounds are comprised of reworked soils, brick waste and quarry overburden. Fragments of ACM were observed in the northern fill mound. Potential for TPH, BTEX, PAH, Phenols, PCB, HM, Herbicide, Pesticide and Asbestos impacts in soil. Potential for contaminants to leach to the groundwater.
19	Clay Storage Shed (former)	Shed structure used to store clay. TP23 targeted this location; fill was logged to a depth of 1.5 mbgl and comprised sandy clays and silts with gravels, bricks and shale pieces. Potential for Asbestos impacts in soil.
20	Weatherboard Cottage (former)	Located approximately 20 m east of Crusher 3 (Lester Firth and Associates). A coal store and stable were attached to the cottage, demolished prior to the 1920s.

AEC	Description	Comments
		Potential for PAH and Asbestos impacts in soil.
Brickworks Workers Accommodation		
21	Workers Accommodation (former) – General Areas and Former Buildings	Area included camps and later the workers accommodation (both demolished). Several demolished brick buildings and footings were observed in the former brickworks workers accommodation. The demolition waste generally comprised bricks, metal and concrete, occasional fragments of ACM were also observed. Several small fill mounds were also identified in the general area; inspection of the mounds was limited by the presence of grass cover. Detailed inspection of the area was negated by the presence of grass and woody weed species, potential for unidentified building footprints, fill and dumped materials. Potential for fill of unknown origin to be present throughout the former workers accommodation. The approximate historical location of the former building is provided in Figure 2b, **Appendix A**. Assessment of AEC 19 should include the location of these former buildings. Potential for TPH, BTEX, PAH, Phenols, PCB, HM, Herbicide, Pesticide and Asbestos impacts in soil. Potential for contaminants to leach to the groundwater.
22	Interceptor Pit	A triple interceptor type structure identified adjacent north to the former kitchen/mess hall building likely to receive oils, domestic chemicals and food wastes. Potential for TPH, PAH, Oil, Grease and Phenol impacts in soil. Potential for contaminants to leach to the groundwater.
23	Abandoned Vehicle	An abandoned vehicle overgrown with woody weed species was identified, potential for hydrocarbon impacts and heavy metal impacts (deterioration of metals). Potential for TPH, BTEX, PAH and HM impacts in soil. Potential for contaminants to leach to the groundwater.
24	Dumping Area	Area of dumped materials including wood, rusted metal containers, a tar drum, electric fuse box and general waste (plastic, wood and metal pieces). Possible location of a former building. Potential for TPH, BTEX, PAH, PCB, Phenols and Asbestos impacts. Potential for contaminants to leach to the groundwater.
25	Scrap Metal Stockpile	Stockpile approximately 10m x 8m, volume difficult to determine inspection limited by woody weeds. Observed to contain reworked soils, sheet metal, bricks and an old fridge. Potential for TPH, BTEX, PAH, Phenols, PCB, HM, and Asbestos impacts in soil.
26	Fill Mound	A large stockpile 50m^3 observed adjacent to brickworks boundary fence. Observed to comprise reworked soils, rusted metal (sheets and pipes), concrete and bricks. Potential for TPH, BTEX, PAH, Phenols, PCB, HM, Herbicide, Pesticide and Asbestos impacts

AEC	Description	Comments
		in soil. Potential for contaminants to leach to the groundwater.
27	Cleared Area	Large cleared area with patches of asphalt was observed adjacent to the workers accommodation, no mounding or dumped materials were identified. The purpose of the area is unclear but is identifiable on historical plans since the 1920s; more recent uses may include the storage of materials. Fill was logged to a depth of 0.5 mbgl and comprised sandy clay with gravels, glass and bitumen. Potential for TPH, BTEX, PAH, and HM impacts in soil.
28	Explosive Store (former)	Lester Firth & Associates reported that the original explosives store was located 180 m south of the current Power House, and was later relocated 160 m west of the Power House. Potential for impacts from explosive compounds in soils and/or groundwater.
Southern Areas		
29	Rail Corridor	Former railway corridor used to transport bricks to parts of Canberra. Historical data also indicated temporary tramways were operated inside the quarry. Contamination may include treated timber sleepers (pesticides), asbestos from brake pads and vegetation control (in corridor). Potential for Herbicide, HM and Asbestos impacts in soil.
30	Vehicle Tracks (site wide)	The Site contains multiple vehicle tracks (current and historical). Potential for hydrocarbon impacts from oil/fuel spills and leaks. Assessment should include areas likely to receive wash (drains, low points etc). Potential for TPH, BTEX and PAH impacts in soil.
31	Waste Pile	A small waste pile (around 10 m^3) was identified near Adelaide Avenue. Material comprised bricks, metal, and general waste (plastics and cardboard). Several fragments of potential ACM were identified at this location. Potential for TPH, BTEX, PAH, Phenols, PCB, HM, Herbicide, Pesticide and Asbestos impacts in soil. Potential for contaminants to leach to the groundwater.
32	Fill (Road)	Fill materials comprising silty cobbles to gravelly sand with traces of brick and bitumen was logged at TP02 until refusal at 2.0 mbgl on a large piece of concrete. The nature and extent of fill is unknown but is likely attributed to filling required meet the design grade of the Cotter rd and Yarra Glen overpass. Potential for TPH, BTEX, PAH, Phenols, PCB, HM, Herbicide, Pesticide and Asbestos impacts in soil. Potential for contaminants to leach to the groundwater.

4 CONCEPTUAL SITE MODEL

4.1 Conceptual Site Model

A Preliminary Conceptual Site Model (CSM) has been developed to integrate the:

I. Contaminants of Concern (historical data review, **Section 3.6**);

II. Potential Source(s) of Contamination (AECs, **Section 3.7**);

III. Potential Pathway(s) of Contamination transport and exposure; and

IV. Potential Receptor(s) of Contamination (past, present and future ecological/human receptors).

The CSM for the Site is summarised below in **Table 4.1.**

Table 4-1 Conceptual Site Model

Potential Source (current and former)	Pathway (preferential and exposure)	Receptors (past, present and future)
AEC 1, 4, and 8. Ash waste associated with operation of brickworks, likely restricted to fill (PAH impacts)	Direct Exposure. Leaching of contaminants to groundwater.	(past, present) Site Workers (d, in) (future) Residential Site Occupiers (d, in) (past, present) Sub-surface soil and/or groundwater ecology (d, in, phy)
AEC 7 Machinery used to crush, refine and produce bricks. (Heavy Metal and Hydrocarbon based impacts).	Direct Exposure. Migration of dissolved contaminants through Surface and/ or Groundwater. Vapour migration and inhalation.	(past, present) Site Workers (d, in) (future) Residential Site Occupiers (d, in) (past, present) Sub-surface soil and/or groundwater ecology (d, in, phy)
AEC 4 Explosive Store(s) (TPH, BTEX and volatile organic compounds)	Direct Exposure. Migration of dissolved contaminants through Surface and/ or Groundwater. Vapour migration and inhalation.	(past, present) Site Workers (d, in) (future) Residential Site Occupiers (d, in) (past, present) Sub-surface soil ecology (d, in, phy)
AEC 1, 6, 10, 12-21, 24, 26, 29-32. ACM in fill materials and Site buildings. (ACM, FA and FA impacts)	Migration of airborne fibres generated by disturbance of ACM, or asbestos impacted soils.	(past, present) Site Workers (inh) (future) Residential Site Occupiers (inh)
AEC 23 and 30 Spills and/or leaks of fuels oils from vehicles and mobile machinery. (TPH, BTEX, PAH, Phenols and Heavy Metal impacts)	Direct Exposure. Migration of dissolved contaminants through Surface and/ or Groundwater. Vapour migration and inhalation.	(past, present) Site Workers (d, in) (future) Residential Site Occupiers (d, in) (past, present) Sub-surface soil and/or groundwater ecology (d, in, phy)
AEC 2, 6, 8 and 12 Workshop spills and/or leaks of fuels, oils and solvents etc. (TPH, BTEX, PAH, Phenols and Heavy Metal impacts)	Direct Exposure. Migration of dissolved contaminants through Surface and/ or Groundwater. Vapour migration and inhalation.	(past, present) Site Workers (d, in) (future) Residential Site Occupiers (d, in) (past, present) Sub-surface soil and/or groundwater ecology (d, in, phy)

AEC 1, 10, 14, 15, 18, 26, 29 and 31 Pesticide use (building footprints, rail corridor and former agricultural land) (Heavy Metal, OCP and OPP impacts)	Direct Exposure. Migration of persistent contaminants via Surface and/ or Groundwater.	(past, present) Site Visitors (d, in) (future) Residential Site Occupiers (d, in) (past, present) Sub-surface soil ecology (d, in, phy)
AEC 1, 10, 14, 15, 18, 26, 31 and 32 Uncontrolled Fill (TPH, BTEX, PAH, Phenols, PCB, HM, Herbicides and Pesticides and Asbestos impacts)	Direct Exposure. Migration of dissolved contaminants through Surface and/ or Groundwater. Vapour migration and inhalation.	(past, present) Site Workers (d, in) (future) Residential Site Occupiers (d, in) (past, present) Sub-surface soil ecology (d, in, phy)
AEC 3, AEC 7, AEC 8, AEC 17 Storage of fuels and oil (TPH, BTEX, PAH and lead impacts)	Direct Exposure. Migration of dissolved contaminants through Surface and/ or Groundwater. Vapour migration and inhalation.	(past, present) Site Workers (d, in) (future) Residential Site Occupiers (d, in) (past, present) Sub-surface soil and/or groundwater ecology (d, in, phy)

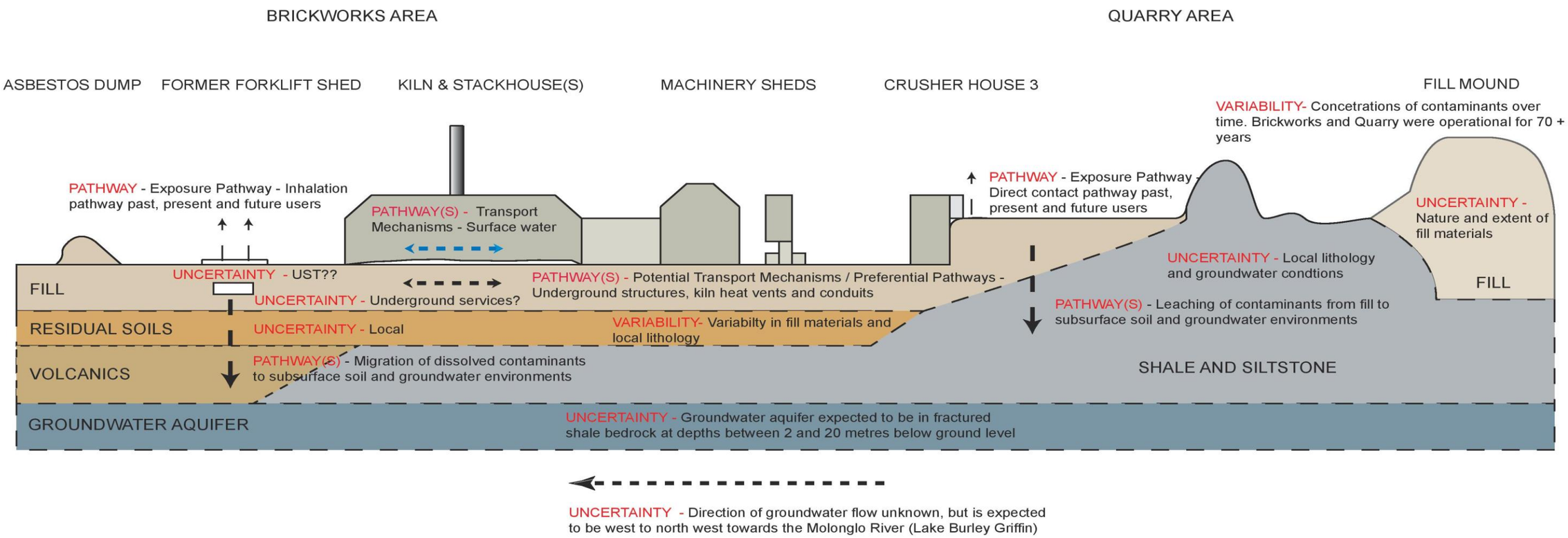
Notes: exposure
d = dermal inh = inhalation in = ingestion ex = explosion phy = roots

4.2 Graphical CSM

A graphical CSM of a typical section through the brickworks and quarry (east to west) illustrating some of the potential transport mechanisms, preferential pathways and data gaps identified in the PSI is provided below. Uncertainties indicated on the CSM indicate areas of uncertainty where additional information may be obtained during a future DSI. Variability indicated in the CSM may require additional data to meet DSI DQOs.

Conceptual Site Model

N.T.S
Not To Scale



4.3 Data Gaps

Subsurface conditions (soil, sediment and groundwater) can be complex and heterogeneous with many unknown geologic interactions that may affect the movement and/or concentrations of potential contaminants. This uncertainty is increased by the lack of sufficient field testing (logging of soil conditions, collection of samples and the evaluation of the concentrations of potential contaminants) to adequately assess the Site. Some of these uncertainties and variability's are identified in the Graphical CSM show above in **Section 4.2**.

Further assessment(s) are recommended to reduce the degree of uncertainty; the data gaps identified should be targeted to yield a greater understanding of the assessment area.

5 SITE ASSESSMENT CRITERIA

5.1 Soil Assessment Criteria

The PSI was conducted with reference to with the current assessment guidelines endorsed by the ACT Environment Protection Authority (EPA) which include the following guidelines:

- ACT EPA, 2009. Contaminated Sites Environment Protection Policy;
- Environment Protection Act, 1997;
- Environment Protection Regulation, 2005;
- NEPC Amended 2013. National Environmental Protection Measure Assessment of Site Contamination (ASC NEPM); and
- NSW EPA, 2000, Guidelines for Consultants Reporting on Contaminated Sites.

The application of these guidelines is summarised below.

5.2 Health Based Investigation Levels (HILs)

Health based soil Investigation Levels (HILs) are provided in the CSM NEPM for metal and inorganic contaminants for a range of exposure settings, based on the current or proposed/approved use(s) of the land, including:

- Residential A (HIL A): Residential with gardens and accessible soil (home-grown produce contributing less than 10% fruit and vegetable intake; no poultry), including children's day care centres, kindergartens, preschools and primary schools.
- Residential B (HIL B): Residential with minimal access to soil; includes dwellings with fully and permanently paved yard space such as including high-rise buildings and apartments.
- Recreational C (HIL C): Public open space such as parks, playgrounds, playing fields, secondary schools and footpaths.
- Commercial/Industrial D (HIL D): Commercial/ industrial, includes premises such as shops, offices, factories and industrial sites.

Conservatively, residential (HIL A) concentrations have been adopted as screening levels for all results from the limited soil sampling conducted as part of this preliminary investigation. Further consideration of the local exposure scenarios (e.g. commercial or open space use) or site specific risk assessment would be appropriate during any detailed investigation and when redevelopment land use plans are available.

5.3 Ecological Investigation Levels (EILs)

The EILs provided in the CSM NEPM relate to the protection of terrestrial ecosystems and are generally applicable to contaminants in the top 2 m of the soil at finished/ground level which corresponds to the root and habitation zone of species. EILs relevant to gardens and low density residential land use have been adopted for the whole site.

Calculation of some EILs also requires measurement of soil pH and cation exchange capacity (CAC), where this is the case we have assumed typical values for the soil types observed. If soil

concentrations exceed these, indicative, EILs further consideration of local soil / fill conditions and specific biota to be supported by the soil/ fill (e.g. tree plantings) may be warranted when detailed redevelopment plans are available.

5.4 Health Screening Levels (HSLs)

Health Screening Levels (HSLs) are provided in the amended NEPM for petroleum hydrocarbon compounds using the same land use settings as those prescribed by the HILs for Metal and in Organic Contaminants, however the values for Residential A and B are combined in the HSL tables as they are based on the same exposure conditions for vapour inhalation pathways. The HSLs include additional consideration of soil texture and depth to source to determine appropriate soil, groundwater and soil vapour criteria for the exposure scenario. The Site's soils are predominately clay based. However given the porous nature of fill materials (brick waste and unconsolidated fill) present at the brickworks and quarry, a sand soil profile has been adopted conservatively.

5.5 Asbestos Containing Materials (ACM)

Materials containing asbestos on the surface or within the fill are considered to be potentially contaminated and therefore require assessment and remediation in accordance with the ACT EPA endorsed Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (WA Department of Health, 2009).

The purpose of the PSI was to identify the presence/absence of asbestos in Site soils, as such the adopted field sampling and laboratory analytical methodology did not meet the requirements of the ACT EPA endorsed WA guidelines.

5.6 Aesthetic Considerations

Auditor guidelines require the consideration of soil aesthetics. For the purposes of this preliminary investigation any soils with discoloured or that are affected by odours or containing foreign materials have been noted for consideration at the appropriate stage of the contamination assessment / audit process.

5.7 Adopted Assessment Criteria

The soil analytical results were compared (conservatively) to low density residential land use criteria as summarised below in **Table 5.7**:

Table 5.7 – Adopted Assessment Criteria

Adopted Criteria	CoC
NEPM (amended 2013) HIL A	Metals, PAH, Phenols, OCP, OPP, PCB
NEPM (amended 2013) HSL A & B, 0 to <1m, Sand	BTEX, TPH
NEPM (amended 2013) EIL	DDT, Naphthalene, Metals (as, pb, cu, ni, zn)
Presence/Absence	Asbestos

The soil analytical results are compared to the adopted assessment criteria in Table 1, **Appendix I**.

6 SAMPLING PLAN AND METHODOLOGY

6.1 Soil Sampling Rationale

A limited program of geotechnical and environmental test pitting was conducted at the Site to provide preliminary geotechnical data for future development within the Site (TP01 to TP13); environmental samples were collected at these locations to assess general site soil conditions.

The remainder of the sampling locations were targeted to either confirm previous soil data or to fill data gaps to better inform the recommendations outlined in this PSI. The sampling location plan is presented in Figure 4**, Appendix A**.

It is also noted the sampling locations were placed to minimise impacts on the critically endangered Golden Sun Moth (GSM) population in the Southern Area of the Site. The GSM populations are shown in Figure 2a, **Appendix A**.

A summary of the sampling plan is provided below in **Table 6.1**.

Table 6-1 Sampling Plan

Test Pit Location	Targeted AEC	Comment
TP01 to TP13, excluding TP12	General Site / AEC 1 Waste Fill	General Site coverage – to describe general site subsurface conditions including identification of filled areas
TP12 and TP14	AEC 29 Rail Corridor	Targeted – to assess impacts associated with treated timber sleepers (pesticides), asbestos from brake pads and vegetation control (in corridor)
TP15 to TP17	Targeted: AEC 21 Brickworks Workers Accommodation (former) – General Areas	General coverage Brickworks Workers Accommodation (former) – to describe subsurface conditions including the nature and extent of filled areas
TP18	Targeted: Grove of Deciduous Trees / Open Space Areas	Targeted – to assess the potential former use of pesticides
TP19	Targeted: AEC 5 Explosives Store	Targeted – to assess impacts from storage of explosive compounds
TP20	Targeted: AEC 2 General Areas - Recycled Timber Holding Yard	Targeted – to assess potential metal impacts leaching from treated timbers
TP21	Targeted: AEC 3 UST near Forklift Shed (former)	Targeted– to describe subsurface conditions including indications of hydrocarbon impacts (odours and/or staining)
TP22	Targeted: Robson Laboratories BH14 / AEC 7 Operation of Crusher and Refinery Plant(s)	Targeted – to describe subsurface conditions including indications of hydrocarbon impacts identified by Robson (2006)
TP23, TP24, TP26, TP27 and TP28	Targeted: AEC 1 Waste Fill and AEC 19 Clay Storage Shed (former)	General coverage Quarry area – to describe subsurface conditions including the nature and extent of fill
TP25	Targeted: AEC 18 Fill Mound(s)	Targeted – to describe nature of mounded materials

6.2 Assessment Methodology

6.2.1 Service Clearance

Test pit locations were cleared for the presence of underground services by a Telstra accredited plant location contractor referencing utility plans obtained through a Dial Before (DBYD) You Dig search.

6.2.2 Test Pitting

Test pitting activities were undertaken between the 9 and 11 September 2013 using an 8 tonne excavator. Test pits were advanced to either refusal (on bedrock) or until the maximum investigation depth of 3 mbgl.

Sub surface conditions were logged in accordance with the Unified Soil Classification System (USCS); test pit logs are included in **Appendix J**.

6.2.3 Soil Sample Collection

Soil samples were collected directly from the bulk undisturbed soil from the centre of the excavator bucket. A new disposable nitrile gloves was used for each sample depth and location. The soil sample was directly placed into laboratory supplied sample jars by a nitrile gloved hand. Samples were collected at nominal depths of 0.0, 0.5, 1.0, 2.0 and 3.0 mbgl and intervals of 100 mm.

Actual sample depths form each test pit was modified to target each type of material present areas of suspected contamination (staining, odour and/or fill).

6.2.4 Sample Storage and Handling

Soil Samples
Soil sample were placed into 250 ml glass jars with Teflon lined lids supplied by SGS Laboratories. The jars were completely filled with soil (so there was minimal to zero headspace), labelled with the job number, date, time, sampler and unique sampling point identification.

The soil jars, once filled with sample, were immediately placed in an ice-filled esky to keep the samples below a temperature of approximately 4^{o}C. A chain of custody (CoC) form was filled in with the sample names, sampling date and required analyses. This documentation and the samples were then sent to the laboratory for analysis, within the prescribed analyte holding times

6.2.5 Decontamination

No reusable sampling equipment was utilised in the investigation. Decontamination and the collection of rinsate blanks were not required.

6.2.6 Quality Control samples

Field QC samples included field replicate samples (duplicates and triplicates), field blanks, trip blanks and trip spikes. A detailed account of the QA/QC program adopted for the PSI can be found in **Appendix K**.

6.2.7 GPS

The GPS coordinates of each test pit were recorded on SMEC field sheets and provided below in Table 6.2.

Table 6-2 GPS Coordinates UTM 55

Test Pit	X Coordinate	Y Coordinate
1	689767	6090210
2	689948	6090023
3	690043	6090013
4	690271	6089946
5	690313	6089784
6	690410	6089820
7	690472	6089844
8	690564	6089879
9	690469	6090000
10	690579	6090051
11	690247	6090052
12	690044	6090134
13	689959	6090229
14	689871	6090319
15	689890	6090442
16	689910	6090388
17	690017	6090363
18	690215	6090246
19	689822	6090537
20	689930	6090474
21	689908	6090610
22	690015	6090615
23	690053	6090548
24	690113	6090541
25	690142	6090461
26	690109	6090581
27	690137	6090729
28	690208	6090566

7 QUALITY ASSURANCE/QUALITY CONTROL

7.1 Field and Laboratory QA/QC

A summary of the Field and Laboratory QA/QC is provided in **Appendix K**.

7.2 Summary QA/QC Assessment

Assessment of the field and laboratory QA/QC indicate that the accuracy and precision of the analysis was satisfactory and constitute an appropriate reflection of soil conditions and are suitably reliable for the objectives of the PSI.

8 RESULTS

8.1 Subsurface Conditions

The subsurface conditions encountered during the PSI are summarised in the following sections, test pit logs can be found in **Appendix J**.

8.1.1 Fill Materials

Fill was encountered at 18 test pit locations across the Site and was typically logged to comprise Fill reworked natural sandy to silty clays. Ash waste likely sourced from the operation of the brickworks (combustion of wood and coal) was identified in fill at both the brickworks and quarry. The presence of ash if fill is further discussed in **Section 9.1** and **9.4**.

With the exception of test pits TP23 to TP28 in the quarry area and TP02 fill generally terminated at depths less than a 1 mbgl. Deeper fill comprising brick waste, ash, quarry cuttings (shale) with traces of anthropogenic inclusions (glass, metal and bitumen) was identified in TP 25 and TP28 within the quarry area to the maximum investigation (and the limit of the excavator) depth of 3 mbgl.

At test pit location TP02 fill logged to comprise silty cobbles to gravelly sand with traces of brick and bitumen. The test pit terminated at 2 mbgl due to refusal on a large piece of concrete, a piece of pipe was also identified at this depth. The source of the fill is unknown but is likely attributed to filling to meet the design grade of the Cotter road.

8.1.2 Natural Soils

Natural soils were generally comprised soft brown silty topsoils underlain by medium to stiff red-brown silty clays and clays. Variable components of sand, cobbles and weathered rock (shale and siltstone) were also logged.

Natural soils ranged from silts to clays with variable components of sand and weathered rock (shale, ironstone and was typically encountered between depths of 0.0 and 1.0 mbgl.

8.1.3 Residual Soils and Bedrock

Natural soils graded to weathered red brown residual soils (silty clays and clay) and were underlain by shale, dacite, siltstone or sandstone bedrock. Strength and weathering of the bedrock material varied across the Site. With the exception of TP03, TP23 and TP28 (terminated in fill) bedrock was typically logged between depths of 0.17 and 1.9 mbgl.

8.2 Soil Analytical Results

Soil analytical results are compared to the adopted assessment criteria and can be found in **Appendix I**.

With the exception of TRH, Metals and PAH concentrations all samples submitted for laboratory analysis returned concentrations of analytes below the laboratory LOR and therefore the adopted assessment criteria. Copies of the laboratory certificates are provided in **Appendix L**.

A summary of the results is provided below:

TRH

Concentrations of TRH C_{10}-C_{40} (120 mg/kg) above the laboratory LOR of 110 mg/kg were reported in sample TP26-2.0. The sample location comprised of fill material containing brick waste, metal and bitumen.

PAH

Phenanthrene (0.1 mg/kg) was detected at sample TP22-0.5 marginally above the laboratory LOR of <0.1 mg/kg. The sample location comprised of fill material containing brick waste, ash and bitumen.

Metals

Concentrations of metals were below the adopted assessment criteria in all soil samples submitted for analysis.

Asbestos

The presence of asbestos was not identified in any of the fill samples submitted for analysis.

PCB

Concentrations of PCBs were below the adopted assessment criteria in all soil samples submitted for analysis.

BTEX

Concentrations of BTEX were below the adopted assessment criteria in all soil samples submitted for analysis.

OCP/OPP

Concentrations of OCP/OPP were below the adopted assessment criteria in all soil samples submitted for analysis.

Phenols

Concentrations of Phenols were below the adopted assessment criteria in all soil samples submitted for analysis.

Explosives

Explosive compounds were not detected in sample TP19-0.0 targeting AEC 5.

9 DISCUSSION & RECOMMENDATIONS

The Site history data indicates the potential for contamination to be present; a discussion of the history review, field and laboratory data is provided below.

9.1 AEC 1 – Waste Fill

Fill Materials

Likely contained to the brickworks and quarry areas of the Site, as shown in Figure 2a, 4 and 5, **Appendix A**.

The nature and extent of fill material at the brickworks and quarry is unknown, observational data indicate the material comprised reworked natural materials (silts, clays and shale) with variable amounts of brick (or tile) waste, ash and anthropogenic inclusions (including metal, concrete and wood). Although not observed in fill, occasional surface fragments of potential ACM were noted at both the brickworks and quarry.

The presence of ash in waste fill is discussed is discussed in **Section 9.4**.

Fill extended beyond the maximum investigation depth of 3.0 mbgl at test pits TP25, 26 and 28 (quarry area). The available historical data did not indicate the depth of the quarry nor the nature of filling activities. TP24 located approximately 10 m south east of TP26 was terminated on shale bedrock at 0.5m bgl, indicating the presence and depth of fill is variable across the quarry.

At test pit location TP02, fill was logged to comprise silty cobbles to gravelly sand with traces of brick and bitumen. The test pit terminated at 2 mbgl due to refusal on a concrete slab, a pipe was also identified at this depth. The source of the fill is unknown but is likely attributed to filling to meet the design grade of the Cotter road.

The limited available soil analytical data suggests that the encountered fill materials contain low concentrations of metals, TRH and PAHs.

Given the uncertainty around the nature and extent of fill at the Site further investigation is recommended.

9.2 AEC 2 –Recycled Timber Storage

Storage of recycled timbers

Various areas of the brickworks are currently used for the storage of recycled timber materials. The exact volume and extent of materials stored is unknown but is restricted to the brickworks area of the Site, as shown in Figure 2a, 4 and 5, **Appendix A**.

In an interview, the business owner Mr Thor Diesenfdorf stated that it was unlikely that any of the stored wood (past or present) was treated given the regulations around the reuse of these materials (arsenic and/or OCP treated timbers). However it was possible that some creosote treated and/or painted (potentially lead based) timber have been reused during the twenty years the business has been operational.

TP20 targeted an accessible area used for the storage of wood (potentially treated) materials by Thor's Hammer. Gravel and clay fill was logged to a depth of 0.27 mbgl and was underlain by moderately weathered siltstone.

Elevated concentrations of metals were not detected in the surface soil sample submitted for analysis.

The potential for contamination is considered low. No further investigation is recommended.

9.3 AEC 3 – Fuel Storage

TP21 targeted the potential location of a 1000L petrol UST identified by the historical data between the former forklift shed and Fan House 2. Fill materials were logged to comprise silty cobbles with brick and tile waste, ash, coal and bitumen. No UST or associated infrastructure were identified, nor were any staining or hydrocarbon odours observed. Given the (relative) small size of the UST it possibly remains in-situ.

Robson (October 2010) reported the presence of UST (filling point and breather vents) near Kiln 1 and a small empty above ground storage tank near Machinery Shed 3. These features were not identified during the PSI.

Further investigation is recommended to determine the presence and condition of any fuels storage tanks at the Site.

9.4 AEC 4 – Stackhouse(s)

Four stackhouses were observed to be present at the brickworks, they have been used to burn coal, wood and later oil. Variable amounts of ash waste was observed to be present inside the firing chamber in each stackhouse. Stored coal was observed adjacent to Fan House 2, and was presumably used to fire Stackhouse 3.

Ash Waste in Fill

Ash waste was identified in the PSI either as a discernible layer or mixed in Waste Fill (AEC 1) within both the brickworks and quarry (TP12, TP21, TP22, TP25 and TP26).

The low detected concentration of PAHs indicate the ash material is benign, this may be related to the stackhouses operating at high temperatures resulting in the complete combustion of carbon based (coal and wood) fuels, however the ash layer was often variable (both partially and heavily combusted)

Given the uncertainty around the nature and extent of ash waste at the Site further assessment is recommended. The assessment should include the stackhouse(s) and coal storage facility(ies) which were not targeted as part of the PSI.

9.5 AEC 5 –Explosives Store 1

A building footprint comprising concrete tiles (around 30 cm x 30 cm) was targeted (TP19) as the potential base of the explosives store. No odours or staining were observed beneath the building footprint, underlying soils graded to natural clays at a depth of 0.3 mbgl. Several surface fragments of ACM were observed in the general area.

Sample TP19-0.0 was submitted to evaluate concentrations of explosives. Laboratory analysis did not did not detect any explosive compounds in the submitted sample.

Remnant features of the building were not easily identifiable during the PSIand the disposition of the explosive store and level of control of explosives (potential for spill) is not known. Explosive residues may occur away from the sampled location further investigation is recommended.

9.6 AEC 6 – Machinery Sheds

A brief inspection of the machinery sheds was completed as part of the PSI. The sheds were observed to be used for the storage of wood materials (Thor's Hammer) and remnant machinery from former operations. No staining was observed on the floors which were sealed (concrete), however some sheen was observed in surface water drains around Machine Shed 1.

General areas around the machinery sheds were littered with empty drums, scrap metal and other waste materials. No obvious signs of staining and/or odours were noted during the inspection.

Further investigation of the machinery sheds including surrounding areas is recommended.

9.7 AEC 7 – Operation of Crusher and Refinery Plant(s)

Robson (2006) completed a limited intrusive investigation at the brickworks. The soil data identified TPH at 10 550 mg/kg (C_6 to C_{36}) in a soils sample collected from (Robson) borehole location BH14 (to the rear of Machine Shed 3 at a depth of 0.5-0.7 mbgl. An oil pressure/storage was identified near the north eastern corner of Machine Shed 3 suggesting oils may have also been used and/or stored in the area.

Several test pits including TP22 were advanced in this area to investigate the potential for hydrocarbon contamination of soil. Fill materials were encountered which generally comprised sandy clays with angular shale gravels, ash, bitumen and bricks. Field observations and soil analytical data did not indicate the presence of hydrocarbon impacted soils

It is possible that the TPH impact (identified in one sample by Robson) was related to an isolated spill of oil (long chain hydrocarbon fractions) associated with plant machinery (removed) previously used during the crushing, conveying and refining of raw materials from the quarry to Machine Shed 3. A diagrammatic representation of the brick making process is presented in **Appendix E** (1960).

9.8 AEC 8 – Coal/Oil Storage Facility(ies)

Historical information and aerial imagery presented in the Lovell and Chen CMP (page 168) identified the presence of two large above ground storage tanks at the Model Railway Shed. At the time of the PSI it was observed to be an unsealed and empty shed. No odours or staining were observed.

Robson (2006) identified an additional coal storage facility north of Machine Shed 3. SMEC observed to be a remnant steel structure, the surrounding area was observed to be sealed (concrete) with no obvious signs of staining and/or odours. It is likely that there are smaller stores of coal within the brickworks as observed near Fan House 2.

The potential for contamination arising from the storage of coal/oil is considered low to moderate, however further investigation is recommended in areas identified as used for the storage of oils.

9.9 AEC 9 – Kiln Sand

Kilns sands are likely to be present in Kilns 1 to 6 as shown in Figure 2a (**Appendix A)**. There is potential of kilns sands to present in demolition waste associated with AEC 12 (former Kilns).

Robson (2006) reported elevated concentrations of lead (770 mg/kg) in a sample collected from kiln sand. Robson stated '*The source of the lead may be from the glaze and not be specifically from the kiln sands (sand on the floor of the kilns)'*.

The investigation of kiln sands did not form part of SMEC's scope for this investigation.

Further investigation to assess the source and presence of metal impacts in kilns sand is recommended.

9.10 AEC 10 – Asbestos Dump

Robson (2006-2012) identified the presence of asbestos in the building structures of the brickworks. A asbestos dump in the western portion of the brickworks was also identified by Robsons (2006).

A review of previous reports suggests that Robson's completed some remedial work and have prepared a Remediation Action Plan (RAP) for the dump estimated to be 500 m^3. SMEC have not sighted the RAP or any assessment reports relating to the dump.

- The LDA have advised SMEC that Robson Environmental is managing the remediation of the asbestos dump. The remediation area is shown in **Figure 2a, Appendix A**. This area was bound by a security exclusion fence and was not investigated during this PSI.

Asbestos in Waste Fill (AEC 1)

Asbestos was not identified in fill material encountered in this PSI, however surface fragments of ACM sheeting were observed at several locations across the brickworks, former workers accommodation, and quarry.

Given the volume of waste fill across the brickworks, former workers accommodation and quarry; SMEC recommends further investigation to determine the presence (or absence) of asbestos in fill materials.

9.11 AEC 11 – Septic Tank

Historical data indicates the septic tank is located in the western portion of the brickworks area. Inspection of the septic tank was not completed as part of the PSI due to a security fence excluding access to this area (and the asbestos dump, AEC 10).

Further investigation to assess potential impacts in soil and/or groundwater is recommended.

9.12 AEC 12 – Carpenters Workshop

Historical data identified the presence a carpenter's workshop south east of the brickworks. No identifiable remnants of the former building were observed during the PSI.

The contamination status of the building footprint and surrounding area is unknown, further investigation is recommended.

9.13 AEC 13 –Former Kilns

Historical data identified the presence of additional former kilns south east of the brickworks. No signs of theses kilns were identified during the PSI.

The contamination status of the building footprint and surrounding area is unknown, further investigation is recommended.

9.14 AEC 14 - Fill Mounds

Two fill mounds were identified immediately south of the quarry fence. A detailed inspection of the mounds was limited by the presence of grass. The mounds may contain demolition waste from nearby former structures AEC 11 and AEC 12 (carpenters workshop and former kilns respectively).

Further investigation to evaluate potential contamination associated with the fill mounds is recommended.

9.15 AEC 15 – Weighbridge (former)

Former weighbridge used to weigh imported raw materials, Lester Firth & Associates (1986) report the concrete pit as remaining and has since been filled with material of unknown origin (likely consistent with AEC 1 – Waste Fill) .

This feature was not identified in the PSI, and indicative location is provided in Figure 2a, **Appendix A**.

Potential for impacts associated with AEC 1, further investigation is recommended.

9.16 AEC 16 – Power House

The Power House building was used since 1915 to breakdown high voltage power supplied from the Kingston Power House. The electricity was then distributed across the Site.

A review of the 1916 historical plan (**Appendix E)** indicates that at least some of the electricity was distributed across the Site in underground electrical conduits. It is probable that these conduits were constructed of ACM.

The Power House buildings were not inspected as part of the PSI. There is potential for PCBs and/or ACM to be present in the building and in the surrounding soils.

Further investigation assessment is recommended.

9.17 AEC 17 – Boiler House and adjoining Substation

The Boiler House and adjoining Substation were constructed to service the brick extrusion plant and were briefly operated for approximated 5 years (1971 to 1976). All internal infrastructures have since been removed from the buildings. It is unknown if the boiler was fuel (wood, coal or oil) or electricity driven.

The potential for contamination at this location is considered low given the brief operation period (5 years) and the removal of potential sources of contamination (transformers used in the substation, operation of the boiler etc). However given the age of the building(s) they are likely constructed of ACM.

The potential for t contamination at this AEC is considered low, although further investigation may be considered to verify this.

9.18 AEC 18 – Fill Mound(s)

Two large fill mounds were also identified in the quarry area; the purpose of the mounds is unclear but may have been related to directing rain water away from the quarry pit. Observational data indicate the material comprised reworked natural materials (silts, clays and shale) with variable amounts of

brick waste, ash and anthropogenic inclusions (including metal). Fragments of ACM were observed in the northern fill mound.

The limited available soil analytical data suggests that fill used to create the mounds contain low concentrations of metals, TRH and PAHs. Given the uncertainty around the nature and extent of fill at contained in the mounds further investigation is recommended.

9.19 AEC 19 – Clay Storage Shed (former)

Test pit TP23 was advance into a small mound of fill proximal to the footprint of the Clay Storage Shed. Fill was logged to 1.6 mbgl and comprised sandy silts to sandy clays with coarse angular gravels (fresh siltstone), bricks and bitumen. The fill material was underlain by slightly weathered siltstone bedrock.

The available soil analytical data from TP23 indicate the fill waste contained concentrations of TRH, PAH and metals less than the adopted assessment criteria.

The potential for contamination at this location sourced from the Clay Storage Shed is considered low, no further investigation is recommended.

9.20 AEC 20 – Former Weatherboard Cottage

A weatherboard cottage with attached stable and coal storage (demolished 1920s) was identified by Lester Firth and Associates (1986). Remnant features of the building and/or attached structures were not observed during the PSI.

The potential for contamination is considered low, no further investigation recommended.

9.21 AEC 21 – Former Workers Accommodation

The workers accommodation was observed to contain several demolished brick buildings and footings. The demolition waste generally comprised bricks, metal and concrete, occasional fragments of ACM were also observed.

Test Pit TP15 and TP16 were advanced in the general areas of the workers accommodation. Fill materials were only logged at TP15 to a depth of 1.0 mbgl and were comprised of reworked natural soil (silts) with traces of brick, glass and charcoal.

It is probable that the area contains pockets of fill containing demolition waste from the former workers accommodation building(s). The limited soil analytical data from TP15 and TP16 did not identify concentrations of contaminants greater than the adopted assessment criteria. Further assessment to determine the nature and extent of fill in the workers accommodation area is recommended.

9.22 AEC 22 – Interceptor Pit

A triple interceptor type structure identified adjacent north to a demolished building thought to have been the kitchen/mess hall (Figure 2b, **Appendix A**). The interceptor likely received grease and fats from the kitchen/ mess hall operations, no odours and/or staining was observed.

The pit may have also received petroleum based oils and domestic chemicals.

The potential for contamination is considered low, further investigation may be considered to verify this.

9.23 AEC 23 – Abandoned Vehicle

An abandoned vehicle overgrown with woody weeds (Blackberries) was identified during the PSI. A detailed inspection was limited by the presence of vegetation, however given the age of the vehicle it has likely been abandoned for over 20 years. No staining and/or odours were observed at the time of the PSI.

The potential for contamination sourced from the abandoned vehicle is considered low, further investigation may be considered to verify this.

9.24 AEC 24 – Dumping Area

Area of dumped materials including wood, rusted metal containers, a tar drum, electric fuse box and general waste (plastic, wood and metal pieces). No staining and/or odours were observed at the time of the PSI.

The potential for contamination is considered to be low to moderate, further investigation is recommended.

9.25 AEC 25 – Scrap Metal Stockpile

Stockpile approximately 10m x 8m, volume difficult to determine inspection limited by woody weeds. Observed to contain reworked soils, sheet metal, bricks and an old fridge. It is probable that the scrap metal originated from the former workers accommodation.

Given the uncertainty around the nature and extent of fill at this location further investigation is recommended.

9.26 AEC 26 – Fill Mound

A large stockpile 50m^3 observed adjacent to brickworks boundary fence. Observed to comprise reworked soils, rusted metal (sheets and pipes), concrete and bricks. The source of the fill mound is unknown but may have been created during the demolition of the former workers accommodation.

Given the uncertainty around the nature and extent of fill at this location further investigation is recommended.

9.27 AEC 27 – Cleared Area

A large cleared area with patches of asphalt was observed adjacent to the brickworks workers accommodation, no mounding or dumped materials were identified. The purpose of the area is unclear but is identifiable on historical plans since the 1920s; more recent uses may include the storage of materials.

Fill was logged to a depth of 0.5 mbgl and comprised sandy clay with gravels, glass and bitumen. Soil analytical results at this location were less than the adopted assessment criteria.

Historical aerial photographs indicate activities in this have been undertaken since the 1950's. Given the long and undocumented historical use of the area further investigation is recommended.

9.28 AEC 28 – Explosives Store 2

Lester Firth & Associates (1986) reported that the original explosives store was located 180 m south of the current Power House, and was later relocated 160 m west of the Power House (AEC 5).

Remnant features of the building were not identifiable during the PSI. Potential for explosive CoPC to be present in soils, further investigation is recommended.

9.29 AEC 29 – Rail Corridor

A rail corridor was observed in the western portion of the Site and was noted to be free of remnant infrastructure (ballast, track or sleepers).

Test Pit TP12 and TP14 were advanced within the corridor; fill was logged to maximum depth of 0.8 mbgl and comprised reworked natural soils (silts and clays). Fill layers were generally underlain by either residual soils (silty clay) and bedrock (siltstone). Analytical results at these sample locations were less than the adopted assessment criteria.

The available historical data indicate the rail line was only briefly used in the 1920s before being dismantled and wooden sleepers used to fire the stackhouses.

The potential for contamination in the rail corridor is considered low, although further investigation may be considered to verify this.

9.30 AEC 30 – Vehicle Tracks (site wide)

The Site contains multiple tracks (both current and former) with a long history of vehicular usage. The current (roads, streets, avenues) and former (denoted by a dashed blue line) vehicle tracks are shown in Figure 5, **Appendix A**.

There is potential for impacts arising from spills and leaks which are likely to accumulate in areas that receive wash (drains, low points and other drainage features).

The potential for contamination is considered low to moderate, further investigation is recommended.

9.31 AEC 31 – Waste Pile

A small waste pile (around 10 m^3) comprising bricks, metal, general waste (plastics and cardboard) and several fragments of potential ACM was identified near Adelaide Avenue. The material appeared to have been dumped.

It is recommended that the asbestos dump be assessed and disposed offsite in accordance with ACT EPA requirements.

9.32 AEC 32 – Fill (Road)

Fill comprising silty cobbles to gravelly sand with traces of brick and bitumen was logged at sample location TP02. The test pit terminated at 2 mbgl due to refusal on a large piece of concrete, a piece pipe was also identified at this depth. Soil analytical results at this location were less than the adopted assessment criteria.

Given the uncertainty around the nature and extent of fill at this location further investigation is recommended.

10 CONCLUSIONS

SMEC completed a Preliminary Site Investigation (PSI) at the Site to provide preliminary contamination data for potential purchasers (and developers) of the Site. Key findings include:

The available historical data indicate the northern portion of the Site has been used as brickworks since the early 1900's. Remnant buildings include, 6 kilns, 4 stackhouses, office building and amenities, 3 machinery sheds, workshops, boiler house, a substation, a power house (prior to 1915 was powered by a steam donkey engine), storage sheds and other minor buildings. A disused quarry is located adjacent (east) to the brickworks is also present at the Site.

Demolished features include temporary kilns (south east), two explosive stores (180 m south and 130 m west respectively), a forklift shed (west), clay storage shed (quarry) and a weatherboard house (quarry). Significant amounts of filling across the brickworks and quarry is evident and is poorly documented.

Parts of the brickworks are currently leased by Thor's Hammer a wood recycling business, the potential for contamination due to current land uses is considered low. The reminder of the Site was formerly grazing land which has been developed to include road infrastructure (Cotter Road, Adelaide Avenue and Yarra Glen).

A total of 28 test pits were advanced across the Site and 42 samples submitted for laboratory analysis to evaluate contaminants of concern. The purpose of the sampling plan was to provide preliminary geotechnical and environmental data for the Site.

Fill material was logged at 18 of the 28 test pit locations. Dependent on the sample location the fill materials were observed to comprise:

- **Brickworks and Quarry**: brick waste, ash, quarry cuttings (shale) with traces of anthropogenic inclusions (glass, metal and bitumen) to a maximum depth of 3 mbgl, the nature and extent of fill is unknown;
- **Surrounding Areas**: sandy to silty clay, probable reworked natural soils, generally encountered at shallow depths less than 1 mbgl; and
- **Adjacent Cotter Rd**: silty cobbles to gravelly sand with traces of brick and bitumen, refusal on concrete 2 mbgl, the nature and extent of fill is unknown.

Whilst the preliminary data did not identify contamination in the above fill materials, the nature and extent of fill materials is unknown. Remediation may also be considered for aesthetic reasons.

Natural soils were logged to comprise soft brown silty topsoils underlain by medium to stiff red-brown silty clays and clays. Natural soils graded to weathered red brown residual soils (silty clays and clay) and were underlain by shale, dacite, siltstone or sandstone bedrock. Strength and weathering of the bedrock material varied across the Site and was logged between depths of 0.17 and 1.9 mbgl.

All analyte concentrations in natural and fill samples submitted for analysis were less than the adopted (human health based and ecological) assessment criteria. In particular, it was noted that polycyclic aromatic hydrocarbon (PAH) concentrations in fill containing coal ash (which are often associated with PAH contamination) were below assessment criteria and typically below laboratory detection limits.

It should be noted, however, that the sampling densities adopted during this preliminary assessment were below though that would typically be adopted during a detailed site investigation (DSI) and the full depth of fill in the quarry has not been investigated.

Based on the our review of previous reports and exiting data SMEC relating to the Site a total of 32 areas of environmental concern (AEC) were identified at the site. Potential risks to human health and the environment associated with each AEC were considered, supported by data from the limited supplemental soil sampling and analysis conducted by SMEC as part of this preliminary investigation. On this basis preliminary information reviewed to date 28 of the 32 identified AECs were qualitatively assessed be of low risk with no further investigation or limited further investigation recommended.

Generally, based on the limited soil data collected during this PSI, the site ecological and human health risks associated with brickworks, quarry and the former workers accommodation areas of the site are considered moderate to low The remainder of the Site (the Southern Areas) typically comprised of natural soils grading to weathered bedrock. Soil analytical results returned concentrations of contaminants less than the adopted assessment criteria, the potential for contamination is therefore considered low.

Although no potential source of groundwater contamination was identified during this investigation, no groundwater testing or assessment groundwater conditions at the site has been made.

The results of this primary investigation are not sufficient to assess the suitability of the site for a specific planned land use. It is recommended that, once detailed plans indicating the proposed land use(s) across the Site have been developed that a detailed site investigation (DSI) be undertaken to assess the suitability of the site for the planned land use(s). Typically a Site Audit Report (SAR) and Site Audit Statement (SAS) regarding the suitability of the Site would be required by the approving authority and an ACT EPA accredited Site Contamination Auditor would be engaged to independently review the DSI and any subsequent remedial works as supported by the ACT EPA.

11 REFERENCES

ACT EPA, 2008. Practice Note No 1 Requirements for the Assessment and Validation of Former Service Station Sites in the ACT

ACT EPA, 2008. Practice Note No 2. Contaminated Sites

ACT EPA, 2008. Practice Note No 3. Contaminated Soil

ACT EPA, 2011. Information Sheet No. 1 – Contaminated Sites – Decommissioning, Assessment and Audit of Sites Containing Above Ground or Underground Fuel Storage Tanks.

ACT Government, Environment and Sustainable Development (ESDD), 2011. Environmental Guidelines for Service Station Sites and Hydrocarbon Storage. Department of the Environment, Climate Change, Energy and Water.

ANZECC (1992a) Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites Australian and New Zealand Environment and Conservation Council, National Health and Medical Research Council.

ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand.

Connell & Wagner (February 2001), Brickworks Contamination Report, Appendix F.

DEC NSW [2nd edition (2006)] Contaminated Sites Guidelines for the NSW Site Auditor Scheme.

Geology of Canberra (1992), 1:100 000 Geological Series Sheet 8727, Bureau of Mineral Resources.

Lester Firth & Associates Pty Ltd (June1986), Old Canberra Brickworks, Conservation Plan.

Lovell, Chen – Architects & Heritage Consultants (March 2010), Conservation Management Plan – Canberra Brickworks, Denman Street, Yarralumla, Canberra.

NEPM Amended 2013 National Environment Protection (Assessment of Site Contamination) Measure, National Environment Protection Council.

NHMRC & NRMMC, 2011. National Water Quality Management Strategy, Australian Drinking Water Guidelines 6, 2011. National Health and Medical Research Council & Natural resource Management Ministerial Council.

NSW Office of Environment and Heritage EPA 2011, Contaminated Sites Guidelines for Consultants Reporting on Contaminated Sites.

NSW DECC (2009) Contaminated Sites Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997.

Robson Laboratories Pty Ltd (October 2006), Environmental Investigation Audit, Yarralumla Brickworks Block 1 Section 102 Yarralumla, Canberra Central, ACT.

Robson Laboratories Pty Ltd (March 2006), Survey to Determine the Extent and Condition of Hazardous Building Material at Yarralumla Brickworks, Yarralumla ACT.

Robson Laboratories Pty Ltd (May 2010), Review of Past Site Works and Indicative Costings for Further Assessment and Remediation, Yarralumla Brickworks, Yarralumla, ACT.

Robson Laboratories Pty Ltd (October 2010), Hazardous Material Survey & Management, Denman St Yarralumla Brickworks, Yarralumla ACT.

Robson Laboratories Pty Ltd (February 2012), Hazardous Material Survey & Management, Yarralumla Brickworks, Yarralumla ACT.

SMEC Pty Ltd (December 2013), Canberra Brickworks and Environs Options & Evaluation Report Update' dated 17 December 2013

Standards Australia (2005) Australian Standard Guide to the sampling and investigation of potentially contaminated soil Part I: Non-volatile and semi-volatile compounds (AS 4482.1), Standards Australia, November 2005.

Standards Australia (1999) Australian Standard Guide to the sampling and investigation of potentially contaminated soil Part II: Volatile substances, Australian Standard 4482.

West Australian Department of Health. 2009. Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia.

APPENDIX A: FIGURES



FIG NO.	FIGURE TITLE
1	**Site Location**

DATE		PAGE SIZE	COORDINATE SYSTEM
17/02/2014	0 155 310 620 Meters, 1:25,000	A4	ACT Grid 1966

PROJECT NO.	PROJECT TITLE
3002369	Canberra Brickworks Preliminary Site Investigation

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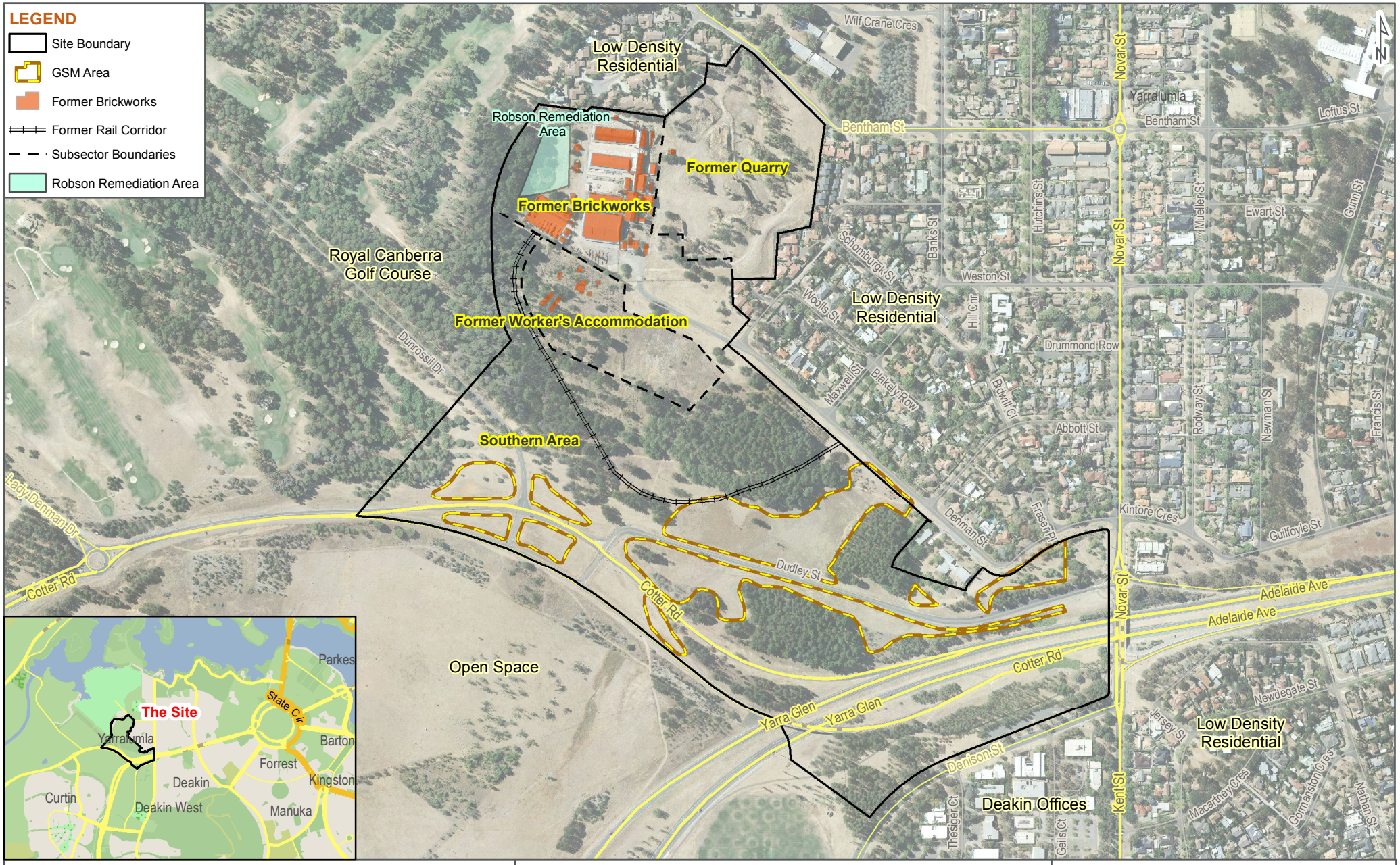
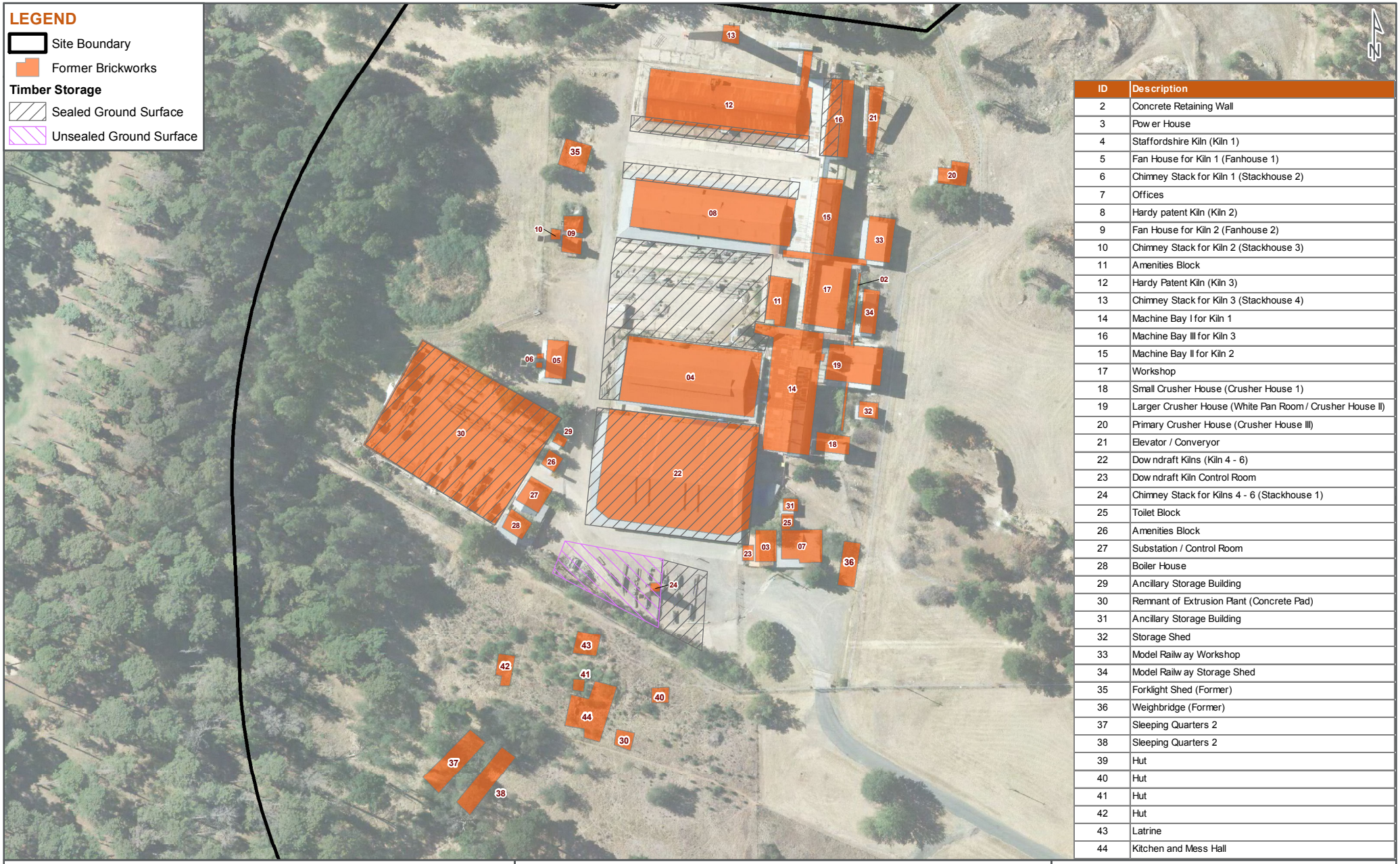


FIG NO. 2a	**FIGURE TITLE** Site Layout	**DATE** 17/02/2014	0 40 80 160 Meters 1:7,000	**PAGE SIZE** A4	**COORDINATE SYSTEM** ACT Grid 1966
PROJECT NO. 3002369	**PROJECT TITLE** Canberra Brickworks Preliminary Site Investigation	**CREATED BY** J. Seng	**SOURCES** Imagery © Bing Maps, Imagery © Roadnet		

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Location: X:\PROJECT\3002369 Yarralumla Brickworks Site Investigation\6 Delivery\6.2 Figures and Result Tables\6.2.1 GIS\Figure 2a - Layout.mxd



ID	Description
2	Concrete Retaining Wall
3	Pow er House
4	Staffordshire Kiln (Kiln 1)
5	Fan House for Kiln 1 (Fanhouse 1)
6	Chimney Stack for Kiln 1 (Stackhouse 2)
7	Offices
8	Hardy patent Kiln (Kiln 2)
9	Fan House for Kiln 2 (Fanhouse 2)
10	Chimney Stack for Kiln 2 (Stackhouse 3)
11	Amenities Block
12	Hardy Patent Kiln (Kiln 3)
13	Chimney Stack for Kiln 3 (Stackhouse 4)
14	Machine Bay I for Kiln 1
16	Machine Bay III for Kiln 3
15	Machine Bay II for Kiln 2
17	Workshop
18	Small Crusher House (Crusher House 1)
19	Larger Crusher House (White Pan Room / Crusher House II)
20	Primary Crusher House (Crusher House III)
21	Elevator / Converyor
22	Dow ndraft Kilns (Kiln 4 - 6)
23	Dow ndraft Kiln Control Room
24	Chimney Stack for Kilns 4 - 6 (Stackhouse 1)
25	Toilet Block
26	Amenities Block
27	Substation / Control Room
28	Boiler House
29	Ancillary Storage Building
30	Remnant of Extrusion Plant (Concrete Pad)
31	Ancillary Storage Building
32	Storage Shed
33	Model Railw ay Workshop
34	Model Railw ay Storage Shed
35	Forklight Shed (Former)
36	Weighbridge (Former)
37	Sleeping Quarters 2
38	Sleeping Quarters 2
39	Hut
40	Hut
41	Hut
42	Hut
43	Latrine
44	Kitchen and Mess Hall

FIG NO. 2b

FIGURE TITLE Former Canberra Brickworks Features

DATE 17/02/2014

0 15 30 60
1:1,750 Meters

PAGE SIZE A4

COORDINATE SYSTEM ACT Grid 1966

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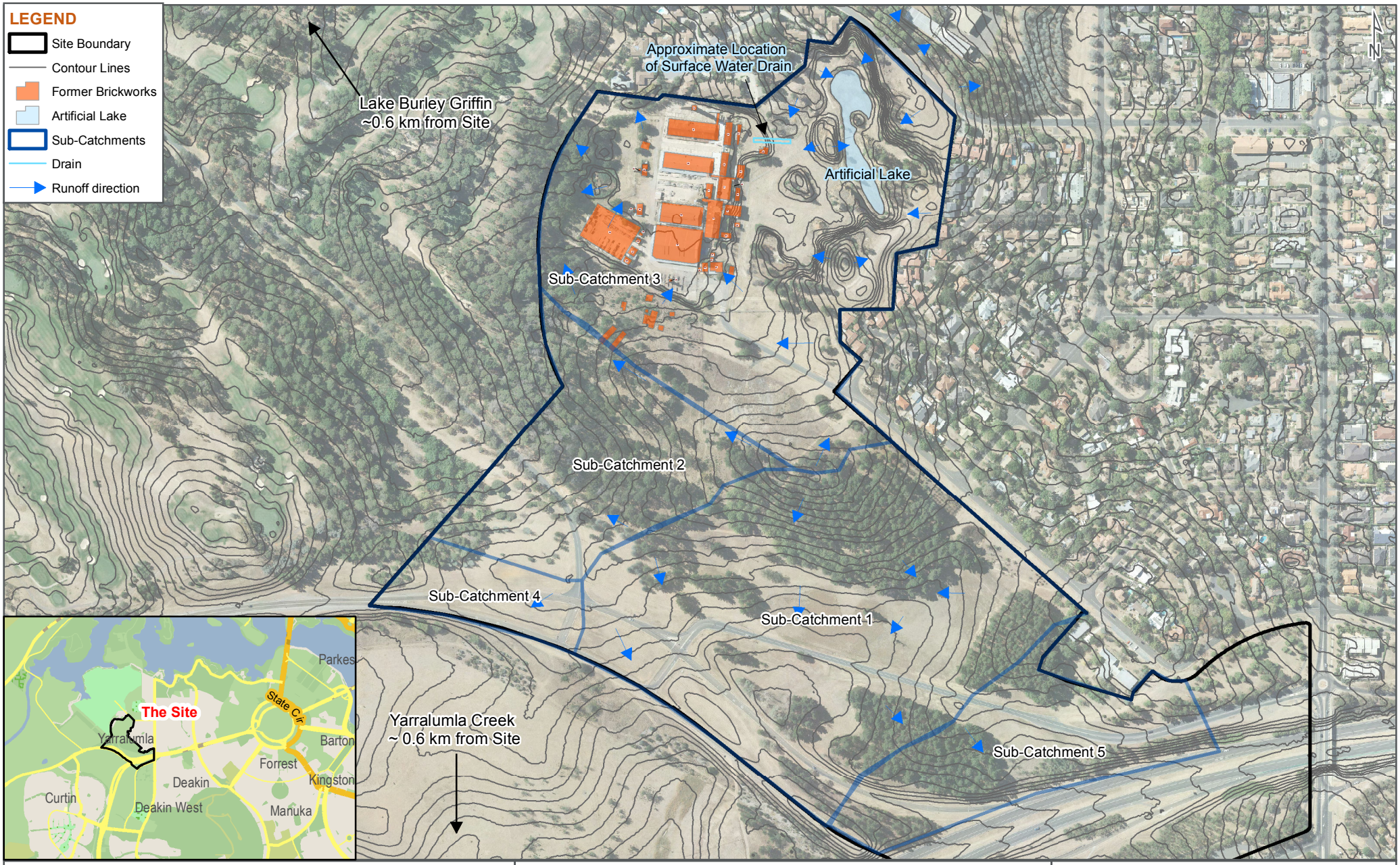


FIG NO. 2c	**FIGURE TITLE** **Topography, Sub-Catchments and Drainage**	**DATE** 17/02/2014	0 50 100 200 1:5,600 Meters	**PAGE SIZE** A4	**COORDINATE SYSTEM** ACT Grid 1966
PROJECT NO. 3002369	**PROJECT TITLE** Canberra Brickworks Preliminary Site Investigation	**CREATED BY** J. Seng	**SOURCES** Imagery © BingMaps, Imagery © Roadnet		

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Location: X:\PROJECT\3002369 Yarralumla Brickworks Site Investigation\6 Delivery\6.2 Figures and Result Tables\6.2.1 GIS\Figure 2d - Catchment Top and Drainage.mxd



FIG NO.	FIGURE TITLE
3a	Historical Aerial Photograph - 1951

DATE		PAGE SIZE	COORDINATE SYSTEM
3/10/2013	0 50 100 200 Meters, 1:6,500	A4	ACT Grid 1966

PROJECT NO.	PROJECT TITLE
3002369	Canberra Brickworks Preliminary Site Investigation

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FIG NO. 3b	**FIGURE TITLE** Historical Aerial Photograph - 1958	**DATE** 3/10/2013	0 50 100 200 1:6,500 Meters	**PAGE SIZE** A4	**COORDINATE SYSTEM** ACT Grid 1966
PROJECT NO. 3002369	**PROJECT TITLE** Canberra Brickworks Preliminary Site Investigation	**CREATED BY** J. Seng	**SOURCES** Imagery © ACTMapi, Imagery © Roadnet		

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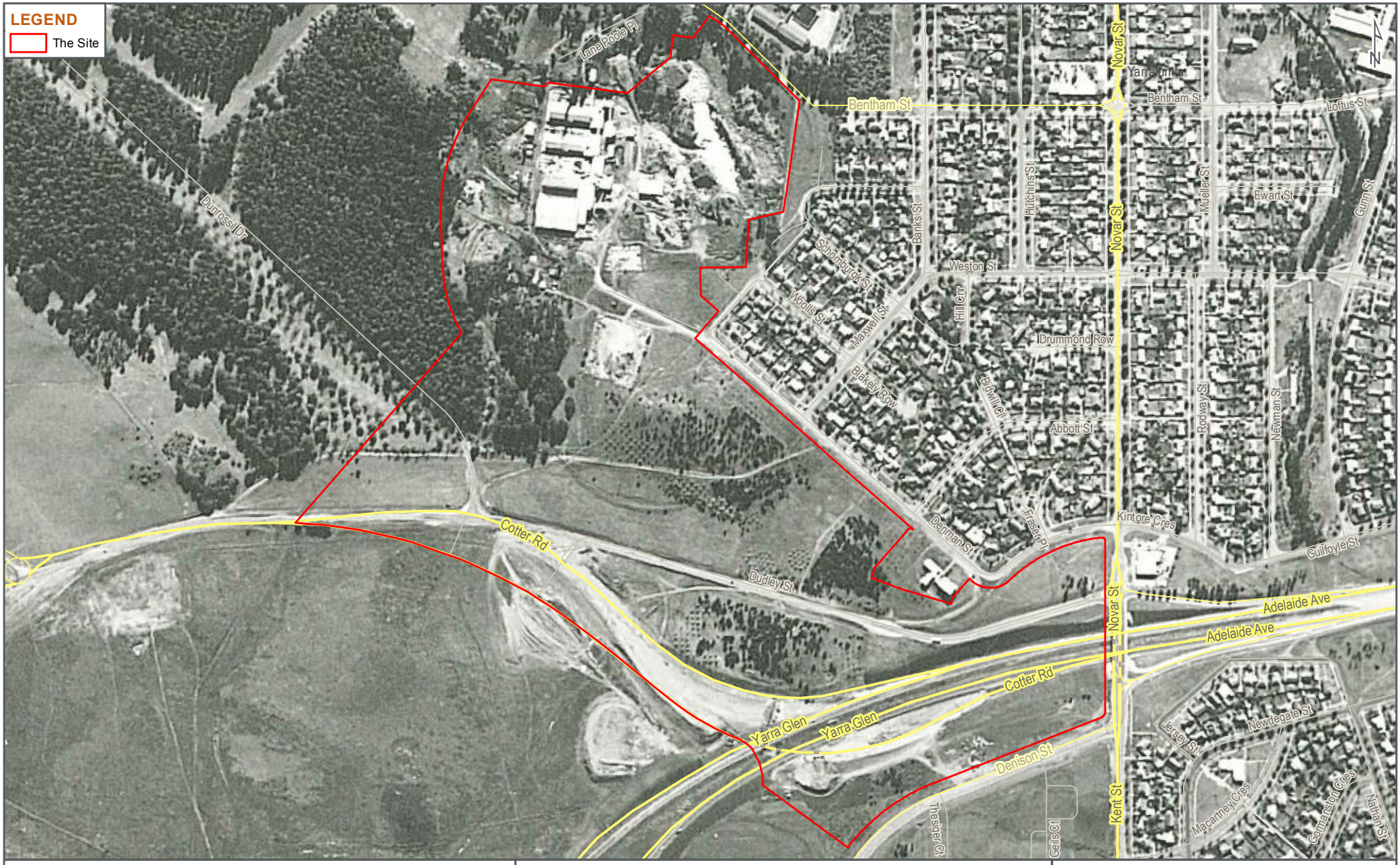


FIG NO. 3c	**FIGURE TITLE** **Historical Aerial Photograph - 1968**	**DATE** 3/10/2013	0 50 100 200 1:6,500 Meters	**PAGE SIZE** A4	**COORDINATE SYSTEM** ACT Grid 1966
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FIG NO.	FIGURE TITLE	DATE		PAGE SIZE	COORDINATE SYSTEM
3d	Historical Aerial Photograph - 1978	3/10/2013	0 50 100 200 Meters 1:6,500	A4	ACT Grid 1966

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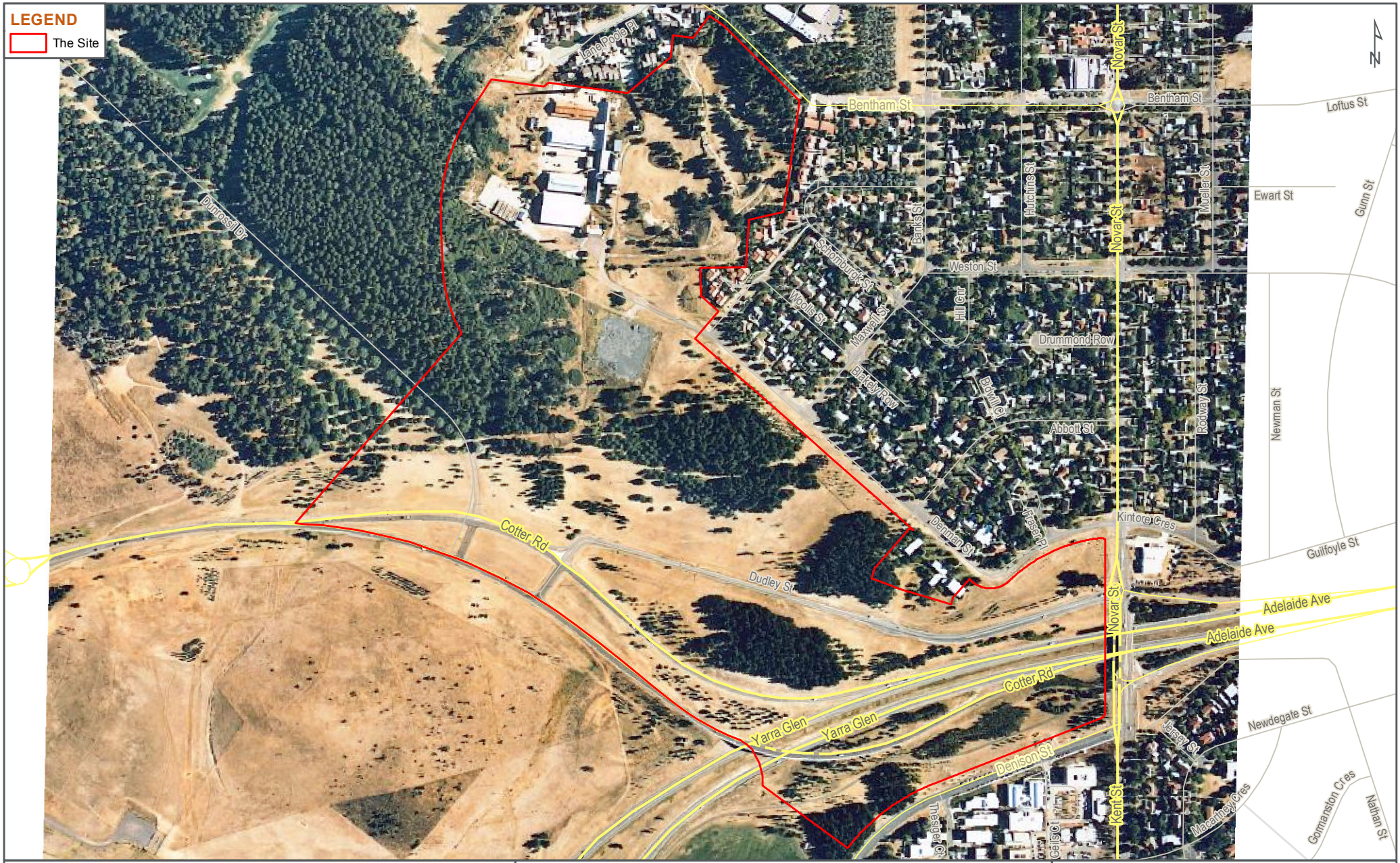


FIG NO. 3e	**FIGURE TITLE** Historical Aerial Photograph - 1988	**DATE** 3/10/2013	0 50 100 200 1:6,500 Meters	**PAGE SIZE** A4	**COORDINATE SYSTEM** ACT Grid 1966
PROJECT NO. 3002369	**PROJECT TITLE** Canberra Brickworks Preliminary Site Investigation	**CREATED BY** J. Seng	**SOURCES** Imagery © ACTMapi, Imagery © Roadnet		

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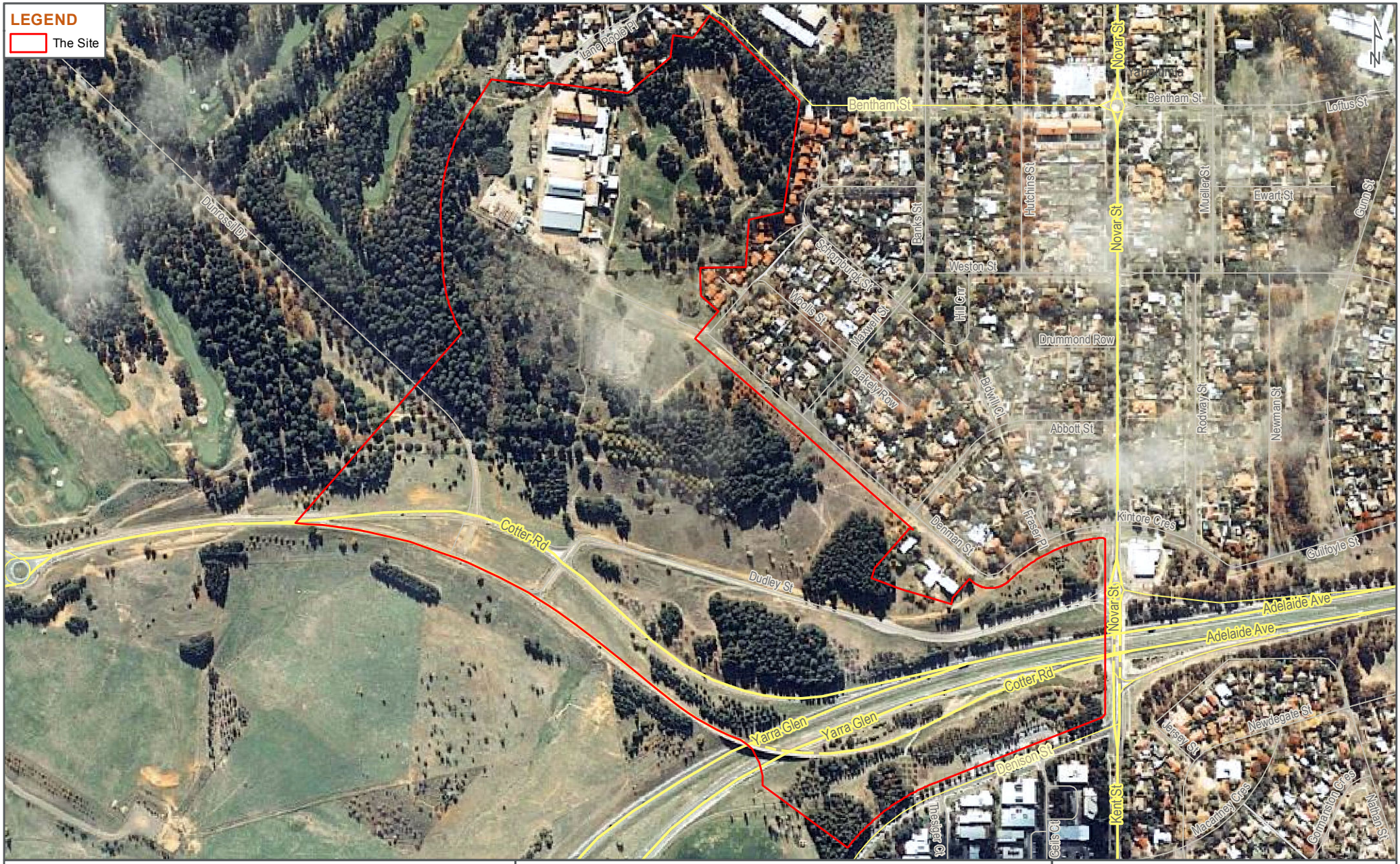


FIG NO. 3f	**FIGURE TITLE** Historical Aerial Photograph - 1998	**DATE** 3/10/2013	0 50 100 200 1:6,500 Meters	**PAGE SIZE** A4	**COORDINATE SYSTEM** ACT Grid 1966
PROJECT NO. 3002369	**PROJECT TITLE** Canberra Brickworks Preliminary Site Investigation	**CREATED BY** J. Seng	**SOURCES** Imagery © ACTMapi, Imagery © Roadnet		

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FIG NO. 3g	**FIGURE TITLE** Historical Aerial Photograph - 2009	**DATE** 3/10/2013	0 50 100 200 1:6,500 Meters	**PAGE SIZE** A4	**COORDINATE SYSTEM** ACT Grid 1966
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FIG NO. 3h	**FIGURE TITLE** Historical Aerial Photograph - 2012	**DATE** 3/10/2013	0 50 100 200 1:6,500 Meters	**PAGE SIZE** A4	**COORDINATE SYSTEM** ACT Grid 1966
PROJECT NO. 3002369	**PROJECT TITLE** Canberra Brickworks Preliminary Site Investigation	**CREATED BY** J. Seng	**SOURCES** Imagery © ACTMapi, Imagery © Roadnet		

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SMEC

Location: X:\PROJECT\3002369 Yarralumla Brickworks Site Investigation\6 Delivery\6.2 Figures and Result Tables\6.2.1 GIS\Figure 3.mxd

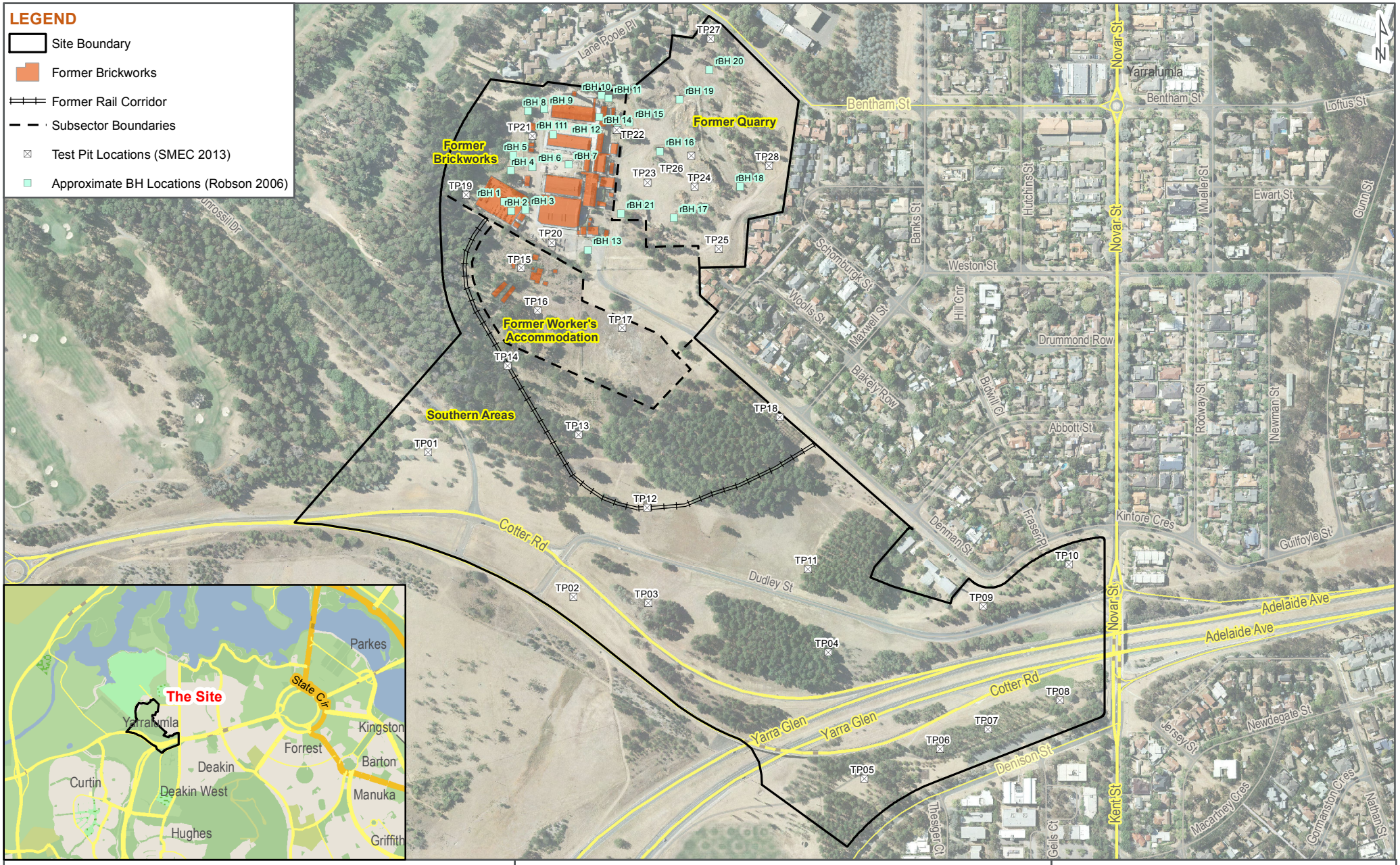


FIG NO. 4	**FIGURE TITLE** Test Pit and Borehole Locations	**DATE** 17/02/2014	0 50 100 200 Meters 1:6,500	**PAGE SIZE** A4	**COORDINATE SYSTEM** ACT Grid 1966
PROJECT NO. 3002369	**PROJECT TITLE** Yarralumla Brickworks Environmental Investigation	**CREATED BY** J. Seng	**SOURCES** Imagery © Bing Maps, Imagery © Roadnet		

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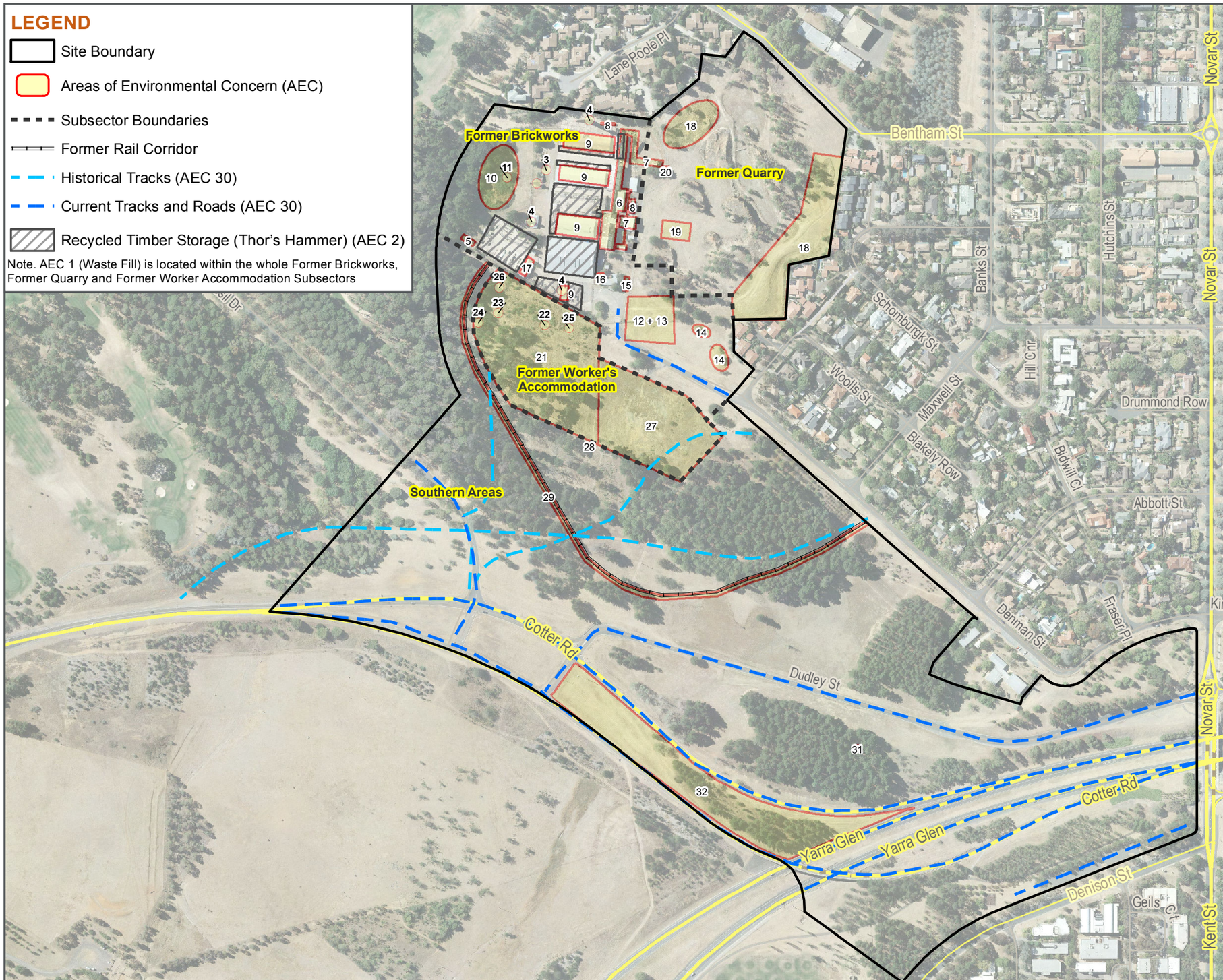
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Location: X:\PROJECT\3002369 Yarralumla Brickworks Site Investigation\6 Delivery\6.2 Figures and Result Tables\6.2.1 GIS\Figure 4.mxd

LEGEND

- Site Boundary
- Areas of Environmental Concern (AEC)
- Subsector Boundaries
- Former Rail Corridor
- Historical Tracks (AEC 30)
- Current Tracks and Roads (AEC 30)
- Recycled Timber Storage (Thor's Hammer) (AEC 2)

Note. AEC 1 (Waste Fill) is located within the whole Former Brickworks, Former Quarry and Former Worker Accommodation Subsectors



AEC	Description
1	Waste Fill
Former Brickworks	
2	Recycled Timber Storage (Thor's Hammer)
3	UST(s) and Forklift Shed (former)
4	Stackhouse(s)
5	Explosive Store (former)
6	Machinery Shed(s)
7	Operation of Crusher and Refinery Plant(s)
8	Coal/Oil Storage Facility(ies)
9	Kiln Sand
10	Asbestos Dump
11	Septic Tank
12	Carpenters Workshop (former)
13	Former Kiln(s)
14	Fill Mound(s)
15	Weighbridge (former)
16	Power House and Underground Conduits
17	Boiler House and adjoining Substation (former)
Former Quarry	
18	Fill Mound(s)
19	Clay Storage Shed (former)
20	Weatherboard Cottage (former)
Brickworks Workers Accommodation	
21	Workers Accommodation (former) – General Areas and Former Buildings
22	Interceptor Pit
23	Abandoned Vehicle
24	Dumping Area
25	Scrap Metal Stockpile
26	Fill Mound
27	Cleared Area
28	Explosive Store (former)
Southern Areas	
29	Rail Corridor
30	Vehicle Tracks (site wide)
31	Waste Pile
32	Fill (Road)

FIG NO. 5

FIGURE TITLE Areas of Environmental Concern

DATE 17/02/2014

0 35 70 140 Meters
1:6,500

PAGE SIZE A3

COORDINATE SYSTEM ACT Grid 1966

PROJECT NO. 3002369

PROJECT TITLE Canberra Brickworks Preliminary Site Investigation

CREATED BY J. Seng

SOURCES Imagery © Bing Maps, Imagery © Roadnet

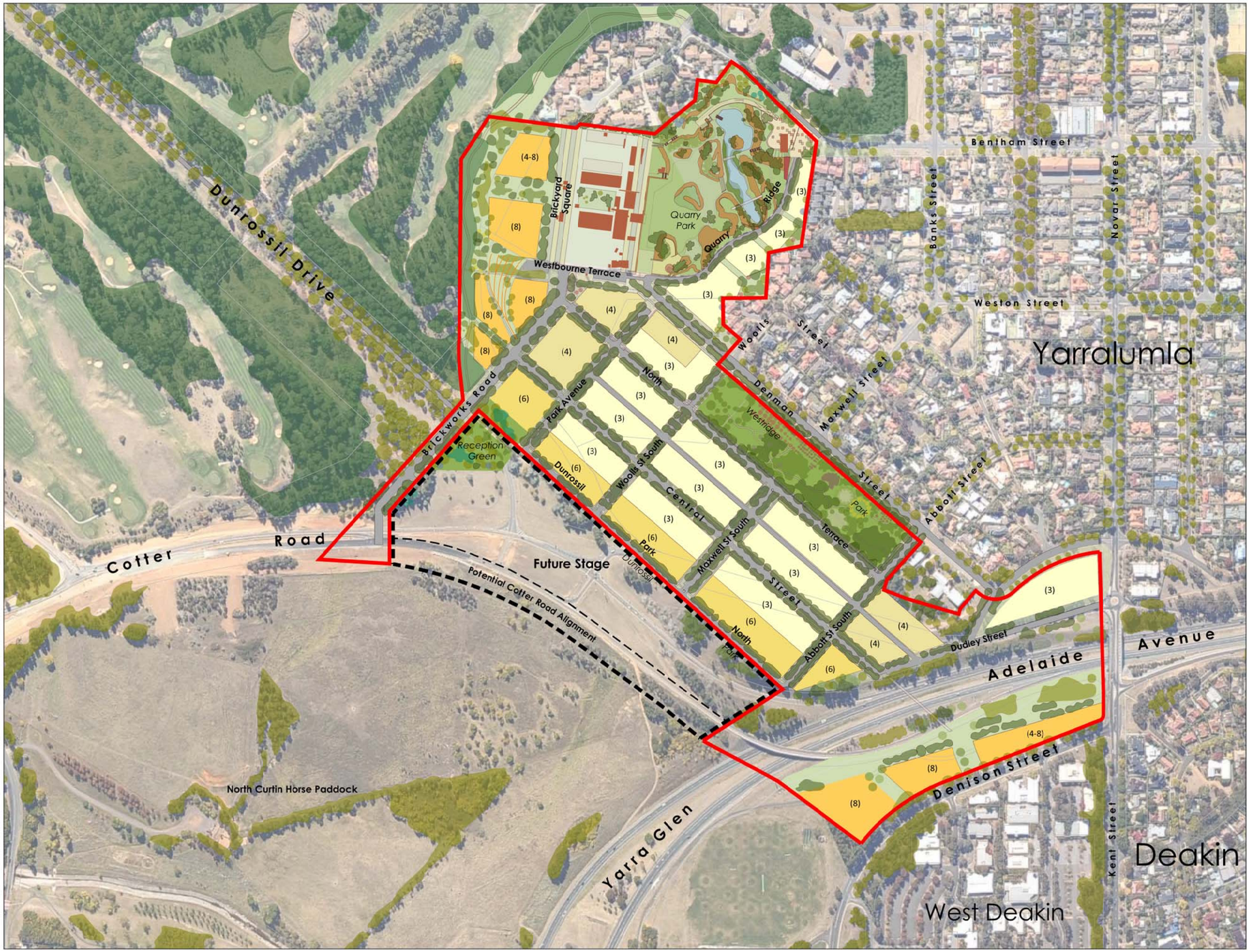
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SMEC Celebrating 40 years 1970 - 2010

Location: X:\PROJECT\3002369 Yarralumla Brickworks Site Investigation\6 Delivery\6.2 Figures and Result Tables\6.2.1 GIS\Figure 5.mxd

APPENDIX B: DRAFT MASTERPLAN



CANBERRA BRICKWORKS AND ENVIRONS MASTER PLAN

ACT Government
Economic Development

Land Development Agency
CANBERRA FIRST

SEPTEMBER 2013
P00311 - CB+E MP

APPENDIX C: DATA QUALITY OBJECTIVES

DATA QUALITY OBJECTIVIES

Data Quality Objectives

The Data Quality Objective (DQO) process for this project has been derived from the NSW DEC (2006) "Guidelines for the NSW Site Auditor Scheme (2nd Edition)" and the NEPM (1999) "Guideline on Data Collection, Sample Design and Reporting". The DQO process is a seven step process to assist the development of sampling programs that support the decision making process.

Step 1: State the Problem

Problem Definition

At present there is limited data on the contamination status of the Site. A review of available historical data indicates there is potential for significant contamination to be present.

The Planning Team

This team has been selected to work together through the seven steps of the project DQO process. The size of the planning team reflects the complexity of the project, however as the DQO Process is iterative, team members may be added to address areas of expertise not initially considered.

Decision Makers and Stakeholders

- LDA Project Manager: Gary Travis
- SMEC Project Manager: Peter Hicks
- SMEC Senior Environmental Scientist: Nathalie O'Toole
- SMEC Environmental Scientist: John O'Brien

Stakeholders

Stakeholders are individuals and organisations that are directly affected by a decision, interested in a problem, and want to be involved, offer input, or seek information. The involvement of stakeholders early on in the DQO process can provide a forum for communication as well as foster trust in the decision making process. At this stage it is envisaged that communication is limited to LDA staff and individuals directly involved in the project. Future communication and consultation may include the following stakeholders:

- Current users of the Site (Thor's Hammer);
- ACT Environment Protection Authority (EPA); and
- Yarralumla Residents Association.

Step 2 : Identify the Decision

The purpose of this step is to define the decision statement that the study will attempt to resolve, based on the problem stated above in Step 1. The Principal Study Question can therefore be summarised as:

> *To assess the potential risks posed by contamination and obtain sufficient data to allow the development of strategies to remediate and/or manage the contamination to an end land use that is suitable for the proposed redevelopment.*

Project Decisions include:

- Do the Site soils and/or groundwater contain concentrations of contaminants of concern (CoC) above the ACT EPA endorsed assessment criteria for the current and proposed land use;
- Do current concentrations of contaminants pose a human health or ecological risk to the receptors of concern;
- Determine the pathways of exposure for human and ecological receptors;
- Is there sufficient data to develop the scope for further investigation or remedial strategies; and
- Can the Site be made suitable for the proposed future land use.

Step 3: Identify the Inputs to the Decision

Introduction

The primary inputs required to be measured by the PSI sampling program are:

- Identify and undertake limited assessment of the areas of environmental concern;
- Assess in greater detail the current site conditions (i.e. topography, hydrogeology) and their potential to influence the migration of contamination;
- Aesthetic impacts in residual surface and deeper soils caused by contamination, including staining, odours and visible asbestos;
- Determine preliminary data on the background quality of soils at the Site;
- Use of appropriate sampling techniques to obtain representative samples from the Site;
- Use of NATA accredited laboratories for selected analysis of sampled medium (soil, surface water, groundwater)
- Determine the migration potential of contamination (if any) at the Site;
- Determine the type and location of contamination;
- ACT Environment Protection Authority and National Environment Protection Measures (NEPM) endorsed adopted site assessment criteria; and
- ACT Environment Protection Authority endorsed site investigation and environmental guidelines.

- The following sections more specifically identify the DQOs associated with key fieldwork components of the assessment.

DQO Decision Inputs

Purpose & Required Information

The purpose of the intrusive investigation works is to visually inspect subsoils and to obtain samples of soils and groundwater for chemical analysis.

Fieldwork information requirements are:

- Maps of the Areas of Environmental Concern;
- Logs of the soil profile;
- Information on the nature of materials encountered during works;
- Photographic logs of Site conditions and features; and
- Collection of representative soil samples in accordance with ACT Environment Protection Authority endorsed criteria, for chemical analysis at NATA accredited laboratories.

Information Sources

The grid based sampling plan was designed to provide preliminary geotechnical data for future development within the Site (TP01 to TP14); environmental samples were collected at these locations to assess for background soil conditions. The sampling plan is presented in Figure 4 **Appendix A**.

The remainder of the sampling locations were targeted to either confirm previous soil data or to fill data gaps to better inform the recommendations outlined in this PSI.

Determining the Action Level

Field screening of soil samples, based upon:

- Visual or olfactory evidence of contamination.

Step 4: Define the Study Boundaries

The study boundaries include spatial and temporal boundaries of the site, including potential receptors of concern. The “Study Boundaries” have been divided into the following descriptors:

- Target population (subsurface boundaries to include fill, residual soils and bedrock);
- Geographic boundaries (the Site boundary as presented in Table 1 **Appendix A**); and
- Temporal boundaries.

Target Population

The target population for this study comprises the environmental samples of:

- Surface and subsurface soils.

The decision makers will base assessment and management decisions on information gained from these target populations.

The conditions of these populations [soils] will be compared to the adopted site assessment criteria to determine the response to the Principal Study Question.

Geographic Boundaries

The geographic boundaries of the data collection and decision making process for this project are shown in Figure 1 **Appendix A**.

Temporal Boundaries

The temporal boundaries included in the decision making process are based the persistence of potential contaminants of concern in the environment and the mobility of potential soil contamination. Metals and PAH are considered to be persistent contaminants, with potential impacts occurring over time scales of 10 years or more.

Step 5: Decision Rules

As the PSI has been developed to provide preliminary contamination data, the following key drivers and relevant decision rules that will be applied in the decision making process:

- Assess the need for further investigation at the Site to assess the identified areas of environmental concern;
- The risk to current and future users of the Site; and
- Potential impacts to offsite receptors (water bodies)

The analytical and field data generated through the PIS sampling program will be compared to the adopted site assessment, and the decision rules become:

- If contaminant concentrations in soils are greater than adopted soil investigation levels then consider further investigation;
- If contaminant concentrations in soils are less than adopted soil investigation levels then consider the data gaps, further investigation may still be recommended;
- If aesthetic issues (i.e. visible waste material) remain then consider further remediation works.

Step 6: Tolerable Limits On Decision Errors

The Tolerable Limits of Decision Errors establish the Data Quality Indicators (DQIs), by which the data collected during the limited Phase 2 ESA sampling program is measured. The DQIs are summarised as follows:

Data representativeness:

- Use of appropriately trained field personnel to collect data and investigate site conditions. Careful soil logging to confirm nature and depth of impact has been removed and residual impacts documented.

Documentation and Data completeness:

- Site conditions properly described;
- Sample locations to be properly described and recorded on field notes/logs;

- Field records are appropriately completed;
- Completion of calibration results, chain of custody documentation, laboratory reports from National Association of Testing Authorities registered laboratories;
- Collection of representative samples from each identified area of environmental concern. Locations are recorded to enable relocation at the completion of the project;
- Samples are tested for appropriate Contaminants of Concern (CoC). Field parameters (as required) including olfactory assessment.

Data Comparability:

- Appropriate techniques are used for sample handling (including sampling, storage and transport);
- Use of NATA accredited test methods in primary laboratory using NEPM procedures;
- Use of NATA accredited test methods in check/secondary laboratory using NEPM procedures.
- Precision and accuracy for sampling and analysis:
- Blind duplicates to be collected at a rate of 1:20 and analysed in the primary laboratory;
- Triplicate samples to be collected at a rate of 1:20 and analysed by the check/secondary laboratory;
- Relative Percentage Differences (RPDs) for inorganic analytes to be less than 30%;
- RPDs for organic analytes to be less than 50%;
- Acceptable quality of field blanks, trip blanks and trip spikes; and
- Acceptable data quality control results by the laboratories are achieved.

Step 7: Optimisation Of The Data Collection Process

The grid based sampling plan was designed to provide preliminary geotechnical data for future development within the Site; environmental samples were collected at these locations to assess for background soil conditions. The sampling plan is presented in Figure 4 **Appendix A**. The remainder of the sampling locations were targeted to either confirm previous soil data or to fill data gaps to better inform the recommendations outlined in this PSI.

The investigation was undertaken in general accordance with the initial sampling plan, slight changes to the locations were made during the fieldwork component of the PSI based on observational data to:

- Ensure a dynamic sampling plan that allowed flexibility to locate test pits based on the proposed design and field observations;
- Targeting sampling at the most significant areas of environmental concern at the Site.

It is noted that the PSI was to provide preliminary contamination data and all identified areas of environmental concern were not targeted as part of the investigation.

APPENDIX D: GROUNDWATER BORE SEARCH

ACT Government
Environment and Sustainable Development

Mr John O'Brien
SMEC
Email: john.o'brien@smec.com

Dear Mr O'Brien

I refer to your application for a groundwater bore search with a 2 km buffer zone of Block 1 Section 102 Yarralumla. There are three (3) privately managed groundwater abstraction bores registered under the *Water Resources Act 2007* within the search area

Bore Number	Construction Date	Depth of Bore	Static Water Level
WU36	Unknown	43m	35m
WU105	Unknown	Unknown	Unknown
WU609	Unknown	Unknown	Unknown

There is also one (1) investigation or monitoring bores ('Woden3') within the 2km buffer, and a fourth groundwater abstraction bore (WU611) just outside of the search area. No further information is available for either 'Woden3' or WU611.

Please note that this search does not include bores associated with contaminated sites. If you require more information please contact Contaminated Sites (Environment Protection Authority) on 132281.

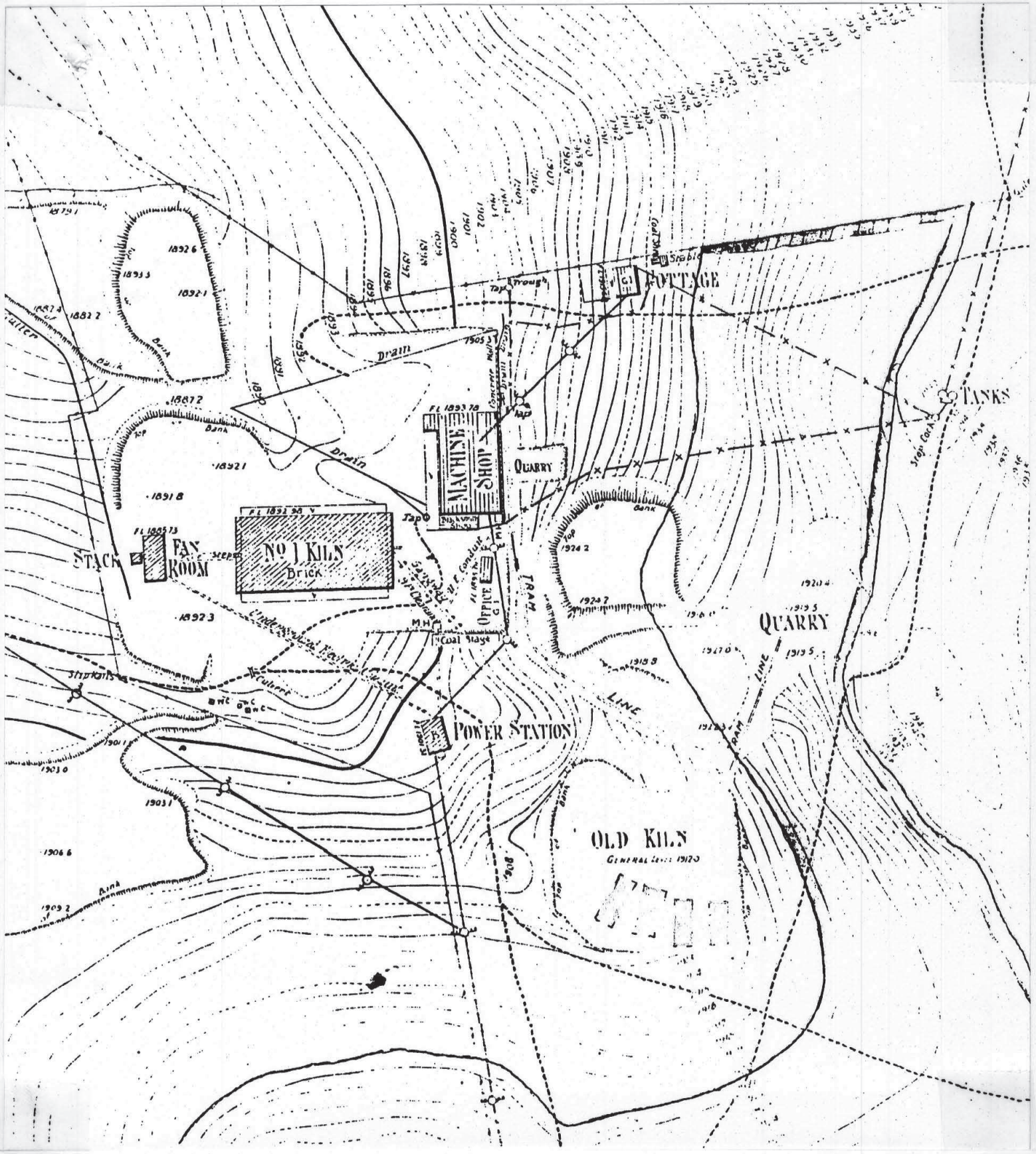
If you have any questions please contact me on (02) 6207 1354 or email Ronald.chesham@act.gov.au.

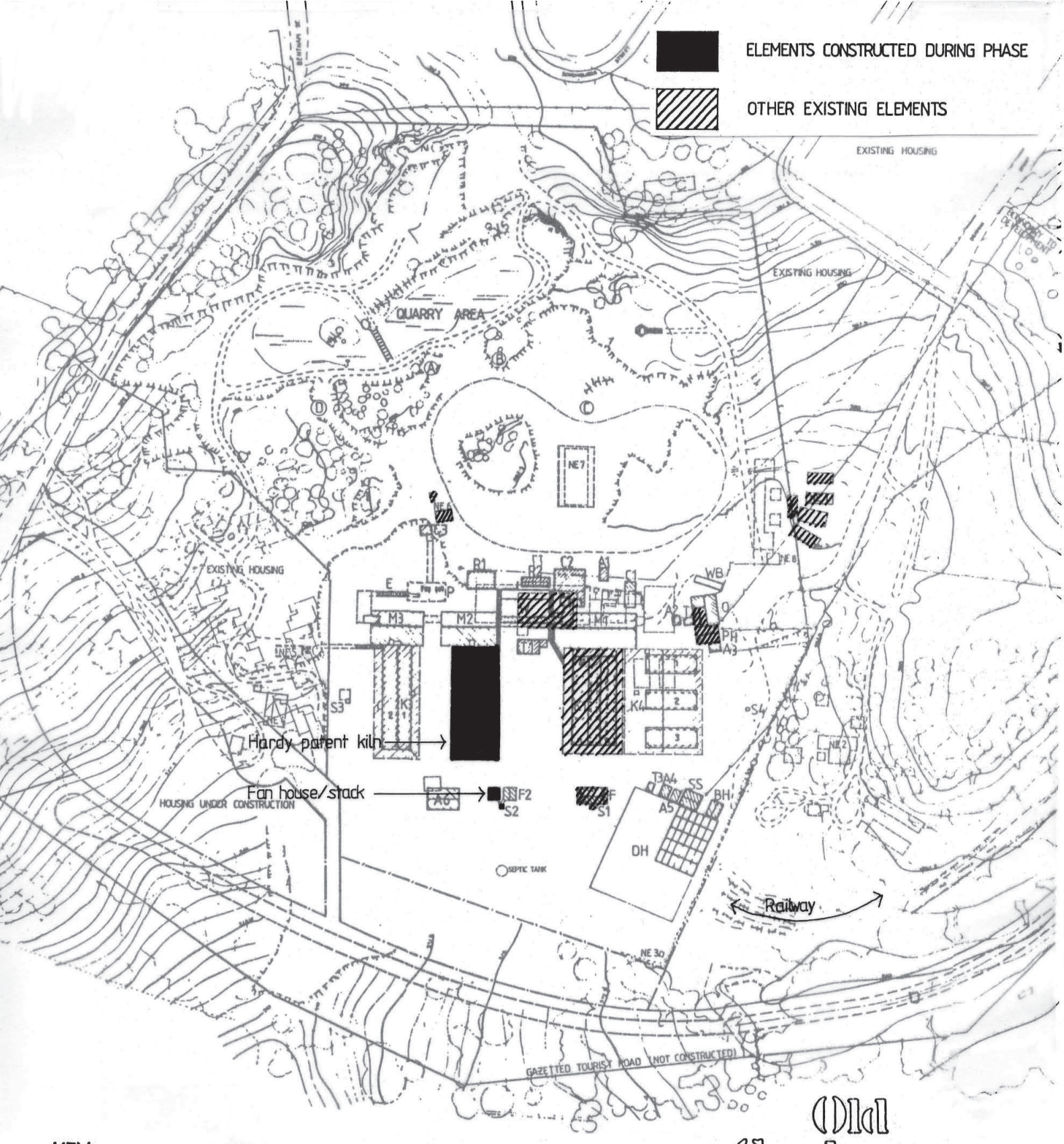
Yours sincerely

Ron Chesham
Environment Protection Officer
Water Regulation
3 October 2013

Environment Protection and Water Regulation
Environment and Sustainable Development Directorate
Dame Pattie Menzies House - 16 Challis Street - Dickson ACT 2602
GPO Box 158 Canberra ACT 2601
Telephone 132281 - Facsimile 6207 6084

APPENDIX E: HISTORICAL PLANS


COTTAGE
TANKS
MACHINE SHOP
QUARRY
No 1 KILN
Brick
STACK
FAN ROOM
OFFICE
Coal Stage
POWER STATION
QUARRY
OLD KILN
Drain
Bank
Top
Trough
Stable
Steps
Culvert
Underground Power Cable
Steps
Tramline
Line
Tramline
Line
Bank
Top
Bank
Top
Bank
Top



Old Canberra Brickworks

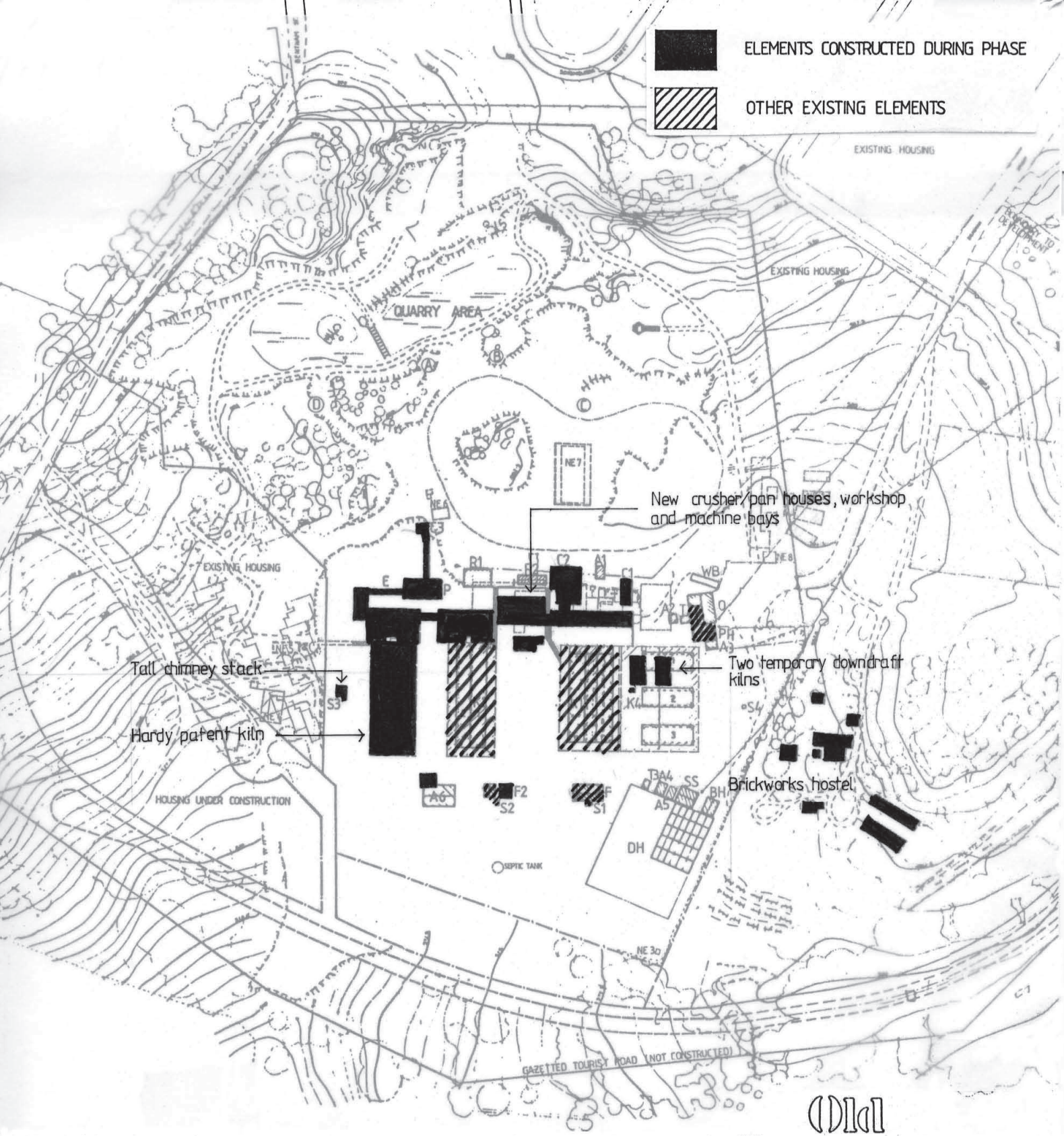
EXPANSION PHASE mid 1920's

Lester Firth Associates Pty Ltd

0 10 20 30 50 100 m

KEY

K1 Kiln . Staffordshire c 1915
K2 Kiln . Hardy Patent c 1927
K3 Kiln . Hardy Patent c 1953
K4 Kiln . Downdraft c 1961
F1 Fan House for Staffordshire c 1915
F2 Fan House for Patent c 1927
S1 Chimney Stack for Staffordshire c 1915
S2 Chimney Stack for Patent c 1927
S3 Chimney Stack for Patent c 1953
S4 Chimney Stack for Downdraft c 1961
M1 Machine Bay for Staffordshire and Downdraft c 1955 (also Brick Press Building 1)
M2 Machine Bay Patent c 1955
M3 Machine Bay Patent c 1955
W Workshop c 1955
C1 Small Crusher House (Hazemeg)
C2 Large Crusher House (or Pan Building) c 1955
C3 Primary Crusher House c 1955
P Pan Building Site c 1955
E Elevator Conveyor c 1955
O Offices c 1916
PH Power House c 1915
WB Weighbridge c 1960's
T1 Toilet Block (lockers, lunch & first aid) c 1947/50
T2 Minor toilet block
T3 Minor toilet block
BH Boiler House c 1971
SS Sub Station and Control Room c 1971
DH Drying House and Slab c 1971
R1 Railway (model) Workshop c 1979
R2 Railway (model) Storage Shed c 1979
Q Quarry Brickpit
A Geological Monument
B Geological Monument
C Geological Monument
D Geological Monument
A1 Ancillary Building Storage Shed c 1958
A2 Ancillary Building Studio/Shed
A3 Ancillary Building Studio/Shed Former Burners Hut
A4 Ancillary Building Studio/Shed
A5 Ancillary Building Studio/Shed
A6 Forklift Shed c 1965
NE1 Site of 1913 Temporary Open kilns and workshop
NE2 Site of Brickworks Camp (Accommodation village)
NE3 Site of Explosives Store
NE4 Site of Weatherboard Cottage
NE5 Site of oil tank/coal store
NE6 Site of Cottage and associated buildings 1916
NE7 Site of Clay Storage Area (shed)
NE8 Site of Carpenters Shed



Old Canberra Brickworks

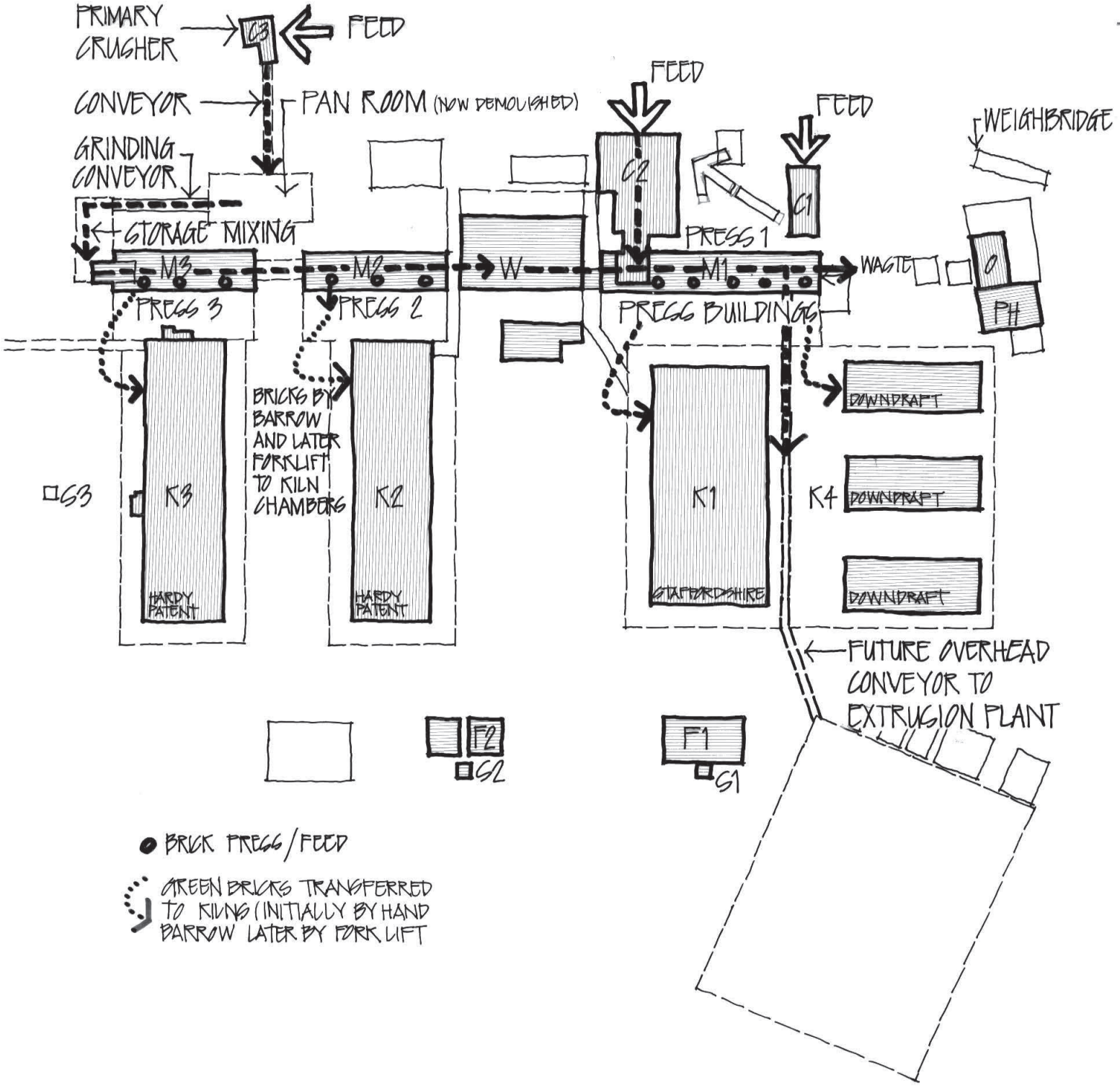
EXPANSION PHASE 1950's

KEY

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K2 Kiln . Hardy Patent c 1927
K3 Kiln . Hardy Patent c 1953
K4 Kiln . Downdraft c 1963
F1 Fan House for Staffordshire c 1915
F2 Fan House for Patent c 1927
S1 Chimney Stack for Staffordshire c 1915
S2 Chimney Stack for Patent c 1927
S3 Chimney Stack for Patent c 1953
S4 Chimney Stack for Downdraft c 1963
M1 Machine Bay for Staffordshire and Downdraft c 1955 (also Brick Press Building 1)
M2 Machine Bay Patent c 1955
M3 Machine Bay Patent c 1955
W Workshop c 1955
C1 Small Crusher House (Hazemeg)
C2 Large Crusher House (or Pan Building) c 1955
C3 Primary Crusher House c 1955
P Pan Building Site c 1955
E Elevator Conveyor c 1955
O Offices c 1916
PH Power House c 1915
WB Weighbridge c 1960's
T1 Toilet Block (lockers, lunch & first aid) c 1947/50
T2 Minor toilet block
T3 Minor toilet block
BH Boiler House c 1971
SS Sub Station and Control Room c 1971
DH Drying House and Slab c 1971
R1 Railway (model) Workshop c 1979
R2 Railway (model) Storage Shed c 1979
Q Quarry Brickpit
A Geological Monument
B Geological Monument
C Geological Monument
D Geological Monument
A1 Ancillary Building Storage Shed c 1958
A2 Ancillary Building Studio/Shed
A3 Ancillary Building Studio/Shed Former Burners Hut
A4 Ancillary Building Studio/Shed
A5 Ancillary Building Studio/Shed
A6 Forklift Shed c 1965
NE1 Site of 1913 Temporary Open kilns and workshop
NE2 Site of Brickworks Camp (Accomodation village)
NE3 Site of Explosives Store
NE4 Site of Weatherboard Cottage
NE5 Site of oil tank/coal store
NE6 Site of Cottage and associated buildings 1916
NE7 Site of Clay Storage Area (shed)
NE8 Site of Carpenters Shed

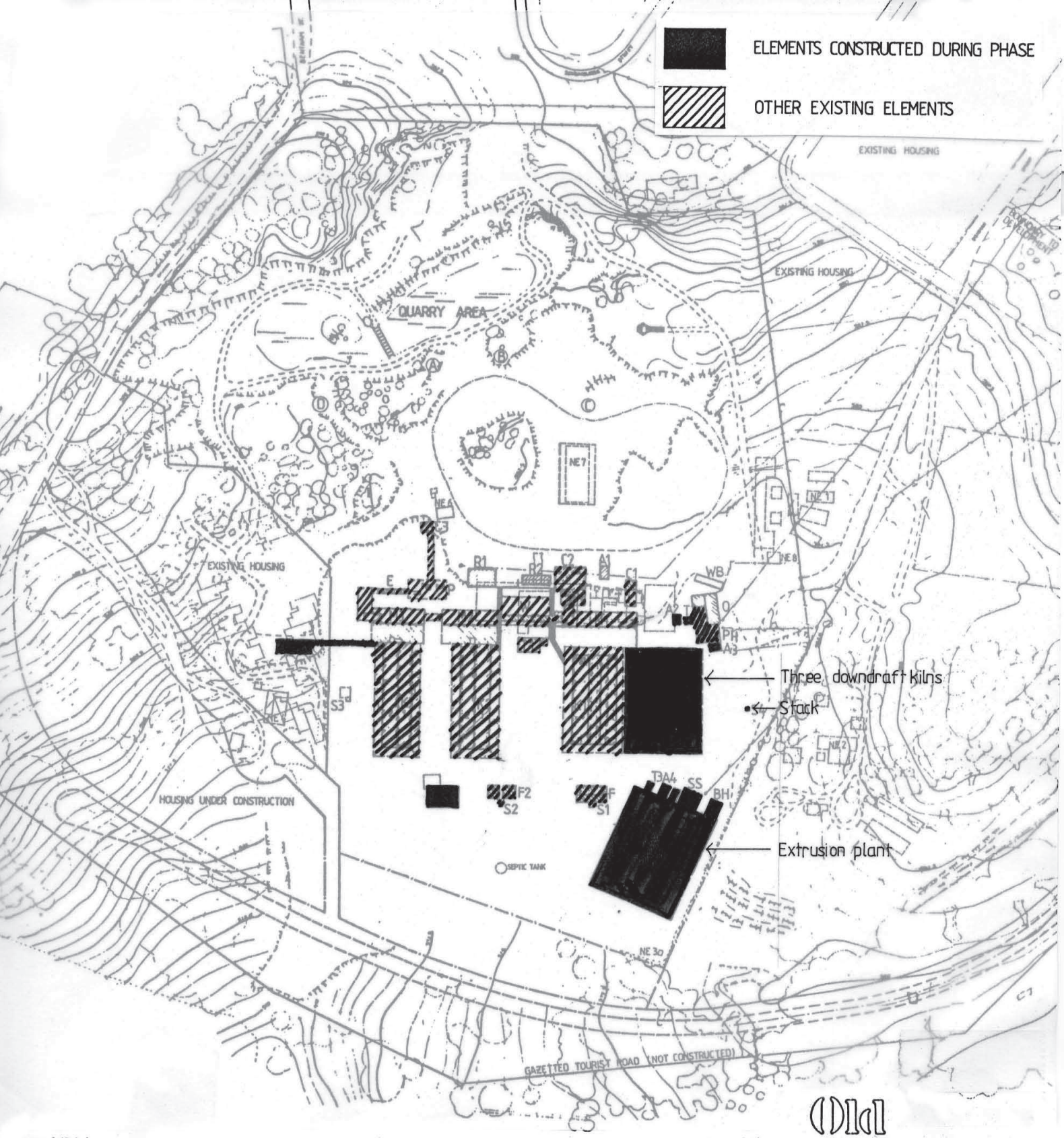
Lester Firth Associates Pty Ltd

0 10 20 30 50 100 m



Old Canberra Brickworks

PROCESS c.1960



Old Canberra Brickworks

EXPANSION PHASE 1960 – mid 1970's

KEY

K1 Kiln . Staffordshire c 1915
K2 Kiln . Hardy Patent c 1927
K3 Kiln . Hardy Patent c 1953
K4 Kiln . Downdraft c 1963
F1 Fan House for Staffordshire c 1915
F2 Fan House for Patent c 1927
S1 Chimney Stack for Staffordshire c 1915
S2 Chimney Stack for Patent c 1927
S3 Chimney Stack for Patent c 1953
S4 Chimney Stack for Downdraft c 1963
M1 Machine Bay for Staffordshire and Downdraft c 1955 (also Brick Press Building 1)
M2 Machine Bay Patent c 1955
M3 Machine Bay Patent c 1955
W Workshop c 1955
C1 Small Crusher House (Hazemeg)
C2 Large Crusher House (or Pan Building) c 1955
C3 Primary Crusher House c 1955
P Pan Building Site c 1955
E Elevator Conveyor c 1955
O Offices c 1916
PH Power House c 1915
WB Weighbridge c 1960's
T1 Toilet Block (lockers, lunch & first aid) c 1947/50
T2 Minor toilet block
T3 Minor toilet block
BH Boiler House c 1971
SS Sub Station and Control Room c 1971
DH Drying House and Slab c 1971
R1 Railway (model) Workshop c 1979
R2 Railway (model) Storage Shed c 1979
Q Quarry Brickpit
A Geological Monument
B Geological Monument
C Geological Monument
D Geological Monument
A1 Ancillary Building Storage Shed c 1958
A2 Ancillary Building Studio/Shed
A3 Ancillary Building Studio/Shed Former Burners Hut
A4 Ancillary Building Studio/Shed
A5 Ancillary Building Studio/Shed
A6 Forklift Shed c 1965
NE1 Site of 1913 Temporary Open kilns and workshop
NE2 Site of Brickworks Camp (Accommodation village)
NE3 Site of Explosives Store
NE4 Site of Weatherboard Cottage
NE5 Site of oil tank/coal store
NE6 Site of Cottage and associated buildings 1916
NE7 Site of Clay Storage Area (shed)
NE8 Site of Carpenters Shed

Lester Firth Associates Pty Ltd

0 10 20 30 50 100 m

APPENDIX F: ESDD CONTAMINATED LAND SEARCH

ACT Government
Environment and Sustainable Development

File Ref: 99/2645

Mr John O'Brien
SMEC Australia Pty Ltd
Suite 2, Level 1, 243 Northbourne Ave
Lyneham ACT 2602

RE: CONTAMINATED LAND SEARCH

Dear Mr O'Brien

Thank you for your search form request of 20/09/2013 enquiring about:

Blocks 1, 7 and 20 Section 102 Yarralumla Canberra Central

Records held by the Environment Protection Authority (EPA) for the above block(s) indicate the following:

The blocks are recorded on the EPA's contaminated sites management database and geographic information system.

There are records of an abandoned commercial brickworks on Blocks 1, 7 and 20 Section 102 Yarralumla.

The EPA has received a phase1 environmental assessment report prepared by Cornell Wagner dated February 2001 for the former brickworks site. The report identified a number of areas of environmental concern which included underground fuel storage, coal storage, explosive storage, landfill areas and brickworks buildings and kilns and a list of possible contaminants which included: hydrocarbons, PAHs, PCBs, BTEX, heavy metals and asbestos.

The EPA supported the consultant's recommendations that further assessment, remediation and validation was required at the site and included that any further assessment would require independent audit by an EPA accredited environmental auditor.

The ANZECC 1992, Guidelines for the Assessment and Management of Contaminated Sites and the ACT EPA 2009, Contaminated Sites Environment Protection Policy (CSEPP) list fuel storage facilities, brickworks and landfilling as activities associated with land contamination.

A draft remedial action plan for the remediation of identifed asbestos material in soil at the site was received by the EPA in 2007. The EPA has no records to indicate that these works were undertaken.

The EPA also received a contaminated land notification under the *Environment Protection Act 1997* from ACT Property Group in 2007 in relation to identified contamination at the site.

The ACT Government's "Strategic Plan for Contaminated Sites Management 1995" and the CSEPP specifically requires that potentially contaminated land be investigated at the earliest stages of the planning process to ensure a site is suitable for the proposed development.

Due to the large quantity of asbestos sheeting at the site and the likelihood of fuel storage you or your client should also contact WorkSafe ACT on (02) 6205 0200 regarding the status of any fuel storage facilities at the site and the status of any asbestos abatement work at the site.

The EPA has not issued any environment protection orders under sections 91C (1), 91D (1) or 125 (4) of the *Environment Protection Act 1997* (the Act) over the sites and as a result the sites are not recorded on the Register of contaminated sites under section 21(A) of the Act.

The information detailed above only relates to records held by the EPA and may not represent the actual condition of the site.

At present the EPA has no information on contamination of the above block(s) other than as detailed above. However, this does not absolutely rule out the possibility of contamination and should not be interpreted as a warranty that there is no contamination.

I appreciate that this does not absolutely rule out the existence of contamination of the soils. If you or your clients wish to be completely sure you, or they, should arrange to conduct independent tests.

Yours sincerely

Mark Heckenberg

Mark Heckenberg
Project Officer
Environment Protection and Water Regulation

23/09/2013

ACT Government
Environment and Sustainable Development

File Ref: 97/5182; 97/5209; 97/19894

Mr John O'Brien
SMEC Australia Pty Ltd
Suite 2, Level 1, 243 Northbourne Ave
Lyneham ACT 2602

RE: CONTAMINATED LAND SEARCH

Dear Mr O'Brien

Thank you for your search form request of 20/09/2013 enquiring about:

Block 1 Section 75 Deakin Canberra Central

Block 3 Section 94, Block 2 Section 103, Block 1 Section 113, Block 7 Section 121, and Block 1 Section 127 Yarralumla Canberra Central

Block 1 Section 123 Curtin Woden Valley

Records held by the Environment Protection Authority (EPA) for the above block(s) indicate the following:

The blocks are not recorded on the EPA's contaminated sites management database or geographic information system.

The EPA has not issued any environment protection orders under sections 91C (1), 91D (1) or 125 (4) of the *Environment Protection Act 1997* (the Act) over the sites and as a result the sites are not recorded on the Register of contaminated sites under section 21(A) of the Act.

At present the EPA has no information on contamination of the above block(s). However, this does not absolutely rule out the possibility of contamination and should not be interpreted as a warranty that there is no contamination.

I appreciate that this does not absolutely rule out the existence of contamination of the soils. If you or your clients wish to be completely sure, you, or they, should arrange to conduct independent tests.

Yours sincerely

Mark Heckenberg
Project Officer
Environment Protection and Water Regulation
23/09/2013

ACT Government
Environment and Sustainable Development

File Ref: 97/05209

Mr John O'Brien
SMEC Australia Pty Ltd
Suite 2, Level 1, 243 Northbourne Ave
Lyneham ACT 2602

RE: CONTAMINATED LAND SEARCH

Dear Mr O'Brien

Thank you for your search form request of 03/10/2013 enquiring about:

Block 4 Section 65 Deakin Canberra Central

Records held by the Environment Protection Authority (EPA) for the above block(s) indicate the following:

The block is not recorded on the EPA's contaminated sites management database or geographic information system.

EPA records indicate that the site is currently occupied by public playing fields. Whilst there is no recorded information on potential site contamination, public playing fields have been associated in the past with site contamination due to the application of certain chemicals for the control of weeds and pests and the placement of uncontrolled fill during the establishment of the fields. The storage of herbicides/pesticides may also have been undertaken at the site for the above purpose.

The EPA has not issued any environment protection orders under sections 91C (1), 91D (1) or 125 (4) of the Environment Protection Act 1997 (the Act) over the site and as a result the site is not recorded on the Register of contaminated sites under section 21(A) of the Act.

The information detailed above only relates to records held by the EPA and may not represent the actual condition of the site.

At present EPA has no information on contamination of the above block(s) other than as detailed above. However, this does not absolutely rule out the possibility of contamination and should not be interpreted as a warranty that there is no contamination.

I appreciate that this does not absolutely rule out the existence of contamination of the soils. If you or your clients wish to be completely sure you, or they, should arrange to conduct independent tests.

Yours sincerely

Mark Heckenberg

Mark Heckenberg
Project Officer
Environment Protection and Water Regulation

08/10/2013

ACT Government
Environment and Sustainable Development

TAX INVOICE

Date: 03/10/2013

Receipt Number: 1269112248

To:
Mr John O'Brien
SMEC Australia Pty Ltd
Suite 2, Level 1, 243 Northbourne Ave
Lyneham ACT 2602

Quantity	Description of Supply	Price	Total
	Contaminated Land Search		
1	Block 4, Section 65, Deakin, Canberra Central	$39.90	$39.90
TOTAL AMOUNT PAID			$39.90

THE TOTAL PRICE INCLUDES GST

APPENDIX G: DANGEROUS GOODS

OFFICE OF REGULATORY SERVICES
DEPARTMENT OF JUSTICE & COMMUNITY SAFETY

2 September 2013

John O'Brien
SMEC Australia Pty Ltd
Suite 2, Level 1
243 Northbourne Ave
LYNEHAM ACT 2602

Thank you for your application for a records search for the Block 1 and 7 Section 10 Old Canberra Brickworks, Denman Street Yarralumla ACT.

I have conducted a search of the Dangerous Substances Register and the Dangerous Goods Database and hold no records for the above block and section.

(Please note: Under the *Dangerous Goods Act 1975* (1975 to April 2004), tanks of 50,000 litres which contained Diesel were not required to be licenced with WorkCover, only if the capacity was over 50,000 litres).

If you have any questions in relation to this matter please do not hesitate in contacting me on 62076353 or email lisa.curran@act.gov.au.

Regards

Lisa Curran
Administration Officer
Dangerous Substances Licencing
WorkSafe ACT

WORKSAFE ACT
LVL 3 CALLAM OFFICES EASTY STREET PHILLIP ACT 2606 |
GPO BOX 158 CANBERRA ACT 2601 |
PHONE 6207 3000 | FAX 6205 0336 |
WORKSAFE@ACT.GOV.AU | WORKSAFE.ACT.GOV.AU

APPENDIX H: SITE PHOTOGRAPHIC LOG

SITE PHOTOGRAPHIC LOG

PHOTO ID: 1	CANBERRA BRICKWORKS
DATE: 2/10/13 **DESCRIPTION:** The brickworks are currently used by Thor's Hammer for the storage of recycled wood	

PHOTO ID: 2	
DATE: 2/10/13 **DESCRIPTION:** Remnant brick buildings, some showing signs of disrepair.	

PHOTO ID: 3	CANBERRA BRICKWORKS
DATE: 2/10/13 **DESCRIPTION:** Sheen observed in drains at the rear of Machine Shed 1	
PHOTO ID: 4	
DATE: 2/10/13 **DESCRIPTION:** Remnant structure of crusher plants. Several rusted oil drums (labelled lubrication oil) were also noted.	

PHOTO ID: 5	CANBERRA BRICKWORKS
DATE: 2/10/2013 **DESCRIPTION:** General areas around the machinery sheds were littered with empty drums, scrap metal and other waste materials	

PHOTO ID: 6	
DATE: 20/8/2013 **DESCRIPTION:** Remnant concrete footing of machinery used in the crushing and transporting of raw materials to the machinery shed. The disused oil pressure/storage tank located left of the footings. Crusher House 3 is located in the background.	

PHOTO ID: 7	CANBERRA BRICKWORKS
DATE: 2/10/2013 **DESCRIPTION:** Northern fill mound at the quarry. Observed to comprise reworked natural soils, brick waste and quarry overburden. Several fragments of ACM were observed.	
PHOTO ID: 8	
DATE: 2/10/2013 **DESCRIPTION:** Remnant brick structure, pieces of brick, concrete and structural steel observed.	

PHOTO ID: 9	CANBERRA BRICKWORKS
DATE: 2/10/2013 **DESCRIPTION:** Interceptor pit located adjacent to remnant brick structure. Purpose is unclear. Likely used to receive domestic wash (oils, fats cleaning products).	
PHOTO ID: 10	
DATE: 2/10/2013 **DESCRIPTION:** Abandoned vehicle overgrown with grass and black berry bushes.	

PHOTO ID: 11	CANBERRA BRICKWORKS
DATE: 2/10/2013 **DESCRIPTION:** Two concrete lined pits were located adjacent to remnants of an unnamed vehicle track (currently used by pedestrians	
PHOTO ID: 12	
DATE: 2/10/2013 **DESCRIPTION:** The pits were empty with soil material, broken tiles and glass bottles observed at the base.	

PHOTO ID: 13	CANBERRA BRICKWORKS
DATE: 2/10/2013 **DESCRIPTION:** The material comprised bricks, metal, and general waste and was approximated to be 10 m^3. Several fragments of ACM were also observed.	
PHOTO ID: 12	
DATE: 2/10/2013 **DESCRIPTION:** The pits were empty with soil material, broken tiles and glass bottles observed at the base.	

APPENDIX I: SOIL ANALYTICAL TABLES

						BTEX							Halogenated Benzenes	Lead	Metals											
			Benzo(b&j)fluoranthene	Carcinogenic PAHs (as BaP TEQ)	TRH C37-C40	TRH C6-C10 minus BTEX (F1)	Benzene	Ethylbenzene	Toluene	Total BTEX	Xylene (m & p)	Xylene (o)	Xylene Total	Hexachlorobenzene	Lead	Arsenic	Beryllium	Boron	Cadmium	Chromium (hexavalent)	Cobalt	Copper	Manganese	Mercury	Nickel	Selenium	Zinc
			mg/kg	TEQ	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.1	0.2	100	25	0.1	0.1	0.1	0.6	0.2	0.1	0.3	0.1	1	3	0.3	5	0.3	0.5	0.3	0.5	0.3	0.01	0.5	2	0.5
CSM NEPM Residential A Soil														10	300	100	60	4500	20	100	100	6000	3800	40	400	200	7400
CSM NEPM Residential B Soil														15	1200	500	90	40000	150	500	600	30000	14000	120	1200	1400	60000
CSM NEPM Recreational C Soil														10	600	300	90	20000	90	300	300	17000	19000	80	1200	700	30000
CSM NEPM Residential HSL A & B for Vapour Intrusion, 0 to <1m, Sand							1	330	1300		220	220	220														
CSM NEPM P EIL															1100	100						210			270		770
Field_ID	**Date**	**SDG**																									
TP01-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	19	3	0.5	<5	<0.3	<0.5	8.4	10	620	0.02	7.8	<2	41
TP02-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	18	<3	0.7	<5	<0.3	<0.5	4.4	6.5	250	0.02	4.3	<2	22
TP03-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	35	9	1.1	<5	<0.3	<0.5	15	16	1200	0.01	13	<2	49
TP04-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	15	<3	0.6	<5	<0.3	<0.5	6.2	8.6	310	0.01	11	<2	45
TP05-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	39	6	0.7	<5	<0.3	<0.5	8.4	14	720	0.02	11	<2	68
TP06-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	54	5	0.4	<5	<0.3	<0.5	5.2	10	900	0.02	6.2	<2	56
TP07-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	93	8	0.8	<5	<0.3	<0.5	12	15	830	0.03	8.8	<2	50
TP08-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	47	5	0.6	<5	<0.3	<0.5	8.7	12	530	0.02	8.8	<2	49
TP09-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	52	6	0.5	<5	<0.3	<0.5	6.7	11	410	0.02	7.9	<2	75
TP10-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	62	4	0.8	<5	<0.3	<0.5	18	23	1500	0.03	9	<2	34
TP11-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	23	7	0.8	<5	<0.3	<0.5	13	16	820	0.02	20	<2	46
TP12-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	15	4	0.5	<5	<0.3	<0.5	6.3	7.1	360	0.02	8.3	<2	110
TP13-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	21	11	0.6	<5	<0.3	<0.5	6.8	8.2	650	0.02	6.5	<2	27
TP14-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	17	<3	0.4	<5	<0.3	<0.5	6	8.1	880	0.01	6.8	<2	30
TP15-0.0	9/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	-	130	6	0.6	<5	0.6	<0.5	7.8	32	800	0.19	8.8	<2	260
TP16-0.0	9/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	-	110	7	0.6	<5	<0.3	<0.5	17	13	1200	0.02	9.8	<2	95
TP17-0.0	9/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	-	25	8	0.6	<5	<0.3	<0.5	8.2	9.6	390	0.01	12	<2	49
TP18-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	<0.1	49	8	1.1	<5	<0.3	<0.5	30	17	1900	0.02	19	2	18
TP19-0.0	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP20-0.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	160	4	<0.3	6	<0.3	<0.5	3.1	70	160	0.01	9.4	<2	44
TP20-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	10	<3	<0.3	<5	<0.3	<0.5	1.8	3.2	73	0.01	3.1	<2	7.9
TP21-0.5	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	-	34	5	0.6	<5	<0.3	<0.5	5.5	30	350	0.02	12	<2	93
TP21-1.0	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	-	37	11	0.6	30	<0.3	<0.5	7.2	25	270	0.02	21	<2	71
TP22-0.5	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	-	51	7	1.1	8	<0.3	<0.5	8.8	17	400	0.03	19	<2	96
TP22-1.0	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	-	29	13	1	11	<0.3	<0.5	10	27	630	0.01	37	<2	150
TP23-0.5	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	28	9	0.8	<5	<0.3	<0.5	9.9	19	460	0.02	19	<2	55
TP23-2.0	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	29	8	0.7	<5	<0.3	<0.5	15	14	730	0.01	20	<2	66
TP24-0.0	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	10	4	0.4	<5	<0.3	<0.5	5.6	7.6	210	0.01	7.5	<2	24
TP25-0.5	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	31	12	0.7	<5	<0.3	<0.5	12	21	720	0.03	22	<2	74
TP25-2.0	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	32	10	0.8	7	<0.3	<0.5	13	20	640	0.04	24	<2	79
TP26-0.5	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	25	6	0.7	<5	<0.3	<0.5	12	22	1100	0.01	18	<2	53
TP26-2.0	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	24	5	0.7	<5	<0.3	<0.5	11	39	740	<0.01	19	<2	65
TP27-0.0	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	23	10	0.7	<5	<0.3	<0.5	11	12	520	0.04	17	<2	45
TP28-0.5	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	14	6	0.8	<5	<0.3	<0.5	11	22	970	0.01	22	<2	49
TP28-2.0	11/09/2013	SE120709-1	<0.1	<0.2	<100	<25	<0.1	<0.1	<0.1	<0.6	<0.2	<0.1	<0.3	<0.1	11	7	0.8	<5	<0.3	<0.5	12	20	620	<0.01	24	<2	38

EIL = Ecological Investigation Levels (residnetial/open space - aged)
HSL = Health Screening Level
HIL = Health Based Investigation Limit
EQL = Estimated Quantitation Limit
n.d = Non-detect

			Organochlorine Pesticides																										Pesticides			Phenolics	Other		
			2,4-DDT	4,4-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane (cis)	gamma-Chlordane	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	o,p-DDD	o,p'-DDE	trans-Nonachlor	Isodrin	Mirex	Parathion	Phenols	Estimated Fibres	Azinophos methyl	Bromophos-ethyl
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1		0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	100	0.2	0.2
CSM NEPM Residential A Soil							6							240					10				6		300					10					
CSM NEPM Residential B Soil							10							600					20				10		500					20					
CSM NEPM Recreational C Soil							10							400					20				10		400					20					
CSM NEPM Residential HSL A & B for Vapour Intrusion																																			
CSM NEPM P EIL														180																					
Field_ID	**Date**	**SDG**																																	
TP01-0.0	10/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP02-0.0	10/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP03-0.0	10/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP04-0.0	10/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP05-0.0	9/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP06-0.0	9/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP07-0.0	9/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP08-0.0	9/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP09-0.0	9/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP10-0.0	10/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP11-0.0	10/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP12-0.0	10/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	0	<0.2	<0.2
TP13-0.0	10/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP14-0.0	9/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP15-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-
TP16-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-
TP17-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-
TP18-0.0	10/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	-	<0.2	<0.2
TP19-0.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP20-0.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-
TP20-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP21-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP21-1.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP22-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-
TP22-1.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-
TP23-0.5	11/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	0.1	0	<0.2	<0.2
TP23-2.0	11/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	0	<0.2	<0.2
TP24-0.0	11/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	0.2	0	<0.2	<0.2
TP25-0.5	11/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	0	<0.2	<0.2
TP25-2.0	11/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	0	<0.2	<0.2
TP26-0.5	11/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	0	<0.2	<0.2
TP26-2.0	11/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	0	<0.2	<0.2
TP27-0.0	11/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	0.3	0	<0.2	<0.2
TP28-0.5	11/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	0	<0.2	<0.2
TP28-2.0	11/09/2013	SE120709-1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	0	<0.2	<0.2

EIL = Ecological Investigation Levels (residnetial/open sp
HSL = Health Screening Level
HIL = Health Based Investigation Limit
EQL = Estimated Quantitation Limit
n.d = Non-detect

	Organophosphorous Pesticides								PAH/Phenols																				Polychlorinated Biphenyls						
	Chlorpyrifos	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Methidathion	1-Methylnaphthalene	2-methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Carcinogenic PAHs as B(a)P TPE	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.2	0.5	0.5	0.5	0.2	0.2	0.2	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2
CSM NEPM Residential A Soil	160															3									300									
CSM NEPM Residential B Soil	340															4									400									
CSM NEPM Recreational C Soil	250															3									300									
CSM NEPM Residential HSL A & B for Vapour Intrusion,																																		
CSM NEPM P EIL																								170										
Field_ID	**Date**	**SDG**																																	
TP01-0.0	10/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP02-0.0	10/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP03-0.0	10/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP04-0.0	10/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP05-0.0	9/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP06-0.0	9/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP07-0.0	9/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP08-0.0	9/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP09-0.0	9/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10-0.0	10/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP11-0.0	10/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP12-0.0	10/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP13-0.0	10/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP14-0.0	9/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP15-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	-	-	-	-	-	-	-
TP16-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	-	-	-	-	-	-	-
TP17-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	-	-	-	-	-	-	-
TP18-0.0	10/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19-0.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	-	-	-	-	-	-	-
TP20-0.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP20-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP21-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	-	-	-	-	-	-	-
TP21-1.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	-	-	-	-	-	-	-
TP22-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	0.1	<0.1	-	-	-	-	-	-	-
TP22-1.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	-	-	-	-	-	-	-
TP23-0.5	11/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TP23-2.0	11/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TP24-0.0	11/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TP25-0.5	11/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TP25-2.0	11/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TP26-0.5	11/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TP26-2.0	11/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TP27-0.0	11/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TP28-0.5	11/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TP28-2.0	11/09/2013	SE120709-1	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.232	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.8	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

EIL = Ecological Investigation Levels (residnetial/open sp
HSL = Health Screening Level
HIL = Health Based Investigation Limit
EQL = Estimated Quantitation Limit
n.d = Non-detect

				TPH										Explosives Suite																							
	Arochlor 1268	Aroclor 1262	PCBs (Sum of total)	C10-C16	C16-C34	C34-C40	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	C10 - C40 (Sum of total)	C6-C10	HMX	RDX	1.3.5-TNB	1.3-DNB	Tetryl	NB	TNT	4-Amino-2.6-Dinitrotoluene	2-Amino-4.6-Dinitrotoluene	DNT	2-MNT	3-MNT	4-MNT	PETN	NG	1.4-DNB	2-Amino-4.6-Dinitrotoluene	4-Amino-2.6-Dinitrotoluene	1.3-DNB	1.4-DNB			
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/L	mg/L	mg/L	mg/L			
EQL	0.2	0.2	1	25	90	120	20	20	45	45	110	210	25	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0			
CSM NEPM Residential A Soil			1																																		
CSM NEPM Residential B Soil			1																																		
CSM NEPM Recreational C Soil			1																																		
CSM NEPM Residential HSL A & B for Vapour Intrusion,				130									180																								
CSM NEPM P EIL																																					

Field_ID	Date	SDG																																				
TP01-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP02-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP03-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP04-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP05-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP06-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP07-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP08-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP09-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP11-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP12-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP13-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP14-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP15-0.0	9/09/2013	SE120709-1	-	-	-	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP16-0.0	9/09/2013	SE120709-1	-	-	-	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP17-0.0	9/09/2013	SE120709-1	-	-	-	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19-0.0	11/09/2013	SE120709-1	-	-	-	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
TP20-0.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP20-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP21-0.5	11/09/2013	SE120709-1	-	-	-	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP21-1.0	11/09/2013	SE120709-1	-	-	-	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP22-0.5	11/09/2013	SE120709-1	-	-	-	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP22-1.0	11/09/2013	SE120709-1	-	-	-	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP23-0.5	11/09/2013	SE120709-1	<0.2	<0.2	<1	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP23-2.0	11/09/2013	SE120709-1	<0.2	<0.2	<1	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP24-0.0	11/09/2013	SE120709-1	<0.2	<0.2	<1	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP25-0.5	11/09/2013	SE120709-1	<0.2	<0.2	<1	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP25-2.0	11/09/2013	SE120709-1	<0.2	<0.2	<1	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP26-0.5	11/09/2013	SE120709-1	<0.2	<0.2	<1	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP26-2.0	11/09/2013	SE120709-1	<0.2	<0.2	<1	35	110	<120	<20	<20	120	<45	120 - 152.5	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP27-0.0	11/09/2013	SE120709-1	<0.2	<0.2	<1	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP28-0.5	11/09/2013	SE120709-1	<0.2	<0.2	<1	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP28-2.0	11/09/2013	SE120709-1	<0.2	<0.2	<1	<25	<90	<120	<20	<20	<45	<45	<110	<210	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

EIL = Ecological Investigation Levels (residnetial/open s
HSL = Health Screening Level
HIL = Health Based Investigation Limit
EQL = Estimated Quantitation Limit
n.d = Non-detect

	DNT	HMX	2-MNT	3-MNT	4-MNT	NB	NG	PETN	RDX	Tetryl	1.3.5-TNB	TNT
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL	0	0	0	0	0	0	0	0	0	0	0	0
CSM NEPM Residential A Soil												
CSM NEPM Residential B Soil												
CSM NEPM Recreational C Soil												
CSM NEPM Residential HSL A & B for Vapour Intrusion,												
CSM NEPM P EIL												

Field_ID	Date	SDG											
TP01-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP02-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP03-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP04-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP05-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP06-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP07-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP08-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP09-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP10-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP11-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP12-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP13-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP14-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP15-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP16-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP17-0.0	9/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP18-0.0	10/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP19-0.0	11/09/2013	SE120709-1	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
TP20-0.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP20-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP21-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP21-1.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP22-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP22-1.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP23-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP23-2.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP24-0.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP25-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP25-2.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP26-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP26-2.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP27-0.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP28-0.5	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-
TP28-2.0	11/09/2013	SE120709-1	-	-	-	-	-	-	-	-	-	-	-	-

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n.d = Non-detect

SDG	SE120709-1	SE120709-1		SE120709-1	SE120709-1		SE120709-1	Interlab_D		SE120709-1	Interlab_D	
Field_ID	TP28-0.5	QC 111	RPD	TP21-1.0	QC 112	RPD	TP26-0.5	QC110	RPD	TP22-0.5	QC113	RPD
Sampled_Date-Time	11/09/2013	11/09/2013		11/09/2013	11/09/2013		11/09/2013	11/09/2013		11/09/2013	11/09/2013	
Chem_Gro	ChemName	Units	EQL									
	Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0			
	Carcinogenic PAHs (as BaP TEQ)	TEQ	0.2	<0.2	<0.2	0	<0.2	<0.2	0			
	TRH C37-C40	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0	0			
	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25.0	<25.0	0	<25.0	<25.0	0			
BTEX	Benzene	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0
	Benzene	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0
	Ethylbenzene	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0
	Toluene	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0
	Total BTEX	mg/kg	0.6	<0.6	<0.6	0	<0.6	<0.6	0						
	Xylene (m & p)	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.2	0
	Xylene (o)	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0
	Xylene Total	mg/kg	0.3	<0.3	<0.3	0	<0.3	<0.3	0	<0.3	<0.3	0	<0.3	<0.3	0
Halogenat	Hexachlorobenzene	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
Lead	Lead	mg/kg	1 (Primary): 5 (Interlab)	14.0	10.0	33	**37.0**	**27.0**	**31**	25.0	25.0	0	**51.0**	**36.0**	**34**
Metals	Arsenic	mg/kg	3 (Primary): 2 (Interlab)	6.0	4.0	40	11.0	9.0	20	6.0	3.2	61	7.0	3.8	**59**
	Beryllium	mg/kg	0.3 (Primary): 2 (Interlab)	0.8	0.5	46	0.6	0.6	0	0.7	<2.0	0	1.1	<2.0	0
	Boron	mg/kg	5 (Primary): 10 (Interlab)	<5.0	<5.0	0	30.0	46.0	42	<5.0	<10.0	0	8.0	<10.0	0
	Cadmium	mg/kg	0.3 (Primary): 0.4 (Interlab)	<0.3	<0.3	0	<0.3	<0.3	0	<0.3	<0.4	0	<0.3	<0.4	0
	Chromium (hexavalent)	mg/kg	0.5 (Primary): 1 (Interlab)	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<1.0	0	<0.5	<1.0	0
	Cobalt	mg/kg	0.3 (Primary): 5 (Interlab)	**11.0**	**7.0**	**44**	7.2	6.7	7	**12.0**	**6.7**	**57**	8.8	9.1	3
	Copper	mg/kg	0.5 (Primary): 5 (Interlab)	**22.0**	**10.0**	**75**	25.0	28.0	11	**22.0**	**11.0**	**67**	17.0	16.0	6
	Manganese	mg/kg	0.3 (Primary): 5 (Interlab)	970.0	730.0	28	270.0	250.0	8	**1100.0**	**480.0**	**78**	400.0	470.0	16
	Mercury	mg/kg	0.01 (Primary): 0.05 (Interlab)	0.01	<0.01	0	0.02	0.01	**67**	0.01	<0.05	0	0.03	<0.05	0
	Nickel	mg/kg	0.5 (Primary): 5 (Interlab)	**22.0**	**12.0**	**59**	21.0	20.0	5	**18.0**	**9.0**	**67**	19.0	15.0	24
	Selenium	mg/kg	2	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	2.1	5
	Zinc	mg/kg	0.5 (Primary): 5 (Interlab)	49.0	48.0	2	71.0	60.0	17	**53.0**	**33.0**	**47**	96.0	120.0	22
Organochl	2,4-DDT	mg/kg	0.1	<0.1	<0.1	0									
	4,4-DDE	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	a-BHC	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	Aldrin	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	b-BHC	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	Chlordane (cis)	mg/kg	0.1	<0.1	<0.1	0									
	gamma-Chlordane	mg/kg	0.1	<0.1	<0.1	0									
	d-BHC	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	DDD	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	DDT	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	Dieldrin	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
	Endosulfan I	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
	Endosulfan II	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
	Endosulfan sulphate	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	Endrin	mg/kg	0.2 (Primary): 0.05 (Interlab)	<0.2	<0.2	0				<0.2	<0.05	0			
	Endrin aldehyde	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	Endrin ketone	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	g-BHC (Lindane)	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	Heptachlor	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	Heptachlor epoxide	mg/kg	0.1 (Primary): 0.05 (Interlab)	<0.1	<0.1	0				<0.1	<0.05	0			
	Methoxychlor	mg/kg	0.1 (Primary): 0.2 (Interlab)	<0.1	<0.1	0				<0.1	<0.2	0			
	o,p-DDD	mg/kg	0.1	<0.1	<0.1	0									
	o,p'-DDE	mg/kg	0.1	<0.1	<0.1	0									
	trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	0									
Organopho	Azinophos methyl	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
	Bromophos-ethyl	mg/kg	0.2	<0.2	<0.2	0									
	Chlorpyrifos	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
	Diazinon	mg/kg	0.5	<0.5	<0.5	0				<0.5	<0.5	0			
	Dichlorvos	mg/kg	0.5	<0.5	<0.5	0				<0.5	<0.5	0			
	Dimethoate	mg/kg	0.5	<0.5	<0.5	0				<0.5	<0.5	0			
	Ethion	mg/kg	0.2	<0.2	<0.2	0									
	Fenitrothion	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
	Malathion	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
	Methidathion	mg/kg	0.5	<0.5	<0.5	0									
Other	Estimated Fibres	mg/kg	100	0.0	0.0	0									
PAH/Phen	1-Methylnaphthalene	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0						
	2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0						
	Acenaphthene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Acenaphthylene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Anthracene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Benz(a)anthracene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Benzo(a) pyrene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Benzo(g,h,i)perylene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Benzo(k)fluoranthene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Chrysene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Dibenz(a,h)anthracene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Fluoranthene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Fluorene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Naphthalene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	Naphthalene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0
	PAHs (Sum of total)	mg/kg	0.8 (Primary): 1 (Interlab)	<0.8	<0.8	0	<0.8	<0.8	0	<0.8	<0.5	0	<0.8	0.5	0
	Phenanthrene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	0.1	0.5	**133**
	Pyrene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.5	0

SDG				SE120709-1	SE120709-1		SE120709-1	SE120709-1		SE120709-1	Interlab_D		SE120709-1	Interlab_D	
Field_ID				TP28-0.5	QC 111	RPD	TP21-1.0	QC 112	RPD	TP26-0.5	QC110	RPD	TP22-0.5	QC113	RPD
Sampled_Date-Time				11/09/2013	11/09/2013		11/09/2013	11/09/2013		11/09/2013	11/09/2013		11/09/2013	11/09/2013	
Pesticides	Isodrin	mg/kg	0.1	<0.1	<0.1	0									
	Mirex	mg/kg	0.1	<0.1	<0.1	0									
	Parathion	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
Phenolics	Phenols	mg/kg	0.1	<0.1	0.1	0									
Polychlorin	Arochlor 1016	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
	Arochlor 1221	mg/kg	0.2	<0.2	<0.2	0									
	Arochlor 1232	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
	Arochlor 1242	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
	Arochlor 1248	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
	Arochlor 1254	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
	Arochlor 1260	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0				<0.2	<0.5	0			
	Arochlor 1268	mg/kg	0.2	<0.2	<0.2	0									
	Aroclor 1262	mg/kg	0.2	<0.2	<0.2	0									
	PCBs (Sum of total)	mg/kg	1 (Primary): 0.5 (Interlab)	<1.0	<1.0	0				<1.0	<0.5	0			
TPH	C10-C16	mg/kg	25 (Primary): 50 (Interlab)	<25.0	<25.0	0	<25.0	<25.0	0	<25.0	<50.0	0	<25.0	<50.0	0
	C16-C34	mg/kg	90 (Primary): 100 (Interlab)	<90.0	<90.0	0	<90.0	<90.0	0	<90.0	<100.0	0	<90.0	<100.0	0
	C34-C40	mg/kg	120 (Primary): 100 (Interlab)	<120.0	<120.0	0	<120.0	<120.0	0	<120.0	<100.0	0	<120.0	<100.0	0
	C6 - C9	mg/kg	20	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0
	C10 - C14	mg/kg	20	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0
	C15 - C28	mg/kg	45 (Primary): 50 (Interlab)	<45.0	<45.0	0	<45.0	48.0	6	<45.0	<50.0	0	<45.0	51.0	13
	C29-C36	mg/kg	45 (Primary): 50 (Interlab)	<45.0	<45.0	0	<45.0	<45.0	0	<45.0	<50.0	0	<45.0	<50.0	0
	+C10 - C36 (Sum of total)	mg/kg	110 (Primary): 50 (Interlab)	<110.0	<110.0	0	<110.0	<110.0	0	<110.0	<50.0	0	<110.0	51.0	0
	C10 - C40 (Sum of total)	mg/kg	210	<210.0	<210.0	0	<210.0	<210.0	0						
	C6-C10	mg/kg	25 (Primary): 20 (Interlab)	<25.0	<25.0	0	<25.0	<25.0	0	<25.0	<20.0	0	<25.0	<20.0	0

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 80 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

APPENDIX J: TEST PIT LOGS

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP01

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 689880.000, N: 6090395.000 (56 MGA94)
SURFACE ELEVATION : 585.000 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 10/9/13
LOGGED BY : Kara Stariha
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP01-0.0 (0.0-0.2)	585.0 / 0.0		ML	SILT low plasticity, dark brown, trace gravel, rootlets, no odour, no staining	D	F			TOPSOIL
			0.30m TP01-0.5 (0.3-0.5)								0.17: HP In-situ =200 - >450 kPa	
							0.37m					
						GW	Sandy GRAVEL medium grained, to 20 mm, well graded, sub-rounded, grey-brown, with silt, no odour, no staining		D			RESIDUAL SOIL
							0.49m				0.43: HP In-situ =375 - >450 kPa	
				585.5 / 0.5		CL	CLAY low plasticity, grey mottled orange, trace sand, rootlets, no odour, no staining		Fb			
			0.80m TP01-1.0 (0.8-1.0)								0.74: HP In-situ >450 kPa	
				586.0 / 1.0			1.01m					
							DACITE coarse grained, porphyritic, massive, orange with red bands, extremely low strength, highly weathered, highly fractured, no odour, no staining					BEDROCK
							1.16m					
							EXCAVATION TP01 TERMINATED AT 1.16 m Refusal					
				586.5 / 1.5								
				587.0 / 2.0								
				587.5 / 2.5								
				588.0 / 3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP02

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690061.000, N: 6090208.000 (56 MGA94)
SURFACE ELEVATION : 594.960 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 10/9/13
LOGGED BY : Kara Stariha
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP02-0.0 (0.0-0.2)	595.0	0.0		CL	CLAY low plasticity, dark brown, with sand, with grass rootlets, no odour, no staining	D to M	St			TOPSOIL 0.20: HP In-situ =225 - 450 kPa
			0.40m TP02-0.5 (0.4-0.6)	595.5	0.5		ML	0.40m SILT with cobbles low plasticity, dark orange-brown, with gravel, with bitumen, no odour, no staining		S			FILL 0.51: HP In-situ =125 - 150 kPa
			1.00m TP02-1.0 (1.0-1.2)	596.0	1.0			0.62m COBBLES coarse, to 400 mm, well graded, angular, grey, with gravel, with clay, no odour, no staining		MD			
			1.20m TP02-1.3 (1.2-1.4)	596.5	1.5		SW	1.12m Gravelly SAND coarse grained, to 200 mm, well graded, angular, red-brown, with cobbles, with bitumen, bricks, no odour, no staining	D	D			1.20: HP In-situ =425 - >450 kPa 1.30: bricks observed
			1.80m QC108 TP02-2.0 (1.8-2.0)	597.0	2.0			2.10m EXCAVATION TP02 TERMINATED AT 2.10 m Refusal on concrete - Possible abandoned pipe					1.90: asphalt observed
				597.5	2.5								
					3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP03

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690156.000, N: 6090198.000 (56 MGA94)
SURFACE ELEVATION : 592.330 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 10/9/13
LOGGED BY : Kara Stariha
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			QC107 TP03-0.0 (0.0-0.2)	0.0 592.5		CL	CLAY low to medium plasticity, dark brown, with medium grained, well graded, sub-rounded gravel, with grass rootlets, no odour, no staining	D to M	S to F		100 200 300 400	TOPSOIL 0.12: HP In-situ =100 - 150 kPa
			0.30m TP03-0.5 (0.3-0.5)	0.24m		CI	CLAY medium plasticity, grey mottled orange, with medium grained, well graded, sub-rounded gravel, no odour, no staining	M	St			ALLUVIUM 0.37: HP In-situ =175 - 75 kPa
				0.5 593.0		CI	Gravelly CLAY medium plasticity, orange mottled grey, with medium to fine grained, well graded, sub-angular gravel, no odour, no staining	W	VSt			0.58: HP In-situ =450 - >450 kPa
			0.80m TP03-1.0 (0.8-1.0)	0.65m 1.0 593.5			SILTSTONE fine grained, layered, grey weathered orange, medium strength, highly weathered, slightly fractured, no odour, iron staining in fractures	M				BEDROCK
			1.80m TP03-2.0 (1.8-2.0)	1.5 594.0								1.65: Ripper used from 1.65 m
				2.00m 2.0 594.5			EXCAVATION TP03 TERMINATED AT 2.00 m Refusal					
				2.5 595.0								
				3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP04

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690384.000, N: 6090131.000 (56 MGA94)
SURFACE ELEVATION : 590.490 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 10/9/13
LOGGED BY : Kara Stariha
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / E / F / H PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	HAND PENETROMETER kPa 100 200 300 400	STRUCTURE & Other Observations
			TP04-0.0 (0.0-0.2)	590.5 0.0		ML	SILT low plasticity, brown, with coarse, angular gravel, with grass rootlets, non odour, non staining		St			TOPSOIL 0.08: HP In-situ >450 - 325 kPa
			0.30m TP04- 0.50 (0.3-0.45)	0.17m			SILTSTONE fine grained, layered, red brown, low strength, moderately weathered, highly fractured, no odour, iron staining in fractures	D				BEDROCK
				0.45m 591.0 0.5			EXCAVATION TP04 TERMINATED AT 0.45 m Refusal					
				591.5 1.0								
				592.0 1.5								
				592.5 2.0								
				593.0 2.5								
				3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP05

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690426.000, N: 6089969.000 (56 MGA94)
SURFACE ELEVATION : 596.650 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 9/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP05-0.0 (0.0-0.2)	0.0 597.0		ML	Clayey SILT low plasticity, dark brown, with clay, grass rootlets, no odour, no staining	D	S			TOPSOIL
			0.40m TP05-0.5 (0.4-0.6)	0.40m 0.5		CL	Silty CLAY low plasticity, red brown, no odour, no staining		H		0.53	RESIDUAL SOIL 0.53: HP In-situ =425 kPa
			0.80m TP05-1.0 (0.8-1.0)	0.65m 597.5			SILTSTONE fine grained, layered, pale orange, extremely low strength, extremely weathered, highly fractured, no odour, iron staining				0.75	ROCK 0.75: HP In-situ >425 kPa
				0.90m 1.0			SILTSTONE fine grained, massive, light grey with orange staining, medium strength, highly weathered, slightly fractured, no odour, iron staining					
				1.15m 598.0 1.5 598.5 2.0 599.0 2.5 599.5 3.0			EXCAVATION TP05 TERMINATED AT 1.15 m Refusal					

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP06

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690523.000, N: 6090005.000 (56 MGA94)
SURFACE ELEVATION : 598.770 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 9/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	HAND PENETROMETER 100 200 300 400 kPa	STRUCTURE & Other Observations
			TP06-0.0 (0.0-0.2)	0.0 599.0		ML	SILT low plasticity, brown, trace clay, with grass rootlets, no odour, no staining		VSt			TOPSOIL 0.20: HP In-situ >450 kPa
			0.40m TP06-0.5 (0.4-0.6)	0.45m								
			0.80m TP06-1.0 (0.8-1.0)	0.5 599.5		GW	Silty GRAVEL medium grained, to 20 mm, well graded, sub-rounded, light brown, no odour, iron staining	D	D			ALLUVIUM 0.75: HP In-situ >450 kPa
				1.00m 1.0 600.0			SILTSTONE fine grained, layered, orange brown, extremely low strength, extremely weathered, highly fractured, no odour, iron staining in fractures					BEDROCK 1.25: HP In-situ >450 kPa
			1.50m TP06-1.7 (1.5-1.7)	1.50m 1.5			becoming grey weathered orange in fractures					
				1.60m			becoming grey, high strength, slightly weathered, slightly fractured					
				1.70m 600.5			EXCAVATION TP06 TERMINATED AT 1.70 m Refusal					
				2.0 601.0								
				2.5 601.5								
				3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP07

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690585.000, N: 6090029.000 (56 MGA94)
SURFACE ELEVATION : 593.470 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 9/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETRO-METER Blows/150mm	HAND PENETRO-METER kPa	STRUCTURE & Other Observations
			TP07-0.0 (0.0-0.2)	593.5	0.0		ML	SILT low plasticity, red brown mottled black, with fine grained gravel, with grass rootlets, no odour, no staining	D	H			TOPSOIL 0.20: HP In-situ >450 kPa
			0.40m TP07-0.5 (0.4-0.6)	594.0	0.5		CL	Gravelly CLAY low plasticity, light grey, well graded, sub-angular gravel, trace sand, no odour, no staining					FILL 0.75: HP In-situ >450 kPa
			0.80m TP07-1.0 (0.8-1.0)	594.5	1.0		CL	CLAY low plasticity, pale brown mottled grey, no odour, no staining					RESIDUAL SOIL 1.25: HP In-situ >450 kPa
			1.70m TP07-1.9 (1.7-1.9)	595.0	1.5			SANDSTONE medium to coarse grained, massive, grey weathered orange, extremely low strength, extremely weathered, no odour, iron staining					BEDROCK 1.60: Ripper from 1.6 m
				595.5	2.0			EXCAVATION TP07 TERMINATED AT 1.90 m Refusal					
				596.0	2.5								
					3.0								

1.00m
1.50m
1.90m

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP08

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690677.000, N: 6090064.000 (56 MGA94)
SURFACE ELEVATION : 595.930 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 9/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	HAND PENETROMETER 100 200 300 400 kPa	STRUCTURE & Other Observations
			TP08-0.0 (0.0-0.2)	0.0 596.0		ML	SILT low plasticity, dark brown, trace sand, with grass rootlets, no odour, no staining		VSt			TOPSOIL 0.25: HP In-situ =250 - 450 kPa
			0.40m TP08-0.5 (0.4-0.6)	0.45m								
				0.5		CL	Sandy CLAY low plasticity, orange-brown, coarse sand, with fine, well graded, sub-rounded gravel, no odour, no staining		H			FILL 0.50: HP In-situ =250 - >450 kPa
				0.55m 596.5			Sandy Silty CLAY medium plasticity, red-brown, no odour, iron staining	D				RESIDUAL SOIL 0.60: Large patch of iron staining
			0.80m TP08-1.0 (0.8-1.0)			CI			H			0.75: HP In-situ >450 kPa
			1.00m TP08-1.5 (1.3-1.5)	1.00m 1.0 597.0			DACITE coarse grained, porphyritic, massive, orange-brown, extremely low strength, extremely weathered, no odour, no staining					BEDROCK 1.10: Ripper used from 1.1 m
				1.30m			becoming low strength, slightly weathered					
				1.50m 1.5 597.5			EXCAVATION TP08 TERMINATED AT 1.50 m Refusal					
				2.0 598.0								
				2.5 598.5								
				3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

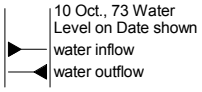
METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION



WATER



SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP09

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690582.000, N: 6090185.000 (56 MGA94)
SURFACE ELEVATION : 592.450 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 10/9/13
LOGGED BY : Kara
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETRO-METER Blows/150mm	HAND PENETRO-METER kPa	STRUCTURE & Other Observations
			TP09-0.0 (0.0-0.2)	0.0 592.5		ML	SILT low plasticity, light brown, with fine grained sand, with grass rootlets, no odour, no staining		H	2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	100 200 300 400	TOPSOIL 0.20: HP In-situ >450 kPa
			0.40m TP09-0.5 (0.4-0.6)	0.36m 0.5 593.0		CL-CI	CLAY low to medium plasticity, orange-brown, trace fine grained sand, no odour, no staining					RESIDUAL SOIL 0.49: HP In-situ >450 kPa
			0.80m TP09-1.0 (0.8-1.0)	0.62m 1.0 593.5			DACITE coarse grained, porphyritic, massive, orange-brown, low strength, highly weathered, moderately fractured, no odour, iron staining particularly in fractures	D				BEDROCK
				1.06m becoming medium strength, highly weathered, moderately fractured 1.26m			EXCAVATION TP09 TERMINATED AT 1.26 m Refusal					
				1.5 594.0 2.0 594.5 2.5 595.0 3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP10

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690692.000, N: 6090236.000 (56 MGA94)
SURFACE ELEVATION : 596.420 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 10/9/13
LOGGED BY : Kara
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP10-0.0 (0.0-0.2)	596.5 / 0.0		ML	SILT low plasticity, dark brown, with coarse, <20 mm gravel, with grass rootlets, no odour, no staining	D	St			TOPSOIL 0.20: HP In-situ =150 - 225 kPa
			0.40m TP10-0.5 (0.4-0.6)	0.39m		CL	Silty CLAY low plasticity, light orange brown, no odour, no staining		VSt			FILL 0.45: HP In-situ =325 - 450 kPa
			0.90m TP10-1.0 (0.9-1.1)	597.0 / 0.5 / 597.5 / 1.0		CI	CLAY medium plasticity, light orange brown speckled black, trace sand, no odour, no staining		H / Fb			0.85: HP In-situ =450 - >450 kPa
				1.5 / 1.58m			EXCAVATION TP10 TERMINATED AT 1.58 m Refusal					
				598.0 / 2.0 / 598.5 / 2.5 / 599.0 / 3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP11

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690360.000, N: 6090237.000 (56 MGA94)
SURFACE ELEVATION : 584.110 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 10/9/13
LOGGED BY : Kara
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP11-0.0 (0.0-0.2)	584.5 0.0		ML	Clayey SILT low plasticity, red-brown, with grass rootlets, no odour, no staining		VSt			TOPSOIL
							0.21m SILTSTONE fine grained, layered, orange brown, low strength, highly weathered, highly fractured, no odour, iron staining in fractures					BEDROCK
			0.40m TP11-0.5 (0.4-0.6)	0.5			0.60m becoming medium strength, slightly weathered, highly fractured	D				0.78: Ripper from 0.78
			1.00m TP11-1.0 (1.0-1.2)	585.0 1.0			1.12m EXCAVATION TP11 TERMINATED AT 1.12 m Refusal					
				585.5 1.5								
				586.0 2.0								
				586.5 2.5								
				587.0 3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP12

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690156.000, N: 6090337.000 (56 MGA94)
SURFACE ELEVATION : 585.070 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 10/9/13
LOGGED BY : Kara
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	HAND PENETROMETER kPa 100 200 300 400	STRUCTURE & Other Observations
			TP12-0. (0.0-0.2)	0.0 585.5 0.5		ML	Sandy SILT low plasticity, dark brown, well graded sand, no odour, no staining	D to M	F			TOPSOIL 0.15: HP In-situ =0 kPa
			0.40m TP12-0.5 (0.4-0.6)	0.31m		ML	Gravelly SILT to 400 mm, low plasticity, dark red-brown, well graded, sub-angular gravel, with cobbles, with boulders, no odour, no staining		F			FILL 0.45: HP In-situ =300 kPa
				586.0 1.0 1.20m			SILTSTONE fine grained, layered, orange brown, low strength, highly weathered, highly fractured, no odour, iron staining, particularly in fractures	D				BEDROCK 0.60: Bitumen observed BEDROCK
				586.5 1.5 587.0 2.0 587.5 2.5 588.0 3.0			EXCAVATION TP12 TERMINATED AT 1.20 m Refusal					1.20: Note: Sample location likely to recieve wash from surrounding area

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP13

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690045.000, N: 6090415.000 (56 MGA94)
SURFACE ELEVATION : 583.820 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 10/9/13
LOGGED BY : Kara
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP13-0.0 (0.0-0.2)	0.0 584.0		ML	SILT low plasticity, brown, with clay, with grass rootlets, no odour, no staining	D	F		100 200 300 400	TOPSOIL 0.15: HP In-situ =50 - 375 kPa
			0.40m TP13-0.5 (0.4-0.6)	0.32m 0.5		CL	CLAY low plasticity, red-brown, with sand, with gravel, no odour, no staining		H			RESIDUAL SOIL 0.55: HP In-situ =425 - >450 kPa
			0.80m TP13-1.0 (0.8-1.0)	0.69m 584.5 1.0 585.0			SILTSTONE fine grained, amorphous, layered, grey weathered orange, high strength, fresh, moderately weathered, no odour, iron staining in fractures					BEDROCK
				1.30m 1.5 585.5 2.0 586.0 2.5 586.5 3.0			EXCAVATION TP13 TERMINATED AT 1.30 m Refusal					

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP14

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690044.000, N: 6090417.000 (56 MGA94)
SURFACE ELEVATION : 597.420 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 9/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	HAND PENETROMETER 100 200 300 400 kPa	STRUCTURE & Other Observations
			TP14-0.0 (0.0-0.2)	0.0 597.5		ML	Clayey SILT low plasticity, dark brown, with grass rootlets, no odour, no staining	D to M	St			TOPSOIL
				0.25m								
			0.40m TP14-0.5 (0.4-0.6)	0.5 598.0		CL	Silty CLAY low plasticity, red brown, no odour, no staining		VSt		0.50: HP In-situ =125 - 350 kPa	FILL
			0.80m TP14-1.0 (0.8-1.0)	0.80m								
				1.0 598.5		SW	Gravelly SAND orange brown, fine to coarse grained, well graded, sub-rounded gravel, no odour, iron staining		VD		1.00: HP In-situ =300 - >450 kPa	RESIDUAL SOIL
				1.15m			DACITE coarse grained, porphyritic, massive, orange brown, very low strength, highly weathered, no odour, iron staining					BEDROCK
				1.35m			EXCAVATION TP14 TERMINATED AT 1.35 m Refusal					
				1.5 599.0								
				2.0 599.5								
				2.5 600.0								
				3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP15

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690003.000, N: 6090627.000 (56 MGA94)
SURFACE ELEVATION : 595.880 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 9/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION (Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components)	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			QC103 QC104 TP15-0.0 (0.0-0.2)	0.0 596.0		ML	SILT low plasticity, dark brown, with sand, with medium grained, sub-angular gravel, with grass rootlets and bricks, no odour, no staining	D	F		100 200 300 400	TOPSOIL 0.15: HP In-situ =75 - 400 kPa
				0.20m			SILT low plasticity, red-brown, with clay, with glass and charcoal, no odour, iron staining					FILL
			0.40m TP15-05 (0.4-0.6)	0.5 596.5		ML						0.60: HP In-situ =375 - >450 kPa
			0.80m TP15-1.0 (0.8-1.0)	1.0								
				1.00m			Silty CLAY low plasticity, orange mottled black, with sand, no odour, iron staining	D to M	H			RESIDUAL SOIL
			1.80m TP15-2.0 (1.8-2.0)	1.5 597.0 597.5		CL						
				1.90m			SILTSTONE fine grained, amorphous, layered, grey, low strength, moderately weathered, moderately fractured, no odour, iron staining in fractures					BEDROCK
				2.0 598.0			EXCAVATION TP15 TERMINATED AT 2.00 m Refusal					
				2.5 598.5								
				3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP16

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690023.000, N: 6090573.000 (56 MGA94)
SURFACE ELEVATION : 593.710 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 9/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP16-0.0 (0.0-0.2)	0.0 / 594.0		GW	Silty GRAVEL coarse grained, well graded, sub-angular, dark brown, with cobbles, no odour, iron staining in gravel	D to M	VD			TOPSOIL 0.15: HP In-situ =175 kPa
			0.40m TP16-0.5 (0.4-0.6)	0.30m / 0.5		CL	Gravelly CLAY low plasticity, red-brown, natural sandstone, medium grained, subrounded gravel, with sand, no odour, iron staining in gravel		VSt			RESIDUAL SOIL 0.40: HP In-situ =300 - >450 kPa 0.60: HP In-situ =450 - >450 kPa
			0.75m TP16-1.0 (0.8-1.0)	0.75m / 594.5 / 1.0			SANDSTONE medium to coarse grained, massive, red/orange brown, very low strength, extremely weathered, no odour, iron staining along fractures					BEDROCK
				1.15m / 595.0 / 1.5			EXCAVATION TP16 TERMINATED AT 1.15 m Refusal					
				595.5 / 2.0								
				596.0 / 2.5								
				596.5 / 3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP17

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690130.000, N: 6090548.000 (56 MGA94)
SURFACE ELEVATION : 591.270 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 9/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

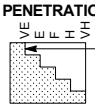
VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	HAND PENETROMETER kPa 100 200 300 400	STRUCTURE & Other Observations
			QC102 TP17-0.0 (0.0-0.2)	0.0 591.5		CL	Sandy CLAY low to medium plasticity, orange brown, with coarse, to 15 mm, well graded gravel, with grass rootlets, with bitumen and glass, no odour, no staining					TOPSOIL
			0.40m TP17-0.5 (0.4-0.6)	0.20m 0.5 592.0		CL	Sandy CLAY coarse, to 15 mm, well graded, low to medium plasticity, orange brown, with gravel, with bitumen and glass, no odour, no staining		H			FILL 0.25: HP In-situ =425 - >450 kPa
			0.80m TP17-1.0 (0.8-1.0)	0.50m 1.0 592.5			SILTSTONE fine grained, layered, grey weathered orange, very low strength, highly weathered, highly fractured, interspersed with fresh, grey, high strength shale corestones ~500 mm in diameter from ~ 0.6 m., no odour, iron staining in fractures	D				BEDROCK
				1.70m 1.5 593.0			EXCAVATION TP17 TERMINATED AT 1.70 m Refusal					
				2.0 593.5								
				2.5 594.0								
				3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

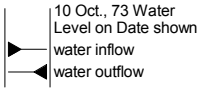
METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION



WATER



SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP18

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690328.000, N: 6090431.000 (56 MGA94)
SURFACE ELEVATION : 596.560 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 10/9/13
LOGGED BY : Kara
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP18-0.0 (0.0-0.1)	597.0	0.0		SW	Clayey SAND medium grained, well graded, dark brown, trace gravel, with grass rootlets, no odour, no staining	D to M	MD			TOPSOIL 0.20: HP In-situ =200 - 275 kPa
			0.40m TP18-0.5 (0.4-0.6)		0.34m		CI	CLAY medium plasticity, red brown, trace gravel, no odour, no staining		St			RESIDUAL SOIL 0.45: HP In-situ =175 - 375 kPa
				597.5	0.5 0.54m			SILTSTONE fine grained, layered, orange mottled grey and red, extremely low strength, extremely weathered, highly fractured, no odour, iron staining particularly in fractures					BEDROCK 0.70: HP In-situ =350 - >475 kPa
			1.00m TP18-1.0 (1.0-1.2)		0.88m 0.95m 1.0			becoming grey weathered orange, very low strength, highly weathered, moderately fractured becoming medium strength, slightly weathered, moderately fractured					
				598.0	1.37m 1.5			EXCAVATION TP18 TERMINATED AT 1.37 m Refusal					
				598.5	2.0								
				599.0	2.5								
				599.5	3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP19

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 689935.000, N: 6090722.000 (56 MGA94)
SURFACE ELEVATION : 589.000 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 11/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	HAND PENETROMETER 100 200 300 400 kPa	STRUCTURE & Other Observations
			TP19-0.0 (0.0-0.2)	589.0	0.0		CL	CLAY low plasticity, dark brown, with silt, with grass rootlets, no odour, no staining	D to M	F			TOPSOIL 0.00: ACM Fragments observed in vicinity TOPSOIL
					0.18m								
			0.30m TP19-0.3 (0.3-0.5)				CI	CLAY medium plasticity, orange brown mottled grey, trace sand, trace well graded, sub-angular gravel, no odour, no staining	M	VSt			RESIDUAL SOIL
			0.50m TP19-1.0 (0.8-1.0)	589.5	0.5								0.50: HP In-situ =325 - >450 kPa 0.60: Decomposed organic matter observed - possible tree root
					0.79m								
								DACITE coarse grained, porphyritic, massive, orange brown mottled red, extremely low strength, extremely weathered, no odour, iron staining					BEDROCK
					0.98m								
				590.0	1.0			becoming low strength, highly weathered					
					1.10m								
								EXCAVATION TP19 TERMINATED AT 1.10 m Refusal					
				590.5	1.5								
				591.0	2.0								
				591.5	2.5								
				592.0	3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP20

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690043.000, N: 6090659.000 (56 MGA94)
SURFACE ELEVATION : 583.000 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 11/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP20-0.0 (0.0-0.2)	583.0 0.0		GP	0.05m GRAVEL medium to coarse grained, to 20 mm, poorly graded, angular, grey, DGB, well compacted gravel sealed carpark, no odour, no staining		D			FILL
						CI	CLAY medium plasticity, light brown, with coarse, to 20 mm, well graded, angular, shale and brick gravel, with bitumen and brick, no odour, no staining		St			
							0.27m SILTSTONE fine grained, amorphous, layered, grey weathered orange, low to medium strength, moderately weathered, highly fractured, no odour, iron staining in fractures					BEDROCK
			0.40m TP20-0.5 (0.4-0.6)	583.5 0.5			0.47m becoming medium to high strength, slightly weathered, moderately fractured	D				
			1.00m TP20-1.0 (1.0-1.2)	584.0 1.0			1.20m EXCAVATION TP20 TERMINATED AT 1.20 m Refusal					
				584.5 1.5								
				585.0 2.0								
				585.5 2.5								
				586.0 3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP21

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690222.000, N: 6090766.000 (56 MGA94)
SURFACE ELEVATION : 588.000 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 11/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP21-0.0 (0.0-0.2)	588.0 0.0		ML	Gravelly SILT low plasticity, dark brown, coarse, to 20 mm, well graded, sub-angular gravel, with grass rootlets, with brick, no odour, no staining		S			TOPSOIL
				0.14m			Silty COBBLES coarse, to 400 mm, well graded, angular, red-brown, with boulders, combination of bricks, tiles, quarry refuse (shale), and white tuff fragments. Also ash, coal and bitumen observed, no odour, no staining	D	VL			FILL
			0.40m TP21-0.5 (0.4-0.6)	588.5 0.5								
			0.80m TP21-1.0 (0.8-1.0)	589.0 1.0								
				589.5 1.5								
				1.56m			EXCAVATION TP21 TERMINATED AT 1.56 m Collapse					
				590.0 2.0								
				590.5 2.5								
				591.0 3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP22

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690128.000, N: 6090800.000 (56 MGA94)
SURFACE ELEVATION : 586.000 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 11/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION (Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components)	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP22-0.0 (0.0-0.2)	586.0 0.0		CL	Sandy CLAY low plasticity, brown, with metal, with grass rootlets, no odour, no staining	D	St			TOPSOIL
				0.19m		SW	Gravelly SAND brown, medium grained, well graded, angular shale gravel, with clay, with ash and bitumen, no odour, no staining	D to M	MD			FILL
			0.40m QC113 TP22-0.5 (0.4-0.6)	0.38m 586.5 0.5		GW	Sandy GRAVEL medium grained, well graded, angular, grey speckled white, with ash and bitumen, no odour, no staining					0.45: HP In-situ =350 - >450 kPa
				0.54m		CL	Sandy CLAY low plasticity, brown mottled red, with ash, bitumen and bricks, no odour, no staining	M	VSt			
			0.80m TP22-1.0 (0.8-1.0)	587.0 1.0								0.75: HP In-situ >450 kPa
				1.25m								
				1.30m			SILTSTONE fine grained, amorphous, layered, grey, high strength, slightly weathered, moderately fractured, no odour, iron staining in fractures					BEDROCK
				587.5 1.5			EXCAVATION TP22 TERMINATED AT 1.30 m Refusal					
				588.0 2.0								
				588.5 2.5								
				589.0 3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP23

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690166.000, N: 6090733.000 (56 MGA94)
SURFACE ELEVATION : 605.500 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 11/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	HAND PENETROMETER kPa 100 200 300 400	STRUCTURE & Other Observations
			TP23-0.0 (0.0-0.2)	605.5 / 0.0		ML	Sandy SILT low plasticity, brown, with grass rootlets, with brick, no odour, no staining		St			TOPSOIL 0.15: HP In-situ =375 - 450 kPa
			0.40m TP23-0.5 (0.4-0.6)	606.0 / 0.5			0.30m Sandy CLAY medium plasticity, brown, with coarse, to 300 mm, angular gravel, cobbles and boulders of fresh siltstone (quarry cuttings), brick, bitumen, no odour, no staining					FILL 0.50: HP In-situ =350 - 450 kPa
			0.80m TP23-1.0 (0.8-1.0)	606.5 / 1.0		CI		D	St			
			1.80m TP23-2.0 (1.8-2.0)	607.0 / 1.5			1.59m SILTSTONE fine grained, amorphous, layered, orange-brown, medium strength, slightly weathered, highly fractured, no odour, iron staining particularly in fractures					BEDROCK
				607.5 / 2.0			2.37m EXCAVATION TP23 TERMINATED AT 2.37 m Refusal					2.37: No ACM observed
				608.0 / 2.5								
				608.5 / 3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP24

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690226.000, N: 6090726.000 (56 MGA94)
SURFACE ELEVATION : 597.500 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 11/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION (E F H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION (Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components)	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP24-0.0 (0.0-0.2)	597.5 0.0		ML	Sandy SILT low plasticity, brown, with grass rootlets, bitumen and bricks, no odour, no staining	D	St			TOPSOIL
				0.10m		CI	Gravelly CLAY medium plasticity, orange-brown, medium grained, to 200 mm, well graded, angular, possible DGB or quarry cuttings gravel, no odour, no staining	M	St			FILL
				0.30m		CL	Gravelly CLAY low plasticity, light grey, medium grained, shale, to 100 mm, well graded, sub-rounded gravel, possible quarry cuttings , no odour, no staining		F			
			0.40m TP24-0.5 (0.4-0.5)	0.40m								BEDROCK
				0.50m			SILTSTONE fine grained, amorphous, layered, dark grey, high strength, slightly weathered, moderately fractured, no odour, iron staining in fractures					
				598.0 0.5			EXCAVATION TP24 TERMINATED AT 0.50 m Refusal					
				598.5 1.0								
				599.0 1.5								
				599.5 2.0								
				600.0 2.5								
				600.5 3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP25

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690255.000, N: 6090627.000 (56 MGA94)
SURFACE ELEVATION : 601.000 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 11/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	HAND PENETROMETER kPa 100 200 300 400	STRUCTURE & Other Observations
			TP25-0.0 (0.0-0.2)	601.0 0.0		Cl	0.10m CLAY medium plasticity, light brown, with coarse, well graded, angular gravel, with brick, glass and grass rootlets, no odour, no staining		St			TOPSOIL FILL
			0.50m TP25-0.5 (0.4-0.6)	601.5 0.5			Clayey COBBLES coarse, well graded, angular, light brown and grey, with fresh to slightly weathered shale boulders, some bricks and glass, no odour, no staining, reworked natural material, possible quarry cuttings					0.10: reworked natural material, possible quarry cuttings 0.30: metal pipe observed
			1.00m TP25-1.0 (0.8-1.0)	602.0 1.0								
				602.5 1.5				D	MD			
			2.00m TP25-2.0 (1.9-2.1)	603.0 2.0								2.00: rusted metal container - possibly old drum
				603.5 2.5								
			3.00m TP25-3.0 (2.8-3.0)	604.0 3.0			3.00m EXCAVATION TP25 TERMINATED AT 3.10 m Machine Limit					3.00: bitumen and ash observed
				604.5 3.5								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

UPDATED SMEC LIBRARY_AGS 3_1 RTA 1_1 LIB 08_WITH FENCE TOOL_15-05-2013.GLB Log SMEC EXCAVATION WITH DCP CANBERRA BRICKWORKS REV 2.GPJ <<DrawingFile>> 30/10/2013 13:54 8.30.003

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP26

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690222.000, N: 6090766.000 (56 MGA94)
SURFACE ELEVATION : 588.000 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 11/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUNDWATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm	HAND PENETROMETER kPa	STRUCTURE & Other Observations
			TP26-0.0 (0.0-0.2)	588.0 0.0		ML	SILT low plasticity, dark brown, with sand, with glass, grass rootlets, no odour, no staining		St			TOPSOIL
			0.40m QC110 TP26-0.5 (0.4-0.6)	588.5 0.5			0.34m COBBLES coarse, to 250 mm, poorly graded, angular, red-brown, whole bricks , with metal, ash, bitumen, no odour, no staining		MD			FILL
			0.80m TP26-1.0 (0.8-1.0)	589.0 1.0		Cl	0.56m CLAY medium plasticity, grey and brown, with silt, with bitumen, ash, no odour, no staining		St			
			1.80m TP26-2.0 (1.8-2.0)	589.5 1.5			1.10m COBBLES coarse, to 250 mm, poorly graded, angular, red-brown, whole bricks , metal, ash, bitumen, no odour, no staining	D	L			2.00: Metal engine part observed
			2.80m TP26-3.0 (2.8-3.0)	590.0 2.0								
				590.5 2.5								
				591.0 3.0			3.00m EXCAVATION TP26 TERMINATED AT 3.00 m Collapse					
				591.5 3.5								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP27

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690250.000, N: 6090914.000 (56 MGA94)
SURFACE ELEVATION : 594.000 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 11/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	HAND PENETROMETER 100 200 300 400 kPa	STRUCTURE & Other Observations
			TP27-0.0 (0.0-0.7)	594.0 0.0		CL	Gravelly CLAY low plasticity, dark brown, coarse, angular gravel, with grass rootlets, no odour, no staining		St			TOPSOIL
							0.28m COBBLES coarse, to 300 mm, well graded, angular, grey, with shale boulders, reworked natural material - probably quarry cuttings, overlying fine grained, fresh, high strength natural outcrops, no odour, no staining	D	L			0.15: HP In-situ =200 - >450 kPa FILL
			0.40m TP27-0.5 (0.4-0.6)	594.5 0.5								
			0.80m TP27-1.0 (0.8-1.0)	595.0 1.0			1.05m fill ending at 1.05 m, becoming unworked siltstone - high strength, fresh, moderately fractured					BEDROCK
							1.30m EXCAVATION TP27 TERMINATED AT 1.30 m Refusal					
				595.5 1.5								
				596.0 2.0								
				596.5 2.5								
				597.0 3.0								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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EXCAVATION - GEOLOGICAL LOG

PIT NO : TP28

PROJECT : Old Canberra Brickworks
LOCATION : Yarralumla ACT
CLIENT : Land Development Agency
FEATURE : Geotechnical
FILE / JOB NO : 3002369
SHEET : 1 OF 1

POSITION : E: 690321.000, N: 6090751.000 (56 MGA94)
SURFACE ELEVATION : 597.000 (AHD)

EQUIPMENT TYPE : 8-tonne Excavator
METHOD : Test Pit

DATE EXCAVATED : 11/9/13
LOGGED BY : Claudia Rodriquez
CHECKED BY :

EXCAVATION DIMENSIONS : 2.00 m LONG 0.60 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	DYNAMIC CONE PENETROMETER Blows/150mm 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5	HAND PENETROMETER 100 200 300 400 kPa	STRUCTURE & Other Observations
			TP28-0.0 (0.0-0.2)	597.0 0.0		CI	Gravelly CLAY medium plasticity, dark brown, medium grained, well sorted, angular gravel, with sand, with brick, glass, bitumen, and grass rootlets, no odour, no staining		St			TOPSOIL
				0.10m			Clayey COBBLES coarse, to 250 mm, poorly graded, angular, red-brown, whole brick fill , with sand, with glass and bitumen, no odour, no staining					FILL
			0.40m TP28-0.5 (0.4-0.6)	597.5 0.5								
				598.0 1.0								
				598.5 1.5				D	L			
				599.0 2.0								
				599.5 2.5								
				3.00m			EXCAVATION TP28 TERMINATED AT 3.00 m Collapse					
				600.0 3.0								
				600.5 3.5								

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

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APPENDIX K: FIELD AND LABORATORY QAQC SUMMARY

QUALITY ASSURANCE / QUALITY CONTROL

QA/QC Objectives

The objective of the quality assurance / quality control program was to ensure representativeness, reliability, completeness and comparability of all data and conclusions obtained during the project. To achieve this objective, comprehensive QA/QC procedures were integrated into the sampling and analytical program.

The procedures included:

- decontamination, sample preparation and handling in accordance with best practice, Australian Standards and documented procedures during field work;
- use of experienced personnel and supervision by senior staff;
- collection and analysis of QC samples;
- use of NATA accredited laboratories and methods for all analyses undertaken; and
- internal laboratory QA/QC program.

Field QA/QC

Field Staff

The soil sampling component of the PSI was completed by John O'Brien a suitably qualified SMEC Environmental Scientist.

Field QAQC Documentation

All samples, including QA/QC samples, were transported to the laboratories with relevant chain of custody (CoC) documentation. The CoC detailed the following information:

- Site identification;
- Sampler(s);
- Nature of the sample – Soil, water or sediment;
- Collection time and date;
- Analyses to be performed; and
- Sample preservation method.

Field Quality Control Samples

Field Replicates

Field replicated soil samples were collected from the same conditions as the primary sample (location, depth and strata) by splitting equal portions of soil into laboratory prepared sample jars.

The purpose of Intra-laboratory (Duplicate) field samples is to estimate the variability of the sampling material. Inter-laboratory (Triplicate) field duplicate samples are also collected and submitted to a secondary laboratory as a means to assess the accuracy of the primary laboratory. Duplicate samples were labelled to conceal their relationship to the primary sample. The sample plan required the rate of

collected and analysed replicates (both duplicate and triplicate) to be 1:20 in accordance with the NEPM (amended 2013) requirements.

The rate of replicate sample analysis is summarised below in Table 1:

Table 1 Replicate sample analysis

COC	No. Primary Samples	Duplicate Rate	Triplicate Rate
Asbestos	19	1 (1:19)	0
TPH	18	2 (1:9)	2 (1:9)
BTEX	18	2 (1:9)	2 (1:9)
PAH/Phenols	18	2 (1:9)	2 (1:9)
Metals	34	2 (1:12)	2 (1:12)
Explosive Suite	1	0	0
OCP/OPP	25	1 (1:25)	1 (1:25)
PCB	10	1 (1:10)	1 (1:10)

With the exception of asbestos and the explosive suite analysis the replicate rate of analysis met the required rate of 1:20 and are suitable for the purpose of the PSI

Field and Trip Blanks

Field prepared blanks were collected daily (QC101, QC105 and QC109), the purpose of the blanks were to assess the potential for cross contamination during sampling and holding in the field. Field prepared blanks were placed in esky utilised for each day of sampling.

A single laboratory prepared Trip Blank was kept with the sample batch during sample collection and transport.

Concentrations of contaminates of concern were below the laboratory detection limit in both the trip and field blank samples indicating that contamination did not occur during sampling.

Tabulated results of the blanks are presented in Table 3 of **Appendix I**.

Trip Blanks

A laboratory prepared trip blank (Trip Blank) was supplied to accompany samples during collection and transport until receipt at the analysing laboratory on the 11 September 2013. Trip blanks were analysed for TPH C_6–C_9 and BTEX compounds.

Concentrations of TPH and BTEX were below the laboratory detection limit indicating that cross contamination did not occur during sampling and transport.

Tabulated results of the blank are presented in Table 3 of **Appendix I**.

Trip Spikes

A single laboratory trip spike (Trip Spike) sample was utilised during the investigation on the 11 September 2013. The sample accompanied the primary samples scheduled for volatile analysis which were collected on the same day.

The primary aim of these samples was to determine the possibility of loss of volatile components during the sampling and transport procedure.

The results for the soil field matrix spikes (between 70% and 93%) indicate that in general volatiles have not been lost during the sampling and transport.

Field Sampling Methods

Test Pits

Samples were collected directly from undisturbed bulk samples from the centre of excavator bucket to minimise the potential for cross contamination. A new pair of nitrile gloves was used at each sample depth and location. GPS coordinates for each test pit was recorded on SMEC field sheets; similarly the sample depth was measured (tape measure) and recorded.

Sub surface conditions were logged in accordance with the Unified Soil Classification System (USCS); test pit logs are included in **Appendix J**.

Sample Receipt, Handling, Storage and Transportation

All soil samples were placed in laboratory prepared and supplied jars, before being placed in ice filled eskies and then transported to the laboratories with accompanying CoC documentation (refer to **Appendix L** for CoC documentation and Sample Receipt Notification).

Chain of Custody documentation was signed and dated stating that:

- All samples were received cool and in good order;
- All samples were presented in adequate sample containers;
- All samples submitted for volatiles were correctly contained with no headspace; and
- All samples were labelled appropriately to current quality field sampling protocols.

Laboratory QA/QC Procedures

Laboratories and Accreditation

The primary laboratory SGS (NATA Accreditation No. 2562, site No. 4354) is NATA accredited and used NATA accredited testing procedures. The secondary laboratory Eurofins/MGT (NATA Accreditation No. 1261, site No. 18217) also used NATA accredited testing procedures.

Analytical Methods

The laboratory analytical methods were in accordance with NEPC APHA 20th and can be found in **Appendix L**. A summary of the laboratory analytical methods is provided below in Table 2.

Table 2 Laboratory Analytical Methods

PCOC	SGS Analytical Methods	MGT Analytical Methods
Asbestos	AS 4964-2004 (PLM, DS)	-
As, Cd, Cr, Cu, Ni, Pb, Zn	APHA 20th 3120-USEPA 6010C/APHA 21st 3120B	E022 Acid Extractable metals in Soils
Mercury	APHA 21st 3120B	E026 Acid Extractable metals in Soils Mercury
PCB	USEPA 8081/8082	GC-ECD E013.1 and E013.2
TPH C6-C9	USEPA 5030B/8260B	GC-MS techniques using in-house MGT 100A
TPH C10-C36	USEPA SW846-8015A	GC-FID using in-house LTM-ORG-2010
BTEX	USEPA 5030B/8260B	In house E029/E016
PAH	USEPA SW846-8270B	GC-MS in house
OCP	USEPA 8081/8082	GC-MS using in-house E013.1, E013.2, E014.1, E014.2, E017.1 and E017.2

Holding Times

The time lapse between sample collection and analyte extraction was kept minimal to reduce any biological, chemical or physical alteration of the analyte. NEPC (1999) prescribe recommended holding times for which a valid analytical results can be extracted. The relevant holding times for analytes applicable to the PSI are summarised below in Table 3.

Table 3 Recommend Holding Times

Analyte	Matrix	Recommended Holding Time
Asbestos	Soil	N/A
Metals (As,Cd, Cr, Cu, Ni, Pb, Zn	Soil	6 Months
	Water	
Mercury	Soil	28 Days
	Water	
TPH	Soil	14 days
	Water	7 Days
BTEX, VOC	Soil	14 days
	Water	

PAH	Soil	14 days
	Water	7 Days
OCP, OPP, PCB	Soil	14 days
	Water	7 Days

SMEC completed a review of sample receipt notification and chain of custody documentation for the PSI. No holding time exceedances were reported.

Internal Laboratory Control Measures

To assess the accuracy of laboratory analysis the primary laboratory implemented the control measures detailed in Table 4.

Table 4 Laboratory Control Measures

QC Sample	Definition	Objective	Frequency	Acceptable Range
Laboratory Control Spike	Certified reference material.	To quality check laboratory preparation techniques.	1 per analytical batch per analytical method.	70-130% Recovery
Batch Duplicate	An intra-laboratory duplicate sample randomly selected from the sample batch.	To measure the precision in a given sample matrix.	1 every 10 samples per analytical method per matrix.	RPD < 50%

The acceptance targets for laboratory control samples and matrix spikes etc. is generally defined independently by each laboratory. The acceptance criteria used is that 80% of the precision and accuracy must fall within the laboratory control limits. Based on this the acceptance targets generally range between 60% and 130% recovery.

The laboratory internal standards, calibration blanks and mid-range calibration verifications were within acceptable range.

Laboratory QA/QC Results

Laboratory QC analytical results are summarised below:

- The percentage recovery for spiked samples calculated by the laboratory was within the acceptance limits for the methods used, for the majority of the analytes, for each of the testing laboratories;
- Percentage recovery results for laboratory control samples and surrogates were within acceptance limits for the majority of samples and exhibit a high percentage recovery;
- The laboratory internal standards, calibration blanks and mid-range calibration verifications were all within the acceptable range.
- The Interpretive Quality Control Reports for each laboratory are presented in Appendix H
- Laboratory blanks throughout the validation program were reported within the acceptance criteria, with no target analytes detected in any of the analysis blanks; and
- All samples were analysed within the prescribed holding time for each analyte (refer to **Appendix L** – Laboratory Reports).

Completeness

The following documentation has been included to demonstrate the completeness of valid measurements compared to the total number of measurements made:

- Chain of Custody forms;
- Sample receipt forms;
- All sample results reported;
- All laboratory duplicates reported and RPDs calculated;
- All surrogate spike data reported;
- All matrix spike (MS) data reported;
- Spike recovery acceptable limits reported; and
- National Association of Testing Authorities (NATA) stamp on reports.

This ensures the confident use of the collected data for site assessment.

Accuracy

Accuracy is the level of agreement between an experimental determination and the true value of the parameter being measured. Reference samples of matrix spikes were used to determine the accuracy of the analytical technique. The percentage recovery for spiked samples, calculated by the laboratory, is within the acceptance limits for the methods used [±30%]. Details are provided in the laboratory reports included within **Appendix L**.

SMEC considers that the laboratory results reported represents the true values of contaminants in situ and that bias has not been introduced:

- By chemicals during handling or transport;
- From contaminated equipment;
- From contaminated reagents; and
- During laboratory preparation and analysis.

Precision

Replicates from duplicate analyses are used to determine the precision or reproducibility of results. Precision is normally measured as the RPD between samples. The RPD should be within the recommended range of ±50%.

Variation from the recommended range up to predefined control limits is considered acceptable. Data precision control limits adopted for the PSI is as follows:

Replicate RPDs:

- Should not exceed 50 %RPD at concentration levels greater than ten times the practical quantization limit (PQL) / estimated quantization limit (EQL) / limit of reporting (LOR).
- Should not exceed 75 %RPD at concentrations between five to ten times the PQL/ EQL/ LOR.

- Should not exceed 100 %RPD at concentration levels less than two times the PQL/ EQL/ LOR.

These Control Limits allow for higher RPDs between results of low absolute value (in comparison to LORs).

The RPD results of replicated samples generally met recommended range of ±50%.with the exception of:

- TP28-0.5/QC111: RPDs for cobalt (44%), copper (75%) and nickel (59%);
- TP21-1.0/QC112: RPD for lead (31%);
- TP26-0.5/QC110: RPD for cobalt (57%), copper (67%), manganese (78%), nickel (67%) and zinc (47); and
- TP22-0.5/QC113: RPD for lead (34%).

The exceedances were attributed to sample heterogeneity of fill material sampled, it is noted that all detected concentrations were below the adopted assessment criteria.

SMEC considers that sufficient field and laboratory duplicates have been collected to provide a quantitative assessment of variability (or reproducibility) of data.

Sensitivity

The method detection limit is a measure of how sensitively the analytical technique / measurement quantify the concentration of the compound present. The detection limits achieved by the laboratories should be within criteria for each compound analysed. Therefore, sufficient confidence can be placed in the results obtained. The sensitivity is described as the Estimated Quantitation Limit (EQL), which is typically between 2 and 5 times the method detection limit.

Holding Times

The time between the field sampling and analyte result was as short as practicable in order to prevent any biological, chemical or physical alteration of the analyte. All samples were analysed within the prescribed holding time for each analyte (**Appendix L**).

Representativeness

Representativeness indicates how accurately and precisely the collected data represents the characteristics of a population, parameter variations at a sampling point or an environmental condition. SMEC consider that the samples collected were representative of the environmental media targeted during sampling.

QA/QC Decision Error Limits

For the purposes of this investigation, an overall error limit of 95% (i.e. 5% outside acceptable limits) was adopted in line with industry standards.

Summary QA/QC Assessment

A total population of 35 soil samples were analysed for contaminants of concern for soils. A total of two (2) duplicate samples were analysed by the primary laboratory (SGS) which is within the target

ratio of 1:20. A total of two (2) triplicate samples were sent to the inter-laboratory (eurofins|mgt), which is within the target ratio of 1:20.

The reported results indicate that the accuracy and precision of the analysis was satisfactory and constitute an appropriate reflection of in-situ concentrations for soil and are thus suitable to form an adequate basis for the assessment of site conditions.

APPENDIX L: LABORATORY CERTIFICATES

SMEC

CHAIN OF CUSTODY FORM

1/10

SMEC OFFICE: Canberra	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT		LAB: SGS Australia
PROJECT: OCB	☐ Non Standard TAT (List due date):		ATTENTION:
PROJECT NUMBER: 3002369	LAB QUOTE NO: ENV1-2A568E	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.): 16/33 Maddox St
PROJECT MANAGER: Nathalie O'toole	CONTACT PH: 6234 1967	COC: (1) 2 3 4 5 6 7	Alexandria NSW 2015
SAMPLED BY: John O'Brien		OF: 1 2 3 4 5 6 7	
DATE SAMPLED: Nathalie.O'toole@smec.com	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
Email reports to (will default to PM if blank): John.O'B...@smec.com	DATE/TIME: John O'Brien 11/9/2013	DATE/TIME:	DATE/TIME: / DATE/TIME:
Email Invoice to (will default to PM if blank): [illegible]			

Special Laboratory Instructions:

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Hold	TRH	BTEX	13 Metals NEPM	OCP/OPP				
	TP01-0.0	10/9/13	S	JAR	1				X	X				
	TP01-0.5	10/9/13	S	"	1	X								
	TP01-1.0	10/9/13	S	"	1	X								
	TP02-0.0	10/9/13	"	"	1				X	X				
	TP02-0.5	10/9/13	"	"	1	X								
	TP02-1.0	10/9/13	"	"	1	X								
	TP02-1.3	10/9/13	"	"	1	X								
	TP02-2.0	10/9/13	"	"	1	X								
	TP03-0.0	10/9/13	"	"	1				X	X				
	TP03-0.5	10/9/13	"	"	1	X								
	TP03-1.0	10/9/13	"	"	1	X								
				TOTAL	11	8			3	3				

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

CHAIN OF CUSTODY FORM

2/10

SMEC

SMEC OFFICE: CANBERRA	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT ☐ Non Standard TAT (List due date):		LAB: SGS AUSTRALIA
PROJECT: OCB			ATTENTION:
PROJECT NUMBER: 3002369	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle) COC: 1 (2) 3 4 5 6 7 OF: 1 2 3 4 5 6 7	DISPATCH TO (ADDRESS & PHONE NO.): 16/33 MADDOX ST. ALEXANDRIA NSW 2015
PROJECT MANAGER: NATHALIE O'TOOLE	CONTACT PH: 62341967		
SAMPLED BY: JOHN O'BRIEN			
DATE SAMPLED: Nathalie.O'Toole@Smec.com	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
Email reports to (will default to PM if blank): John.OBrien@SMEC.com	DATE/TIME:	DATE/TIME:	DATE/TIME: / DATE/TIME:
Email Invoice to (will default to PM if blank): AS above			

Special Laboratory Instructions:

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Hold	TRH	BTEX	13 Metals NEPM	OCP/OPP				
	TP03-2.0	10/9/13	S	JAR	1	X								
	TP04-0.0	10/9/13			1				X	X				
	TP04-0.5	10/9/13			1	X								
	TP05-0.0	9/9/13			1				X	X				
	TP05-0.5	9/9/13			1	X								
	TP05-1.0	9/9/13			1	X								
	TP06-0.0	9/9/13			1				X	X				
	TP06-0.5	9/9/13			1	X								
	TP06-1.0	9/9/13			1	X								
	TP06-1.7	9/9/13			1	X								
	TP07-0.0	9/9/13	↓	↓	1				X	X				
				TOTAL	11	7			4	4				

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

CHAIN OF CUSTODY FORM

3/10

SMEC OFFICE: CANBERRA	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT		LAB: SGS AUSTRALIA
PROJECT: OCB	☐ Non Standard TAT (List due date):		ATTENTION:
PROJECT NUMBER: 300 2309	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.):
PROJECT MANAGER: NATHALIE O'TOOLE	CONTACT PH: 6234 1967	COC: 1 2 (3) 4 5 6 7	16/33 MADDOX ST.
SAMPLED BY: JOHN O'BRIEN		OF: 1 2 3 4 5 6 7	ALEXANDRIA NSW 2015
DATE SAMPLED: Nathalie.O'Toole@smec.com	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
Email reports to (will default to PM if blank): John.O'Brien@smec.com	DATE/TIME:	DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if blank): AS ABOVE			

Special Laboratory Instructions:

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Hold	TRH	BTEX	OC/OPP	13 metals NEPM				
	TP07-0.5	9/9/13	S	JAR	1	X								
	TP07-1.0	↓	↓	↓	1	X								
	TP07-1.9				1	X								
	TP08-0.0				1				X	X				
	TP08-0.5				1	X								
	TP08-1.0				1	X								
	TP08-1.5	↓			1	X								
	TP09-0.0	10/9/2013			1				X	X				
	TP09-0.5	10/9/2013			1	X								
	TP09-1.0	10/9/2013			1	X								
	TP10-0.0	10/9/2013	↓	↓	1				X	X				
				TOTAL	11	8			3	3				

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

0307

CHAIN OF CUSTODY FORM

4/10

SMEC OFFICE: CANBERRA	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT		LAB: SGS AUSTRALIA
PROJECT: CCB	☐ Non Standard TAT (List due date):		ATTENTION:
PROJECT NUMBER: 30025669	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.): 16/33 MADDOX ST.
PROJECT MANAGER: NATHALIE O'TOOLE	CONTACT PH: 62341907	COC: 1 2 3 (4) 5 6 7	ALEXANDRIA NSW 2015
SAMPLED BY: JOHN O'BRIEN		OF: 1 2 3 4 5 6 7	
DATE SAMPLED: Nathalie.O'Toole@SMEC.com	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
Email reports to (will default to PM if blank): ...@SMEC.com	DATE/TIME:	DATE/TIME:	DATE/TIME: / DATE/TIME:
Email Invoice to (will default to PM if blank): AS ABOVE			

Special Laboratory Instructions:

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Ho/Cp	TRH	BTEX	OCP/OP?	13 Metals Nepm	Asbestos			
	TP10 - 0.5	10/9/2013	S	JAR	1	X								
	TP10 - 1.0				1	X								
	TP11 - 0.0				1				X	X				
	TP11 - 0.5				1	X								
	TP11 - 1.0				1	X								
	TP12 - 0.0				1				X	X	X			
	TP12 - 0.5				1	X								
	TP13 - 0.0				1				X	X				
	TP13 - 0.5				1	X								
	TP13 - 1.0				1	X								
	TP14 - 0.0	9/9/13			1				X	X				
				TOTAL	11	7			4	4	1			

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

CHAIN OF CUSTODY FORM

5/10

SMEC OFFICE: CANBERRA	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT		LAB: SGS AUSTRALIA
PROJECT: OCB	☐ Non Standard TAT (List due date):		ATTENTION:
PROJECT NUMBER: 30023609	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.):
PROJECT MANAGER: NATHALIE O'TOOLE	CONTACT PH: 62341967	COC: 1 2 3 4 (5) 6 7	16/33 MADDOX ST.
SAMPLED BY: JOHN O'BRIEN		OF: 1 2 3 4 5 6 7	ALEXANDRIA NSW 2015
DATE SAMPLED: Nathalie.OToole@Smec.com	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
Email reports to (will default to PM if blank): John.OBrien@smec.com	DATE/TIME:	DATE/TIME:	DATE/TIME: / DATE/TIME:
Email Invoice to (will default to PM if blank): AS ABOVE			

Special Laboratory Instructions:

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Hold	TRH	BTEX	13 metals NEPM	PAH	Asbestos			
	TP 14 - 0.5	9/9/2013	S	JAR	1	X								
	TP 14 - 1.0	↓	↓	↓	1	X								
	TP 15 - 0.0				1		X	X	X	X	X			
	TP 15 - 0.5				1	X								
	TP 15 - 1.0				1	X								
	TP 15 - 2.0				1	X								
	TP 16 - 0.0				1		X	X	X	X	X			
	TP 16 - 0.5				1	X								
	TP 16 - 1.0				1	X								
	TP 17 - 0.0				1		X	X	X	X	X			
	TP 17 - 0.5	↓	↓	↓	1	X								
				TOTAL	11	8	3	3	3	3	3			

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

0309

CHAIN OF CUSTODY FORM

6/10

SMEC

SMEC OFFICE: CANBERRA	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT ☐ Non Standard TAT (List due date):		LAB: SGS AUSTRALIA
PROJECT: OCB			ATTENTION:
PROJECT NUMBER: 30023369	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.): 16/33 MADDOX ST. ALEXANDRIA NSW 2015
PROJECT MANAGER: NATHALIE O'TOOLE	CONTACT PH: 02 84 1907	COC: 1 2 3 4 5 (6) 7	
SAMPLED BY: JOHN O'BRIEN		OF: 1 2 3 4 5 6 7	
DATE SAMPLED: Nathalie.OToole@Smec.com	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
Email reports to (will default to PM if blank): John.OBrien@Smec.com	DATE/TIME:	DATE/TIME:	DATE/TIME: / DATE/TIME:
Email Invoice to (will default to PM if blank): AS ABOVE			

Special Laboratory Instructions:

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Asbestos	TRH	BTEX	OCP/OPP	13 Metals NEPM	PAH	Explosive Suite		
	TP17 -1.0	9/9/2013	S	JAR	1	X								
	TP18 - 0.0	10/9/2013	|	|	1	|	|	|	X	X	|	|	|	
	TP18 - 0.5	|	|	|	1	X	|	|	|	|	|	|	|	
	TP18 - 1.0	↓	|	|	1	X	|	|	|	|	|	|	|	
	TP19 - 0.0	11/9/2013	|	|	1	|	X	X	|	|	X	X	|	
	TP19 - 0.5	|	|	|	1	X	|	|	|	|	|	|	|	
	TP19 - 1.0	|	|	|	1	X	|	|	|	|	|	|	|	
	TP21 - 0.0	|	|	|	1	|	|	|	|	|	|	|	|	
	TP21 - 0.5	|	|	|	1	|	X	X	|	X	X	|	|	
	TP21 - 1.0	|	|	|	1	|	X	X	|	X	X	|	|	
	TP23 - 0.0	↓	↓	↓	1	X	|	|	|	|	|	|	|	
				TOTAL	11	6	3	3	1	3	3	1		

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

0310

CHAIN OF CUSTODY FORM

7/10

SMEC OFFICE: CANBERRA	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT ☐ Non Standard TAT (List due date):		LAB: SGS AUSTRALIA
PROJECT: OCB			ATTENTION:
PROJECT NUMBER: 300236G9	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.): 16/33 MADDOX ST.
PROJECT MANAGER: NATHALIE O'TOOLE	CONTACT PH: 62341967	COC: 1 2 3 4 5 6 (7)	ALEXANDRIA NSW 2015
SAMPLED BY: JOHN O'BRIEN		OF: 1 2 3 4 5 6 7	
DATE SAMPLED: Nathalie.OToole@Smec.com	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
Email reports to (will default to PM if blank): John.O'Brien@SMEC.com	DATE/TIME: 7/10/2013	DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if blank): AS ABOVE			
Special Laboratory Instructions:			

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Hold	TRH	BTEX	13 Metals NEPM	PAH	OCP/OP	PCB	Phenols	Asbestos	
	TP23 -0.5	11/9/2013	S	JAR	1		X	X	X	X	X	X	X	X	
	TP 23 -1.0				1	X									
	TP 23-2.0				1		X	X	X	X	X	X	X	X	
	TP 24 -0.0				1		X	X	X	X	X	X	X	X	
	TP 24 -0.5				1	X									
	TP 26 -0.0				1	X									
	TP 26 -0.5				1		X	X	X	X	X	X	X	X	
	TP 26 -1.0				1	X									
	TP 26 -2.0				1		X	X	X	X	X	X	X	X	
	TP 26 -3.0				1	X									
	TP 27 -0.0	↓	↓	↓	1		X	X	X	X	X	X	X	X	
				TOTAL	11	5	6	6	6	6	6	6	6	6	

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

SMEC

CHAIN OF CUSTODY FORM

8/10

SMEC OFFICE: CANBERRA	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT		LAB: SGS AUSTRALIA
PROJECT: OCB	☐ Non Standard TAT (List due date):		ATTENTION:
PROJECT NUMBER: 30023G9	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.): 16/33 MADDOX ST.
PROJECT MANAGER: NATHALIE O'TOOLE	CONTACT PH: 62341967	COC: 1 2 3 4 5 6 7	ALEXANDRIA NSW 2015
SAMPLED BY: JOHN O'BRIEN		OF: 1 2 3 4 5 6 7	
DATE SAMPLED: Nathalie.O'Toole@SMEC.com	RELINQUISHED BY: John O'Brien	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
Email reports to (will default to PM if blank): John.OBrien@SMEC.com	DATE/TIME: 11/9/2013	DATE/TIME:	DATE/TIME: / DATE/TIME:
Email Invoice to (will default to PM if blank): AS ABOVE			

Special Laboratory Instructions:

SAMPLE DETAILS						ANALYSIS REQUIRED									COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Hold	TRH	BTEX	13 Metals NEPM	PAH	PCB	Phenols	OCP/OPP	Asbestos	
	TP27 - 0.5	11/9/2013	S	JAR	1	X									
	TP27 - 1.0				1	X									
	TP23 - 0.0				1	X									
	TP26 - 0.5				1		X	X	X	X	X	X	X	X	
	TP25 - 0.0				1	X									
	TP25 - 0.5				1		X	X	X	X	X	X	X	X	
	TP25 - 1.0				1	X									
	TP25 - 2.0				1		X	X	X	X	X	X	X	X	
	TP25 - 3.0				1	X									
	TP22 - 0.0				1	X									
	TP22 - 0.5	↓	↓	↓	1		X	X	X	X				X	
				TOTAL	11	7	4	4	4	4	3	3	3	5	

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

CHAIN OF CUSTODY FORM 9/10

SMEC

SMEC OFFICE: CANBERRA	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT ☐ Non Standard TAT (List due date):		LAB: SGS AUSTRALIA
PROJECT: OCB			ATTENTION:
PROJECT NUMBER: 300369	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.): 10/33 MADDOX ST ALEXANDRIA NSW 2015
PROJECT MANAGER: NATHALIE O'TOOLE	CONTACT PH: 6234 1967	COC: 1 2 3 4 5 6 7	
SAMPLED BY: JOHN O'BRIEN		OF: 1 2 3 4 5 6 7	
DATE SAMPLED: Nathalie.O'Toole@SMEC.com	RELINQUISHED BY: John O'Brien	RECEIVED BY:	RELINQUISHED BY:
Email reports to (will default to PM if blank): John.O'Brien@SMEC.com	DATE/TIME: 11/9/2013	DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if blank): AS ABOVE			RECEIVED BY:
Special Laboratory Instructions:			DATE/TIME:

SAMPLE DETAILS						ANALYSIS REQUIRED									COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Hold	TRH	BTEX	~~HM~~ 13 Metals Nepm	PAH	PCB	OCP/OPP	Phenols	Asbestos	
	TP22-1.0	11/9/2013	S	JAR	1		X	X	X	X				X	
	TP20-0.0				1				X					X	
	TP20-0.5				1				X						
	TP20-1.0				1	X									
	QC101	9/9/2013			4		X	X	X	X	X	X	X		
	QC102	9/9/2013			1	X									
	QC103	9/9/2013			1	X									
	QC104	9/9/2013			1	X									
	QC105	10/9/2013			4		X	X	X	X	X	X	X		
	QC106	10/9/2013			1	X									
	QC107	10/9/2013			1	X									
				TOTAL	~~17~~ 16	6	3	3	5	3	2	2	2	2	

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

CHAIN OF CUSTODY FORM

10/10

SMEC

SMEC OFFICE: CANBERRA	TURNAROUND REQUIREMENTS: ☒ Standard - 5 day TAT ☐ Non Standard TAT (List due date):		LAB: SGS AUSTRALIA
PROJECT: OCB			ATTENTION:
PROJECT NUMBER: 3009369	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.): 16/33 MADDOX ST.
PROJECT MANAGER: NATHALIE O'TOOLE	CONTACT PH: 6234 1967	COC: 1 2 3 4 5 6 7	ALEXANDRIA NSW 2015
SAMPLED BY: JOHN O'BRIEN		OF: 1 2 3 4 5 6 7	
DATE SAMPLED: Nathalie.OToole@Sme.com	RELINQUISHED BY: John O'Brien	RECEIVED BY:	RELINQUISHED BY:
Email reports to (will default to PM if blank):	DATE/TIME: 11/9/2013	DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if blank): AS ABOVE			

Special Laboratory Instructions: * Please FWD QC110 + QC113 to Eurofins Sydney, Chilled Condition

SAMPLE DETAILS						ANALYSIS REQUIRED									COMMENTS		
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Hold	TRH	BTEX	PAH	PCB	13 metals Nepm	Phenols	OCP/OPP	Asbestos	TRH C6-C10	Explosive Soils	
	QC 108	10/9/2013	S	JAR	1	X											
	QC 109	11/9/2013	W	↓	4		X	X	X	X	X	X	X			X	
*	QC 110	11/9/2013			1		X	X	X	X	X	X	X	X			*
	QC 111	11/9/2013			1		X	X	X	X	X	X	X	X			
	QC 112	11/9/2013			1		X	X	X		X			X			
*	QC 113	11/9/2013	↓	↓	1		X	X	X		X			X			*
	Trip Blank	9/9/2013	W	Vial	2			X							X		
	Trip Spike	11/9/2013	S	Vial	1		X	X									
	TP2-1-0	10/9/2013	S	Jar	1	X											
	TP28-1-0	11/9/13	S	Jar	1	X											
	TP28-2-0	11/9/13	S	Jar	1		X	X	X	X	X	X	X	X			
				TOTAL	16	3	7	8	6	4	6	4	4	5	1	1	

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

SAMPLE RECEIPT ADVICE

SE120709

CLIENT DETAILS

Contact	Nathalie O'Toole
Client	SMEC Australia Pty Ltd - ACT
Address	Sun Micro Building Suite 2, Level 1 243 Northbourne Avenue LYNEHAM ACT 2602
Telephone	02 6234 1900
Facsimile	02 6234 1966
Email	Nathalie.O'Toole@smec.com
Project	**3002369 - OCB**
Order Number	**0304--0313**
Samples	42

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
Samples Received	Thu 12/9/2013
Report Due	Thu 19/9/2013
SGS Reference	**SE120709**

SUBMISSION DETAILS

This is to confirm that 42 samples were received on Thursday 12/9/2013. Results are expected to be ready by Thursday 19/9/2013. Please quote SGS reference SE120709 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Sample counts by matrix	38 Soils, 4 Waters	Type of documentation received	COC
Date documentation received	12/9/13@3:25pm	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	3°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice	Samples clearly labelled	Yes
Complete documentation received	Yes		

Samples will be held for one month for water samples and two months for soil samples from date of report, unless otherwise instructed.

COMMENTS

For Explosives results refer SGS SE120709A.
Trip Spike analysed for BTEX only.
A separate portion was not supplied for Asbestos analysis. A sub-sample will be used from the jar provided.
66x samples have been placed on hold as no tests have been assigned for them by the client. These samples will not be processed.

To the extent not inconsistent with the other provisions of this document and unless specifically agreed otherwise in writing by SGS, all SGS services are rendered in accordance with the applicable SGS General Conditions of Service accessible at http://www.sgs.com/en/Terms-and-Conditions/General-Conditions-of-Services-English.aspx as at the date of this document.
Attention is drawn to the limitations of liability and to the clauses of indemnification.

SAMPLE RECEIPT ADVICE

SE120709

CLIENT DETAILS

Client SMEC Australia Pty Ltd - ACT

Project 3002369 - OCB

SUMMARY OF ANALYSIS

No.	Sample ID	OC Pesticides in Soil	OP Pesticides in Soil	PAH (Polynuclear Aromatic Hydrocarbons) in	PCBs in Soil	Total Phenolics in Soil	TRH (Total Recoverable Hydrocarbons) in Soil	VOC's in Soil	Volatile Petroleum Hydrocarbons in Soil
001	TP01-0.0	28	13	-	-	-	-	-	-
002	TP02-0.0	28	13	-	-	-	-	-	-
003	TP03-0.0	28	13	-	-	-	-	-	-
004	TP04-0.0	28	13	-	-	-	-	-	-
005	TP05-0.0	28	13	-	-	-	-	-	-
006	TP06-0.0	28	13	-	-	-	-	-	-
007	TP07-0.0	28	13	-	-	-	-	-	-
008	TP08-0.0	28	13	-	-	-	-	-	-
009	TP09-0.0	28	13	-	-	-	-	-	-
010	TP10-0.0	28	13	-	-	-	-	-	-
011	TP11-0.0	28	13	-	-	-	-	-	-
012	TP12-0.0	28	13	-	-	-	-	-	-
013	TP13-0.0	28	13	-	-	-	-	-	-
014	TP14-0.0	28	13	-	-	-	-	-	-
015	TP15-0.0	-	-	23	-	-	9	12	8
016	TP16-0.0	-	-	23	-	-	9	12	8
017	TP17-0.0	-	-	23	-	-	9	12	8
018	TP18-0.0	28	13	-	-	-	-	-	-
019	TP19-0.0	-	-	23	-	-	9	12	8
020	TP21-0.5	-	-	23	-	-	9	12	8
021	TP21-1.0	-	-	23	-	-	9	12	8
022	TP23-0.5	28	13	23	11	1	9	12	8
023	TP23-2.0	28	13	23	11	1	9	12	8
024	TP24-0.0	28	13	23	11	1	9	12	8

CONTINUED OVERLEAF

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
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Please indicate as soon as possible should your request differ from these details.
Testing as per this table shall commence immediately unless the client intervenes with a correction.

SAMPLE RECEIPT ADVICE

SE120709

CLIENT DETAILS

Client SMEC Australia Pty Ltd - ACT

Project 3002369 - OCB

SUMMARY OF ANALYSIS

No.	Sample ID	OC Pesticides in Soil	OP Pesticides in Soil	PAH (Polynuclear Aromatic Hydrocarbons) in	PCBs in Soil	Total Phenolics in Soil	TRH (Total Recoverable Hydrocarbons) in Soil	VOC's in Soil	Volatile Petroleum Hydrocarbons in Soil
025	TP26-0.5	28	13	23	11	1	9	12	8
026	TP26-2.0	28	13	23	11	1	9	12	8
027	TP27-0.0	28	13	23	11	1	9	12	8
028	TP28-0.5	28	13	23	11	1	9	12	8
029	TP25-0.5	28	13	23	11	1	9	12	8
030	TP25-2.0	28	13	23	11	1	9	12	8
031	TP22-0.5	-	-	23	-	-	9	12	8
032	TP22-1.0	-	-	23	-	-	9	12	8
038	QC 111	28	13	23	11	1	9	12	8
039	QC 112	-	-	23	-	-	9	12	8
041	Trip Spike	-	-	-	-	-	-	12	-
042	TP28-2.0	28	13	23	11	1	9	12	8

CONTINUED OVERLEAF

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SAMPLE RECEIPT ADVICE

SE120709

CLIENT DETAILS

Client SMEC Australia Pty Ltd - ACT

Project 3002369 - OCB

SUMMARY OF ANALYSIS

No.	Sample ID	Fibre Identification in soil	Hexavalent Chromium in Soil UV/Vis	Mercury in Soil	Moisture Content	Total Recoverable Metals in Soil by ICPOES from
001	TP01-0.0	-	1	1	1	11
002	TP02-0.0	-	1	1	1	11
003	TP03-0.0	-	1	1	1	11
004	TP04-0.0	-	1	1	1	11
005	TP05-0.0	-	1	1	1	11
006	TP06-0.0	-	1	1	1	11
007	TP07-0.0	-	1	1	1	11
008	TP08-0.0	-	1	1	1	11
009	TP09-0.0	-	1	1	1	11
010	TP10-0.0	-	1	1	1	11
011	TP11-0.0	-	1	1	1	11
012	TP12-0.0	2	1	1	1	11
013	TP13-0.0	-	1	1	1	11
014	TP14-0.0	-	1	1	1	11
015	TP15-0.0	2	1	1	1	11
016	TP16-0.0	2	1	1	1	11
017	TP17-0.0	2	1	1	1	11
018	TP18-0.0	-	1	1	1	11
019	TP19-0.0	-	-	-	1	-
020	TP21-0.5	-	1	1	1	11
021	TP21-1.0	-	1	1	1	11
022	TP23-0.5	2	1	1	1	11
023	TP23-2.0	2	1	1	1	11
024	TP24-0.0	2	1	1	1	11

CONTINUED OVERLEAF

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SAMPLE RECEIPT ADVICE

SE120709

CLIENT DETAILS

Client SMEC Australia Pty Ltd - ACT

Project 3002369 - OCB

SUMMARY OF ANALYSIS

No.	Sample ID	Fibre Identification in soil	Hexavalent Chromium in Soil UV/Vis	Mercury in Soil	Moisture Content	Total Recoverable Metals in Soil by ICPOES from	VOCs in Water	Volatile Petroleum Hydrocarbons in Water
025	TP26-0.5	2	1	1	1	11	-	-
026	TP26-2.0	2	1	1	1	11	-	-
027	TP27-0.0	2	1	1	1	11	-	-
028	TP28-0.5	2	1	1	1	11	-	-
029	TP25-0.5	2	1	1	1	11	-	-
030	TP25-2.0	2	1	1	1	11	-	-
031	TP22-0.5	2	1	1	1	11	-	-
032	TP22-1.0	2	1	1	1	11	-	-
033	TP20-0.0	2	1	1	1	11	-	-
034	TP20-0.5	-	1	1	1	11	-	-
035	QC 101	-	-	-	-	-	12	8
036	QC 105	-	-	-	-	-	12	8
037	QC 109	-	-	-	-	-	12	8
038	QC 111	2	1	1	1	11	-	-
039	QC 112	2	1	1	1	11	-	-
040	Trip Blank	-	-	-	-	-	12	8
042	TP28-2.0	2	1	1	1	11	-	-

CONTINUED OVERLEAF

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SAMPLE RECEIPT ADVICE

SE120709

CLIENT DETAILS

Client SMEC Australia Pty Ltd - ACT

Project 3002369 - OCB

SUMMARY OF ANALYSIS

No.	Sample ID	Hexavalent Chromium in water by Discrete Analyser	Mercury (dissolved) in Water	OC Pesticides in Water	OP Pesticides in Water	PAH (Polynuclear Aromatic Hydrocarbons) in	PCBs in Water	Total Phenolics in Water	Trace Metals (Dissolved) in Water by ICPMS	TRH (Total Recoverable Hydrocarbons) in Water
035	QC 101	1	1	28	13	22	11	1	11	9
036	QC 105	1	1	28	13	22	11	1	11	9
037	QC 109	1	1	28	13	22	11	1	11	9

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details.
Testing as per this table shall commence immediately unless the client intervenes with a correction.

ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS

Contact	Nathalie O'Toole
Client	SMEC Australia Pty Ltd - ACT
Address	Sun Micro Building Suite 2, Level 1 243 Northbourne Avenue LYNEHAM ACT 2602
Telephone	02 6234 1900
Facsimile	02 6234 1966
Email	Nathalie.O'Toole@smec.com
Project	**3002369 - OCB**
Order Number	**0304--0313**
Samples	42
Date Received	12/9/2013

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE120709 R0**
Report Number	0000065698
Date Reported	20/9/2013

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

No respirable fibres detected in all samples using trace analysis technique.

Asbestos analysed by Approved Identifier Ravee Sivasubramaniam.

SIGNATORIES

Andy Sutton
Senior Organic Chemist

Dong Liang
Metals/Inorganics Team Leader

Kamrul Ahsan
Senior Chemist

Ravee Sivasubramaniam
Asbestos Analyst

Sheila Lepasana
Senior Technician

Snezana Kostoska
2IC Inorganics Chemist

VOC's in Soil [AN433/AN434]

PARAMETER	UOM	LOR	TP15-0.0 SOIL 9/9/2013 SE120709.015	TP16-0.0 SOIL 9/9/2013 SE120709.016	TP17-0.0 SOIL 9/9/2013 SE120709.017	TP19-0.0 SOIL 11/9/2013 SE120709.019	TP21-0.5 SOIL 11/9/2013 SE120709.020	TP21-1.0 SOIL 11/9/2013 SE120709.021
Benzene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Xylenes*	mg/kg	0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX*	mg/kg	0.60	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Naphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibromofluoromethane (Surrogate)	%	-	74	74	93	76	71	71
d4-1,2-dichloroethane (Surrogate)	%	-	82	85	105	91	86	87
d8-toluene (Surrogate)	%	-	84	85	108	88	84	85
Bromofluorobenzene (Surrogate)	%	-	103	96	109	106	100	94

PARAMETER	UOM	LOR	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024	TP26-0.5 SOIL 11/9/2013 SE120709.025	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027
Benzene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Xylenes*	mg/kg	0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX*	mg/kg	0.60	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Naphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibromofluoromethane (Surrogate)	%	-	70	73	78	86	85	86
d4-1,2-dichloroethane (Surrogate)	%	-	80	91	95	107	105	106
d8-toluene (Surrogate)	%	-	80	90	93	101	102	103
Bromofluorobenzene (Surrogate)	%	-	92	104	97	116	109	111

PARAMETER	UOM	LOR	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030	TP22-0.5 SOIL 11/9/2013 SE120709.031	TP22-1.0 SOIL 11/9/2013 SE120709.032	QC 111 SOIL 11/9/2013 SE120709.038
Benzene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-xylene	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-xylene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Xylenes*	mg/kg	0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total BTEX*	mg/kg	0.60	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Naphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibromofluoromethane (Surrogate)	%	-	79	80	77	77	77	90
d4-1,2-dichloroethane (Surrogate)	%	-	103	102	98	100	101	116
d8-toluene (Surrogate)	%	-	101	96	95	95	99	115
Bromofluorobenzene (Surrogate)	%	-	111	100	99	96	103	118

VOC's in Soil [AN433/AN434] (continued)

PARAMETER	UOM	LOR	QC 112 SOIL 11/9/2013 SE120709.039	Trip Spike SOIL 11/9/2013 SE120709.041	TP28-2.0 SOIL 11/9/2013 SE120709.042
Benzene	mg/kg	0.10	<0.1	[70%]	<0.1
Toluene	mg/kg	0.10	<0.1	[89%]	<0.1
Ethylbenzene	mg/kg	0.10	<0.1	[89%]	<0.1
m/p-xylene	mg/kg	0.20	<0.2	[93%]	<0.2
o-xylene	mg/kg	0.10	<0.1	[93%]	<0.1
Total Xylenes*	mg/kg	0.30	<0.3	-	<0.3
Total BTEX*	mg/kg	0.60	<0.6	-	<0.6
Naphthalene	mg/kg	0.10	<0.1	<0.1	<0.1
Dibromofluoromethane (Surrogate)	%	-	82	80	71
d4-1,2-dichloroethane (Surrogate)	%	-	108	105	90
d8-toluene (Surrogate)	%	-	104	105	85
Bromofluorobenzene (Surrogate)	%	-	103	107	88

Volatile Petroleum Hydrocarbons in Soil [AN433/AN434/AN410]

PARAMETER	UOM	LOR	TP15-0.0 SOIL 9/9/2013 SE120709.015	TP16-0.0 SOIL 9/9/2013 SE120709.016	TP17-0.0 SOIL 9/9/2013 SE120709.017	TP19-0.0 SOIL 11/9/2013 SE120709.019	TP21-0.5 SOIL 11/9/2013 SE120709.020	TP21-1.0 SOIL 11/9/2013 SE120709.021
TRH C6-C9	mg/kg	20	<20	<20	<20	<20	<20	<20
Benzene (F0)	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10	mg/kg	25.0	<25	<25	<25	<25	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25.0	<25	<25	<25	<25	<25	<25
Dibromofluoromethane (Surrogate)	%	-	74	74	93	76	71	71
d4-1,2-dichloroethane (Surrogate)	%	-	82	85	105	91	86	87
d8-toluene (Surrogate)	%	-	84	85	108	88	84	85
Bromofluorobenzene (Surrogate)	%	-	103	96	109	106	100	94

PARAMETER	UOM	LOR	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024	TP26-0.5 SOIL 11/9/2013 SE120709.025	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027
TRH C6-C9	mg/kg	20	<20	<20	<20	<20	<20	<20
Benzene (F0)	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10	mg/kg	25.0	<25	<25	<25	<25	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25.0	<25	<25	<25	<25	<25	<25
Dibromofluoromethane (Surrogate)	%	-	70	73	78	86	85	86
d4-1,2-dichloroethane (Surrogate)	%	-	80	91	95	107	105	106
d8-toluene (Surrogate)	%	-	80	90	93	101	102	103
Bromofluorobenzene (Surrogate)	%	-	92	104	97	116	109	111

PARAMETER	UOM	LOR	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030	TP22-0.5 SOIL 11/9/2013 SE120709.031	TP22-1.0 SOIL 11/9/2013 SE120709.032	QC 111 SOIL 11/9/2013 SE120709.038
TRH C6-C9	mg/kg	20	<20	<20	<20	<20	<20	<20
Benzene (F0)	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C10	mg/kg	25.0	<25	<25	<25	<25	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25.0	<25	<25	<25	<25	<25	<25
Dibromofluoromethane (Surrogate)	%	-	79	80	77	77	77	90
d4-1,2-dichloroethane (Surrogate)	%	-	103	102	98	100	101	116
d8-toluene (Surrogate)	%	-	101	96	95	95	99	115
Bromofluorobenzene (Surrogate)	%	-	111	100	99	96	103	118

PARAMETER	UOM	LOR	QC 112 SOIL 11/9/2013 SE120709.039	TP28-2.0 SOIL 11/9/2013 SE120709.042
TRH C6-C9	mg/kg	20	<20	<20
Benzene (F0)	mg/kg	0.10	<0.1	<0.1
TRH C6-C10	mg/kg	25.0	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25.0	<25	<25
Dibromofluoromethane (Surrogate)	%	-	82	71
d4-1,2-dichloroethane (Surrogate)	%	-	108	90
d8-toluene (Surrogate)	%	-	104	85
Bromofluorobenzene (Surrogate)	%	-	103	88

TRH (Total Recoverable Hydrocarbons) in Soil [AN403]

PARAMETER	UOM	LOR	TP15-0.0 SOIL 9/9/2013 SE120709.015	TP16-0.0 SOIL 9/9/2013 SE120709.016	TP17-0.0 SOIL 9/9/2013 SE120709.017	TP19-0.0 SOIL 11/9/2013 SE120709.019	TP21-0.5 SOIL 11/9/2013 SE120709.020	TP21-1.0 SOIL 11/9/2013 SE120709.021
TRH C10-C14	mg/kg	20	<20	<20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45.0	<45	<45	<45	<45	<45	<45
TRH C29-C36	mg/kg	45.0	<45	<45	<45	<45	<45	<45
TRH C37-C40	mg/kg	100	<100	<100	<100	<100	<100	<100
TRH >C10-C16 (F2)	mg/kg	25.0	<25	<25	<25	<25	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	<90	<90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120	<120	<120
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	<110	<110	<110
TRH C10-C40 Total	mg/kg	210	<210	<210	<210	<210	<210	<210

PARAMETER	UOM	LOR	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024	TP26-0.5 SOIL 11/9/2013 SE120709.025	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027
TRH C10-C14	mg/kg	20	<20	<20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45.0	<45	<45	<45	<45	**120**	<45
TRH C29-C36	mg/kg	45.0	<45	<45	<45	<45	<45	<45
TRH C37-C40	mg/kg	100	<100	<100	<100	<100	<100	<100
TRH >C10-C16 (F2)	mg/kg	25.0	<25	<25	<25	<25	**35**	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	<90	**110**	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120	<120	<120
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	<110	**120**	<110
TRH C10-C40 Total	mg/kg	210	<210	<210	<210	<210	<210	<210

PARAMETER	UOM	LOR	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030	TP22-0.5 SOIL 11/9/2013 SE120709.031	TP22-1.0 SOIL 11/9/2013 SE120709.032	QC 111 SOIL 11/9/2013 SE120709.038
TRH C10-C14	mg/kg	20	<20	<20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45.0	<45	<45	<45	<45	<45	<45
TRH C29-C36	mg/kg	45.0	<45	<45	<45	<45	<45	<45
TRH C37-C40	mg/kg	100	<100	<100	<100	<100	<100	<100
TRH >C10-C16 (F2)	mg/kg	25.0	<25	<25	<25	<25	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90	<90	<90	<90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120	<120	<120	<120	<120
TRH C10-C36 Total	mg/kg	110	<110	<110	<110	<110	<110	<110
TRH C10-C40 Total	mg/kg	210	<210	<210	<210	<210	<210	<210

PARAMETER	UOM	LOR	QC 112 SOIL 11/9/2013 SE120709.039	TP28-2.0 SOIL 11/9/2013 SE120709.042
TRH C10-C14	mg/kg	20	<20	<20
TRH C15-C28	mg/kg	45.0	**48**	<45
TRH C29-C36	mg/kg	45.0	<45	<45
TRH C37-C40	mg/kg	100	<100	<100
TRH >C10-C16 (F2)	mg/kg	25.0	<25	<25
TRH >C16-C34 (F3)	mg/kg	90	<90	<90
TRH >C34-C40 (F4)	mg/kg	120	<120	<120
TRH C10-C36 Total	mg/kg	110	<110	<110
TRH C10-C40 Total	mg/kg	210	<210	<210

PAH (Polynuclear Aromatic Hydrocarbons) in Soil [AN420]

PARAMETER	UOM	LOR	TP15-0.0 SOIL 9/9/2013 SE120709.015	TP16-0.0 SOIL 9/9/2013 SE120709.016	TP17-0.0 SOIL 9/9/2013 SE120709.017	TP19-0.0 SOIL 11/9/2013 SE120709.019	TP21-0.5 SOIL 11/9/2013 SE120709.020	TP21-1.0 SOIL 11/9/2013 SE120709.021
Naphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total PAH	mg/kg	0.80	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Carcinogenic PAHs (as BaP TEQ)*	TEQ	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
d5-nitrobenzene (Surrogate)	%	-	94	98	96	92	92	92
2-fluorobiphenyl (Surrogate)	%	-	92	92	92	86	90	90
d14-p-terphenyl (Surrogate)	%	-	108	116	108	112	106	106

PARAMETER	UOM	LOR	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024	TP26-0.5 SOIL 11/9/2013 SE120709.025	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027
Naphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total PAH	mg/kg	0.80	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Carcinogenic PAHs (as BaP TEQ)*	TEQ	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
d5-nitrobenzene (Surrogate)	%	-	94	86	90	88	94	94
2-fluorobiphenyl (Surrogate)	%	-	92	86	88	92	102	90
d14-p-terphenyl (Surrogate)	%	-	112	106	110	114	112	108

PAH (Polynuclear Aromatic Hydrocarbons) in Soil [AN420] (continued)

PARAMETER	UOM	LOR	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030	TP22-0.5 SOIL 11/9/2013 SE120709.031	TP22-1.0 SOIL 11/9/2013 SE120709.032	QC 111 SOIL 11/9/2013 SE120709.038
Naphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.10	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Anthracene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total PAH	mg/kg	0.80	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Carcinogenic PAHs (as BaP TEQ)*	TEQ	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
d5-nitrobenzene (Surrogate)	%	-	98	102	106	90	84	94
2-fluorobiphenyl (Surrogate)	%	-	102	96	106	98	86	94
d14-p-terphenyl (Surrogate)	%	-	108	104	114	110	104	102

PARAMETER	UOM	LOR	QC 112 SOIL 11/9/2013 SE120709.039	TP28-2.0 SOIL 11/9/2013 SE120709.042
Naphthalene	mg/kg	0.10	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.10	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.10	<0.1	<0.1
Acenaphthylene	mg/kg	0.10	<0.1	<0.1
Acenaphthene	mg/kg	0.10	<0.1	<0.1
Fluorene	mg/kg	0.10	<0.1	<0.1
Phenanthrene	mg/kg	0.10	<0.1	<0.1
Anthracene	mg/kg	0.10	<0.1	<0.1
Fluoranthene	mg/kg	0.10	<0.1	<0.1
Pyrene	mg/kg	0.10	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.10	<0.1	<0.1
Chrysene	mg/kg	0.10	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.10	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.10	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.10	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.10	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.10	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.10	<0.1	<0.1
Total PAH	mg/kg	0.80	<0.8	<0.8
Carcinogenic PAHs (as BaP TEQ)*	TEQ	0.20	<0.2	<0.2
d5-nitrobenzene (Surrogate)	%	-	88	92
2-fluorobiphenyl (Surrogate)	%	-	92	92
d14-p-terphenyl (Surrogate)	%	-	104	116

OC Pesticides in Soil [AN400/AN420]

PARAMETER	UOM	LOR	TP01-0.0 SOIL 10/9/2013 SE120709.001	TP02-0.0 SOIL 10/9/2013 SE120709.002	TP03-0.0 SOIL 10/9/2013 SE120709.003	TP04-0.0 SOIL 10/9/2013 SE120709.004	TP05-0.0 SOIL 9/9/2013 SE120709.005	TP06-0.0 SOIL 9/9/2013 SE120709.006
Hexachlorobenzene (HCB)	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lindane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Delta BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Gamma Chlordane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Chlordane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDD	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta Endosulfan	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDD	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isodrin	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mirex	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tetrachloro-m-xylene (TCMX)	%	-	**101**	**105**	**123**	**109**	**101**	**101**

OC Pesticides in Soil [AN400/AN420] (continued)

PARAMETER	UOM	LOR	TP07-0.0 SOIL 9/9/2013 SE120709.007	TP08-0.0 SOIL 9/9/2013 SE120709.008	TP09-0.0 SOIL 9/9/2013 SE120709.009	TP10-0.0 SOIL 10/9/2013 SE120709.010	TP11-0.0 SOIL 10/9/2013 SE120709.011	TP12-0.0 SOIL 10/9/2013 SE120709.012
Hexachlorobenzene (HCB)	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lindane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Delta BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Gamma Chlordane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Chlordane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDD	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta Endosulfan	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDD	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isodrin	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mirex	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tetrachloro-m-xylene (TCMX)	%	-	**105**	**109**	**107**	**109**	**113**	**107**

OC Pesticides in Soil [AN400/AN420] (continued)

PARAMETER	UOM	LOR	TP13-0.0 SOIL 10/9/2013 SE120709.013	TP14-0.0 SOIL 9/9/2013 SE120709.014	TP18-0.0 SOIL 10/9/2013 SE120709.018	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024
Hexachlorobenzene (HCB)	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lindane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Delta BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Gamma Chlordane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Chlordane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDD	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta Endosulfan	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDD	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isodrin	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mirex	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tetrachloro-m-xylene (TCMX)	%	-	**105**	**102**	**111**	**75**	**99**	**108**

OC Pesticides in Soil [AN400/AN420] (continued)

PARAMETER	UOM	LOR	TP26-0.5 SOIL 11/9/2013 SE120709.025	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030
Hexachlorobenzene (HCB)	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lindane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Delta BHC	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Gamma Chlordane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Chlordane	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDD	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta Endosulfan	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDD	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isodrin	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mirex	mg/kg	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tetrachloro-m-xylene (TCMX)	%	-	**95**	**111**	**107**	**108**	**113**	**107**

OC Pesticides in Soil [AN400/AN420] (continued)

PARAMETER	UOM	LOR	QC 111 SOIL 11/9/2013 SE120709.038	TP28-2.0 SOIL 11/9/2013 SE120709.042
Hexachlorobenzene (HCB)	mg/kg	0.10	<0.1	<0.1
Alpha BHC	mg/kg	0.10	<0.1	<0.1
Lindane	mg/kg	0.10	<0.1	<0.1
Heptachlor	mg/kg	0.10	<0.1	<0.1
Aldrin	mg/kg	0.10	<0.1	<0.1
Beta BHC	mg/kg	0.10	<0.1	<0.1
Delta BHC	mg/kg	0.10	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.10	<0.1	<0.1
o,p'-DDE	mg/kg	0.10	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.20	<0.2	<0.2
Gamma Chlordane	mg/kg	0.10	<0.1	<0.1
Alpha Chlordane	mg/kg	0.10	<0.1	<0.1
trans-Nonachlor	mg/kg	0.10	<0.1	<0.1
p,p'-DDE	mg/kg	0.10	<0.1	<0.1
Dieldrin	mg/kg	0.20	<0.2	<0.2
Endrin	mg/kg	0.20	<0.2	<0.2
o,p'-DDD	mg/kg	0.10	<0.1	<0.1
o,p'-DDT	mg/kg	0.10	<0.1	<0.1
Beta Endosulfan	mg/kg	0.20	<0.2	<0.2
p,p'-DDD	mg/kg	0.10	<0.1	<0.1
p,p'-DDT	mg/kg	0.10	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.10	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.10	<0.1	<0.1
Methoxychlor	mg/kg	0.10	<0.1	<0.1
Endrin Ketone	mg/kg	0.10	<0.1	<0.1
Isodrin	mg/kg	0.10	<0.1	<0.1
Mirex	mg/kg	0.10	<0.1	<0.1
Tetrachloro-m-xylene (TCMX)	%	-	**115**	**118**

OP Pesticides in Soil [AN400/AN420]

PARAMETER	UOM	LOR	TP01-0.0 SOIL 10/9/2013 SE120709.001	TP02-0.0 SOIL 10/9/2013 SE120709.002	TP03-0.0 SOIL 10/9/2013 SE120709.003	TP04-0.0 SOIL 10/9/2013 SE120709.004	TP05-0.0 SOIL 9/9/2013 SE120709.005	TP06-0.0 SOIL 9/9/2013 SE120709.006
Dichlorvos	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dimethoate	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diazinon (Dimpylate)	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fenitrothion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Parathion-ethyl (Parathion)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bromophos Ethyl	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Methidathion	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Azinphos-methyl (Guthion)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2-fluorobiphenyl (Surrogate)	%	-	106	108	120	104	110	112
d14-p-terphenyl (Surrogate)	%	-	108	112	122	110	116	116

PARAMETER	UOM	LOR	TP07-0.0 SOIL 9/9/2013 SE120709.007	TP08-0.0 SOIL 9/9/2013 SE120709.008	TP09-0.0 SOIL 9/9/2013 SE120709.009	TP10-0.0 SOIL 10/9/2013 SE120709.010	TP11-0.0 SOIL 10/9/2013 SE120709.011	TP12-0.0 SOIL 10/9/2013 SE120709.012
Dichlorvos	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dimethoate	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diazinon (Dimpylate)	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fenitrothion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Parathion-ethyl (Parathion)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bromophos Ethyl	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Methidathion	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Azinphos-methyl (Guthion)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2-fluorobiphenyl (Surrogate)	%	-	110	102	110	102	120	112
d14-p-terphenyl (Surrogate)	%	-	118	106	114	104	126	116

PARAMETER	UOM	LOR	TP13-0.0 SOIL 10/9/2013 SE120709.013	TP14-0.0 SOIL 9/9/2013 SE120709.014	TP18-0.0 SOIL 10/9/2013 SE120709.018	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024
Dichlorvos	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dimethoate	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diazinon (Dimpylate)	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fenitrothion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Parathion-ethyl (Parathion)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bromophos Ethyl	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Methidathion	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Azinphos-methyl (Guthion)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2-fluorobiphenyl (Surrogate)	%	-	106	104	100	92	86	88
d14-p-terphenyl (Surrogate)	%	-	110	108	104	112	106	110

OP Pesticides in Soil [AN400/AN420] (continued)

PARAMETER	UOM	LOR	TP26-0.5 SOIL 11/9/2013 SE120709.025	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030
Dichlorvos	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dimethoate	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diazinon (Dimpylate)	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fenitrothion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Parathion-ethyl (Parathion)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bromophos Ethyl	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Methidathion	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethion	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Azinphos-methyl (Guthion)	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2-fluorobiphenyl (Surrogate)	%	-	**92**	**102**	**90**	**102**	**96**	**106**
d14-p-terphenyl (Surrogate)	%	-	**114**	**112**	**108**	**108**	**104**	**114**

PARAMETER	UOM	LOR	QC 111 SOIL 11/9/2013 SE120709.038	TP28-2.0 SOIL 11/9/2013 SE120709.042
Dichlorvos	mg/kg	0.50	<0.5	<0.5
Dimethoate	mg/kg	0.50	<0.5	<0.5
Diazinon (Dimpylate)	mg/kg	0.50	<0.5	<0.5
Fenitrothion	mg/kg	0.20	<0.2	<0.2
Malathion	mg/kg	0.20	<0.2	<0.2
Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.20	<0.2	<0.2
Parathion-ethyl (Parathion)	mg/kg	0.20	<0.2	<0.2
Bromophos Ethyl	mg/kg	0.20	<0.2	<0.2
Methidathion	mg/kg	0.50	<0.5	<0.5
Ethion	mg/kg	0.20	<0.2	<0.2
Azinphos-methyl (Guthion)	mg/kg	0.20	<0.2	<0.2
2-fluorobiphenyl (Surrogate)	%	-	**94**	**92**
d14-p-terphenyl (Surrogate)	%	-	**102**	**116**

PCBs in Soil [AN400/AN420]

PARAMETER	UOM	LOR	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024	TP26-0.5 SOIL 11/9/2013 SE120709.025	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027
Arochlor 1016	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1221	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1232	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1242	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1248	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1254	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1260	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1262	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1268	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total PCBs (Arochlors)	mg/kg	1.0	<1	<1	<1	<1	<1	<1
Tetrachloro-m-xylene (TCMX)	%	-	**75**	**99**	**108**	**95**	**111**	**107**

PARAMETER	UOM	LOR	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030	QC 111 SOIL 11/9/2013 SE120709.038	TP28-2.0 SOIL 11/9/2013 SE120709.042
Arochlor 1016	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1221	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1232	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1242	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1248	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1254	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1260	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1262	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2
Arochlor 1268	mg/kg	0.20	<0.2	<0.2	<0.2	<0.2	<0.2
Total PCBs (Arochlors)	mg/kg	1.0	<1	<1	<1	<1	<1
Tetrachloro-m-xylene (TCMX)	%	-	**108**	**113**	**107**	**115**	**118**

Total Phenolics in Soil [AN289]

PARAMETER	UOM	LOR	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024	TP26-0.5 SOIL 11/9/2013 SE120709.025	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027
Total Phenols	mg/kg	0.10	0.1	<0.1	0.2	<0.1	<0.1	0.3

PARAMETER	UOM	LOR	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030	QC 111 SOIL 11/9/2013 SE120709.038	TP28-2.0 SOIL 11/9/2013 SE120709.042
Total Phenols	mg/kg	0.10	<0.1	<0.1	<0.1	0.1	<0.1

Hexavalent Chromium in Soil UV/Vis [AN075/AN201]

PARAMETER	UOM	LOR	TP01-0.0 SOIL 10/9/2013 SE120709.001	TP02-0.0 SOIL 10/9/2013 SE120709.002	TP03-0.0 SOIL 10/9/2013 SE120709.003	TP04-0.0 SOIL 10/9/2013 SE120709.004	TP05-0.0 SOIL 9/9/2013 SE120709.005	TP06-0.0 SOIL 9/9/2013 SE120709.006
Hexavalent Chromium, Cr6+	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

PARAMETER	UOM	LOR	TP07-0.0 SOIL 9/9/2013 SE120709.007	TP08-0.0 SOIL 9/9/2013 SE120709.008	TP09-0.0 SOIL 9/9/2013 SE120709.009	TP10-0.0 SOIL 10/9/2013 SE120709.010	TP11-0.0 SOIL 10/9/2013 SE120709.011	TP12-0.0 SOIL 10/9/2013 SE120709.012
Hexavalent Chromium, Cr6+	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

PARAMETER	UOM	LOR	TP13-0.0 SOIL 10/9/2013 SE120709.013	TP14-0.0 SOIL 9/9/2013 SE120709.014	TP15-0.0 SOIL 9/9/2013 SE120709.015	TP16-0.0 SOIL 9/9/2013 SE120709.016	TP17-0.0 SOIL 9/9/2013 SE120709.017	TP18-0.0 SOIL 10/9/2013 SE120709.018
Hexavalent Chromium, Cr6+	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

PARAMETER	UOM	LOR	TP21-0.5 SOIL 11/9/2013 SE120709.020	TP21-1.0 SOIL 11/9/2013 SE120709.021	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024	TP26-0.5 SOIL 11/9/2013 SE120709.025
Hexavalent Chromium, Cr6+	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

PARAMETER	UOM	LOR	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030	TP22-0.5 SOIL 11/9/2013 SE120709.031
Hexavalent Chromium, Cr6+	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

PARAMETER	UOM	LOR	TP22-1.0 SOIL 11/9/2013 SE120709.032	TP20-0.0 SOIL 11/9/2013 SE120709.033	TP20-0.5 SOIL 11/9/2013 SE120709.034	QC 111 SOIL 11/9/2013 SE120709.038	QC 112 SOIL 11/9/2013 SE120709.039	TP28-2.0 SOIL 11/9/2013 SE120709.042
Hexavalent Chromium, Cr6+	mg/kg	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest [AN040/AN320]

PARAMETER	UOM	LOR	TP01-0.0 SOIL 10/9/2013 SE120709.001	TP02-0.0 SOIL 10/9/2013 SE120709.002	TP03-0.0 SOIL 10/9/2013 SE120709.003	TP04-0.0 SOIL 10/9/2013 SE120709.004	TP05-0.0 SOIL 9/9/2013 SE120709.005	TP06-0.0 SOIL 9/9/2013 SE120709.006
Arsenic, As	mg/kg	3.0	3	<3	9	<3	6	5
Beryllium, Be	mg/kg	0.30	0.5	0.7	1.1	0.6	0.7	0.4
Boron, B	mg/kg	5.0	<5	<5	<5	<5	<5	<5
Cadmium, Cd	mg/kg	0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Cobalt, Co	mg/kg	0.30	8.4	4.4	15	6.2	8.4	5.2
Copper, Cu	mg/kg	0.50	10	6.5	16	8.6	14	10
Lead, Pb	mg/kg	1.0	19	18	35	15	39	54
Manganese, Mn	mg/kg	0.30	620	250	1200	310	720	900
Nickel, Ni	mg/kg	0.50	7.8	4.3	13	11	11	6.2
Selenium, Se	mg/kg	2.0	<2	<2	<2	<2	<2	<2
Zinc, Zn	mg/kg	0.50	41	22	49	45	68	56

PARAMETER	UOM	LOR	TP07-0.0 SOIL 9/9/2013 SE120709.007	TP08-0.0 SOIL 9/9/2013 SE120709.008	TP09-0.0 SOIL 9/9/2013 SE120709.009	TP10-0.0 SOIL 10/9/2013 SE120709.010	TP11-0.0 SOIL 10/9/2013 SE120709.011	TP12-0.0 SOIL 10/9/2013 SE120709.012
Arsenic, As	mg/kg	3.0	8	5	6	4	7	4
Beryllium, Be	mg/kg	0.30	0.8	0.6	0.5	0.8	0.8	0.5
Boron, B	mg/kg	5.0	<5	<5	<5	<5	<5	<5
Cadmium, Cd	mg/kg	0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Cobalt, Co	mg/kg	0.30	12	8.7	6.7	18	13	6.3
Copper, Cu	mg/kg	0.50	15	12	11	23	16	7.1
Lead, Pb	mg/kg	1.0	93	47	52	62	23	15
Manganese, Mn	mg/kg	0.30	830	530	410	1500	820	360
Nickel, Ni	mg/kg	0.50	8.8	8.8	7.9	9.0	20	8.3
Selenium, Se	mg/kg	2.0	<2	<2	<2	<2	<2	<2
Zinc, Zn	mg/kg	0.50	50	49	75	34	46	110

PARAMETER	UOM	LOR	TP13-0.0 SOIL 10/9/2013 SE120709.013	TP14-0.0 SOIL 9/9/2013 SE120709.014	TP15-0.0 SOIL 9/9/2013 SE120709.015	TP16-0.0 SOIL 9/9/2013 SE120709.016	TP17-0.0 SOIL 9/9/2013 SE120709.017	TP18-0.0 SOIL 10/9/2013 SE120709.018
Arsenic, As	mg/kg	3.0	11	<3	6	7	8	8
Beryllium, Be	mg/kg	0.30	0.6	0.4	0.6	0.6	0.6	1.1
Boron, B	mg/kg	5.0	<5	<5	<5	<5	<5	<5
Cadmium, Cd	mg/kg	0.30	<0.3	<0.3	0.6	<0.3	<0.3	<0.3
Cobalt, Co	mg/kg	0.30	6.8	6.0	7.8	17	8.2	30
Copper, Cu	mg/kg	0.50	8.2	8.1	32	13	9.6	17
Lead, Pb	mg/kg	1.0	21	17	130	110	25	49
Manganese, Mn	mg/kg	0.30	650	880	800	1200	390	1900
Nickel, Ni	mg/kg	0.50	6.5	6.8	8.8	9.8	12	19
Selenium, Se	mg/kg	2.0	<2	<2	<2	<2	<2	2
Zinc, Zn	mg/kg	0.50	27	30	260	95	49	18

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest [AN040/AN320] (continued)

PARAMETER	UOM	LOR	TP21-0.5 SOIL 11/9/2013 SE120709.020	TP21-1.0 SOIL 11/9/2013 SE120709.021	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024	TP26-0.5 SOIL 11/9/2013 SE120709.025
Arsenic, As	mg/kg	3.0	5	11	9	8	4	6
Beryllium, Be	mg/kg	0.30	0.6	0.6	0.8	0.7	0.4	0.7
Boron, B	mg/kg	5.0	<5	30	<5	<5	<5	<5
Cadmium, Cd	mg/kg	0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Cobalt, Co	mg/kg	0.30	5.5	7.2	9.9	15	5.6	12
Copper, Cu	mg/kg	0.50	30	25	19	14	7.6	22
Lead, Pb	mg/kg	1.0	34	37	28	29	10	25
Manganese, Mn	mg/kg	0.30	350	270	460	730	210	1100
Nickel, Ni	mg/kg	0.50	12	21	19	20	7.5	18
Selenium, Se	mg/kg	2.0	<2	<2	<2	<2	<2	<2
Zinc, Zn	mg/kg	0.50	93	71	55	66	24	53

PARAMETER	UOM	LOR	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030	TP22-0.5 SOIL 11/9/2013 SE120709.031
Arsenic, As	mg/kg	3.0	5	10	6	12	10	7
Beryllium, Be	mg/kg	0.30	0.7	0.7	0.8	0.7	0.8	1.1
Boron, B	mg/kg	5.0	<5	<5	<5	<5	7	8
Cadmium, Cd	mg/kg	0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Cobalt, Co	mg/kg	0.30	11	11	11	12	13	8.8
Copper, Cu	mg/kg	0.50	39	12	22	21	20	17
Lead, Pb	mg/kg	1.0	24	23	14	31	32	51
Manganese, Mn	mg/kg	0.30	740	520	970	720	640	400
Nickel, Ni	mg/kg	0.50	19	17	22	22	24	19
Selenium, Se	mg/kg	2.0	<2	<2	<2	<2	<2	<2
Zinc, Zn	mg/kg	0.50	65	45	49	74	79	96

PARAMETER	UOM	LOR	TP22-1.0 SOIL 11/9/2013 SE120709.032	TP20-0.0 SOIL 11/9/2013 SE120709.033	TP20-0.5 SOIL 11/9/2013 SE120709.034	QC 111 SOIL 11/9/2013 SE120709.038	QC 112 SOIL 11/9/2013 SE120709.039	TP28-2.0 SOIL 11/9/2013 SE120709.042
Arsenic, As	mg/kg	3.0	13	4	<3	4	9	7
Beryllium, Be	mg/kg	0.30	1.0	<0.3	<0.3	0.5	0.6	0.8
Boron, B	mg/kg	5.0	11	6	<5	<5	46	<5
Cadmium, Cd	mg/kg	0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Cobalt, Co	mg/kg	0.30	10	3.1	1.8	7.0	6.7	12
Copper, Cu	mg/kg	0.50	27	70	3.2	10	28	20
Lead, Pb	mg/kg	1.0	29	160	10	10	27	11
Manganese, Mn	mg/kg	0.30	630	160	73	730	250	620
Nickel, Ni	mg/kg	0.50	37	9.4	3.1	12	20	24
Selenium, Se	mg/kg	2.0	<2	<2	<2	<2	<2	<2
Zinc, Zn	mg/kg	0.50	150	44	7.9	48	60	38

Mercury in Soil [AN312]

PARAMETER	UOM	LOR	TP01-0.0 SOIL 10/9/2013 SE120709.001	TP02-0.0 SOIL 10/9/2013 SE120709.002	TP03-0.0 SOIL 10/9/2013 SE120709.003	TP04-0.0 SOIL 10/9/2013 SE120709.004	TP05-0.0 SOIL 9/9/2013 SE120709.005	TP06-0.0 SOIL 9/9/2013 SE120709.006
Mercury	mg/kg	0.010	0.02	0.02	0.01	0.01	0.02	0.02

PARAMETER	UOM	LOR	TP07-0.0 SOIL 9/9/2013 SE120709.007	TP08-0.0 SOIL 9/9/2013 SE120709.008	TP09-0.0 SOIL 9/9/2013 SE120709.009	TP10-0.0 SOIL 10/9/2013 SE120709.010	TP11-0.0 SOIL 10/9/2013 SE120709.011	TP12-0.0 SOIL 10/9/2013 SE120709.012
Mercury	mg/kg	0.010	0.03	0.02	0.02	0.03	0.02	0.02

PARAMETER	UOM	LOR	TP13-0.0 SOIL 10/9/2013 SE120709.013	TP14-0.0 SOIL 9/9/2013 SE120709.014	TP15-0.0 SOIL 9/9/2013 SE120709.015	TP16-0.0 SOIL 9/9/2013 SE120709.016	TP17-0.0 SOIL 9/9/2013 SE120709.017	TP18-0.0 SOIL 10/9/2013 SE120709.018
Mercury	mg/kg	0.010	0.02	0.01	0.19	0.02	0.01	0.02

PARAMETER	UOM	LOR	TP21-0.5 SOIL 11/9/2013 SE120709.020	TP21-1.0 SOIL 11/9/2013 SE120709.021	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024	TP26-0.5 SOIL 11/9/2013 SE120709.025
Mercury	mg/kg	0.010	0.02	0.02	0.02	0.01	0.01	0.01

PARAMETER	UOM	LOR	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030	TP22-0.5 SOIL 11/9/2013 SE120709.031
Mercury	mg/kg	0.010	<0.01	0.04	0.01	0.03	0.04	0.03

PARAMETER	UOM	LOR	TP22-1.0 SOIL 11/9/2013 SE120709.032	TP20-0.0 SOIL 11/9/2013 SE120709.033	TP20-0.5 SOIL 11/9/2013 SE120709.034	QC 111 SOIL 11/9/2013 SE120709.038	QC 112 SOIL 11/9/2013 SE120709.039	TP28-2.0 SOIL 11/9/2013 SE120709.042
Mercury	mg/kg	0.010	0.01	0.01	0.01	<0.01	0.01	<0.01

Fibre Identification in soil [AN602]

PARAMETER	UOM	LOR	TP12-0.0 SOIL 10/9/2013 SE120709.012	TP15-0.0 SOIL 9/9/2013 SE120709.015	TP16-0.0 SOIL 9/9/2013 SE120709.016	TP17-0.0 SOIL 9/9/2013 SE120709.017	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023
Asbestos Detected	No unit	-	No	No	No	No	No	No
Estimated Fibres	%w/w	0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

PARAMETER	UOM	LOR	TP24-0.0 SOIL 11/9/2013 SE120709.024	TP26-0.5 SOIL 11/9/2013 SE120709.025	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029
Asbestos Detected	No unit	-	No	No	No	No	No	No
Estimated Fibres	%w/w	0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

PARAMETER	UOM	LOR	TP25-2.0 SOIL 11/9/2013 SE120709.030	TP22-0.5 SOIL 11/9/2013 SE120709.031	TP22-1.0 SOIL 11/9/2013 SE120709.032	TP20-0.0 SOIL 11/9/2013 SE120709.033	QC 111 SOIL 11/9/2013 SE120709.038	QC 112 SOIL 11/9/2013 SE120709.039
Asbestos Detected	No unit	-	No	No	No	No	No	No
Estimated Fibres	%w/w	0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

PARAMETER	UOM	LOR	TP28-2.0 SOIL 11/9/2013 SE120709.042
Asbestos Detected	No unit	-	No
Estimated Fibres	%w/w	0.010	<0.01

Moisture Content [AN002]

PARAMETER	UOM	LOR	TP01-0.0 SOIL 10/9/2013 SE120709.001	TP02-0.0 SOIL 10/9/2013 SE120709.002	TP03-0.0 SOIL 10/9/2013 SE120709.003	TP04-0.0 SOIL 10/9/2013 SE120709.004	TP05-0.0 SOIL 9/9/2013 SE120709.005	TP06-0.0 SOIL 9/9/2013 SE120709.006
% Moisture	%	0.50	11.7	15.3	24.3	7.0	22.4	15.2

PARAMETER	UOM	LOR	TP07-0.0 SOIL 9/9/2013 SE120709.007	TP08-0.0 SOIL 9/9/2013 SE120709.008	TP09-0.0 SOIL 9/9/2013 SE120709.009	TP10-0.0 SOIL 10/9/2013 SE120709.010	TP11-0.0 SOIL 10/9/2013 SE120709.011	TP12-0.0 SOIL 10/9/2013 SE120709.012
% Moisture	%	0.50	18.0	22.3	19.7	18.8	15.4	24.7

PARAMETER	UOM	LOR	TP13-0.0 SOIL 10/9/2013 SE120709.013	TP14-0.0 SOIL 9/9/2013 SE120709.014	TP15-0.0 SOIL 9/9/2013 SE120709.015	TP16-0.0 SOIL 9/9/2013 SE120709.016	TP17-0.0 SOIL 9/9/2013 SE120709.017	TP18-0.0 SOIL 10/9/2013 SE120709.018
% Moisture	%	0.50	13.5	14.2	13.4	27.8	7.5	14.7

PARAMETER	UOM	LOR	TP19-0.0 SOIL 11/9/2013 SE120709.019	TP21-0.5 SOIL 11/9/2013 SE120709.020	TP21-1.0 SOIL 11/9/2013 SE120709.021	TP23-0.5 SOIL 11/9/2013 SE120709.022	TP23-2.0 SOIL 11/9/2013 SE120709.023	TP24-0.0 SOIL 11/9/2013 SE120709.024
% Moisture	%	0.50	11.3	17.0	25.3	17.4	8.1	23.0

PARAMETER	UOM	LOR	TP26-0.5 SOIL 11/9/2013 SE120709.025	TP26-2.0 SOIL 11/9/2013 SE120709.026	TP27-0.0 SOIL 11/9/2013 SE120709.027	TP28-0.5 SOIL 11/9/2013 SE120709.028	TP25-0.5 SOIL 11/9/2013 SE120709.029	TP25-2.0 SOIL 11/9/2013 SE120709.030
% Moisture	%	0.50	12.6	11.3	9.6	13.3	10.5	10.6

PARAMETER	UOM	LOR	TP22-0.5 SOIL 11/9/2013 SE120709.031	TP22-1.0 SOIL 11/9/2013 SE120709.032	TP20-0.0 SOIL 11/9/2013 SE120709.033	TP20-0.5 SOIL 11/9/2013 SE120709.034	QC 111 SOIL 11/9/2013 SE120709.038	QC 112 SOIL 11/9/2013 SE120709.039
% Moisture	%	0.50	17.7	19.0	1.9	4.7	12.3	18.0

PARAMETER	UOM	LOR	TP28-2.0 SOIL 11/9/2013 SE120709.042
% Moisture	%	0.50	14.6

Volatile Petroleum Hydrocarbons in Water [AN433/AN434/AN410]

PARAMETER	UOM	LOR	QC 101 WATER 9/9/2013 SE120709.035	QC 105 WATER 10/9/2013 SE120709.036	QC 109 WATER 11/9/2013 SE120709.037	Trip Blank WATER 9/9/2013 SE120709.040
Benzene (F0)	µg/L	0.50	<0.5	<0.5	<0.5	<0.5
TRH C6-C9	µg/L	40	<40	<40	<40	<40
TRH C6-C10	µg/L	50	<50	<50	<50	<50
TRH C6-C10 minus BTEX (F1)	µg/L	50	<50	<50	<50	<50
Dibromofluoromethane (Surrogate)	%	-	103	106	106	107
d4-1,2-dichloroethane (Surrogate)	%	-	111	115	115	117
d8-toluene (Surrogate)	%	-	106	108	106	106
Bromofluorobenzene (Surrogate)	%	-	100	99	100	100

VOCs in Water [AN433/AN434]

PARAMETER	UOM	LOR	QC 101 WATER 9/9/2013 SE120709.035	QC 105 WATER 10/9/2013 SE120709.036	QC 109 WATER 11/9/2013 SE120709.037	Trip Blank WATER 9/9/2013 SE120709.040
Benzene	µg/L	0.50	<0.5	<0.5	<0.5	<0.5
Toluene	µg/L	0.50	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	µg/L	0.50	<0.5	<0.5	<0.5	<0.5
m/p-xylene	µg/L	1.0	<1	<1	<1	<1
o-xylene	µg/L	0.50	<0.5	<0.5	<0.5	<0.5
Naphthalene	µg/L	0.50	<0.5	<0.5	<0.5	<0.5
Total Xylenes	µg/L	1.50	<1.5	<1.5	<1.5	<1.5
Total BTEX	µg/L	3.0	<3	<3	<3	<3
Dibromofluoromethane (Surrogate)	%	-	103	106	106	107
d4-1,2-dichloroethane (Surrogate)	%	-	111	115	115	117
d8-toluene (Surrogate)	%	-	106	108	106	106
Bromofluorobenzene (Surrogate)	%	-	100	99	100	100

TRH (Total Recoverable Hydrocarbons) in Water [AN403]

PARAMETER	UOM	LOR	QC 101 WATER 9/9/2013 SE120709.035	QC 105 WATER 10/9/2013 SE120709.036	QC 109 WATER 11/9/2013 SE120709.037
TRH C10-C14	µg/L	50	<50	<50	<50
TRH C15-C28	µg/L	200	<200	<200	<200
TRH C29-C36	µg/L	200	<200	<200	<200
TRH C37-C40	µg/L	200	<200	<200	<200
TRH >C10-C16 (F2)	µg/L	60	<60	<60	<60
TRH >C16-C34 (F3)	µg/L	500	<500	<500	<500
TRH >C34-C40 (F4)	µg/L	500	<500	<500	<500
TRH C10-C36	µg/L	450	<450	<450	<450
TRH C10-C40	µg/L	650	<650	<650	<650

PAH (Polynuclear Aromatic Hydrocarbons) in Water [AN420]

PARAMETER	UOM	LOR	QC 101 WATER 9/9/2013 SE120709.035	QC 105 WATER 10/9/2013 SE120709.036	QC 109 WATER 11/9/2013 SE120709.037
Naphthalene	µg/L	0.10	<0.1	<0.1	<0.1
2-methylnaphthalene	µg/L	0.10	<0.1	<0.1	<0.1
1-methylnaphthalene	µg/L	0.10	<0.1	<0.1	<0.1
Acenaphthylene	µg/L	0.10	<0.1	<0.1	<0.1
Acenaphthene	µg/L	0.10	<0.1	<0.1	<0.1
Fluorene	µg/L	0.10	<0.1	<0.1	<0.1
Phenanthrene	µg/L	0.10	<0.1	<0.1	<0.1
Anthracene	µg/L	0.10	<0.1	<0.1	<0.1
Fluoranthene	µg/L	0.10	<0.1	<0.1	<0.1
Pyrene	µg/L	0.10	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	0.10	<0.1	<0.1	<0.1
Chrysene	µg/L	0.10	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	µg/L	0.10	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	µg/L	0.10	<0.1	<0.1	<0.1
Benzo(a)pyrene	µg/L	0.10	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	µg/L	0.10	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	µg/L	0.10	<0.1	<0.1	<0.1
Benzo(ghi)perylene	µg/L	0.10	<0.1	<0.1	<0.1
Total PAH (18)	µg/L	1.0	<1	<1	<1
d5-nitrobenzene (Surrogate)	%	-	**76**	**84**	**96**
2-fluorobiphenyl (Surrogate)	%	-	**88**	**96**	**104**
d14-p-terphenyl (Surrogate)	%	-	**116**	**124**	**120**

OC Pesticides in Water [AN400/AN420]

PARAMETER	UOM	LOR	QC 101 WATER 9/9/2013 SE120709.035	QC 105 WATER 10/9/2013 SE120709.036	QC 109 WATER 11/9/2013 SE120709.037
Alpha BHC	µg/L	0.10	<0.1	<0.1	<0.1
Hexachlorobenzene (HCB)	µg/L	0.10	<0.1	<0.1	<0.1
Beta BHC	µg/L	0.10	<0.1	<0.1	<0.1
Lindane (gamma BHC)	µg/L	0.10	<0.1	<0.1	<0.1
Delta BHC	µg/L	0.10	<0.1	<0.1	<0.1
Heptachlor	µg/L	0.10	<0.1	<0.1	<0.1
Aldrin	µg/L	0.10	<0.1	<0.1	<0.1
Heptachlor epoxide	µg/L	0.10	<0.1	<0.1	<0.1
Gamma Chlordane	µg/L	0.10	<0.1	<0.1	<0.1
Alpha Chlordane	µg/L	0.10	<0.1	<0.1	<0.1
Alpha Endosulfan	µg/L	0.10	<0.1	<0.1	<0.1
o,p'-DDE	µg/L	0.10	<0.1	<0.1	<0.1
p,p'-DDE	µg/L	0.10	<0.1	<0.1	<0.1
Dieldrin	µg/L	0.10	<0.1	<0.1	<0.1
Endrin	µg/L	0.10	<0.1	<0.1	<0.1
Beta Endosulfan	µg/L	0.10	<0.1	<0.1	<0.1
o,p'-DDD	µg/L	0.10	<0.1	<0.1	<0.1
p,p'-DDD	µg/L	0.10	<0.1	<0.1	<0.1
Endosulfan sulphate	µg/L	0.10	<0.1	<0.1	<0.1
o,p'-DDT	µg/L	0.10	<0.1	<0.1	<0.1
p,p'-DDT	µg/L	0.10	<0.1	<0.1	<0.1
Endrin ketone	µg/L	0.10	<0.1	<0.1	<0.1
Methoxychlor	µg/L	0.10	<0.1	<0.1	<0.1
trans-Nonachlor	µg/L	0.10	<0.1	<0.1	<0.1
Endrin aldehyde	µg/L	0.10	<0.1	<0.1	<0.1
Isodrin	µg/L	0.10	<0.1	<0.1	<0.1
Mirex	µg/L	0.10	<0.1	<0.1	<0.1
Tetrachloro-m-xylene (TCMX)	%	-	**68**	**71**	**68**

OP Pesticides in Water [AN400/AN420]

PARAMETER	UOM	LOR	QC 101 WATER 9/9/2013 SE120709.035	QC 105 WATER 10/9/2013 SE120709.036	QC 109 WATER 11/9/2013 SE120709.037
Dichlorvos	µg/L	0.50	<0.5	<0.5	<0.5
Dimethoate	µg/L	0.50	<0.5	<0.5	<0.5
Diazinon (Dimpylate)	µg/L	0.50	<0.5	<0.5	<0.5
Fenitrothion	µg/L	0.20	<0.2	<0.2	<0.2
Malathion	µg/L	0.20	<0.2	<0.2	<0.2
Chlorpyrifos (Chlorpyrifos Ethyl)	µg/L	0.20	<0.2	<0.2	<0.2
Parathion-ethyl (Parathion)	µg/L	0.20	<0.2	<0.2	<0.2
Bromophos Ethyl	µg/L	0.20	<0.2	<0.2	<0.2
Methidathion	µg/L	0.50	<0.5	<0.5	<0.5
Ethion	µg/L	0.20	<0.2	<0.2	<0.2
Azinphos-methyl	µg/L	0.20	<0.2	<0.2	<0.2
2-fluorobiphenyl (Surrogate)	%	-	**88**	**96**	**104**
d14-p-terphenyl (Surrogate)	%	-	**116**	**124**	**120**

PCBs in Water [AN400/AN420]

PARAMETER	UOM	LOR	QC 101 WATER 9/9/2013 SE120709.035	QC 105 WATER 10/9/2013 SE120709.036	QC 109 WATER 11/9/2013 SE120709.037
Arochlor 1016	µg/L	1.0	<1	<1	<1
Arochlor 1221	µg/L	1.0	<1	<1	<1
Arochlor 1232	µg/L	1.0	<1	<1	<1
Arochlor 1242	µg/L	1.0	<1	<1	<1
Arochlor 1248	µg/L	1.0	<1	<1	<1
Arochlor 1254	µg/L	1.0	<1	<1	<1
Arochlor 1260	µg/L	1.0	<1	<1	<1
Arochlor 1262	µg/L	1.0	<1	<1	<1
Arochlor 1268	µg/L	1.0	<1	<1	<1
Total Arochlors*	µg/L	5.0	<5	<5	<5
Tetrachloro-m-xylene (Surrogate)	%	-	**68**	**71**	**68**

Total Phenolics in Water [AN289]

PARAMETER	UOM	LOR	QC 101 WATER 9/9/2013 SE120709.035	QC 105 WATER 10/9/2013 SE120709.036	QC 109 WATER 11/9/2013 SE120709.037
Total Phenols	mg/L	0.010	<0.01	<0.01	<0.01

Trace Metals (Dissolved) in Water by ICPMS [AN318]

PARAMETER	UOM	LOR	QC 101 WATER 9/9/2013 SE120709.035	QC 105 WATER 10/9/2013 SE120709.036	QC 109 WATER 11/9/2013 SE120709.037
Arsenic, As	µg/L	1.0	<1	<1	<1
Beryllium, Be	µg/L	1.0	<1	<1	<1
Boron, B	µg/L	5.0	<5	<5	<5
Cadmium, Cd	µg/L	0.10	<0.1	<0.1	<0.1
Cobalt, Co	µg/L	1.0	<1	<1	<1
Copper, Cu	µg/L	1.0	<1	<1	<1
Lead, Pb	µg/L	1.0	<1	<1	<1
Manganese, Mn	µg/L	1.0	<1	<1	<1
Nickel, Ni	µg/L	1.0	<1	<1	<1
Selenium, Se	µg/L	1.0	<1	<1	<1
Zinc, Zn	µg/L	5.0	<5	<5	7

Hexavalent Chromium in water by Discrete Analyser [AN283]

PARAMETER	UOM	LOR	QC 101 WATER 9/9/2013 SE120709.035	QC 105 WATER 10/9/2013 SE120709.036	QC 109 WATER 11/9/2013 SE120709.037
Hexavalent Chromium, Cr6+	mg/L	0.0050	<0.005	<0.005	<0.005

Mercury (dissolved) in Water [AN311/AN312]

PARAMETER	UOM	LOR	QC 101 WATER 9/9/2013 SE120709.035	QC 105 WATER 10/9/2013 SE120709.036	QC 109 WATER 11/9/2013 SE120709.037
Mercury	mg/L	0.00010	<0.0001	<0.0001	<0.0001

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN020	Unpreserved water sample is filtered through a 0.45µm membrane filter and acidified with nitric acid similar to APHA3030B.
AN040	A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analsysis by ASS or ICP as per USEPA Method 200.8.
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN075	This method uses an alkaline digestion to solubilise both water-soluble and water-insoluble forms of hexavalent chromium in solids. The solution is then pH adjusted and the hexavalent chromium concentration in solution determined colourimetrically.
AN083	Separatory funnels are used for aqueous samples and extracted by transferring an appropriate volume (mass) of liquid into a separatory funnel and adding 3 serial aliquots of dichloromethane. Samples receive a single extraction at pH 7 to recover base / neutral analytes and two extractions at pH < 2 to recover acidic analytes. QC samples are prepared by spiking organic free water with target analytes and extracting as per samples.
AN088	Orbital rolling for Organic pollutants are extracted from soil/sediment by transferring an appropriate mass of sample to a clear soil jar and extracting with 1:1 Dichloromethane/Acetone. Orbital Rolling method is intended for the extraction of semi-volatile organic compounds from soil/sediment samples, and is based somewhat on USEPA method 3570 (Micro Organic extraction and sample preparation). Method 3700.
AN201	Cr6+ is determined colourimetrically by reaction with diphenylcarbazide in acid solution. A red-violet colour of unknown composition is produced.
AN283	Hexavalent Chromium via Aquakem DA: Soluble hexavalent chromium forms a red/violet colour with diphenylcarbazide in acidic solution. This procedure is very sensitive and nearly specific for Cr 6+. If total chromium is also measured the trivalent form of chromium Cr 3+ can be calculated from the difference (Total Cr - Cr6+). Reference APHA3500CrB.
AN289	Analysis of Total Phenols in Soil Sediment and Water: Steam distillable phenols react with 4-aminoantipyrine at pH 7.9±0.1 in the presence of potassium ferricyanide to form a coloured antipyrine dye analysed by Discrete Analyser. Reference APHA 5530 B/D.
AN311/AN312	Mercury by Cold Vapour AAS in Waters: Mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500
AN318	Determination of elements at trace level in waters by ICP-MS technique, in accordance with USEPA 6020A.
AN400	OC and OP Pesticides by GC-ECD: The determination of organochlorine (OC) and organophosphorus (OP) pesticides and polychlorinated biphenyls (PCBs) in soils, sludges and groundwater. (Based on USEPA methods 3510, 3550, 8140 and 8080.)
AN403	Total Recoverable Hydrocarbons: Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C6-C9, C10-C14, C15-C28 and C29-C36 and in recognition of the Draft NEPM 2011, >C10-C16 (F2), >C16-C34 (F3) and >C34-C40 (F4). F2 is not corrected for Naphthalene.
AN420	(SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols (etc) in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
AN433/AN434	VOCs and C6-C9 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.
AN433/AN434/AN410	VOCs and C6-C9/C6-C10 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.

AN602	Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by polarised light microscopy (PLM) in conjunction with dispersion staining (DS). AS4964 provides the basis for this document. Unequivocal identification of the asbestos minerals present is made by obtaining sufficient diagnostic `clues`, which provide a reasonable degree of certainty, dispersion staining is a mandatory `clue` for positive identification. If sufficient `clues` are absent, then positive identification of asbestos is not possible. This procedure requires removal of suspect fibres/bundles from the sample which cannot be returned.

FOOTNOTES

*	Analysis not covered by the scope of accreditation.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
^	Performed by outside laboratory.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here:
http://www.sgs.com.au.pv.sgsv3/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

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ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS

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Project	**3002369 - OCB**
Order Number	**0304--0313**
Samples	42

LABORATORY DETAILS

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Laboratory	SGS Alexandria Environmental
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SGS Reference	SE120709 R0
Report Number	0000065714
Date Reported	20 Sep 2013
Date Received	12 Sep 2013

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

No respirable fibres detected in all samples using trace analysis technique.

Asbestos analysed by Approved Identifier Ravee Sivasubramaniam.

SIGNATORIES

Andy Sutton
Senior Organic Chemist

Dong Liang
Metals/Inorganics Team Leader

Kamrul Ahsan
Senior Chemist

Ravee Sivasubramaniam
Asbestos Analyst

Sheila Lepasana
Senior Technician

Snezana Kostoska
2IC Inorganics Chemist

RESULTS

Fibre Identification in soil — Method AN602

Laboratory Reference	Client Reference	Matrix	Sample Description	Date Sampled	Fibre Identification	Est.%w/w
SE120709.012	TP12-0.0	Soil	55g Soil,plantmatter	10 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.015	TP15-0.0	Soil	40g Soil,plantmatter	09 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.016	TP16-0.0	Soil	80g Soil,rocks	09 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.017	TP17-0.0	Soil	75g Soil,rocks,plant matter	09 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.022	TP23-0.5	Soil	67g Soil,clay,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.023	TP23-2.0	Soil	88g Clay,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.024	TP24-0.0	Soil	75g Soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.025	TP26-0.5	Soil	61g Clay,soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.026	TP26-2.0	Soil	70g Clay,soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.027	TP27-0.0	Soil	56g Clay,soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.028	TP28-0.5	Soil	73g Clay,soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.029	TP25-0.5	Soil	96g Clay,soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.030	TP25-2.0	Soil	74g Clay,soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.031	TP22-0.5	Soil	69g Clay,soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.032	TP22-1.0	Soil	72g Clay,soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.033	TP20-0.0	Soil	75g Soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.038	QC 111	Soil	64g Clay,soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.039	QC 112	Soil	59g Clay,soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01
SE120709.042	TP28-2.0	Soil	63g Clay,soil,rocks	11 Sep 2013	No Asbestos Found Organic Fibres Detected	<0.01

METHOD SUMMARY

SE120709 R0

METHOD	METHODOLOGY SUMMARY
AN602	Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by polarised light microscopy (PLM) in conjunction with dispersion staining (DS). AS4964 provides the basis for this document. Unequivocal identification of the asbestos minerals present is made by obtaining sufficient diagnostic `clues`, which provide a reasonable degree of certainty, dispersion staining is a mandatory `clue` for positive identification. If sufficient `clues` are absent, then positive identification of asbestos is not possible. This procedure requires removal of suspect fibres/bundles from the sample which cannot be returned.
AN602	AS4964.2004 Method for the Qualitative Identification of Asbestos in Bulk Samples, Section 8.4, Trace Analysis Criteria, Note 4 states:"Depending upon sample condition and fibre type, the detection limit of this technique has been found to lie generally in the range of 1 in 1,000 to 1 in 10,000 parts by weight, equivalent to 1 to 0.1 g/kg."

FOOTNOTES

Amosite	-	Brown Asbestos	NA	-	Not Analysed
Chrysotile	-	White Asbestos	LNR	-	Listed, Not Required
Crocidolite	-	Blue Asbestos	*	-	Not Accredited
Amphiboles	-	Amosite and/or Crocidolite	**	-	Indicative data, theoretical holding time exceeded.

This report does not comply with the analytical reporting recommendations in the Western Australian Department of Health Guidelines for the Assessment and Remediation and Management of Asbestos Contaminated sites in Western Australia - May 2009.

Sampled by the client.

Where reported: 'Asbestos Detected': Asbestos detected by polarized light microscopy, including dispersion staining.
Where reported: 'No Asbestos Found': No Asbestos Found by polarized light microscopy, including dispersion staining.
Where reported: 'UMF Detected': Mineral fibres of unknown type detected by polarized light microscopy, including dispersion staining. Confirmation by another independent analytical technique may be necessary.

Even after disintegration it can be very difficult, or impossible, to detect the presence of asbestos in some asbestos -containing bulk materials using polarised light microscopy. This is due to the low grade or small length or diameter of asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : http://www.sgs.com.au.pv.sgsv3/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

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STATEMENT OF QA/QC PERFORMANCE

SE120709 R0

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Email	au.environmental.sydney@sgs.com
SGS Reference	SE120709 R0
Report Number	0000065767
Date Reported	20 Sep 2013

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS Environmental Services' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document and was supplied by the Client.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Duplicate	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	1 item
	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	1 item
Matrix Spike	Hexavalent Chromium in Soil UV/Vis	1 item
	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	4 items
	Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest	3 items

SAMPLE SUMMARY

Sample counts by matrix	38 Soils, 4 Waters	Type of documentation received	COC
Date documentation received	12/9/13@3:25pm	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	3°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice	Samples clearly labelled	Yes
Complete documentation received	Yes		

HOLDING TIME SUMMARY

SE120709 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Fibre Identification in soil

Method: ME-(AU)-[ENV]AN602

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP12-0.0	SE120709.012	LB045113	10 Sep 2013	12 Sep 2013	10 Sep 2014	19 Sep 2013	10 Sep 2014	19 Sep 2013
TP15-0.0	SE120709.015	LB045113	09 Sep 2013	12 Sep 2013	09 Sep 2014	19 Sep 2013	09 Sep 2014	19 Sep 2013
TP16-0.0	SE120709.016	LB045113	09 Sep 2013	12 Sep 2013	09 Sep 2014	19 Sep 2013	09 Sep 2014	19 Sep 2013
TP17-0.0	SE120709.017	LB045113	09 Sep 2013	12 Sep 2013	09 Sep 2014	19 Sep 2013	09 Sep 2014	19 Sep 2013
TP23-0.5	SE120709.022	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP23-2.0	SE120709.023	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP24-0.0	SE120709.024	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP26-0.5	SE120709.025	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP26-2.0	SE120709.026	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP27-0.0	SE120709.027	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP28-0.5	SE120709.028	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP25-0.5	SE120709.029	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP25-2.0	SE120709.030	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP22-0.5	SE120709.031	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP22-1.0	SE120709.032	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP20-0.0	SE120709.033	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
QC 111	SE120709.038	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
QC 112	SE120709.039	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013
TP28-2.0	SE120709.042	LB045113	11 Sep 2013	12 Sep 2013	11 Sep 2014	19 Sep 2013	11 Sep 2014	19 Sep 2013

Hexavalent Chromium in Soil UV/Vis

Method: ME-(AU)-[ENV]AN075/AN201

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01-0.0	SE120709.001	LB045093	10 Sep 2013	12 Sep 2013	08 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP02-0.0	SE120709.002	LB045093	10 Sep 2013	12 Sep 2013	08 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP03-0.0	SE120709.003	LB045093	10 Sep 2013	12 Sep 2013	08 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP04-0.0	SE120709.004	LB045093	10 Sep 2013	12 Sep 2013	08 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP05-0.0	SE120709.005	LB045093	09 Sep 2013	12 Sep 2013	07 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP06-0.0	SE120709.006	LB045093	09 Sep 2013	12 Sep 2013	07 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP07-0.0	SE120709.007	LB045093	09 Sep 2013	12 Sep 2013	07 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP08-0.0	SE120709.008	LB045093	09 Sep 2013	12 Sep 2013	07 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP09-0.0	SE120709.009	LB045093	09 Sep 2013	12 Sep 2013	07 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP10-0.0	SE120709.010	LB045093	10 Sep 2013	12 Sep 2013	08 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP11-0.0	SE120709.011	LB045093	10 Sep 2013	12 Sep 2013	08 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP12-0.0	SE120709.012	LB045093	10 Sep 2013	12 Sep 2013	08 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP13-0.0	SE120709.013	LB045093	10 Sep 2013	12 Sep 2013	08 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP14-0.0	SE120709.014	LB045093	09 Sep 2013	12 Sep 2013	07 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP15-0.0	SE120709.015	LB045093	09 Sep 2013	12 Sep 2013	07 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP16-0.0	SE120709.016	LB045093	09 Sep 2013	12 Sep 2013	07 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP17-0.0	SE120709.017	LB045093	09 Sep 2013	12 Sep 2013	07 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP18-0.0	SE120709.018	LB045093	10 Sep 2013	12 Sep 2013	08 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP21-0.5	SE120709.020	LB045093	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP21-1.0	SE120709.021	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP23-0.5	SE120709.022	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP23-2.0	SE120709.023	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP24-0.0	SE120709.024	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP26-0.5	SE120709.025	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP26-2.0	SE120709.026	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP27-0.0	SE120709.027	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP28-0.5	SE120709.028	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP25-0.5	SE120709.029	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP25-2.0	SE120709.030	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP22-0.5	SE120709.031	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP22-1.0	SE120709.032	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP20-0.0	SE120709.033	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP20-0.5	SE120709.034	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
QC 111	SE120709.038	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
QC 112	SE120709.039	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013
TP28-2.0	SE120709.042	LB045094	11 Sep 2013	12 Sep 2013	09 Oct 2013	19 Sep 2013	22 Sep 2013	19 Sep 2013

Hexavalent Chromium in water by Discrete Analyser

Method: ME-(AU)-[ENV]AN283

Sample Name	Sample No.	QC Ref

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Hexavalent Chromium in water by Discrete Analyser (continued)

Method: ME-(AU)-[ENV]AN283

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC 101	SE120709.035	LB044812	09 Sep 2013	12 Sep 2013	07 Oct 2013	13 Sep 2013	07 Oct 2013	13 Sep 2013
QC 105	SE120709.036	LB044812	10 Sep 2013	12 Sep 2013	08 Oct 2013	13 Sep 2013	08 Oct 2013	13 Sep 2013
QC 109	SE120709.037	LB044812	11 Sep 2013	12 Sep 2013	09 Oct 2013	13 Sep 2013	09 Oct 2013	13 Sep 2013

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC 101	SE120709.035	LB045071	09 Sep 2013	12 Sep 2013	07 Oct 2013	18 Sep 2013	07 Oct 2013	19 Sep 2013
QC 105	SE120709.036	LB045071	10 Sep 2013	12 Sep 2013	08 Oct 2013	18 Sep 2013	08 Oct 2013	19 Sep 2013
QC 109	SE120709.037	LB045071	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	19 Sep 2013

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01-0.0	SE120709.001	LB044936	10 Sep 2013	12 Sep 2013	08 Oct 2013	17 Sep 2013	08 Oct 2013	18 Sep 2013
TP02-0.0	SE120709.002	LB044936	10 Sep 2013	12 Sep 2013	08 Oct 2013	17 Sep 2013	08 Oct 2013	18 Sep 2013
TP03-0.0	SE120709.003	LB044936	10 Sep 2013	12 Sep 2013	08 Oct 2013	17 Sep 2013	08 Oct 2013	18 Sep 2013
TP04-0.0	SE120709.004	LB044936	10 Sep 2013	12 Sep 2013	08 Oct 2013	17 Sep 2013	08 Oct 2013	18 Sep 2013
TP05-0.0	SE120709.005	LB044936	09 Sep 2013	12 Sep 2013	07 Oct 2013	17 Sep 2013	07 Oct 2013	18 Sep 2013
TP06-0.0	SE120709.006	LB044936	09 Sep 2013	12 Sep 2013	07 Oct 2013	17 Sep 2013	07 Oct 2013	18 Sep 2013
TP07-0.0	SE120709.007	LB044936	09 Sep 2013	12 Sep 2013	07 Oct 2013	17 Sep 2013	07 Oct 2013	18 Sep 2013
TP08-0.0	SE120709.008	LB044936	09 Sep 2013	12 Sep 2013	07 Oct 2013	17 Sep 2013	07 Oct 2013	18 Sep 2013
TP09-0.0	SE120709.009	LB044936	09 Sep 2013	12 Sep 2013	07 Oct 2013	17 Sep 2013	07 Oct 2013	18 Sep 2013
TP10-0.0	SE120709.010	LB044998	10 Sep 2013	12 Sep 2013	08 Oct 2013	18 Sep 2013	08 Oct 2013	18 Sep 2013
TP11-0.0	SE120709.011	LB044998	10 Sep 2013	12 Sep 2013	08 Oct 2013	18 Sep 2013	08 Oct 2013	18 Sep 2013
TP12-0.0	SE120709.012	LB044998	10 Sep 2013	12 Sep 2013	08 Oct 2013	18 Sep 2013	08 Oct 2013	18 Sep 2013
TP13-0.0	SE120709.013	LB044998	10 Sep 2013	12 Sep 2013	08 Oct 2013	18 Sep 2013	08 Oct 2013	18 Sep 2013
TP14-0.0	SE120709.014	LB044998	09 Sep 2013	12 Sep 2013	07 Oct 2013	18 Sep 2013	07 Oct 2013	18 Sep 2013
TP15-0.0	SE120709.015	LB044998	09 Sep 2013	12 Sep 2013	07 Oct 2013	18 Sep 2013	07 Oct 2013	18 Sep 2013
TP16-0.0	SE120709.016	LB044998	09 Sep 2013	12 Sep 2013	07 Oct 2013	18 Sep 2013	07 Oct 2013	18 Sep 2013
TP17-0.0	SE120709.017	LB044998	09 Sep 2013	12 Sep 2013	07 Oct 2013	18 Sep 2013	07 Oct 2013	18 Sep 2013
TP18-0.0	SE120709.018	LB044998	10 Sep 2013	12 Sep 2013	08 Oct 2013	18 Sep 2013	08 Oct 2013	18 Sep 2013
TP21-0.5	SE120709.020	LB044998	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP21-1.0	SE120709.021	LB044998	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP23-0.5	SE120709.022	LB044998	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP23-2.0	SE120709.023	LB044998	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP24-0.0	SE120709.024	LB044998	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP26-0.5	SE120709.025	LB044998	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP26-2.0	SE120709.026	LB044998	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP27-0.0	SE120709.027	LB044998	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP28-0.5	SE120709.028	LB044998	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP25-0.5	SE120709.029	LB044998	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP25-2.0	SE120709.030	LB045000	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP22-0.5	SE120709.031	LB045000	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP22-1.0	SE120709.032	LB045000	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP20-0.0	SE120709.033	LB045000	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP20-0.5	SE120709.034	LB045000	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
QC 111	SE120709.038	LB045000	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
QC 112	SE120709.039	LB045000	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013
TP28-2.0	SE120709.042	LB045000	11 Sep 2013	12 Sep 2013	09 Oct 2013	18 Sep 2013	09 Oct 2013	18 Sep 2013

Moisture Content

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01-0.0	SE120709.001	LB045006	10 Sep 2013	12 Sep 2013	24 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP02-0.0	SE120709.002	LB045006	10 Sep 2013	12 Sep 2013	24 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP03-0.0	SE120709.003	LB045006	10 Sep 2013	12 Sep 2013	24 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP04-0.0	SE120709.004	LB045006	10 Sep 2013	12 Sep 2013	24 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP05-0.0	SE120709.005	LB045006	09 Sep 2013	12 Sep 2013	23 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP06-0.0	SE120709.006	LB045006	09 Sep 2013	12 Sep 2013	23 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP07-0.0	SE120709.007	LB045006	09 Sep 2013	12 Sep 2013	23 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP08-0.0	SE120709.008	LB045006	09 Sep 2013	12 Sep 2013	23 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP09-0.0	SE120709.009	LB045006	09 Sep 2013	12 Sep 2013	23 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP10-0.0	SE120709.010	LB045006	10 Sep 2013	12 Sep 2013	24 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013

HOLDING TIME SUMMARY

SE120709 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Moisture Content (continued)

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP11-0.0	SE120709.011	LB045006	10 Sep 2013	12 Sep 2013	24 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP12-0.0	SE120709.012	LB045006	10 Sep 2013	12 Sep 2013	24 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP13-0.0	SE120709.013	LB045006	10 Sep 2013	12 Sep 2013	24 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP14-0.0	SE120709.014	LB045006	09 Sep 2013	12 Sep 2013	23 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP15-0.0	SE120709.015	LB045006	09 Sep 2013	12 Sep 2013	23 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP16-0.0	SE120709.016	LB045006	09 Sep 2013	12 Sep 2013	23 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP17-0.0	SE120709.017	LB045006	09 Sep 2013	12 Sep 2013	23 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP18-0.0	SE120709.018	LB045006	10 Sep 2013	12 Sep 2013	24 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP19-0.0	SE120709.019	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP21-0.5	SE120709.020	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP21-1.0	SE120709.021	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP23-0.5	SE120709.022	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP23-2.0	SE120709.023	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP24-0.0	SE120709.024	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP26-0.5	SE120709.025	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP26-2.0	SE120709.026	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP27-0.0	SE120709.027	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP28-0.5	SE120709.028	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP25-0.5	SE120709.029	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP25-2.0	SE120709.030	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP22-0.5	SE120709.031	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP22-1.0	SE120709.032	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP20-0.0	SE120709.033	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP20-0.5	SE120709.034	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
QC 111	SE120709.038	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
QC 112	SE120709.039	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013
TP28-2.0	SE120709.042	LB045006	11 Sep 2013	12 Sep 2013	25 Sep 2013	18 Sep 2013	23 Sep 2013	19 Sep 2013

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01-0.0	SE120709.001	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP02-0.0	SE120709.002	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP03-0.0	SE120709.003	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP04-0.0	SE120709.004	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP05-0.0	SE120709.005	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP06-0.0	SE120709.006	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP07-0.0	SE120709.007	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP08-0.0	SE120709.008	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP09-0.0	SE120709.009	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP10-0.0	SE120709.010	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP11-0.0	SE120709.011	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP12-0.0	SE120709.012	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP13-0.0	SE120709.013	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP14-0.0	SE120709.014	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP15-0.0	SE120709.015	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP16-0.0	SE120709.016	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP17-0.0	SE120709.017	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP18-0.0	SE120709.018	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP19-0.0	SE120709.019	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-0.5	SE120709.020	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-1.0	SE120709.021	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-0.5	SE120709.022	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-2.0	SE120709.023	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP24-0.0	SE120709.024	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-0.5	SE120709.025	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-2.0	SE120709.026	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP27-0.0	SE120709.027	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-0.5	SE120709.028	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP25-0.5	SE120709.029	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP25-2.0	SE120709.030	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

HOLDING TIME SUMMARY

SE120709 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

OC Pesticides in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP22-0.5	SE120709.031	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP22-1.0	SE120709.032	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 111	SE120709.038	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 112	SE120709.039	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-2.0	SE120709.042	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

OC Pesticides in Water

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC 101	SE120709.035	LB044908	09 Sep 2013	12 Sep 2013	16 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 105	SE120709.036	LB044908	10 Sep 2013	12 Sep 2013	17 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 109	SE120709.037	LB044908	11 Sep 2013	12 Sep 2013	18 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

OP Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01-0.0	SE120709.001	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP02-0.0	SE120709.002	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP03-0.0	SE120709.003	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP04-0.0	SE120709.004	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP05-0.0	SE120709.005	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP06-0.0	SE120709.006	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP07-0.0	SE120709.007	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP08-0.0	SE120709.008	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP09-0.0	SE120709.009	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP10-0.0	SE120709.010	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP11-0.0	SE120709.011	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP12-0.0	SE120709.012	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP13-0.0	SE120709.013	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP14-0.0	SE120709.014	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP15-0.0	SE120709.015	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP16-0.0	SE120709.016	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP17-0.0	SE120709.017	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP18-0.0	SE120709.018	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP19-0.0	SE120709.019	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP21-0.5	SE120709.020	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP21-1.0	SE120709.021	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP23-0.5	SE120709.022	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-2.0	SE120709.023	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP24-0.0	SE120709.024	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-0.5	SE120709.025	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-2.0	SE120709.026	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP27-0.0	SE120709.027	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-0.5	SE120709.028	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP25-0.5	SE120709.029	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP25-2.0	SE120709.030	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP22-0.5	SE120709.031	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP22-1.0	SE120709.032	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
QC 111	SE120709.038	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
QC 112	SE120709.039	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP28-2.0	SE120709.042	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013

OP Pesticides in Water

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC 101	SE120709.035	LB044908	09 Sep 2013	12 Sep 2013	16 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 105	SE120709.036	LB044908	10 Sep 2013	12 Sep 2013	17 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 109	SE120709.037	LB044908	11 Sep 2013	12 Sep 2013	18 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01-0.0	SE120709.001	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP02-0.0	SE120709.002	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP03-0.0	SE120709.003	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP04-0.0	SE120709.004	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP05-0.0	SE120709.005	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP06-0.0	SE120709.006	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP07-0.0	SE120709.007	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP08-0.0	SE120709.008	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP09-0.0	SE120709.009	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP10-0.0	SE120709.010	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP11-0.0	SE120709.011	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP12-0.0	SE120709.012	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP13-0.0	SE120709.013	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP14-0.0	SE120709.014	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP15-0.0	SE120709.015	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP16-0.0	SE120709.016	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP17-0.0	SE120709.017	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP18-0.0	SE120709.018	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP19-0.0	SE120709.019	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-0.5	SE120709.020	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-1.0	SE120709.021	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-0.5	SE120709.022	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-2.0	SE120709.023	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP24-0.0	SE120709.024	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-0.5	SE120709.025	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-2.0	SE120709.026	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP27-0.0	SE120709.027	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-0.5	SE120709.028	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP25-0.5	SE120709.029	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP25-2.0	SE120709.030	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP22-0.5	SE120709.031	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP22-1.0	SE120709.032	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
QC 111	SE120709.038	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
QC 112	SE120709.039	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
TP28-2.0	SE120709.042	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC 101	SE120709.035	LB044908	09 Sep 2013	12 Sep 2013	16 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 105	SE120709.036	LB044908	10 Sep 2013	12 Sep 2013	17 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 109	SE120709.037	LB044908	11 Sep 2013	12 Sep 2013	18 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01-0.0	SE120709.001	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP02-0.0	SE120709.002	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP03-0.0	SE120709.003	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP04-0.0	SE120709.004	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP05-0.0	SE120709.005	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP06-0.0	SE120709.006	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP07-0.0	SE120709.007	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP08-0.0	SE120709.008	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP09-0.0	SE120709.009	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP10-0.0	SE120709.010	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP11-0.0	SE120709.011	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP12-0.0	SE120709.012	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP13-0.0	SE120709.013	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP14-0.0	SE120709.014	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP15-0.0	SE120709.015	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP16-0.0	SE120709.016	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP17-0.0	SE120709.017	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP18-0.0	SE120709.018	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP19-0.0	SE120709.019	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-0.5	SE120709.020	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-1.0	SE120709.021	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

PCBs in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP23-0.5	SE120709.022	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-2.0	SE120709.023	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP24-0.0	SE120709.024	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-0.5	SE120709.025	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-2.0	SE120709.026	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP27-0.0	SE120709.027	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-0.5	SE120709.028	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP25-0.5	SE120709.029	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP25-2.0	SE120709.030	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP22-0.5	SE120709.031	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP22-1.0	SE120709.032	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 111	SE120709.038	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 112	SE120709.039	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-2.0	SE120709.042	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

PCBs in Water

Method: ME-(AU)-[ENV]AN400/AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC 101	SE120709.035	LB044908	09 Sep 2013	12 Sep 2013	16 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 105	SE120709.036	LB044908	10 Sep 2013	12 Sep 2013	17 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 109	SE120709.037	LB044908	11 Sep 2013	12 Sep 2013	18 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

Total Phenolics in Soil

Method: ME-(AU)-[ENV]AN289

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP23-0.5	SE120709.022	LB045103	11 Sep 2013	12 Sep 2013	25 Sep 2013	19 Sep 2013	25 Sep 2013	19 Sep 2013
TP23-2.0	SE120709.023	LB045103	11 Sep 2013	12 Sep 2013	25 Sep 2013	19 Sep 2013	25 Sep 2013	19 Sep 2013
TP24-0.0	SE120709.024	LB045103	11 Sep 2013	12 Sep 2013	25 Sep 2013	19 Sep 2013	25 Sep 2013	19 Sep 2013
TP26-0.5	SE120709.025	LB045103	11 Sep 2013	12 Sep 2013	25 Sep 2013	19 Sep 2013	25 Sep 2013	19 Sep 2013
TP26-2.0	SE120709.026	LB045103	11 Sep 2013	12 Sep 2013	25 Sep 2013	19 Sep 2013	25 Sep 2013	19 Sep 2013
TP27-0.0	SE120709.027	LB045103	11 Sep 2013	12 Sep 2013	25 Sep 2013	19 Sep 2013	25 Sep 2013	19 Sep 2013
TP28-0.5	SE120709.028	LB045103	11 Sep 2013	12 Sep 2013	25 Sep 2013	19 Sep 2013	25 Sep 2013	19 Sep 2013
TP25-0.5	SE120709.029	LB045103	11 Sep 2013	12 Sep 2013	25 Sep 2013	19 Sep 2013	25 Sep 2013	19 Sep 2013
TP25-2.0	SE120709.030	LB045103	11 Sep 2013	12 Sep 2013	25 Sep 2013	19 Sep 2013	25 Sep 2013	19 Sep 2013
QC 111	SE120709.038	LB045103	11 Sep 2013	12 Sep 2013	25 Sep 2013	19 Sep 2013	25 Sep 2013	19 Sep 2013
TP28-2.0	SE120709.042	LB045103	11 Sep 2013	12 Sep 2013	25 Sep 2013	19 Sep 2013	25 Sep 2013	19 Sep 2013

Total Phenolics in Water

Method: ME-(AU)-[ENV]AN289

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC 101	SE120709.035	LB044854	09 Sep 2013	12 Sep 2013	07 Oct 2013	16 Sep 2013	07 Oct 2013	16 Sep 2013
QC 105	SE120709.036	LB044854	10 Sep 2013	12 Sep 2013	08 Oct 2013	16 Sep 2013	08 Oct 2013	16 Sep 2013
QC 109	SE120709.037	LB044854	11 Sep 2013	12 Sep 2013	09 Oct 2013	16 Sep 2013	09 Oct 2013	16 Sep 2013

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01-0.0	SE120709.001	LB044930	10 Sep 2013	12 Sep 2013	09 Mar 2014	17 Sep 2013	09 Mar 2014	19 Sep 2013
TP02-0.0	SE120709.002	LB044930	10 Sep 2013	12 Sep 2013	09 Mar 2014	17 Sep 2013	09 Mar 2014	19 Sep 2013
TP03-0.0	SE120709.003	LB044930	10 Sep 2013	12 Sep 2013	09 Mar 2014	17 Sep 2013	09 Mar 2014	19 Sep 2013
TP04-0.0	SE120709.004	LB044930	10 Sep 2013	12 Sep 2013	09 Mar 2014	17 Sep 2013	09 Mar 2014	19 Sep 2013
TP05-0.0	SE120709.005	LB044930	09 Sep 2013	12 Sep 2013	08 Mar 2014	17 Sep 2013	08 Mar 2014	19 Sep 2013
TP06-0.0	SE120709.006	LB044930	09 Sep 2013	12 Sep 2013	08 Mar 2014	17 Sep 2013	08 Mar 2014	19 Sep 2013
TP07-0.0	SE120709.007	LB044930	09 Sep 2013	12 Sep 2013	08 Mar 2014	17 Sep 2013	08 Mar 2014	19 Sep 2013
TP08-0.0	SE120709.008	LB044930	09 Sep 2013	12 Sep 2013	08 Mar 2014	17 Sep 2013	08 Mar 2014	19 Sep 2013
TP09-0.0	SE120709.009	LB044930	09 Sep 2013	12 Sep 2013	08 Mar 2014	17 Sep 2013	08 Mar 2014	19 Sep 2013
TP10-0.0	SE120709.010	LB044995	10 Sep 2013	12 Sep 2013	09 Mar 2014	18 Sep 2013	09 Mar 2014	19 Sep 2013
TP11-0.0	SE120709.011	LB044995	10 Sep 2013	12 Sep 2013	09 Mar 2014	18 Sep 2013	09 Mar 2014	19 Sep 2013
TP12-0.0	SE120709.012	LB044995	10 Sep 2013	12 Sep 2013	09 Mar 2014	18 Sep 2013	09 Mar 2014	19 Sep 2013
TP13-0.0	SE120709.013	LB044995	10 Sep 2013	12 Sep 2013	09 Mar 2014	18 Sep 2013	09 Mar 2014	19 Sep 2013
TP14-0.0	SE120709.014	LB044995	09 Sep 2013	12 Sep 2013	08 Mar 2014	18 Sep 2013	08 Mar 2014	19 Sep 2013
TP15-0.0	SE120709.015	LB044995	09 Sep 2013	12 Sep 2013	08 Mar 2014	18 Sep 2013	08 Mar 2014	19 Sep 2013
TP16-0.0	SE120709.016	LB044995	09 Sep 2013	12 Sep 2013	08 Mar 2014	18 Sep 2013	08 Mar 2014	19 Sep 2013
TP17-0.0	SE120709.017	LB044995	09 Sep 2013	12 Sep 2013	08 Mar 2014	18 Sep 2013	08 Mar 2014	19 Sep 2013
TP18-0.0	SE120709.018	LB044995	10 Sep 2013	12 Sep 2013	09 Mar 2014	18 Sep 2013	09 Mar 2014	19 Sep 2013
TP21-0.5	SE120709.020	LB044995	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest (continued)

Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP21-1.0	SE120709.021	LB044995	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP23-0.5	SE120709.022	LB044995	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP23-2.0	SE120709.023	LB044995	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP24-0.0	SE120709.024	LB044995	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP26-0.5	SE120709.025	LB044995	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP26-2.0	SE120709.026	LB044995	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP27-0.0	SE120709.027	LB044995	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP28-0.5	SE120709.028	LB044995	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP25-0.5	SE120709.029	LB044995	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP25-2.0	SE120709.030	LB044996	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP22-0.5	SE120709.031	LB044996	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP22-1.0	SE120709.032	LB044996	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP20-0.0	SE120709.033	LB044996	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP20-0.5	SE120709.034	LB044996	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
QC 111	SE120709.038	LB044996	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
QC 112	SE120709.039	LB044996	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013
TP28-2.0	SE120709.042	LB044996	11 Sep 2013	12 Sep 2013	10 Mar 2014	18 Sep 2013	10 Mar 2014	19 Sep 2013

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC 101	SE120709.035	LB044860	09 Sep 2013	12 Sep 2013	08 Mar 2014	16 Sep 2013	08 Mar 2014	17 Sep 2013
QC 105	SE120709.036	LB044860	10 Sep 2013	12 Sep 2013	09 Mar 2014	16 Sep 2013	09 Mar 2014	17 Sep 2013
QC 109	SE120709.037	LB044860	11 Sep 2013	12 Sep 2013	10 Mar 2014	16 Sep 2013	10 Mar 2014	17 Sep 2013

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP01-0.0	SE120709.001	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP02-0.0	SE120709.002	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP03-0.0	SE120709.003	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP04-0.0	SE120709.004	LB044915	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP05-0.0	SE120709.005	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP06-0.0	SE120709.006	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP07-0.0	SE120709.007	LB044915	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP08-0.0	SE120709.008	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP09-0.0	SE120709.009	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP10-0.0	SE120709.010	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP11-0.0	SE120709.011	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP12-0.0	SE120709.012	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP13-0.0	SE120709.013	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP14-0.0	SE120709.014	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP15-0.0	SE120709.015	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP16-0.0	SE120709.016	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP17-0.0	SE120709.017	LB044916	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP18-0.0	SE120709.018	LB044916	10 Sep 2013	12 Sep 2013	24 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP19-0.0	SE120709.019	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-0.5	SE120709.020	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-1.0	SE120709.021	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-0.5	SE120709.022	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-2.0	SE120709.023	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP24-0.0	SE120709.024	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-0.5	SE120709.025	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-2.0	SE120709.026	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP27-0.0	SE120709.027	LB044916	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-0.5	SE120709.028	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP25-0.5	SE120709.029	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP25-2.0	SE120709.030	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP22-0.5	SE120709.031	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP22-1.0	SE120709.032	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 111	SE120709.038	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 112	SE120709.039	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-2.0	SE120709.042	LB044917	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

HOLDING TIME SUMMARY

SE120709 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

TRH (Total Recoverable Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN403

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC 101	SE120709.035	LB044908	09 Sep 2013	12 Sep 2013	16 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 105	SE120709.036	LB044908	10 Sep 2013	12 Sep 2013	17 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 109	SE120709.037	LB044908	11 Sep 2013	12 Sep 2013	18 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP15-0.0	SE120709.015	LB044824	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP16-0.0	SE120709.016	LB044824	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP17-0.0	SE120709.017	LB044824	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP19-0.0	SE120709.019	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-0.5	SE120709.020	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-1.0	SE120709.021	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-0.5	SE120709.022	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-2.0	SE120709.023	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP24-0.0	SE120709.024	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-0.5	SE120709.025	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-2.0	SE120709.026	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP27-0.0	SE120709.027	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-0.5	SE120709.028	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP25-0.5	SE120709.029	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP25-2.0	SE120709.030	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP22-0.5	SE120709.031	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP22-1.0	SE120709.032	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 111	SE120709.038	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 112	SE120709.039	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
Trip Spike	SE120709.041	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-2.0	SE120709.042	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC 101	SE120709.035	LB045062	09 Sep 2013	12 Sep 2013	16 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
QC 105	SE120709.036	LB045062	10 Sep 2013	12 Sep 2013	17 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
QC 109	SE120709.037	LB045062	11 Sep 2013	12 Sep 2013	18 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
Trip Blank	SE120709.040	LB045062	09 Sep 2013	12 Sep 2013	16 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP15-0.0	SE120709.015	LB044824	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP16-0.0	SE120709.016	LB044824	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP17-0.0	SE120709.017	LB044824	09 Sep 2013	12 Sep 2013	23 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP19-0.0	SE120709.019	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-0.5	SE120709.020	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP21-1.0	SE120709.021	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-0.5	SE120709.022	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP23-2.0	SE120709.023	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP24-0.0	SE120709.024	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-0.5	SE120709.025	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP26-2.0	SE120709.026	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP27-0.0	SE120709.027	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-0.5	SE120709.028	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP25-0.5	SE120709.029	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP25-2.0	SE120709.030	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP22-0.5	SE120709.031	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP22-1.0	SE120709.032	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 111	SE120709.038	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
QC 112	SE120709.039	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
Trip Spike	SE120709.041	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013
TP28-2.0	SE120709.042	LB044824	11 Sep 2013	12 Sep 2013	25 Sep 2013	16 Sep 2013	26 Oct 2013	19 Sep 2013

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Volatile Petroleum Hydrocarbons in Water (continued)

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC 101	SE120709.035	LB045062	09 Sep 2013	12 Sep 2013	16 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
QC 105	SE120709.036	LB045062	10 Sep 2013	12 Sep 2013	17 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
QC 109	SE120709.037	LB045062	11 Sep 2013	12 Sep 2013	18 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013
Trip Blank	SE120709.040	LB045062	09 Sep 2013	12 Sep 2013	16 Sep 2013	16 Sep 2013	26 Oct 2013	20 Sep 2013

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (TCMX) (Surrogate)	TP01-0.0	SE120709.001	%	60 - 130%	101
	TP02-0.0	SE120709.002	%	60 - 130%	105
	TP03-0.0	SE120709.003	%	60 - 130%	123
	TP04-0.0	SE120709.004	%	60 - 130%	109
	TP05-0.0	SE120709.005	%	60 - 130%	101
	TP06-0.0	SE120709.006	%	60 - 130%	101
	TP07-0.0	SE120709.007	%	60 - 130%	105
	TP08-0.0	SE120709.008	%	60 - 130%	109
	TP09-0.0	SE120709.009	%	60 - 130%	107
	TP10-0.0	SE120709.010	%	60 - 130%	109
	TP11-0.0	SE120709.011	%	60 - 130%	113
	TP12-0.0	SE120709.012	%	60 - 130%	107
	TP13-0.0	SE120709.013	%	60 - 130%	105
	TP14-0.0	SE120709.014	%	60 - 130%	102
	TP18-0.0	SE120709.018	%	60 - 130%	111
	TP23-0.5	SE120709.022	%	60 - 130%	75
	TP23-2.0	SE120709.023	%	60 - 130%	99
	TP24-0.0	SE120709.024	%	60 - 130%	108
	TP26-0.5	SE120709.025	%	60 - 130%	95
	TP26-2.0	SE120709.026	%	60 - 130%	111
	TP27-0.0	SE120709.027	%	60 - 130%	107
	TP28-0.5	SE120709.028	%	60 - 130%	108
	TP25-0.5	SE120709.029	%	60 - 130%	113
	TP25-2.0	SE120709.030	%	60 - 130%	107
	QC 111	SE120709.038	%	60 - 130%	115
	TP28-2.0	SE120709.042	%	60 - 130%	118

OC Pesticides in Water

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (TCMX) (Surrogate)	QC 101	SE120709.035	%	40 - 130%	68
	QC 105	SE120709.036	%	40 - 130%	71
	QC 109	SE120709.037	%	40 - 130%	68

OP Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	TP01-0.0	SE120709.001	%	60 - 130%	106
	TP02-0.0	SE120709.002	%	60 - 130%	108
	TP03-0.0	SE120709.003	%	60 - 130%	120
	TP04-0.0	SE120709.004	%	60 - 130%	104
	TP05-0.0	SE120709.005	%	60 - 130%	110
	TP06-0.0	SE120709.006	%	60 - 130%	112
	TP07-0.0	SE120709.007	%	60 - 130%	110
	TP08-0.0	SE120709.008	%	60 - 130%	102
	TP09-0.0	SE120709.009	%	60 - 130%	110
	TP10-0.0	SE120709.010	%	60 - 130%	102
	TP11-0.0	SE120709.011	%	60 - 130%	120
	TP12-0.0	SE120709.012	%	60 - 130%	112
	TP13-0.0	SE120709.013	%	60 - 130%	106
	TP14-0.0	SE120709.014	%	60 - 130%	104
	TP18-0.0	SE120709.018	%	60 - 130%	100
	TP23-0.5	SE120709.022	%	60 - 130%	92
	TP23-2.0	SE120709.023	%	60 - 130%	86
	TP24-0.0	SE120709.024	%	60 - 130%	88
	TP26-0.5	SE120709.025	%	60 - 130%	92
	TP26-2.0	SE120709.026	%	60 - 130%	102
	TP27-0.0	SE120709.027	%	60 - 130%	90
	TP28-0.5	SE120709.028	%	60 - 130%	102
	TP25-0.5	SE120709.029	%	60 - 130%	96
	TP25-2.0	SE120709.030	%	60 - 130%	106
	QC 111	SE120709.038	%	60 - 130%	94
	TP28-2.0	SE120709.042	%	60 - 130%	92
d14-p-terphenyl (Surrogate)	TP01-0.0	SE120709.001	%	60 - 130%	108

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

OP Pesticides in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
d14-p-terphenyl (Surrogate)	TP02-0.0	SE120709.002	%	60 - 130%	112
	TP03-0.0	SE120709.003	%	60 - 130%	122
	TP04-0.0	SE120709.004	%	60 - 130%	110
	TP05-0.0	SE120709.005	%	60 - 130%	116
	TP06-0.0	SE120709.006	%	60 - 130%	116
	TP07-0.0	SE120709.007	%	60 - 130%	118
	TP08-0.0	SE120709.008	%	60 - 130%	106
	TP09-0.0	SE120709.009	%	60 - 130%	114
	TP10-0.0	SE120709.010	%	60 - 130%	104
	TP11-0.0	SE120709.011	%	60 - 130%	126
	TP12-0.0	SE120709.012	%	60 - 130%	116
	TP13-0.0	SE120709.013	%	60 - 130%	110
	TP14-0.0	SE120709.014	%	60 - 130%	108
	TP18-0.0	SE120709.018	%	60 - 130%	104
	TP23-0.5	SE120709.022	%	60 - 130%	112
	TP23-2.0	SE120709.023	%	60 - 130%	106
	TP24-0.0	SE120709.024	%	60 - 130%	110
	TP26-0.5	SE120709.025	%	60 - 130%	114
	TP26-2.0	SE120709.026	%	60 - 130%	112
	TP27-0.0	SE120709.027	%	60 - 130%	108
	TP28-0.5	SE120709.028	%	60 - 130%	108
	TP25-0.5	SE120709.029	%	60 - 130%	104
	TP25-2.0	SE120709.030	%	60 - 130%	114
	QC 111	SE120709.038	%	60 - 130%	102
	TP28-2.0	SE120709.042	%	60 - 130%	116

OP Pesticides in Water

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	QC 101	SE120709.035	%	40 - 130%	88
	QC 105	SE120709.036	%	40 - 130%	96
	QC 109	SE120709.037	%	40 - 130%	104
d14-p-terphenyl (Surrogate)	QC 101	SE120709.035	%	40 - 130%	116
	QC 105	SE120709.036	%	40 - 130%	124
	QC 109	SE120709.037	%	40 - 130%	120

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	TP15-0.0	SE120709.015	%	60 - 130%	92
	TP16-0.0	SE120709.016	%	60 - 130%	92
	TP17-0.0	SE120709.017	%	60 - 130%	92
	TP19-0.0	SE120709.019	%	60 - 130%	86
	TP21-0.5	SE120709.020	%	60 - 130%	90
	TP21-1.0	SE120709.021	%	60 - 130%	90
	TP23-0.5	SE120709.022	%	60 - 130%	92
	TP23-2.0	SE120709.023	%	60 - 130%	86
	TP24-0.0	SE120709.024	%	60 - 130%	88
	TP26-0.5	SE120709.025	%	60 - 130%	92
	TP26-2.0	SE120709.026	%	60 - 130%	102
	TP27-0.0	SE120709.027	%	60 - 130%	90
	TP28-0.5	SE120709.028	%	60 - 130%	102
	TP25-0.5	SE120709.029	%	60 - 130%	96
	TP25-2.0	SE120709.030	%	60 - 130%	106
	TP22-0.5	SE120709.031	%	60 - 130%	98
	TP22-1.0	SE120709.032	%	60 - 130%	86
	QC 111	SE120709.038	%	60 - 130%	94
	QC 112	SE120709.039	%	60 - 130%	92
	TP28-2.0	SE120709.042	%	60 - 130%	92
d14-p-terphenyl (Surrogate)	TP15-0.0	SE120709.015	%	60 - 130%	108
	TP16-0.0	SE120709.016	%	60 - 130%	116
	TP17-0.0	SE120709.017	%	60 - 130%	108
	TP19-0.0	SE120709.019	%	60 - 130%	112
	TP21-0.5	SE120709.020	%	60 - 130%	106

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
d14-p-terphenyl (Surrogate)	TP21-1.0	SE120709.021	%	60 - 130%	106
	TP23-0.5	SE120709.022	%	60 - 130%	112
	TP23-2.0	SE120709.023	%	60 - 130%	106
	TP24-0.0	SE120709.024	%	60 - 130%	110
	TP26-0.5	SE120709.025	%	60 - 130%	114
	TP26-2.0	SE120709.026	%	60 - 130%	112
	TP27-0.0	SE120709.027	%	60 - 130%	108
	TP28-0.5	SE120709.028	%	60 - 130%	108
	TP25-0.5	SE120709.029	%	60 - 130%	104
	TP25-2.0	SE120709.030	%	60 - 130%	114
	TP22-0.5	SE120709.031	%	60 - 130%	110
	TP22-1.0	SE120709.032	%	60 - 130%	104
	QC 111	SE120709.038	%	60 - 130%	102
	QC 112	SE120709.039	%	60 - 130%	104
	TP28-2.0	SE120709.042	%	60 - 130%	116
d5-nitrobenzene (Surrogate)	TP15-0.0	SE120709.015	%	60 - 130%	94
	TP16-0.0	SE120709.016	%	60 - 130%	98
	TP17-0.0	SE120709.017	%	60 - 130%	96
	TP19-0.0	SE120709.019	%	60 - 130%	92
	TP21-0.5	SE120709.020	%	60 - 130%	92
	TP21-1.0	SE120709.021	%	60 - 130%	92
	TP23-0.5	SE120709.022	%	60 - 130%	94
	TP23-2.0	SE120709.023	%	60 - 130%	86
	TP24-0.0	SE120709.024	%	60 - 130%	90
	TP26-0.5	SE120709.025	%	60 - 130%	88
	TP26-2.0	SE120709.026	%	60 - 130%	94
	TP27-0.0	SE120709.027	%	60 - 130%	94
	TP28-0.5	SE120709.028	%	60 - 130%	98
	TP25-0.5	SE120709.029	%	60 - 130%	102
	TP25-2.0	SE120709.030	%	60 - 130%	106
	TP22-0.5	SE120709.031	%	60 - 130%	90
	TP22-1.0	SE120709.032	%	60 - 130%	84
	QC 111	SE120709.038	%	60 - 130%	94
	QC 112	SE120709.039	%	60 - 130%	88
	TP28-2.0	SE120709.042	%	60 - 130%	92

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	QC 101	SE120709.035	%	40 - 130%	88
	QC 105	SE120709.036	%	40 - 130%	96
	QC 109	SE120709.037	%	40 - 130%	104
d14-p-terphenyl (Surrogate)	QC 101	SE120709.035	%	40 - 130%	116
	QC 105	SE120709.036	%	40 - 130%	124
	QC 109	SE120709.037	%	40 - 130%	120
d5-nitrobenzene (Surrogate)	QC 101	SE120709.035	%	40 - 130%	76
	QC 105	SE120709.036	%	40 - 130%	84
	QC 109	SE120709.037	%	40 - 130%	96

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (TCMX) (Surrogate)	TP23-0.5	SE120709.022	%	60 - 130%	75
	TP23-2.0	SE120709.023	%	60 - 130%	99
	TP24-0.0	SE120709.024	%	60 - 130%	108
	TP26-0.5	SE120709.025	%	60 - 130%	95
	TP26-2.0	SE120709.026	%	60 - 130%	111
	TP27-0.0	SE120709.027	%	60 - 130%	107
	TP28-0.5	SE120709.028	%	60 - 130%	108
	TP25-0.5	SE120709.029	%	60 - 130%	113
	TP25-2.0	SE120709.030	%	60 - 130%	107
	QC 111	SE120709.038	%	60 - 130%	115
	TP28-2.0	SE120709.042	%	60 - 130%	118

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PCBs in Water

Method: ME-(AU)-[ENV]AN400/AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (Surrogate)	QC 101	SE120709.035	%	40 - 130%	68
	QC 105	SE120709.036	%	40 - 130%	71
	QC 109	SE120709.037	%	40 - 130%	68

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP15-0.0	SE120709.015	%	60 - 130%	103
	TP16-0.0	SE120709.016	%	60 - 130%	96
	TP17-0.0	SE120709.017	%	60 - 130%	109
	TP19-0.0	SE120709.019	%	60 - 130%	106
	TP21-0.5	SE120709.020	%	60 - 130%	100
	TP21-1.0	SE120709.021	%	60 - 130%	94
	TP23-0.5	SE120709.022	%	60 - 130%	92
	TP23-2.0	SE120709.023	%	60 - 130%	104
	TP24-0.0	SE120709.024	%	60 - 130%	97
	TP26-0.5	SE120709.025	%	60 - 130%	116
	TP26-2.0	SE120709.026	%	60 - 130%	109
	TP27-0.0	SE120709.027	%	60 - 130%	111
	TP28-0.5	SE120709.028	%	60 - 130%	111
	TP25-0.5	SE120709.029	%	60 - 130%	100
	TP25-2.0	SE120709.030	%	60 - 130%	99
	TP22-0.5	SE120709.031	%	60 - 130%	96
	TP22-1.0	SE120709.032	%	60 - 130%	103
	QC 111	SE120709.038	%	60 - 130%	118
	QC 112	SE120709.039	%	60 - 130%	103
	Trip Spike	SE120709.041	%	60 - 130%	107
	TP28-2.0	SE120709.042	%	60 - 130%	88
d4-1,2-dichloroethane (Surrogate)	TP15-0.0	SE120709.015	%	60 - 130%	82
	TP16-0.0	SE120709.016	%	60 - 130%	85
	TP17-0.0	SE120709.017	%	60 - 130%	105
	TP19-0.0	SE120709.019	%	60 - 130%	91
	TP21-0.5	SE120709.020	%	60 - 130%	86
	TP21-1.0	SE120709.021	%	60 - 130%	87
	TP23-0.5	SE120709.022	%	60 - 130%	80
	TP23-2.0	SE120709.023	%	60 - 130%	91
	TP24-0.0	SE120709.024	%	60 - 130%	95
	TP26-0.5	SE120709.025	%	60 - 130%	107
	TP26-2.0	SE120709.026	%	60 - 130%	105
	TP27-0.0	SE120709.027	%	60 - 130%	106
	TP28-0.5	SE120709.028	%	60 - 130%	103
	TP25-0.5	SE120709.029	%	60 - 130%	102
	TP25-2.0	SE120709.030	%	60 - 130%	98
	TP22-0.5	SE120709.031	%	60 - 130%	100
	TP22-1.0	SE120709.032	%	60 - 130%	101
	QC 111	SE120709.038	%	60 - 130%	116
	QC 112	SE120709.039	%	60 - 130%	108
	Trip Spike	SE120709.041	%	60 - 130%	105
	TP28-2.0	SE120709.042	%	60 - 130%	90
d8-toluene (Surrogate)	TP15-0.0	SE120709.015	%	60 - 130%	84
	TP16-0.0	SE120709.016	%	60 - 130%	85
	TP17-0.0	SE120709.017	%	60 - 130%	108
	TP19-0.0	SE120709.019	%	60 - 130%	88
	TP21-0.5	SE120709.020	%	60 - 130%	84
	TP21-1.0	SE120709.021	%	60 - 130%	85
	TP23-0.5	SE120709.022	%	60 - 130%	80
	TP23-2.0	SE120709.023	%	60 - 130%	90
	TP24-0.0	SE120709.024	%	60 - 130%	93
	TP26-0.5	SE120709.025	%	60 - 130%	101
	TP26-2.0	SE120709.026	%	60 - 130%	102
	TP27-0.0	SE120709.027	%	60 - 130%	103
	TP28-0.5	SE120709.028	%	60 - 130%	101

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOC's in Soil (continued)

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
d8-toluene (Surrogate)	TP25-0.5	SE120709.029	%	60 - 130%	96
	TP25-2.0	SE120709.030	%	60 - 130%	95
	TP22-0.5	SE120709.031	%	60 - 130%	95
	TP22-1.0	SE120709.032	%	60 - 130%	99
	QC 111	SE120709.038	%	60 - 130%	115
	QC 112	SE120709.039	%	60 - 130%	104
	Trip Spike	SE120709.041	%	60 - 130%	105
	TP28-2.0	SE120709.042	%	60 - 130%	85
Dibromofluoromethane (Surrogate)	TP15-0.0	SE120709.015	%	60 - 130%	74
	TP16-0.0	SE120709.016	%	60 - 130%	74
	TP17-0.0	SE120709.017	%	60 - 130%	93
	TP19-0.0	SE120709.019	%	60 - 130%	76
	TP21-0.5	SE120709.020	%	60 - 130%	71
	TP21-1.0	SE120709.021	%	60 - 130%	71
	TP23-0.5	SE120709.022	%	60 - 130%	70
	TP23-2.0	SE120709.023	%	60 - 130%	73
	TP24-0.0	SE120709.024	%	60 - 130%	78
	TP26-0.5	SE120709.025	%	60 - 130%	86
	TP26-2.0	SE120709.026	%	60 - 130%	85
	TP27-0.0	SE120709.027	%	60 - 130%	86
	TP28-0.5	SE120709.028	%	60 - 130%	79
	TP25-0.5	SE120709.029	%	60 - 130%	80
	TP25-2.0	SE120709.030	%	60 - 130%	77
	TP22-0.5	SE120709.031	%	60 - 130%	77
	TP22-1.0	SE120709.032	%	60 - 130%	77
	QC 111	SE120709.038	%	60 - 130%	90
	QC 112	SE120709.039	%	60 - 130%	82
	Trip Spike	SE120709.041	%	60 - 130%	80
	TP28-2.0	SE120709.042	%	60 - 130%	71

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	QC 101	SE120709.035	%	40 - 130%	100
	QC 105	SE120709.036	%	40 - 130%	99
	QC 109	SE120709.037	%	40 - 130%	100
	Trip Blank	SE120709.040	%	40 - 130%	100
d4-1,2-dichloroethane (Surrogate)	QC 101	SE120709.035	%	40 - 130%	111
	QC 105	SE120709.036	%	40 - 130%	115
	QC 109	SE120709.037	%	40 - 130%	115
	Trip Blank	SE120709.040	%	40 - 130%	117
d8-toluene (Surrogate)	QC 101	SE120709.035	%	40 - 130%	106
	QC 105	SE120709.036	%	40 - 130%	108
	QC 109	SE120709.037	%	40 - 130%	106
	Trip Blank	SE120709.040	%	40 - 130%	106
Dibromofluoromethane (Surrogate)	QC 101	SE120709.035	%	40 - 130%	103
	QC 105	SE120709.036	%	40 - 130%	106
	QC 109	SE120709.037	%	40 - 130%	106
	Trip Blank	SE120709.040	%	40 - 130%	107

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP15-0.0	SE120709.015	%	60 - 130%	103
	TP16-0.0	SE120709.016	%	60 - 130%	96
	TP17-0.0	SE120709.017	%	60 - 130%	109
	TP19-0.0	SE120709.019	%	60 - 130%	106
	TP21-0.5	SE120709.020	%	60 - 130%	100
	TP21-1.0	SE120709.021	%	60 - 130%	94
	TP23-0.5	SE120709.022	%	60 - 130%	92
	TP23-2.0	SE120709.023	%	60 - 130%	104
	TP24-0.0	SE120709.024	%	60 - 130%	97
	TP26-0.5	SE120709.025	%	60 - 130%	116
	TP26-2.0	SE120709.026	%	60 - 130%	109

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Volatile Petroleum Hydrocarbons in Soil (continued) — **Method: ME-(AU)-[ENV]AN433/AN434/AN410**

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	TP27-0.0	SE120709.027	%	60 - 130%	111
	TP28-0.5	SE120709.028	%	60 - 130%	111
	TP25-0.5	SE120709.029	%	60 - 130%	100
	TP25-2.0	SE120709.030	%	60 - 130%	99
	TP22-0.5	SE120709.031	%	60 - 130%	96
	TP22-1.0	SE120709.032	%	60 - 130%	103
	QC 111	SE120709.038	%	60 - 130%	118
	QC 112	SE120709.039	%	60 - 130%	103
	TP28-2.0	SE120709.042	%	60 - 130%	88
d4-1,2-dichloroethane (Surrogate)	TP15-0.0	SE120709.015	%	60 - 130%	82
	TP16-0.0	SE120709.016	%	60 - 130%	85
	TP17-0.0	SE120709.017	%	60 - 130%	105
	TP19-0.0	SE120709.019	%	60 - 130%	91
	TP21-0.5	SE120709.020	%	60 - 130%	86
	TP21-1.0	SE120709.021	%	60 - 130%	87
	TP23-0.5	SE120709.022	%	60 - 130%	80
	TP23-2.0	SE120709.023	%	60 - 130%	91
	TP24-0.0	SE120709.024	%	60 - 130%	95
	TP26-0.5	SE120709.025	%	60 - 130%	107
	TP26-2.0	SE120709.026	%	60 - 130%	105
	TP27-0.0	SE120709.027	%	60 - 130%	106
	TP28-0.5	SE120709.028	%	60 - 130%	103
	TP25-0.5	SE120709.029	%	60 - 130%	102
	TP25-2.0	SE120709.030	%	60 - 130%	98
	TP22-0.5	SE120709.031	%	60 - 130%	100
	TP22-1.0	SE120709.032	%	60 - 130%	101
	QC 111	SE120709.038	%	60 - 130%	116
	QC 112	SE120709.039	%	60 - 130%	108
	TP28-2.0	SE120709.042	%	60 - 130%	90
d8-toluene (Surrogate)	TP15-0.0	SE120709.015	%	60 - 130%	84
	TP16-0.0	SE120709.016	%	60 - 130%	85
	TP17-0.0	SE120709.017	%	60 - 130%	108
	TP19-0.0	SE120709.019	%	60 - 130%	88
	TP21-0.5	SE120709.020	%	60 - 130%	84
	TP21-1.0	SE120709.021	%	60 - 130%	85
	TP23-0.5	SE120709.022	%	60 - 130%	80
	TP23-2.0	SE120709.023	%	60 - 130%	90
	TP24-0.0	SE120709.024	%	60 - 130%	93
	TP26-0.5	SE120709.025	%	60 - 130%	101
	TP26-2.0	SE120709.026	%	60 - 130%	102
	TP27-0.0	SE120709.027	%	60 - 130%	103
	TP28-0.5	SE120709.028	%	60 - 130%	101
	TP25-0.5	SE120709.029	%	60 - 130%	96
	TP25-2.0	SE120709.030	%	60 - 130%	95
	TP22-0.5	SE120709.031	%	60 - 130%	95
	TP22-1.0	SE120709.032	%	60 - 130%	99
	QC 111	SE120709.038	%	60 - 130%	115
	QC 112	SE120709.039	%	60 - 130%	104
	TP28-2.0	SE120709.042	%	60 - 130%	85
Dibromofluoromethane (Surrogate)	TP15-0.0	SE120709.015	%	60 - 130%	74
	TP16-0.0	SE120709.016	%	60 - 130%	74
	TP17-0.0	SE120709.017	%	60 - 130%	93
	TP19-0.0	SE120709.019	%	60 - 130%	76
	TP21-0.5	SE120709.020	%	60 - 130%	71
	TP21-1.0	SE120709.021	%	60 - 130%	71
	TP23-0.5	SE120709.022	%	60 - 130%	70
	TP23-2.0	SE120709.023	%	60 - 130%	73
	TP24-0.0	SE120709.024	%	60 - 130%	78
	TP26-0.5	SE120709.025	%	60 - 130%	86
	TP26-2.0	SE120709.026	%	60 - 130%	85
	TP27-0.0	SE120709.027	%	60 - 130%	86

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Volatile Petroleum Hydrocarbons in Soil (continued)

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Dibromofluoromethane (Surrogate)	TP28-0.5	SE120709.028	%	60 - 130%	79
	TP25-0.5	SE120709.029	%	60 - 130%	80
	TP25-2.0	SE120709.030	%	60 - 130%	77
	TP22-0.5	SE120709.031	%	60 - 130%	77
	TP22-1.0	SE120709.032	%	60 - 130%	77
	QC 111	SE120709.038	%	60 - 130%	90
	QC 112	SE120709.039	%	60 - 130%	82
	TP28-2.0	SE120709.042	%	60 - 130%	71

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	QC 101	SE120709.035	%	60 - 130%	100
	QC 105	SE120709.036	%	60 - 130%	99
	QC 109	SE120709.037	%	60 - 130%	100
	Trip Blank	SE120709.040	%	60 - 130%	100
d4-1,2-dichloroethane (Surrogate)	QC 101	SE120709.035	%	60 - 130%	111
	QC 105	SE120709.036	%	60 - 130%	115
	QC 109	SE120709.037	%	60 - 130%	115
	Trip Blank	SE120709.040	%	60 - 130%	117
d8-toluene (Surrogate)	QC 101	SE120709.035	%	60 - 130%	106
	QC 105	SE120709.036	%	60 - 130%	108
	QC 109	SE120709.037	%	60 - 130%	106
	Trip Blank	SE120709.040	%	60 - 130%	106
Dibromofluoromethane (Surrogate)	QC 101	SE120709.035	%	60 - 130%	103
	QC 105	SE120709.036	%	60 - 130%	106
	QC 109	SE120709.037	%	60 - 130%	106
	Trip Blank	SE120709.040	%	60 - 130%	107

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Hexavalent Chromium in Soil UV/Vis

Method: ME-(AU)-[ENV]AN075/AN201

Sample Number	Parameter	Units	LOR	Result
LB045093.001	Hexavalent Chromium, Cr6+	mg/kg	0.5	<0.5
LB045094.001	Hexavalent Chromium, Cr6+	mg/kg	0.5	<0.5

Hexavalent Chromium in water by Discrete Analyser

Method: ME-(AU)-[ENV]AN283

Sample Number	Parameter	Units	LOR	Result
LB044812.001	Hexavalent Chromium, Cr6+	mg/L	0.005	<0.005

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Sample Number	Parameter	Units	LOR	Result
LB045071.001	Mercury	mg/L	0.0001	<0.0001

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result
LB044936.001	Mercury	mg/kg	0.01	<0.01
LB044998.001	Mercury	mg/kg	0.01	<0.01
LB045000.001	Mercury	mg/kg	0.01	<0.01

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB044915.001		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1
		Alpha BHC	mg/kg	0.1	<0.1
		Lindane	mg/kg	0.1	<0.1
		Heptachlor	mg/kg	0.1	<0.1
		Aldrin	mg/kg	0.1	<0.1
		Beta BHC	mg/kg	0.1	<0.1
		Delta BHC	mg/kg	0.1	<0.1
		Heptachlor epoxide	mg/kg	0.1	<0.1
		Alpha Endosulfan	mg/kg	0.2	<0.2
		Gamma Chlordane	mg/kg	0.1	<0.1
		Alpha Chlordane	mg/kg	0.1	<0.1
		p,p'-DDE	mg/kg	0.1	<0.1
		Dieldrin	mg/kg	0.2	<0.2
		Endrin	mg/kg	0.2	<0.2
		Beta Endosulfan	mg/kg	0.2	<0.2
		p,p'-DDD	mg/kg	0.1	<0.1
		p,p'-DDT	mg/kg	0.1	<0.1
		Endosulfan sulphate	mg/kg	0.1	<0.1
		Endrin Aldehyde	mg/kg	0.1	<0.1
		Methoxychlor	mg/kg	0.1	<0.1
		Endrin Ketone	mg/kg	0.1	<0.1
		Isodrin	mg/kg	0.1	<0.1
		Mirex	mg/kg	0.1	<0.1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	96
LB044916.001		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1
		Alpha BHC	mg/kg	0.1	<0.1
		Lindane	mg/kg	0.1	<0.1
		Heptachlor	mg/kg	0.1	<0.1
		Aldrin	mg/kg	0.1	<0.1
		Beta BHC	mg/kg	0.1	<0.1
		Delta BHC	mg/kg	0.1	<0.1
		Heptachlor epoxide	mg/kg	0.1	<0.1
		Alpha Endosulfan	mg/kg	0.2	<0.2
		Gamma Chlordane	mg/kg	0.1	<0.1
		Alpha Chlordane	mg/kg	0.1	<0.1
		p,p'-DDE	mg/kg	0.1	<0.1
		Dieldrin	mg/kg	0.2	<0.2
		Endrin	mg/kg	0.2	<0.2
		Beta Endosulfan	mg/kg	0.2	<0.2

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

OC Pesticides in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB044916.001		p,p'-DDD	mg/kg	0.1	<0.1
		p,p'-DDT	mg/kg	0.1	<0.1
		Endosulfan sulphate	mg/kg	0.1	<0.1
		Endrin Aldehyde	mg/kg	0.1	<0.1
		Methoxychlor	mg/kg	0.1	<0.1
		Endrin Ketone	mg/kg	0.1	<0.1
		Isodrin	mg/kg	0.1	<0.1
		Mirex	mg/kg	0.1	<0.1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	101
LB044917.001		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1
		Alpha BHC	mg/kg	0.1	<0.1
		Lindane	mg/kg	0.1	<0.1
		Heptachlor	mg/kg	0.1	<0.1
		Aldrin	mg/kg	0.1	<0.1
		Beta BHC	mg/kg	0.1	<0.1
		Delta BHC	mg/kg	0.1	<0.1
		Heptachlor epoxide	mg/kg	0.1	<0.1
		Alpha Endosulfan	mg/kg	0.2	<0.2
		Gamma Chlordane	mg/kg	0.1	<0.1
		Alpha Chlordane	mg/kg	0.1	<0.1
		p,p'-DDE	mg/kg	0.1	<0.1
		Dieldrin	mg/kg	0.2	<0.2
		Endrin	mg/kg	0.2	<0.2
		Beta Endosulfan	mg/kg	0.2	<0.2
		p,p'-DDD	mg/kg	0.1	<0.1
		p,p'-DDT	mg/kg	0.1	<0.1
		Endosulfan sulphate	mg/kg	0.1	<0.1
		Endrin Aldehyde	mg/kg	0.1	<0.1
		Methoxychlor	mg/kg	0.1	<0.1
		Endrin Ketone	mg/kg	0.1	<0.1
		Isodrin	mg/kg	0.1	<0.1
		Mirex	mg/kg	0.1	<0.1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	110

OC Pesticides in Water

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB044908.001		Alpha BHC	µg/L	0.1	<0.1
		Hexachlorobenzene (HCB)	µg/L	0.1	<0.1
		Beta BHC	µg/L	0.1	<0.1
		Lindane (gamma BHC)	µg/L	0.1	<0.1
		Delta BHC	µg/L	0.1	<0.1
		Heptachlor	µg/L	0.1	<0.1
		Aldrin	µg/L	0.1	<0.1
		Heptachlor epoxide	µg/L	0.1	<0.1
		Gamma Chlordane	µg/L	0.1	<0.1
		Alpha Chlordane	µg/L	0.1	<0.1
		Alpha Endosulfan	µg/L	0.1	<0.1
		p,p'-DDE	µg/L	0.1	<0.1
		Dieldrin	µg/L	0.1	<0.1
		Endrin	µg/L	0.1	<0.1
		Beta Endosulfan	µg/L	0.1	<0.1
		p,p'-DDD	µg/L	0.1	<0.1
		Endosulfan sulphate	µg/L	0.1	<0.1
		p,p'-DDT	µg/L	0.1	<0.1
		Endrin ketone	µg/L	0.1	<0.1
		Methoxychlor	µg/L	0.1	<0.1
		Endrin aldehyde	µg/L	0.1	<0.1
		Isodrin	µg/L	0.1	<0.1
		Mirex	µg/L	0.1	<0.1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	88

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

OP Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB044915.001		Dichlorvos	mg/kg	0.5	<0.5
		Dimethoate	mg/kg	0.5	<0.5
		Diazinon (Dimpylate)	mg/kg	0.5	<0.5
		Fenitrothion	mg/kg	0.2	<0.2
		Malathion	mg/kg	0.2	<0.2
		Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	<0.2
		Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2
		Bromophos Ethyl	mg/kg	0.2	<0.2
		Methidathion	mg/kg	0.5	<0.5
		Ethion	mg/kg	0.2	<0.2
		Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2
	Surrogates	2-fluorobiphenyl (Surrogate)	%	-	106
		d14-p-terphenyl (Surrogate)	%	-	106
LB044916.001		Dichlorvos	mg/kg	0.5	<0.5
		Dimethoate	mg/kg	0.5	<0.5
		Diazinon (Dimpylate)	mg/kg	0.5	<0.5
		Fenitrothion	mg/kg	0.2	<0.2
		Malathion	mg/kg	0.2	<0.2
		Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	<0.2
		Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2
		Bromophos Ethyl	mg/kg	0.2	<0.2
		Methidathion	mg/kg	0.5	<0.5
		Ethion	mg/kg	0.2	<0.2
		Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2
	Surrogates	2-fluorobiphenyl (Surrogate)	%	-	112
		d14-p-terphenyl (Surrogate)	%	-	118
LB044917.001		Dichlorvos	mg/kg	0.5	<0.5
		Dimethoate	mg/kg	0.5	<0.5
		Diazinon (Dimpylate)	mg/kg	0.5	<0.5
		Fenitrothion	mg/kg	0.2	<0.2
		Malathion	mg/kg	0.2	<0.2
		Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	<0.2
		Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2
		Bromophos Ethyl	mg/kg	0.2	<0.2
		Methidathion	mg/kg	0.5	<0.5
		Ethion	mg/kg	0.2	<0.2
		Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2
	Surrogates	2-fluorobiphenyl (Surrogate)	%	-	100
		d14-p-terphenyl (Surrogate)	%	-	100

OP Pesticides in Water

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB044908.001		Dichlorvos	µg/L	0.5	<0.5
		Dimethoate	µg/L	0.5	<0.5
		Diazinon (Dimpylate)	µg/L	0.5	<0.5
		Fenitrothion	µg/L	0.2	<0.2
		Malathion	µg/L	0.2	<0.2
		Chlorpyrifos (Chlorpyrifos Ethyl)	µg/L	0.2	<0.2
		Parathion-ethyl (Parathion)	µg/L	0.2	<0.2
		Bromophos Ethyl	µg/L	0.2	<0.2
		Methidathion	µg/L	0.5	<0.5
		Ethion	µg/L	0.2	<0.2
		Azinphos-methyl	µg/L	0.2	<0.2
	Surrogates	2-fluorobiphenyl (Surrogate)	%	-	77
		d14-p-terphenyl (Surrogate)	%	-	104

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number	Parameter	Units	LOR	Result
LB044916.001	Naphthalene	mg/kg	0.1	<0.1
	2-methylnaphthalene	mg/kg	0.1	<0.1
	1-methylnaphthalene	mg/kg	0.1	<0.1
	Acenaphthylene	mg/kg	0.1	<0.1

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB044916.001		Acenaphthene	mg/kg	0.1	<0.1
		Fluorene	mg/kg	0.1	<0.1
		Phenanthrene	mg/kg	0.1	<0.1
		Anthracene	mg/kg	0.1	<0.1
		Fluoranthene	mg/kg	0.1	<0.1
		Pyrene	mg/kg	0.1	<0.1
		Benzo(a)anthracene	mg/kg	0.1	<0.1
		Chrysene	mg/kg	0.1	<0.1
		Benzo(a)pyrene	mg/kg	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1
		Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1
		Benzo(ghi)perylene	mg/kg	0.1	<0.1
		Total PAH	mg/kg	0.8	<0.8
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	112
		2-fluorobiphenyl (Surrogate)	%	-	110
		d14-p-terphenyl (Surrogate)	%	-	118
LB044917.001		Naphthalene	mg/kg	0.1	<0.1
		2-methylnaphthalene	mg/kg	0.1	<0.1
		1-methylnaphthalene	mg/kg	0.1	<0.1
		Acenaphthylene	mg/kg	0.1	<0.1
		Acenaphthene	mg/kg	0.1	<0.1
		Fluorene	mg/kg	0.1	<0.1
		Phenanthrene	mg/kg	0.1	<0.1
		Anthracene	mg/kg	0.1	<0.1
		Fluoranthene	mg/kg	0.1	<0.1
		Pyrene	mg/kg	0.1	<0.1
		Benzo(a)anthracene	mg/kg	0.1	<0.1
		Chrysene	mg/kg	0.1	<0.1
		Benzo(a)pyrene	mg/kg	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1
		Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1
		Benzo(ghi)perylene	mg/kg	0.1	<0.1
		Total PAH	mg/kg	0.8	<0.8
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	98
		2-fluorobiphenyl (Surrogate)	%	-	100
		d14-p-terphenyl (Surrogate)	%	-	100

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB044908.001		Naphthalene	µg/L	0.1	<0.1
		2-methylnaphthalene	µg/L	0.1	<0.1
		1-methylnaphthalene	µg/L	0.1	<0.1
		Acenaphthylene	µg/L	0.1	<0.1
		Acenaphthene	µg/L	0.1	<0.1
		Fluorene	µg/L	0.1	<0.1
		Phenanthrene	µg/L	0.1	<0.1
		Anthracene	µg/L	0.1	<0.1
		Fluoranthene	µg/L	0.1	<0.1
		Pyrene	µg/L	0.1	<0.1
		Benzo(a)anthracene	µg/L	0.1	<0.1
		Chrysene	µg/L	0.1	<0.1
		Benzo(a)pyrene	µg/L	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1
		Dibenzo(a&h)anthracene	µg/L	0.1	<0.1
		Benzo(ghi)perylene	µg/L	0.1	<0.1
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	80
		2-fluorobiphenyl (Surrogate)	%	-	86
		d14-p-terphenyl (Surrogate)	%	-	82

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number	Parameter	Units	LOR

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

PCBs in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result
LB044916.001		Arochlor 1016	mg/kg	0.2	<0.2
		Arochlor 1221	mg/kg	0.2	<0.2
		Arochlor 1232	mg/kg	0.2	<0.2
		Arochlor 1242	mg/kg	0.2	<0.2
		Arochlor 1248	mg/kg	0.2	<0.2
		Arochlor 1254	mg/kg	0.2	<0.2
		Arochlor 1260	mg/kg	0.2	<0.2
		Arochlor 1262	mg/kg	0.2	<0.2
		Arochlor 1268	mg/kg	0.2	<0.2
		Total PCBs (Arochlors)	mg/kg	1	<1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	101
LB044917.001		Arochlor 1016	mg/kg	0.2	<0.2
		Arochlor 1221	mg/kg	0.2	<0.2
		Arochlor 1232	mg/kg	0.2	<0.2
		Arochlor 1242	mg/kg	0.2	<0.2
		Arochlor 1248	mg/kg	0.2	<0.2
		Arochlor 1254	mg/kg	0.2	<0.2
		Arochlor 1260	mg/kg	0.2	<0.2
		Arochlor 1262	mg/kg	0.2	<0.2
		Arochlor 1268	mg/kg	0.2	<0.2
		Total PCBs (Arochlors)	mg/kg	1	<1
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	109

PCBs in Water

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number	Parameter	Units	LOR	Result
LB044908.001	Arochlor 1016	µg/L	1	<1
	Arochlor 1221	µg/L	1	<1
	Arochlor 1232	µg/L	1	<1
	Arochlor 1242	µg/L	1	<1
	Arochlor 1248	µg/L	1	<1
	Arochlor 1254	µg/L	1	<1
	Arochlor 1260	µg/L	1	<1
	Arochlor 1262	µg/L	1	<1
	Arochlor 1268	µg/L	1	<1

Total Phenolics in Soil

Method: ME-(AU)-[ENV]AN289

Sample Number	Parameter	Units	LOR	Result
LB045103.001	Total Phenols	mg/kg	0.1	<0.1

Total Phenolics in Water

Method: ME-(AU)-[ENV]AN289

Sample Number	Parameter	Units	LOR	Result
LB044854.001	Total Phenols	mg/L	0.01	<0.01

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result
LB044930.001	Arsenic, As	mg/kg	3	<3
	Beryllium, Be	mg/kg	0.3	<0.3
	Cadmium, Cd	mg/kg	0.3	<0.3
	Cobalt, Co	mg/kg	0.3	<0.3
	Copper, Cu	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Manganese, Mn	mg/kg	0.3	<0.3
	Nickel, Ni	mg/kg	0.5	<0.5
	Selenium, Se	mg/kg	2	<2
	Zinc, Zn	mg/kg	0.5	<0.5
LB044995.001	Arsenic, As	mg/kg	3	<3
	Beryllium, Be	mg/kg	0.3	<0.3
	Cadmium, Cd	mg/kg	0.3	<0.3
	Cobalt, Co	mg/kg	0.3	<0.3

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest (continued)

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result
LB044995.001	Copper, Cu	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Manganese, Mn	mg/kg	0.3	<0.3
	Nickel, Ni	mg/kg	0.5	<0.5
	Selenium, Se	mg/kg	2	<2
	Zinc, Zn	mg/kg	0.5	<0.5
LB044996.001	Arsenic, As	mg/kg	3	<1
	Beryllium, Be	mg/kg	0.3	-4.0368E-006
	Cadmium, Cd	mg/kg	0.3	<0.3
	Cobalt, Co	mg/kg	0.3	0.004328825
	Copper, Cu	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Manganese, Mn	mg/kg	0.3	0.13921525
	Nickel, Ni	mg/kg	0.5	<0.5
	Selenium, Se	mg/kg	2	0.20826925
	Zinc, Zn	mg/kg	0.5	<2.0

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Number	Parameter	Units	LOR	Result
LB044860.001	Arsenic, As	µg/L	1	<1
	Beryllium, Be	µg/L	1	<1
	Boron, B	µg/L	5	<5
	Cadmium, Cd	µg/L	0.1	<0.1
	Cobalt, Co	µg/L	1	<1
	Copper, Cu	µg/L	1	<1
	Lead, Pb	µg/L	1	<1
	Manganese, Mn	µg/L	1	<1
	Nickel, Ni	µg/L	1	<1
	Selenium, Se	µg/L	1	<1
	Zinc, Zn	µg/L	5	<5

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number	Parameter	Units	LOR	Result
LB044916.001	TRH C10-C14	mg/kg	20	<20
	TRH C15-C28	mg/kg	45	<45
	TRH C29-C36	mg/kg	45	<45
	TRH C37-C40	mg/kg	100	<100
	TRH C10-C36 Total	mg/kg	110	<110
LB044917.001	TRH C10-C14	mg/kg	20	<20
	TRH C15-C28	mg/kg	45	<45
	TRH C29-C36	mg/kg	45	<45
	TRH C37-C40	mg/kg	100	<100
	TRH C10-C36 Total	mg/kg	110	<110

TRH (Total Recoverable Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN403

Sample Number	Parameter	Units	LOR	Result
LB044908.001	TRH C10-C14	µg/L	50	<50
	TRH C15-C28	µg/L	200	<200
	TRH C29-C36	µg/L	200	<200
	TRH C37-C40	µg/L	200	<200

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB044824.001	Monocyclic Aromatic Hydrocarbons	Benzene	mg/kg	0.1	<0.1
		Toluene	mg/kg	0.1	<0.1
		Ethylbenzene	mg/kg	0.1	<0.1
		m/p-xylene	mg/kg	0.2	<0.2
		o-xylene	mg/kg	0.1	<0.1
	Polycyclic VOCs	Naphthalene	mg/kg	0.1	<0.1
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	76
		d4-1,2-dichloroethane (Surrogate)	%	-	88
		d8-toluene (Surrogate)	%	-	90
		Bromofluorobenzene (Surrogate)	%	-	110

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

VOC's in Soil (continued)

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB044824.001	Totals	Total BTEX*	mg/kg	0.6	<0.6

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB045062.001	Monocyclic Aromatic	Benzene	µg/L	0.5	<0.5
	Hydrocarbons	Toluene	µg/L	0.5	<0.5
		Ethylbenzene	µg/L	0.5	<0.5
		m/p-xylene	µg/L	1	<1
		o-xylene	µg/L	0.5	<0.5
	Polycyclic VOCs	Naphthalene	µg/L	0.5	<0.5
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	93
		d4-1,2-dichloroethane (Surrogate)	%	-	103
		d8-toluene (Surrogate)	%	-	103
		Bromofluorobenzene (Surrogate)	%	-	102

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result
LB044824.001		TRH C6-C9	mg/kg	20	<20
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	76
		d4-1,2-dichloroethane (Surrogate)	%	-	88
		d8-toluene (Surrogate)	%	-	90

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result
LB045062.001		TRH C6-C9	µg/L	40	<40
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	93
		d4-1,2-dichloroethane (Surrogate)	%	-	103
		d8-toluene (Surrogate)	%	-	103
		Bromofluorobenzene (Surrogate)	%	-	102

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Hexavalent Chromium in Soil UV/Vis

Method: ME-(AU)-[ENV]AN075/AN201

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.001	LB045093.004	Hexavalent Chromium, Cr6+	mg/kg	0.5	<0.5	<0.5	200	0
SE120709.011	LB045093.016	Hexavalent Chromium, Cr6+	mg/kg	0.5	<0.5	<0.5	200	0
SE120709.020	LB045093.026	Hexavalent Chromium, Cr6+	mg/kg	0.5	<0.5	<0.5	200	0
SE120709.030	LB045094.013	Hexavalent Chromium, Cr6+	mg/kg	0.5	<0.5	<0.5	200	0

Hexavalent Chromium in water by Discrete Analyser

Method: ME-(AU)-[ENV]AN283

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120683.001	LB044812.004	Hexavalent Chromium, Cr6+	mg/L	0.005	<0.005	<0.005	174	0

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120765.002	LB045071.015	Mercury	µg/L	0.0001	<0.0001	<0.0001	200	0

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120708.011	LB044936.014	Mercury	mg/kg	0.01	0.006024239	7 0.0052803424	200	0
SE120709.009	LB044936.024	Mercury	mg/kg	0.01	0.02	0.02	94	8
SE120709.020	LB044998.014	Mercury	mg/kg	0.01	0.02	0.02	83	11
SE120709.029	LB044998.024	Mercury	mg/kg	0.01	0.03	0.02	70	3
SE120734.001	LB045000.014	Mercury	mg/kg	0.01	<0.01	<0.01	148	0
SE120734.003	LB045000.017	Mercury	mg/kg	0.01	0.01	<0.01	141	4

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120708.001	LB044915.009		Hexachlorobenzene (HCB)	mg/kg	0.1	0	0	200	0
			Alpha BHC	mg/kg	0.1	0	0	200	0
			Lindane	mg/kg	0.1	0	0	200	0
			Heptachlor	mg/kg	0.1	0	0	200	0
			Aldrin	mg/kg	0.1	0	0	200	0
			Beta BHC	mg/kg	0.1	0	0	200	0
			Delta BHC	mg/kg	0.1	0	0	200	0
			Heptachlor epoxide	mg/kg	0.1	0	0	200	0
			o,p'-DDE	mg/kg	0.1	0	0	200	0
			Alpha Endosulfan	mg/kg	0.2	0	0	200	0
			Gamma Chlordane	mg/kg	0.1	0	0	200	0
			Alpha Chlordane	mg/kg	0.1	0	0	200	0
			trans-Nonachlor	mg/kg	0.1	0	0	200	0
			p,p'-DDE	mg/kg	0.1	0	0	200	0
			Dieldrin	mg/kg	0.2	0	0	200	0
			Endrin	mg/kg	0.2	0	0	200	0
			o,p'-DDD	mg/kg	0.1	0	0	200	0
			o,p'-DDT	mg/kg	0.1	0	0	200	0
			Beta Endosulfan	mg/kg	0.2	0	0	200	0
			p,p'-DDD	mg/kg	0.1	0	0	200	0
			p,p'-DDT	mg/kg	0.1	0	0	200	0
			Endosulfan sulphate	mg/kg	0.1	0	0	200	0
			Endrin Aldehyde	mg/kg	0.1	0	0	200	0
			Methoxychlor	mg/kg	0.1	0	0	200	0
			Endrin Ketone	mg/kg	0.1	0	0	200	0
			Isodrin	mg/kg	0.1	0	0	200	0
			Mirex	mg/kg	0.1	0	0	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.103	0.101	30	2
SE120709.004	LB044915.022		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Lindane	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor	mg/kg	0.1	<0.1	<0.1	200	0
			Aldrin	mg/kg	0.1	<0.1	<0.1	200	0
			Beta BHC	mg/kg	0.1	<0.1	<0.1	200	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

OC Pesticides in Soil (continued) — **Method: ME-(AU)-[ENV]AN400/AN420**

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.004	LB044915.022		Delta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Dieldrin	mg/kg	0.2	<0.2	<0.2	200	0
			Endrin	mg/kg	0.2	<0.2	<0.2	200	0
			o,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			p,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	200	0
			Methoxychlor	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Ketone	mg/kg	0.1	<0.1	<0.1	200	0
			Isodrin	mg/kg	0.1	<0.1	<0.1	200	0
			Mirex	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0	30	4
SE120709.008	LB044916.004		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Lindane	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor	mg/kg	0.1	<0.1	<0.1	200	0
			Aldrin	mg/kg	0.1	<0.1	<0.1	200	0
			Beta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Delta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Dieldrin	mg/kg	0.2	<0.2	<0.2	200	0
			Endrin	mg/kg	0.2	<0.2	<0.2	200	0
			o,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			p,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	200	0
			Methoxychlor	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Ketone	mg/kg	0.1	<0.1	<0.1	200	0
			Isodrin	mg/kg	0.1	<0.1	<0.1	200	0
			Mirex	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0	30	4
SE120709.025	LB044916.023		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Lindane	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor	mg/kg	0.1	<0.1	<0.1	200	0
			Aldrin	mg/kg	0.1	<0.1	<0.1	200	0
			Beta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Delta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	200	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

OC Pesticides in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.025	LB044916.023		Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Dieldrin	mg/kg	0.2	<0.2	<0.2	200	0
			Endrin	mg/kg	0.2	<0.2	<0.2	200	0
			o,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			p,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	200	0
			Methoxychlor	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Ketone	mg/kg	0.1	<0.1	<0.1	200	0
			Isodrin	mg/kg	0.1	<0.1	<0.1	200	0
			Mirex	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0	30	9
SE120709.029	LB044917.005		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Lindane	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor	mg/kg	0.1	<0.1	<0.1	200	0
			Aldrin	mg/kg	0.1	<0.1	<0.1	200	0
			Beta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Delta BHC	mg/kg	0.1	<0.1	<0.1	200	0
			Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
			trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
			Dieldrin	mg/kg	0.2	<0.2	<0.2	200	0
			Endrin	mg/kg	0.2	<0.2	<0.2	200	0
			o,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			o,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
			p,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
			p,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
			Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	200	0
			Methoxychlor	mg/kg	0.1	<0.1	<0.1	200	0
			Endrin Ketone	mg/kg	0.1	<0.1	<0.1	200	0
			Isodrin	mg/kg	0.1	<0.1	<0.1	200	0
			Mirex	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0	30	2

OP Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120708.001	LB044915.011		Dichlorvos	mg/kg	0.5	0	0	200	0
			Dimethoate	mg/kg	0.5	0	0	200	0
			Diazinon (Dimpylate)	mg/kg	0.5	0	0	200	0
			Fenitrothion	mg/kg	0.2	0	0	200	0
			Malathion	mg/kg	0.2	0	0	200	0
			Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	0	0	200	0
			Parathion-ethyl (Parathion)	mg/kg	0.2	0	0	200	0
			Bromophos Ethyl	mg/kg	0.2	0	0	200	0
			Methidathion	mg/kg	0.5	0	0	200	0
			Ethion	mg/kg	0.2	0	0	200	0
			Azinphos-methyl (Guthion)	mg/kg	0.2	0	0	200	0
		Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.52	0.53	30	2
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.55	0.54	30	2

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

OP Pesticides in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.004	LB044915.022		Dichlorvos	mg/kg	0.5	<0.5	<0.5	200	0
			Dimethoate	mg/kg	0.5	<0.5	<0.5	200	0
			Diazinon (Dimpylate)	mg/kg	0.5	<0.5	<0.5	200	0
			Fenitrothion	mg/kg	0.2	<0.2	<0.2	200	0
			Malathion	mg/kg	0.2	<0.2	<0.2	200	0
			Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	<0.2	<0.2	200	0
			Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2	<0.2	200	0
			Bromophos Ethyl	mg/kg	0.2	<0.2	<0.2	200	0
			Methidathion	mg/kg	0.5	<0.5	<0.5	200	0
			Ethion	mg/kg	0.2	<0.2	<0.2	200	0
			Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2	<0.2	200	0
		Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	2
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.6	0.6	30	2
SE120709.008	LB044916.004		Dichlorvos	mg/kg	0.5	<0.5	<0.5	200	0
			Dimethoate	mg/kg	0.5	<0.5	<0.5	200	0
			Diazinon (Dimpylate)	mg/kg	0.5	<0.5	<0.5	200	0
			Fenitrothion	mg/kg	0.2	<0.2	<0.2	200	0
			Malathion	mg/kg	0.2	<0.2	<0.2	200	0
			Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	<0.2	<0.2	200	0
			Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2	<0.2	200	0
			Bromophos Ethyl	mg/kg	0.2	<0.2	<0.2	200	0
			Methidathion	mg/kg	0.5	<0.5	<0.5	200	0
			Ethion	mg/kg	0.2	<0.2	<0.2	200	0
			Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2	<0.2	200	0
		Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	0
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	2
SE120709.023	LB044916.021		Dichlorvos	mg/kg	0.5	<0.5	<0.5	200	0
			Dimethoate	mg/kg	0.5	<0.5	<0.5	200	0
			Diazinon (Dimpylate)	mg/kg	0.5	<0.5	<0.5	200	0
			Fenitrothion	mg/kg	0.2	<0.2	<0.2	200	0
			Malathion	mg/kg	0.2	<0.2	<0.2	200	0
			Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	<0.2	<0.2	200	0
			Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2	<0.2	200	0
			Bromophos Ethyl	mg/kg	0.2	<0.2	<0.2	200	0
			Methidathion	mg/kg	0.5	<0.5	<0.5	200	0
			Ethion	mg/kg	0.2	<0.2	<0.2	200	0
			Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2	<0.2	200	0
		Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	30	5
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	0
SE120709.028	LB044917.004		Dichlorvos	mg/kg	0.5	<0.5	<0.5	200	0
			Dimethoate	mg/kg	0.5	<0.5	<0.5	200	0
			Diazinon (Dimpylate)	mg/kg	0.5	<0.5	<0.5	200	0
			Fenitrothion	mg/kg	0.2	<0.2	<0.2	200	0
			Malathion	mg/kg	0.2	<0.2	<0.2	200	0
			Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	<0.2	<0.2	200	0
			Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2	<0.2	200	0
			Bromophos Ethyl	mg/kg	0.2	<0.2	<0.2	200	0
			Methidathion	mg/kg	0.5	<0.5	<0.5	200	0
			Ethion	mg/kg	0.2	<0.2	<0.2	200	0
			Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2	<0.2	200	0
		Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	4
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	2

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.023	LB044916.020	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
		Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
		Fluorene	mg/kg	0.1	<0.1	<0.1	200	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.023	LB044916.020		Phenanthrene	mg/kg	0.1	<0.1	<0.1	200	0
			Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Chrysene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Total PAH	mg/kg	0.8	<0.8	<0.8	200	0
			Carcinogenic PAHs (as BaP TEQ)*	TEQ (mg/kg)	0.2	<0.2	<0.2	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.4	0.4	30	2
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.4	30	5
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	0
SE120709.028	LB044917.004		Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthylene	mg/kg	0.1	<0.1	<0.1	200	0
			Acenaphthene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluorene	mg/kg	0.1	<0.1	<0.1	200	0
			Phenanthrene	mg/kg	0.1	<0.1	0.1	200	10
			Anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Chrysene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	200	0
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	200	0
			Total PAH	mg/kg	0.8	<0.8	<0.8	200	0
			Carcinogenic PAHs (as BaP TEQ)*	TEQ (mg/kg)	0.2	<0.2	<0.2	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	30	4
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	4
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	30	2

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.025	LB044916.021		Arochlor 1016	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1221	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1232	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1242	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1248	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1254	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1260	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1262	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1268	mg/kg	0.2	<0.2	<0.2	200	0
			Total PCBs (Arochlors)	mg/kg	1	<1	<1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0	30	9
SE120709.029	LB044917.005		Arochlor 1016	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1221	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1232	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1242	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1248	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1254	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1260	mg/kg	0.2	<0.2	<0.2	200	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PCBs in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.029	LB044917.005		Arochlor 1262	mg/kg	0.2	<0.2	<0.2	200	0
			Arochlor 1268	mg/kg	0.2	<0.2	<0.2	200	0
			Total PCBs (Arochlors)	mg/kg	1	<1	<1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0	30	2

Total Phenolics in Soil

Method: ME-(AU)-[ENV]AN289

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.042	LB045103.016	Total Phenols	mg/kg	0.1	<0.1	<0.1	200	0

Total Phenolics in Water

Method: ME-(AU)-[ENV]AN289

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.035	LB044854.004	Total Phenols	mg/L	0.01	<0.01	<0.01	131	0

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120708.011	LB044930.014	Arsenic, As	mg/kg	3	2.83537095952	.5057126147	142	12
		Cadmium, Cd	mg/kg	0.3	0.0643830366	0.0899082160	200	0
		Copper, Cu	mg/kg	0.5	6.1125085227	6.0031056119	38	2
		Lead, Pb	mg/kg	1	9.2372916666	9.8732704583	40	7
		Nickel, Ni	mg/kg	0.5	3.2722660984	3.2985345203	45	1
		Zinc, Zn	mg/kg	0.5	25.634329229	25.643094972	38	0
SE120709.009	LB044930.024	Arsenic, As	mg/kg	3	6	9	70	37
		Beryllium, Be	mg/kg	0.3	0.5	0.5	125	0
		Boron, B	mg/kg	5	<5	<5	200	0
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Cobalt, Co	mg/kg	0.3	6.7	6.8	37	2
		Copper, Cu	mg/kg	0.5	11	12	34	6
		Lead, Pb	mg/kg	1	52	58	32	10
		Manganese, Mn	mg/kg	0.3	410	380	30	8
		Nickel, Ni	mg/kg	0.5	7.9	8.3	36	4
		Selenium, Se	mg/kg	2	<2	<2	200	0
		Zinc, Zn	mg/kg	0.5	75	74	33	1
SE120709.020	LB044995.014	Arsenic, As	mg/kg	3	5	5	95	4
		Beryllium, Be	mg/kg	0.3	0.6	0.5	123	11
		Boron, B	mg/kg	5	<5	<5	200	0
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Cobalt, Co	mg/kg	0.3	5.5	5.2	39	6
		Copper, Cu	mg/kg	0.5	30	20	32	41 ⑧
		Lead, Pb	mg/kg	1	34	32	33	5
		Manganese, Mn	mg/kg	0.3	350	310	30	14
		Nickel, Ni	mg/kg	0.5	12	15	34	23
		Selenium, Se	mg/kg	2	<2	<2	200	0
		Zinc, Zn	mg/kg	0.5	93	91	32	1
SE120709.029	LB044995.024	Arsenic, As	mg/kg	3	12	13	54	9
		Beryllium, Be	mg/kg	0.3	0.7	0.7	99	7
		Boron, B	mg/kg	5	<5	<5	200	0
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Cobalt, Co	mg/kg	0.3	12	13	34	14
		Copper, Cu	mg/kg	0.5	21	22	32	1
		Lead, Pb	mg/kg	1	31	33	33	6
		Manganese, Mn	mg/kg	0.3	720	580	30	21
		Nickel, Ni	mg/kg	0.5	22	21	32	2
		Selenium, Se	mg/kg	2	<2	<2	200	0
		Zinc, Zn	mg/kg	0.5	74	69	33	7
SE120734.003	LB044996.019	Arsenic, As	mg/kg	3	10	10	59	5
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	153	0
		Copper, Cu	mg/kg	0.5	14	21	33	38 ②

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest (continued)

Method: ME-(AU)-[ENV]AN040/AN320

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120734.003	LB044996.019	Lead, Pb	mg/kg	1	18	17	36	1
		Nickel, Ni	mg/kg	0.5	6.1	4.6	39	28
		Zinc, Zn	mg/kg	0.5	15	15	44	2

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.037	LB044860.007	Arsenic, As	µg/L	1	<1	<1	200	0
		Beryllium, Be	µg/L	1	<1	<1	200	0
		Boron, B	µg/L	5	<5	<5	128	0
		Cadmium, Cd	µg/L	0.1	<0.1	<0.1	200	0
		Cobalt, Co	µg/L	1	<1	<1	200	0
		Copper, Cu	µg/L	1	<1	<1	200	0
		Lead, Pb	µg/L	1	<1	<1	200	0
		Manganese, Mn	µg/L	1	<1	<1	200	0
		Nickel, Ni	µg/L	1	<1	<1	200	0
		Selenium, Se	µg/L	1	<1	<1	200	0
		Zinc, Zn	µg/L	5	7	<5	128	28

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.023	LB044916.019		TRH C10-C14	mg/kg	20	<20	<20	200	0
			TRH C15-C28	mg/kg	45	<45	<45	200	0
			TRH C29-C36	mg/kg	45	<45	<45	200	0
			TRH C37-C40	mg/kg	100	<100	<100	200	0
			TRH C10-C36 Total	mg/kg	110	<110	<110	200	0
			TRH C10-C40 Total	mg/kg	210	<210	<210	200	0
		TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	<25	<25	200	0
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	200	0
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	200	0
SE120709.028	LB044917.004		TRH C10-C14	mg/kg	20	<20	<20	200	0
			TRH C15-C28	mg/kg	45	<45	<45	200	0
			TRH C29-C36	mg/kg	45	<45	<45	200	0
			TRH C37-C40	mg/kg	100	<100	<100	200	0
			TRH C10-C36 Total	mg/kg	110	<110	<110	200	0
			TRH C10-C40 Total	mg/kg	210	<210	<210	200	0
		TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	<25	<25	200	0
			TRH >C16-C34 (F3)	mg/kg	90	<90	<90	200	0
			TRH >C34-C40 (F4)	mg/kg	120	<120	<120	200	0

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.025	LB044824.015	Monocyclic Aromatic	Benzene	mg/kg	0.1	<0.1	<0.1	200	0
			Toluene	mg/kg	0.1	<0.1	<0.1	200	0
			Ethylbenzene	mg/kg	0.1	<0.1	<0.1	200	0
			m/p-xylene	mg/kg	0.2	<0.2	<0.2	200	0
			o-xylene	mg/kg	0.1	<0.1	<0.1	200	0
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.3	4.4	50	3
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.4	5.4	50	1
			d8-toluene (Surrogate)	mg/kg	-	5.1	5.2	50	2
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.8	5.6	50	4
		Totals	Total Xylenes*	mg/kg	0.3	<0.3	<0.3	200	0
			Total BTEX*	mg/kg	0.6	<0.6	<0.6	200	0

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.035	LB045062.009	Monocyclic Aromatic	Benzene	µg/L	0.5	<0.5	<0.5	200	0
			Toluene	µg/L	0.5	<0.5	<0.5	200	0
			Ethylbenzene	µg/L	0.5	<0.5	<0.5	200	0
			m/p-xylene	µg/L	1	<1	<1	200	0
			o-xylene	µg/L	0.5	<0.5	<0.5	200	0
		Polycyclic	Naphthalene	µg/L	0.5	<0.5	<0.5	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	0.0	0.0	30	1

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOCs in Water (continued)

Method: ME-(AU)-[ENV]AN433/AN434

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.035	LB045062.009	Surrogates	d4-1,2-dichloroethane (Surrogate)	µg/L	-	0.0	0.0	30	0
			d8-toluene (Surrogate)	µg/L	-	0.0	0.0	30	0
			Bromofluorobenzene (Surrogate)	µg/L	-	0.0	0.0	30	2

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.025	LB044824.015		TRH C6-C10	mg/kg	25	<25	<25	200	0
			TRH C6-C9	mg/kg	20	<20	<20	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.3	4.4	30	3
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.4	5.4	30	1
			d8-toluene (Surrogate)	mg/kg	-	5.1	5.2	30	2
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.8	5.6	30	4
		VPH F Bands	Benzene (F0)	mg/kg	0.1	<0.1	<0.1	200	0
			TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	200	0

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE120709.035	LB045062.009		TRH C6-C10	µg/L	50	<50	<50	200	0
			TRH C6-C9	µg/L	40	<40	<40	200	0
		Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	0.0	0.0	30	1
			d4-1,2-dichloroethane (Surrogate)	µg/L	-	0.0	0.0	30	0
			d8-toluene (Surrogate)	µg/L	-	0.0	0.0	30	0
			Bromofluorobenzene (Surrogate)	µg/L	-	0.0	0.0	30	2
		VPH F Bands	Benzene (F0)	µg/L	0.5	<0.5	<0.5	200	0
			TRH C6-C10 minus BTEX (F1)	µg/L	50	<50	<50	200	0

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Hexavalent Chromium in Soil UV/Vis

Method: ME-(AU)-[ENV]AN075/AN201

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB045093.002	Hexavalent Chromium, Cr6+	mg/kg	0.5	20	20	70 - 130	99
LB045094.002	Hexavalent Chromium, Cr6+	mg/kg	0.5	20	20	70 - 130	102

Hexavalent Chromium in water by Discrete Analyser

Method: ME-(AU)-[ENV]AN283

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044812.002	Hexavalent Chromium, Cr6+	mg/L	0.005	0.054	0.05	80 - 120	108

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044936.002	Mercury	mg/kg	0.01	0.23	0.2	70 - 130	113
LB044998.002	Mercury	mg/kg	0.01	0.22	0.2	70 - 130	109
LB045000.002	Mercury	mg/kg	0.01	0.22	0.2	70 - 130	110

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044915.002	Heptachlor	mg/kg	0.1	0.2	0.2	60 - 140	110
	Aldrin	mg/kg	0.1	0.2	0.2	60 - 140	106
	Delta BHC	mg/kg	0.1	0.2	0.2	60 - 140	98
	Dieldrin	mg/kg	0.2	<0.2	0.2	60 - 140	98
	Endrin	mg/kg	0.2	0.2	0.2	60 - 140	114
	p,p'-DDT	mg/kg	0.1	0.2	0.2	60 - 140	96
LB044916.002	Heptachlor	mg/kg	0.1	0.2	0.2	60 - 140	111
	Aldrin	mg/kg	0.1	0.2	0.2	60 - 140	106
	Delta BHC	mg/kg	0.1	0.2	0.2	60 - 140	99
	Dieldrin	mg/kg	0.2	<0.2	0.2	60 - 140	98
	Endrin	mg/kg	0.2	0.2	0.2	60 - 140	113
	p,p'-DDT	mg/kg	0.1	0.2	0.2	60 - 140	90
LB044917.002	Heptachlor	mg/kg	0.1	0.2	0.2	60 - 140	114
	Aldrin	mg/kg	0.1	0.2	0.2	60 - 140	112
	Delta BHC	mg/kg	0.1	0.2	0.2	60 - 140	103
	Dieldrin	mg/kg	0.2	0.2	0.2	60 - 140	107
	Endrin	mg/kg	0.2	0.2	0.2	60 - 140	113
	p,p'-DDT	mg/kg	0.1	0.2	0.2	60 - 140	98

OC Pesticides in Water

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044908.002	Delta BHC	µg/L	0.1	0.2	0.2	60 - 140	83
	Heptachlor	µg/L	0.1	0.2	0.2	60 - 140	94
	Aldrin	µg/L	0.1	0.2	0.2	60 - 140	90
	Dieldrin	µg/L	0.1	0.2	0.2	60 - 140	84
	Endrin	µg/L	0.1	0.2	0.2	60 - 140	101
	p,p'-DDT	µg/L	0.1	0.2	0.2	60 - 140	86

OP Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044915.002		Dichlorvos	mg/kg	0.5	2.5	2	60 - 140	124
		Diazinon (Dimpylate)	mg/kg	0.5	2.1	2	60 - 140	107
		Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	2.3	2	60 - 140	115
		Ethion	mg/kg	0.2	2.7	2	60 - 140	133
	Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	40 - 140	100
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.6	0.5	40 - 140	112
LB044916.002		Dichlorvos	mg/kg	0.5	2.0	2	60 - 140	98
		Diazinon (Dimpylate)	mg/kg	0.5	1.6	2	60 - 140	78
		Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	1.9	2	60 - 140	94
		Ethion	mg/kg	0.2	1.7	2	60 - 140	84
	Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	40 - 140	90
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.6	0.5	40 - 140	110
LB044917.002		Dichlorvos	mg/kg	0.5	1.9	2	60 - 140	94
		Diazinon (Dimpylate)	mg/kg	0.5	1.6	2	60 - 140	82
		Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	1.6	2	60 - 140	82

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

OP Pesticides in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044917.002		Ethion	mg/kg	0.2	1.6	2	60 - 140	80
	Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	40 - 140	98
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	40 - 140	96

OP Pesticides in Water

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044908.002	Dichlorvos	µg/L	0.5	<0.5	0.4	60 - 140	112
	Diazinon (Dimpylate)	µg/L	0.5	<0.5	0.4	60 - 140	100
	Chlorpyrifos (Chlorpyrifos Ethyl)	µg/L	0.2	0.4	0.4	60 - 140	94
	Ethion	µg/L	0.2	0.4	0.4	60 - 140	106

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044916.002		Naphthalene	mg/kg	0.1	4.2	4	60 - 140	104
		Acenaphthylene	mg/kg	0.1	4.3	4	60 - 140	106
		Acenaphthene	mg/kg	0.1	4.2	4	60 - 140	106
		Phenanthrene	mg/kg	0.1	4.4	4	60 - 140	110
		Anthracene	mg/kg	0.1	4.4	4	60 - 140	110
		Fluoranthene	mg/kg	0.1	4.3	4	60 - 140	109
		Pyrene	mg/kg	0.1	4.3	4	60 - 140	106
		Benzo(a)pyrene	mg/kg	0.1	4.3	4	60 - 140	108
	Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.4	0.5	60 - 140	88
		2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.5	60 - 140	88
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	60 - 140	94
LB044917.002		Naphthalene	mg/kg	0.1	4.4	4	60 - 140	111
		Acenaphthylene	mg/kg	0.1	4.8	4	60 - 140	121
		Acenaphthene	mg/kg	0.1	4.6	4	60 - 140	114
		Phenanthrene	mg/kg	0.1	4.9	4	60 - 140	122
		Anthracene	mg/kg	0.1	5.0	4	60 - 140	125
		Fluoranthene	mg/kg	0.1	4.7	4	60 - 140	117
		Pyrene	mg/kg	0.1	4.9	4	60 - 140	123
		Benzo(a)pyrene	mg/kg	0.1	4.6	4	60 - 140	114
	Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.5	0.5	60 - 140	94
		2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.5	60 - 140	98
		d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.5	60 - 140	96

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044908.002	Naphthalene	µg/L	0.1	45	40	60 - 140	114
	Acenaphthylene	µg/L	0.1	47	40	60 - 140	118
	Acenaphthene	µg/L	0.1	48	40	60 - 140	121
	Phenanthrene	µg/L	0.1	47	40	60 - 140	118
	Anthracene	µg/L	0.1	46	40	60 - 140	116
	Fluoranthene	µg/L	0.1	49	40	60 - 140	121
	Pyrene	µg/L	0.1	47	40	60 - 140	117
	Benzo(a)pyrene	µg/L	0.1	50	40	60 - 140	124

PCBs in Soil

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044916.002	Arochlor 1260	mg/kg	0.2	0.4	0.4	60 - 140	107
LB044917.002	Arochlor 1260	mg/kg	0.2	0.4	0.4	60 - 140	112

PCBs in Water

Method: ME-(AU)-[ENV]AN400/AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044908.002	Arochlor 1260	µg/L	1	<1	0.4	60 - 140	101

Total Phenolics in Soil

Method: ME-(AU)-[ENV]AN289

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB045103.002	Total Phenols	mg/kg	0.1	2.5	2.5	70 - 130	100

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Total Phenolics in Water

Method: ME-(AU)-[ENV]AN289

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044854.002	Total Phenols	mg/L	0.01	0.24	0.25	80 - 120	97

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044930.002	Arsenic, As	mg/kg	3	51	50	80 - 120	101
	Beryllium, Be	mg/kg	0.3	47	50	80 - 120	94
	Boron, B	mg/kg	5	47	50	80 - 120	93
	Cadmium, Cd	mg/kg	0.3	51	50	80 - 120	102
	Cobalt, Co	mg/kg	0.3	50	50	80 - 120	101
	Copper, Cu	mg/kg	0.5	51	50	80 - 120	101
	Lead, Pb	mg/kg	1	51	50	80 - 120	101
	Manganese, Mn	mg/kg	0.3	52	50	80 - 120	104
	Nickel, Ni	mg/kg	0.5	52	50	80 - 120	103
	Selenium, Se	mg/kg	2	46	50	80 - 120	92
	Zinc, Zn	mg/kg	0.5	51	50	80 - 120	103
LB044995.002	Arsenic, As	mg/kg	3	48	50	80 - 120	96
	Beryllium, Be	mg/kg	0.3	45	50	80 - 120	90
	Boron, B	mg/kg	5	47	50	80 - 120	93
	Cadmium, Cd	mg/kg	0.3	49	50	80 - 120	97
	Cobalt, Co	mg/kg	0.3	48	50	80 - 120	97
	Copper, Cu	mg/kg	0.5	48	50	80 - 120	96
	Lead, Pb	mg/kg	1	48	50	80 - 120	96
	Manganese, Mn	mg/kg	0.3	50	50	80 - 120	100
	Nickel, Ni	mg/kg	0.5	50	50	80 - 120	99
	Selenium, Se	mg/kg	2	44	50	80 - 120	88
	Zinc, Zn	mg/kg	0.5	49	50	80 - 120	98
LB044996.002	Arsenic, As	mg/kg	3	47	50	80 - 120	93
	Beryllium, Be	mg/kg	0.3	43.64625	50	80 - 120	87
	Boron, B	mg/kg	5	51.2525	50	80 - 120	103
	Cadmium, Cd	mg/kg	0.3	47	50	80 - 120	95
	Cobalt, Co	mg/kg	0.3	47.209	50	80 - 120	94
	Copper, Cu	mg/kg	0.5	47	50	80 - 120	94
	Lead, Pb	mg/kg	1	47	50	80 - 120	94
	Manganese, Mn	mg/kg	0.3	48.204	50	80 - 120	96
	Nickel, Ni	mg/kg	0.5	48	50	80 - 120	96
	Selenium, Se	mg/kg	2	42.55875	50	80 - 120	85
	Zinc, Zn	mg/kg	0.5	48	50	80 - 120	96

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044860.002	Arsenic, As	µg/L	1	19	20	80 - 120	94
	Beryllium, Be	µg/L	1	20	20	80 - 120	99
	Boron, B	µg/L	5	16	20	80 - 120	82
	Cadmium, Cd	µg/L	0.1	20	20	80 - 120	100
	Cobalt, Co	µg/L	1	19	20	80 - 120	96
	Copper, Cu	µg/L	1	19	20	80 - 120	96
	Lead, Pb	µg/L	1	20	20	80 - 120	101
	Manganese, Mn	µg/L	1	20	20	80 - 120	101
	Nickel, Ni	µg/L	1	19	20	80 - 120	97
	Selenium, Se	µg/L	1	19	20	80 - 120	97
	Zinc, Zn	µg/L	5	20	20	80 - 120	101

TRH (Total Recoverable Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN403

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044916.002		TRH C10-C14	mg/kg	20	41	40	60 - 140	103
		TRH C15-C28	mg/kg	45	<45	40	60 - 140	103
		TRH C29-C36	mg/kg	45	<45	40	60 - 140	98
	TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	41	40	60 - 140	103
		TRH >C16-C34 (F3)	mg/kg	90	<90	40	60 - 140	103
		TRH >C34-C40 (F4)	mg/kg	120	<120	20	60 - 140	90

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

TRH (Total Recoverable Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN403

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044917.002		TRH C10-C14	mg/kg	20	42	40	60 - 140	105
		TRH C15-C28	mg/kg	45	<45	40	60 - 140	103
		TRH C29-C36	mg/kg	45	<45	40	60 - 140	90
	TRH F Bands	TRH >C10-C16 (F2)	mg/kg	25	42	40	60 - 140	105
		TRH >C16-C34 (F3)	mg/kg	90	<90	40	60 - 140	103
		TRH >C34-C40 (F4)	mg/kg	120	<120	20	60 - 140	90

TRH (Total Recoverable Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN403

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044908.002		TRH C10-C14	µg/L	50	1000	1200	60 - 140	86
		TRH C15-C28	µg/L	200	1100	1200	60 - 140	92
		TRH C29-C36	µg/L	200	1000	1200	60 - 140	87
	TRH F Bands	TRH >C10-C16 (F2)	µg/L	60	1100	1200	60 - 140	88
		TRH >C16-C34 (F3)	µg/L	500	1100	1200	60 - 140	93
		TRH >C34-C40 (F4)	µg/L	500	520	600	60 - 140	86

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044824.002	Monocyclic	Benzene	mg/kg	0.1	2.1	2.9	60 - 140	72
	Aromatic	Toluene	mg/kg	0.1	1.9	2.9	60 - 140	67
		Ethylbenzene	mg/kg	0.1	2.1	2.9	60 - 140	71
		m/p-xylene	mg/kg	0.2	4.1	5.8	60 - 140	71
		o-xylene	mg/kg	0.1	2.1	2.9	60 - 140	73
	Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.6	5	60 - 140	72
		d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.3	5	60 - 140	85
		d8-toluene (Surrogate)	mg/kg	-	4.5	5	60 - 140	90
		Bromofluorobenzene (Surrogate)	mg/kg	-	5.6	5	60 - 140	112

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB045062.002	Monocyclic	Benzene	µg/L	0.5	47	45.45	60 - 140	104
	Aromatic	Toluene	µg/L	0.5	47	45.45	60 - 140	104
		Ethylbenzene	µg/L	0.5	48	45.45	60 - 140	106
		m/p-xylene	µg/L	1	95	90.9	60 - 140	104
		o-xylene	µg/L	0.5	48	45.45	60 - 140	105

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044824.002		TRH C6-C10	mg/kg	25	<25	24.65	60 - 140	91
		TRH C6-C9	mg/kg	20	<20	23.2	60 - 140	85
	Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	3.6	5	60 - 140	72
		d4-1,2-dichloroethane (Surrogate)	mg/kg	-	4.3	5	60 - 140	85
		d8-toluene (Surrogate)	mg/kg	-	4.5	5	60 - 140	90
		Bromofluorobenzene (Surrogate)	mg/kg	-	5.6	5	60 - 140	112
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	7.25	60 - 140	138

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB045062.002		TRH C6-C10	µg/L	50	1100	946.63	60 - 140	117
		TRH C6-C9	µg/L	40	870	818.71	60 - 140	106
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	µg/L	50	820	639.67	60 - 140	129

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub -sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Hexavalent Chromium in Soil UV/Vis

Method: ME-(AU)-[ENV]AN075/AN201

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120709.002	LB045093.006	Hexavalent Chromium, Cr6+	mg/kg	0.5	16	<0.5	20	78
SE120709.012	LB045093.018	Hexavalent Chromium, Cr6+	mg/kg	0.5	10	<0.5	20	52 ④
SE120709.042	LB045094.021	Hexavalent Chromium, Cr6+	mg/kg	0.5	16	<0.5	20	80

Hexavalent Chromium in water by Discrete Analyser

Method: ME-(AU)-[ENV]AN283

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120709.037	LB044812.011	Hexavalent Chromium, Cr6+	mg/L	0.005	0.049	<0.005	0.05	94
SE120718.001	LB044812.013	Hexavalent Chromium, Cr6+	mg/L	0.005	0.051	<0.005	0.05	96

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120683.001	LB045071.006	Mercury	mg/L	0.0001	0.0081	<0.0001	0.008	101

Mercury in Soil

Method: ME-(AU)-[ENV]AN312

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120705.004	LB044936.004	Mercury	mg/kg	0.01	0.19	<0.01	0.2	93
SE120709.010	LB044998.004	Mercury	mg/kg	0.01	0.22	0.03	0.2	94
SE120709.030	LB045000.004	Mercury	mg/kg	0.01	0.24	0.04	0.2	101

OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120708.003	LB044915.012		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	0	-	-
			Alpha BHC	mg/kg	0.1	<0.1	0	-	-
			Lindane	mg/kg	0.1	<0.1	0	-	-
			Heptachlor	mg/kg	0.1	0.2	0	0.2	112
			Aldrin	mg/kg	0.1	0.2	0	0.2	107
			Beta BHC	mg/kg	0.1	<0.1	0	-	-
			Delta BHC	mg/kg	0.1	0.2	0	0.2	100
			Heptachlor epoxide	mg/kg	0.1	<0.1	0	-	-
			o,p'-DDE	mg/kg	0.1	<0.1	0	-	-
			Alpha Endosulfan	mg/kg	0.2	<0.2	0	-	-
			Gamma Chlordane	mg/kg	0.1	<0.1	0	-	-
			Alpha Chlordane	mg/kg	0.1	<0.1	0	-	-
			trans-Nonachlor	mg/kg	0.1	<0.1	0	-	-
			p,p'-DDE	mg/kg	0.1	<0.1	0	-	-
			Dieldrin	mg/kg	0.2	<0.2	0	0.2	98
			Endrin	mg/kg	0.2	0.2	0	0.2	114
			o,p'-DDD	mg/kg	0.1	<0.1	0	-	-
			o,p'-DDT	mg/kg	0.1	<0.1	0	-	-
			Beta Endosulfan	mg/kg	0.2	<0.2	0	-	-
			p,p'-DDD	mg/kg	0.1	<0.1	0	-	-
			p,p'-DDT	mg/kg	0.1	0.2	0	0.2	96
			Endosulfan sulphate	mg/kg	0.1	<0.1	0	-	-
			Endrin Aldehyde	mg/kg	0.1	<0.1	0	-	-
			Methoxychlor	mg/kg	0.1	<0.1	0	-	-
			Endrin Ketone	mg/kg	0.1	<0.1	0	-	-
			Isodrin	mg/kg	0.1	<0.1	0	-	-
			Mirex	mg/kg	0.1	<0.1	0	-	-
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0.1	-	100
SE120709.009	LB044916.006		Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	-	-
			Alpha BHC	mg/kg	0.1	<0.1	<0.1	-	-
			Lindane	mg/kg	0.1	<0.1	<0.1	-	-
			Heptachlor	mg/kg	0.1	0.2	<0.1	0.2	117
			Aldrin	mg/kg	0.1	0.2	<0.1	0.2	108
			Beta BHC	mg/kg	0.1	<0.1	<0.1	-	-
			Delta BHC	mg/kg	0.1	0.2	<0.1	0.2	103
			Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	-	-
			o,p'-DDE	mg/kg	0.1	<0.1	<0.1	-	-

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub -sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

OC Pesticides in Soil (continued)

Method: ME-(AU)-[ENV]AN400/AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120709.009	LB044916.006		Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	-	-
			Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	-	-
			Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	-	-
			trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	-	-
			p,p'-DDE	mg/kg	0.1	<0.1	<0.1	-	-
			Dieldrin	mg/kg	0.2	0.2	<0.2	0.2	101
			Endrin	mg/kg	0.2	0.2	<0.2	0.2	118
			o,p'-DDD	mg/kg	0.1	<0.1	<0.1	-	-
			o,p'-DDT	mg/kg	0.1	<0.1	<0.1	-	-
			Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	-	-
			p,p'-DDD	mg/kg	0.1	<0.1	<0.1	-	-
			p,p'-DDT	mg/kg	0.1	0.2	<0.1	0.2	97
			Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	-	-
			Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	-	-
			Methoxychlor	mg/kg	0.1	<0.1	<0.1	-	-
			Endrin Ketone	mg/kg	0.1	<0.1	<0.1	-	-
			Isodrin	mg/kg	0.1	<0.1	<0.1	-	-
			Mirex	mg/kg	0.1	<0.1	<0.1	-	-
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0	0	-	107

OP Pesticides in Soil

Method: ME-(AU)-[ENV]AN400/AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120708.004	LB044915.015		Dichlorvos	mg/kg	0.5	2.5	0	2	124
			Dimethoate	mg/kg	0.5	<0.5	0	-	-
			Diazinon (Dimpylate)	mg/kg	0.5	2.4	0	2	120
			Fenitrothion	mg/kg	0.2	<0.2	0	-	-
			Malathion	mg/kg	0.2	<0.2	0	-	-
			Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	2.3	0	2	117
			Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2	0	-	-
			Bromophos Ethyl	mg/kg	0.2	<0.2	0	-	-
			Methidathion	mg/kg	0.5	<0.5	0	-	-
			Ethion	mg/kg	0.2	2.2	0	2	110
			Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2	0	-	-
		Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.5	0.52	0.5	102
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.52	0.5	98
SE120709.022	LB044916.019		Dichlorvos	mg/kg	0.5	2.0	<0.5	2	101
			Dimethoate	mg/kg	0.5	<0.5	<0.5	-	-
			Diazinon (Dimpylate)	mg/kg	0.5	1.7	<0.5	2	84
			Fenitrothion	mg/kg	0.2	<0.2	<0.2	-	-
			Malathion	mg/kg	0.2	<0.2	<0.2	-	-
			Chlorpyrifos (Chlorpyrifos Ethyl)	mg/kg	0.2	1.7	<0.2	2	85
			Parathion-ethyl (Parathion)	mg/kg	0.2	<0.2	<0.2	-	-
			Bromophos Ethyl	mg/kg	0.2	<0.2	<0.2	-	-
			Methidathion	mg/kg	0.5	<0.5	<0.5	-	-
			Ethion	mg/kg	0.2	1.6	<0.2	2	81
			Azinphos-methyl (Guthion)	mg/kg	0.2	<0.2	<0.2	-	-
		Surrogates	2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.5	0.5	86
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.6	0.5	90

PAH (Polynuclear Aromatic Hydrocarbons) in Soil

Method: ME-(AU)-[ENV]AN420

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120709.022	LB044916.018	Naphthalene	mg/kg	0.1	4.7	<0.1	4	117
		2-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
		1-methylnaphthalene	mg/kg	0.1	<0.1	<0.1	-	-
		Acenaphthylene	mg/kg	0.1	4.9	<0.1	4	122
		Acenaphthene	mg/kg	0.1	4.9	<0.1	4	121
		Fluorene	mg/kg	0.1	<0.1	<0.1	-	-
		Phenanthrene	mg/kg	0.1	5.0	<0.1	4	126
		Anthracene	mg/kg	0.1	5.0	<0.1	4	126
		Fluoranthene	mg/kg	0.1	5.0	<0.1	4	125
		Pyrene	mg/kg	0.1	4.8	<0.1	4	121
		Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	-	-

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub -sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Soil (continued)

Method: ME-(AU)-[ENV]AN420

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120709.022	LB044916.018		Chrysene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(b&j)fluoranthene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(k)fluoranthene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(a)pyrene	mg/kg	0.1	4.5	<0.1	4	113
			Indeno(1,2,3-cd)pyrene	mg/kg	0.1	<0.1	<0.1	-	-
			Dibenzo(a&h)anthracene	mg/kg	0.1	<0.1	<0.1	-	-
			Benzo(ghi)perylene	mg/kg	0.1	<0.1	<0.1	-	-
			Total PAH	mg/kg	0.8	39	<0.8	-	-
			Carcinogenic PAHs (as BaP TEQ)*	TEQ	0.2	4.5	<0.2	-	-
		Surrogates	d5-nitrobenzene (Surrogate)	mg/kg	-	0.4	0.5	-	86
			2-fluorobiphenyl (Surrogate)	mg/kg	-	0.4	0.5	-	86
			d14-p-terphenyl (Surrogate)	mg/kg	-	0.5	0.6	-	90

Total Phenolics in Soil

Method: ME-(AU)-[ENV]AN289

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120709.022	LB045103.004	Total Phenols	mg/kg	0.1	2.9	0.1	2.5	110

Total Phenolics in Water

Method: ME-(AU)-[ENV]AN289

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120745.001	LB044854.009	Total Phenols	mg/L	0.01	0.25	0.01	0.25	93

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest

Method: ME-(AU)-[ENV]AN040/AN320

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120705.004	LB044930.004	Arsenic, As	mg/kg	3	40	<3	50	77
		Cadmium, Cd	mg/kg	0.3	43	<0.3	50	85
		Copper, Cu	mg/kg	0.5	50	6.7	50	87
		Lead, Pb	mg/kg	1	48	7	50	82
		Nickel, Ni	mg/kg	0.5	52	5.5	50	92
		Zinc, Zn	mg/kg	0.5	54	7.2	50	94
SE120709.010	LB044995.004	Arsenic, As	mg/kg	3	42	4	50	76
		Beryllium, Be	mg/kg	0.3	2.5	0.8	2.5	69 ④
		Boron, B	mg/kg	5	7	<5	10	72
		Cadmium, Cd	mg/kg	0.3	42	<0.3	50	85
		Cobalt, Co	mg/kg	0.3	55	18	50	74
		Copper, Cu	mg/kg	0.5	60	23	50	73
		Lead, Pb	mg/kg	1	82	62	50	40 ④
		Manganese, Mn	mg/kg	0.3	1200	1500	50	-616 ⑤
		Nickel, Ni	mg/kg	0.5	50	9.0	50	82
		Selenium, Se	mg/kg	2	7	<2	10	68 ④
		Zinc, Zn	mg/kg	0.5	73	34	50	76
SE120709.030	LB044996.004	Arsenic, As	mg/kg	3	50	10	50	79
		Beryllium, Be	mg/kg	0.3	2.64396313364	0.8	2.5	73
		Boron, B	mg/kg	5	12.6751843317	7	10	56 ④
		Cadmium, Cd	mg/kg	0.3	40	<0.3	50	79
		Cobalt, Co	mg/kg	0.3	30.6619815668	13	50	76
		Copper, Cu	mg/kg	0.5	61	20	50	83
		Lead, Pb	mg/kg	1	70	32	50	76
		Manganese, Mn	mg/kg	0.3	76.3894009216	640	50	-125 ⑤
		Nickel, Ni	mg/kg	0.5	61	24	50	75
		Selenium, Se	mg/kg	2	6.73546082949	<2	10	64 ④
		Zinc, Zn	mg/kg	0.5	120	79	50	75

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120709.035	LB044860.004	Arsenic, As	µg/L	1	19	<1	20	96
		Beryllium, Be	µg/L	1	21	<1	20	103
		Boron, B	µg/L	5	16	<5	20	102
		Cadmium, Cd	µg/L	0.1	20	<0.1	20	100

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub -sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Trace Metals (Dissolved) in Water by ICPMS (continued)

Method: ME-(AU)-[ENV]AN318

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120709.035	LB044860.004	Cobalt, Co	µg/L	1	19	<1	20	94
		Copper, Cu	µg/L	1	19	<1	20	96
		Lead, Pb	µg/L	1	20	<1	20	99
		Manganese, Mn	µg/L	1	20	<1	20	99
		Nickel, Ni	µg/L	1	19	<1	20	94
		Selenium, Se	µg/L	1	20	<1	20	100
		Zinc, Zn	µg/L	5	24	<5	20	100

VOC's in Soil

Method: ME-(AU)-[ENV]AN433/AN434

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120709.015	LB044824.004	Monocyclic	Benzene	mg/kg	0.1	2.6	<0.1	2.9	88
		Aromatic	Toluene	mg/kg	0.1	2.4	<0.1	2.9	82
			Ethylbenzene	mg/kg	0.1	2.8	<0.1	2.9	95
			m/p-xylene	mg/kg	0.2	5.6	<0.2	5.8	96
			o-xylene	mg/kg	0.1	2.9	<0.1	2.9	99
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	-	-
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.5	3.7	5	91
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.1	4.1	5	102
			d8-toluene (Surrogate)	mg/kg	-	5.2	4.2	5	104
			Bromofluorobenzene (Surrogate)	mg/kg	-	6.4	5.2	5	128
		Totals	Total Xylenes*	mg/kg	0.3	8.4	<0.3	-	-
			Total BTEX*	mg/kg	0.6	16	<0.6	-	-
SE120709.042	LB044824.026	Monocyclic	Benzene	mg/kg	0.1	2.3	<0.1	2.9	80
		Aromatic	Toluene	mg/kg	0.1	2.3	<0.1	2.9	80
			Ethylbenzene	mg/kg	0.1	2.3	<0.1	2.9	78
			m/p-xylene	mg/kg	0.2	4.6	<0.2	5.8	79
			o-xylene	mg/kg	0.1	2.3	<0.1	2.9	80
		Polycyclic	Naphthalene	mg/kg	0.1	<0.1	<0.1	-	-
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.2	3.5	5	85
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.7	4.5	5	114
			d8-toluene (Surrogate)	mg/kg	-	5.3	4.2	5	106
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.8	4.4	5	115
		Totals	Total Xylenes*	mg/kg	0.3	6.9	<0.3	-	-
			Total BTEX*	mg/kg	0.6	14	<0.6	-	-

Volatile Petroleum Hydrocarbons in Soil

Method: ME-(AU)-[ENV]AN433/AN434/AN410

QC Sample	Sample Number		Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE120709.015	LB044824.005		TRH C6-C10	mg/kg	25	<25	<25	24.65	91
			TRH C6-C9	mg/kg	20	21	<20	23.2	92
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.5	3.7	5	91
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.1	4.1	5	102
			d8-toluene (Surrogate)	mg/kg	-	5.2	4.2	5	104
			Bromofluorobenzene (Surrogate)	mg/kg	-	6.4	5.2	5	128
		VPH F	Benzene (F0)	mg/kg	0.1	2.6	<0.1	-	-
		Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	7.25	87
SE120709.042	LB044824.026		TRH C6-C10	mg/kg	25	<25	<25	24.65	88
			TRH C6-C9	mg/kg	20	22	<20	23.2	93
		Surrogates	Dibromofluoromethane (Surrogate)	mg/kg	-	4.2	3.5	5	85
			d4-1,2-dichloroethane (Surrogate)	mg/kg	-	5.7	4.5	5	114
			d8-toluene (Surrogate)	mg/kg	-	5.3	4.2	5	106
			Bromofluorobenzene (Surrogate)	mg/kg	-	5.8	4.4	5	115
		VPH F	Benzene (F0)	mg/kg	0.1	2.3	<0.1	-	-
		Bands	TRH C6-C10 minus BTEX (F1)	mg/kg	25	<25	<25	7.25	109

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here:
http://www.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-11.pdf

*	Non-accredited analysis.
-	Sample not analysed for this analyte.
^	Analysis performed by external laboratory.

IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.

①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
†	Refer to Analytical Report comments for further information.

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CoC received 12/9/13 @ 3:25pm

0304

CHAIN OF CUSTODY FORM

1/10

SMEC OFFICE: Canberra	TURNAROUND REQUIREMENTS: [X] Standard – 5 day TAT		LAB: SGS Australia
PROJECT: CCB	[ ] Non Standard TAT (List due date):		ATTENTION:
PROJECT NUMBER: 3002369	LAB QUOTE NO: ENVI-2A568E	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.):
PROJECT MANAGER: Nathalie O'toole	CONTACT PH: 6234 1967	COC: (1) 2 3 4 5 6 7	16/33 Maddox St
SAMPLED BY: John O'Brien		OF: 1 2 3 4 5 6 7	Alexandria NSW 2015
DATE SAMPLED:	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Email reports to (will default to PM if blank):	DATE/TIME: 11/9/2013	DATE/TIME:	DATE/TIME:	DATE/TIME: 12/9/13 10
Email invoice to (will default to PM if blank):				

Special Laboratory Instructions:

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Hold	TRH	BTEX	13 Metals NEPM	OCP/OPP				
1	TP01-0.0	10/9/13	S	JAR	1				X	X				
	TP01-0.5	10/9/13	S	"	1	X								
	TP01-1.0	10/9/13	S	"	1	X								
2	TP02-0.0	10/9/13	"	"	1				X	X				
	TP02-0.5	10/9/13	"	"	1	X								
	TP02-1.0	10/9/13	"	"	1	X								
	TP02-1.3	10/9/13	"	"	1	X								
	TP02-2.0	10/9/13	"	"	1	X								
3	TP03-0.0	10/9/13	"	"	1				X	X				
	TP03-0.5	10/9/13	"	"	1	X								
	TP03-1.0	10/9/13	"	"	1	X								
					TOTAL 11	8			3	3				

SGS
Received 12, 9, 13
By EA
Time 10:00 am/pm
Samples intact yes/no
Ice/Cooler Pack yes/no
Temperature on Receipt 3 °C
Storage Location 6758-295, W092
SGS REF No SE130709 A

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

0309

CHAIN OF CUSTODY FORM

6/10

SMEC OFFICE: CANBERRA	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT ☐ Non Standard TAT (List due date):		LAB: SGS AUSTRALIA
PROJECT: DCB			ATTENTION:
PROJECT NUMBER: 30023609	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.): 16/33 MADDOX ST.
PROJECT MANAGER: NATHANIE .C TOOLE	CONTACT PH: 02 6201 1907	COC: 1 2 3 4 5 (6) 7	ALEXANDRIA NSW 2015
SAMPLED BY: JOHN O'BRIEN		OF: 1 2 3 4 5 6 7	
DATE SAMPLED:	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:
Email reports to (will default to PM if blank): nathanie.ctoole@smec.com	DATE/TIME:	DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if blank): AS ABOVE			RECEIVED BY: DATE/TIME: 9/9/13 10:40

Special Laboratory Instructions:

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Metals	TRH	BTEX	OCP/OPP	13 Metals NEPM	PAH	Explosive Suite		
	TP17 -1.0	9/9/2013	S	JAR	1	X								
18	TP18 - 0.0	10/9/2013	|	|	1	|	|	|	X	X	|	|	|	|
	TP18 - 0.5	↓	|	|	1	X	|	|	|	|	|	|	|	|
	TP18 - 1.0	↓	|	|	1	X	|	|	|	|	|	|	|	|
19	TP19 - 0.0	10/9/2013	|	|	1	|	X	X	|	|	X	X	|	|
	TP19 - 0.5	|	|	|	1	X	|	|	|	|	|	|	|	|
	TP19 - 1.0	|	|	|	1	X	|	|	|	|	|	|	|	|
	TP21 - 0.0	|	|	|	1	|	|	|	|	|	|	|	|	|
20	TP21 - 0.5	|	|	|	1	|	X	X	|	X	X	|	|	|
21	TP21 - 1.0	|	|	|	1	|	X	X	|	X	X	|	|	|
	TP23 - 0.0	↓	↓	↓	1	X	|	|	|	|	|	|	|	|
					TOTAL 11	6	3	3	1	3	3	1		

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

0313

CHAIN OF CUSTODY FORM 10/10

SMEC

SMEC OFFICE: Canberra	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT ☐ Non Standard TAT (List due date):		LAB: SGS AUSTRALIA
PROJECT: OCB			ATTENTION:
PROJECT NUMBER: 3001209	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.):
PROJECT MANAGER: Natalie Orpin	CONTACT PH: 02 6201 7107	COC: 1 2 3 4 5 6 7	16/33 MADDOX ST.
SAMPLED BY: Jack Cleary		OF: 1 2 3 4 5 6 7	ALEXANDRIA NSW 2015
DATE SAMPLED: Multiple (Refer Sample Table)	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:
Email reports to (will default to PM if blank): [illegible]	DATE/TIME:	DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if blank): [illegible]			RECEIVED BY: DATE/TIME: 11/9/13

Special Laboratory Instructions: * Please FWD QC110 + QC113 to EuroFins Sydney, Chilled Condition

SAMPLE DETAILS						ANALYSIS REQUIRED									COMMENTS	
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Hold	TRH	BTEX	PAH	PCB	13 Metals Nepm	Phenols	OCP/OPP	Asbestos	TRH silica gel	Explosive Soils
	QC 108	10/9/2013	S	JAR	1	X										
37	QC 109	11/9/2013	W		4		X	X	X	X	X	X	X			X
*	QC 110	11/9/2013			1		X	X	X	X	X	X	X	X			*
38	QC 111	11/9/2013			1		X	X	X	X	X	X	X	X		
39	QC 112	11/9/2013			1		X	X	X		X			X		
*	QC 113	11/9/2013	↓	↓	1		X	X	X		X			X			*
40	Trip Blank	9/9/2013	W	Vial	2			X							X	
41	Trip Spike	11/9/2013	S	Vial	1		X	X								
	TP27 -1.0	10/9/2013	S	Jar	1	X										
	TP28 -1.0	11/9/13	S	Jar	1	X										
42	TP28 -2.0	11/9/13	S	Jar	1		X	X	X	X	X	X	X	X		
					TOTAL	3	7	8	6	4	6	4	4	5	1	1

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

86 on hold

0313

CHAIN OF CUSTODY FORM 10/10

SMEC

SMEC OFFICE:	TURNAROUND REQUIREMENTS: ☒ Standard – 5 day TAT ☐ Non Standard TAT (List due date):	LAB: SGS AUSTRALIA	
PROJECT: QC13		ATTENTION:	
PROJECT NUMBER: 3001309	LAB QUOTE NO:	COC SEQUENCE NUMBER (Circle)	DISPATCH TO (ADDRESS & PHONE NO.): 16/33 MADDOX ST.
PROJECT MANAGER: KATRINA O'TOOLE	CONTACT PH: 6234 1767	COC: 1 2 3 4 5 6 7	ALEXANDRIA NSW 2015
SAMPLED BY: [illegible]		OF: 1 2 3 4 5 6 7	
DATE SAMPLED: [illegible]	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
Email reports to (will default to PM if blank): [illegible]	DATE/TIME:	DATE/TIME:	DATE/TIME: / DATE/TIME:
Email Invoice to (will default to PM if blank): [illegible]			

Special Laboratory Instructions: * Please FWD QC110 + QC113 to Eurofins Sydney, Chilled Condition

SAMPLE DETAILS						ANALYSIS REQUIRED									COMMENTS		
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	Hold	TRH	BTEX	PAH	PCB	13 metals Nepm	Phenols	OCP/OPP	Asbestos	TRH C6-C10	Explosive Soils	
	QC 108	10/9/2013	S	JAR	1	X											
	QC 109	11/9/2013	W		4		X	X	X	X	X	X	X			X	
*	QC 110	11/9/2013			1		X	X	X	X	X	X	X	X			*
	QC 111	11/9/2013			1		X	X	X	X	X	X	X	X			
	QC 112	11/9/2013			1		X	X	X		X			X			
*	QC 113	11/9/2013			1		X	X	X		X			X			*
	Trip Blank	9/9/2013	W	Vial	2			X							X		
	Trip Spike	11/9/2013	S	Vial	1		X	X									13/9/13
	TP2 -1-0	10/9/2013	S	Jar	1	X											Tocfast.
	TP28 -1-0	11/9/13	S	Jar	1	X											660608.
	TP28 -2-0	11/9/13	S	Jar	1		X	X	X	X	X	X	X	X			
				TOTAL	16	3	7	8	6	4	6	4	4	5	1	1	

Notes: Low reporting limits required for groundwater as specified by SMEC Australia Pty Ltd.

Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

SGS

AUSTRALIA – ENVIRONMENTAL SERVICES SYDNEY – PROFORMA FORM
SAMPLE INFORMATION

Approved: D. Liang

JOB No. SE120709

Sample No.	P 100ml UP	P 250ml UP	P 500ml UP	P 1L UP	G 100 Amber UP	G 200 Amber UP	G 500 Amber UP	G 1L Amber UP	G 40ml vial Up	G 40ml Vial ~~HCl~~ NaSO4	P 100ml HCl	G 40ml Vial H2SO4	P 100ml H2SO4	P 250ml H2SO4	G 500ml Amber H2SO4	G 1L H2SO4	P 100/250ml HN03 Total	P 100ml HN03 Filtered	P 250ml NaOH	P 250ml Zn Acetate	Plastic Bag	G 250ml Soil Jar	100ml metal bottle			Sample Matrix	Lab Bottles Supplied By	Comments
1-34,35,39,42																					4	1				Soil	SGS	Full
35,36,37							1			2													1			Water	SGS	Full
40									2																	"	"	"
41									1																	Soil	SGS	Full
			66 Samples on hold																									

SAMPLE RECEIPT ADVICE

SE120709A

CLIENT DETAILS

Contact	Nathalie O'Toole
Client	SMEC Australia Pty Ltd - ACT
Address	Sun Micro Building Suite 2, Level 1 243 Northbourne Avenue LYNEHAM ACT 2602
Telephone	02 6234 1900
Facsimile	02 6234 1966
Email	Nathalie.O'Toole@smec.com
Project	**3002369 - OCB - Explosives**
Order Number	**0309--0313**
Samples	2

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
Samples Received	Thu 12/9/2013
Report Due	Mon 23/9/2013
SGS Reference	**SE120709A**

SUBMISSION DETAILS

This is to confirm that 2 samples were received on Thursday 12/9/2013. Results are expected to be ready by Monday 23/9/2013. Please quote SGS reference SE120709A when making enquiries. Refer below for details relating to sample integrity upon receipt.

Sample counts by matrix	1 Soil, 1 Water	Type of documentation received	COC
Date documentation received	12/9/13@3:25pm	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	3°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice	Samples clearly labelled	Yes
Complete documentation received	Yes		

Samples will be held for one month for water samples and two months for soil samples from date of report, unless otherwise instructed.

COMMENTS

Explosives subcontracted to Leeder Consulting, 4 - 5, 18 Redland Drive Mitcham VIC, NATA Accreditation Number 14429.

To the extent not inconsistent with the other provisions of this document and unless specifically agreed otherwise in writing by SGS, all SGS services are rendered in accordance with the applicable SGS General Conditions of Service accessible at http://www.sgs.com/en/Terms-and-Conditions/General-Conditions-of-Services-English.aspx as at the date of this document.
Attention is drawn to the limitations of liability and to the clauses of indemnification.

SAMPLE RECEIPT ADVICE

SE120709A

CLIENT DETAILS

Client SMEC Australia Pty Ltd - ACT

Project 3002369 - OCB - Explosives

SUMMARY OF ANALYSIS

No.	Sample ID	Explosives in Soil
019	TP19-0.0	16

CONTINUED OVERLEAF

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details.
Testing as per this table shall commence immediately unless the client intervenes with a correction.

SAMPLE RECEIPT ADVICE

SE120709A

CLIENT DETAILS

Client SMEC Australia Pty Ltd - ACT

Project 3002369 - OCB - Explosives

SUMMARY OF ANALYSIS

No.	Sample ID	Explosives in Water
037	QC 109	16

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details.
Testing as per this table shall commence immediately unless the client intervenes with a correction.

A.B.N. 44 000 964 278
3 - 5, 18 Redland Drive
Mitcham, Vic, 3132
Telephone: (03) 9874 1988
Fax: (03) 9874 1933

Chartered Chemists

27-Sep-2013

REPORT NUMBER: M132032

Site/Client Ref: SE120709A

SMEC Canberra

Sun Micro Building
Suite 2, Level 1
243 Northbourne Avenue
Australian Capital Territory 2602
Attention: Nathalie O'Toole

CERTIFICATE OF ANALYSIS

SAMPLES: Two samples were received for analysis

DATE RECEIVED: **16-Sep-2013**

DATE COMMENCED: **16-Sep-2013**

METHODS: See Attached Results

RESULTS: Please refer to attached pages for results.

Note: Results are based on samples as received at SGS Leeder Consulting's laboratories

Note: insufficient water sample for duplicate analysis.

REPORTED BY:

Yan Wang
Senior Chemist

NATA Accredited Laboratory Number: 2562

Accredited for compliance
with ISO/IEC 17025.

(I) RESULTS

Report N°: M132032

Matrix: Soil

Method: MA-1129.SL.01 Explosives

Sample units are expressed in mg/kg on a dry weight basis unless otherwise stated

	Leeder ID	2013024356	2013024357	2013024358
	Client ID	SE120709A-19 TP19-0.0	SE120709A-19 TP19-0.0	Method
Analyte Name	PQL		Duplicate	Blank
HMX	0.1	nd	nd	nd
RDX	0.1	nd	nd	nd
1.3.5-TNB	0.1	nd	nd	nd
1.3-DNB	0.1	nd	nd	nd
Tetryl	0.1	nd	nd	nd
NB	0.1	nd	nd	nd
TNT	0.1	nd	nd	nd
4-Amino-2.6-Dinitrotoluene	0.1	nd	nd	nd
2-Amino-4.6-Dinitrotoluene	0.1	nd	nd	nd
DNT	0.1	nd	nd	nd
2-MNT	0.1	nd	nd	nd
3-MNT	0.1	nd	nd	nd
4-MNT	0.1	nd	nd	nd
PETN	0.1	nd	nd	nd
NG	0.1	nd	nd	nd
1.4-DNB	0.1	nd	nd	nd

(I) RESULTS

Report N°: M132032

Matrix: Water

Method: MA-1129.WW.01 Explosives

Sample units are expressed in mg/L

	Leeder ID	2013024359	2013024361
	Client ID	SE120709A-37 QC109	Method
Analyte Name	**PQL**		Blank
2-Amino-4.6-Dinitrotoluene	0.001	nd	nd
4-Amino-2.6-Dinitrotoluene	0.001	nd	nd
1.3-DNB	0.001	nd	nd
1.4-DNB	0.001	nd	nd
DNT	0.001	nd	nd
HMX	0.001	nd	nd
2-MNT	0.001	nd	nd
3-MNT	0.001	nd	nd
4-MNT	0.001	nd	nd
NB	0.001	nd	nd
NG	0.001	nd	nd
PETN	0.001	nd	nd
RDX	0.001	nd	nd
Tetryl	0.001	nd	nd
1.3.5-TNB	0.001	nd	nd
TNT	0.001	nd	nd

(II) QUALITY CONTROL

Report N°: M132032

Matrix: Soil

Method: MA-1129.SL.01 Explosives

Quality Control Results are expressed in Percent Recovery of expected result

	Leeder ID	2013024362	2013024363
	Client ID	SE120709A-19 TP19-0.0	SE120709A-19 TP19-0.0
Analyte Name	**PQL**	Spike	Spike Dup
HMX		101	99
RDX		102	94
1.3.5-TNB		97	97
1.3-DNB		99	97
Tetryl		99	98
NB		97	100
TNT		82	85
4-Amino-2.6-Dinitrotoluene		96	96
2-Amino-4.6-Dinitrotoluene		96	96
DNT		98	98
2-MNT		95	95
3-MNT		95	95
4-MNT		95	93
1.4-DNB		99	97

(II) QUALITY CONTROL

Report N°: M132032

Matrix: Water

Method: MA-1129.WW.01 Explosives

Quality Control Results are expressed in Percent Recovery of expected result

	Leeder ID	2013024364	2013024365
	Client ID	SE120709A-37 QC109	SE120709A-37 QC109
Analyte Name	**PQL**	Spike	Spike Dup
2-Amino-4.6-Dinitrotoluene		73	74
4-Amino-2.6-Dinitrotoluene		71	74
1.3-DNB		84	84
1.4-DNB		84	84
DNT		82	86
HMX		107	113
2-MNT		68	65
3-MNT		67	70
4-MNT		68	89
NB		69	86
RDX		93	87
Tetryl		70	69

QUALIFIERS / NOTES FOR REPORTED RESULTS

PQL	Practical Quantitation Limit
is	Insufficient Sample to perform this analysis.
T	Tentative identification based on computer library search of mass spectra.
ND	Not Detected – The analyte was not detected above the reported PQL.
NC	Not calculated, Results below PQL
nr	Not Requested for analysis.
R	Rejected Result – results for this analysis failed QC checks.
SQ	Semi-Quantitative result – quantitation based on a generic response factor for this class of analyte.
IM	Inappropriate method of analysis for this compound
U	Unable to provide Quality Control data – high levels of compounds in sample interfered with analysis of QC results.
UF	Unable to provide Quality Control data- Surrogates failed QCchecks due to sample matrix effects
L	Analyte detected at a level above the linear response of calibration curve.
E	Estimated result. NATA accreditation does not cover estimated results.
C1	These compounds co-elute.
C2	These compounds co-elute.
CT	Elevated concentration. Results reported from carbon tube analysis
**	Sample shows non-petroleum hydrocarbon profile

APPENDIX ONE.

CHAIN OF CUSTODY DOCUMENT

CHAIN OF CUSTODY & ANALYSIS REQUEST
(FOR INTERLAB WORK)

Receiving Laboratory: **SGS Leeder**

Initiating Laboratory: SGS Sydney - Alexandria
Initiating Contact: Emily Yin (au.samplereceipt.sydney@sgs.com)
Send Results to:- **AU.Environmental.Sydney@sgs.com**

Final Report Required: **Yes** / No / NATA	Prelim Report Due: 20/9/13 am/pm	Special Prices: Yes / No	
Send To: **Us** / Client	Final Report Due: 20/9/13 am/pm	Quote No:	Client:** SMEC
Address To: Us / **Client*** (Address As Below)	Matrix / Preservation Method / Analysis Required		Remarks

SGS Job No: SE120709A	Client Job No: 3002369 OCB	Water	Soil	Date sampled		Ice	Acid	Other	None	Explosives										Remarks
Sample No.	Sample No.																			Client Contacts for AUENVSE: **INVOICE** = Invoice **SGS_SYD_REPORTS_PM** = REPORTS **SGS_SYD_SRA_PM** = Sample Receipt Advice
SE120709A-19	TP19-0.0		X	11/9						X										
SE120709A-37	QC109	X		11/9						X										

COURIER SERVICE: STARTRACK

CONSIGNMENT No:

Relinquished By: Emily Yin	Date/Time: 13/9/13	Received By: James Phillips	Date/Time 16/9/13 10.00

NOTES:* Client Address: Attention: Nathalie O'Toole
SMEC Canberra
Sun Micro Building
Suite 2, Level 1 243 Northbourne Avenue ACT 2602

*** Special Prices, Quotes, Clients **MUST BE** Referred To.

SLIM CLIENT CODE: SMEC_ACT

eurofins | mgt

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

SMEC Australia Pty Ltd
Suite 2, Level 1, 243 Northbourne Avenue
Lyneham
ACT 2602

Attention: **Nathalie O'Toole**

Report **392824-S**
Client Reference OCB 3002369
Received Date Sep 13, 2013

Client Sample ID			**QC110**	**QC113**
Sample Matrix			**Soil**	**Soil**
Eurofins | mgt Sample No.			**S13-Se10280**	**S13-Se10281**
Date Sampled			**Sep 11, 2013**	**Sep 11, 2013**
Test/Reference	LOR	Unit		
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				
TRH C6-C9	20	mg/kg	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	51
TRH C29-C36	50	mg/kg	< 50	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	51
BTEX				
Benzene	0.1	mg/kg	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	111	107
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5
Chrysene	0.5	mg/kg	< 0.5	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5

Client Sample ID			QC110	QC113
Sample Matrix			Soil	Soil
Eurofins | mgt Sample No.			S13-Se10280	S13-Se10281
Date Sampled			Sep 11, 2013	Sep 11, 2013
Test/Reference	LOR	Unit		
Polycyclic Aromatic Hydrocarbons				
Phenanthrene	0.5	mg/kg	< 0.5	0.5
Pyrene	0.5	mg/kg	< 0.5	< 0.5
Total PAH	1	mg/kg	< 0.5	0.5
Benzo(a)pyrene TEQ*	0.5	mg/kg	0.6	0.6
2-Fluorobiphenyl (surr.)	1	%	102	107
p-Terphenyl-d14 (surr.)	1	%	73	89
Organochlorine Pesticides				
Chlordane	0.1	mg/kg	< 0.1	-
4.4'-DDD	0.05	mg/kg	< 0.05	-
4.4'-DDE	0.05	mg/kg	< 0.05	-
4.4'-DDT	0.05	mg/kg	< 0.05	-
a-BHC	0.05	mg/kg	< 0.05	-
Aldrin	0.05	mg/kg	< 0.05	-
b-BHC	0.05	mg/kg	< 0.05	-
d-BHC	0.05	mg/kg	< 0.05	-
Dieldrin	0.05	mg/kg	< 0.05	-
Endosulfan I	0.05	mg/kg	< 0.05	-
Endosulfan II	0.05	mg/kg	< 0.05	-
Endosulfan sulphate	0.05	mg/kg	< 0.05	-
Endrin	0.05	mg/kg	< 0.05	-
Endrin aldehyde	0.05	mg/kg	< 0.05	-
Endrin ketone	0.05	mg/kg	< 0.05	-
g-BHC (Lindane)	0.05	mg/kg	< 0.05	-
Heptachlor	0.05	mg/kg	< 0.05	-
Heptachlor epoxide	0.05	mg/kg	< 0.05	-
Hexachlorobenzene	0.05	mg/kg	< 0.05	-
Methoxychlor	0.2	mg/kg	< 0.2	-
Toxaphene	1	mg/kg	< 1	-
Dibutylchlorendate (surr.)	1	%	101	-
Tetrachloro-m-xylene (surr.)	1	%	87	-
Polychlorinated Biphenyls (PCB)				
Aroclor-1016	0.5	mg/kg	< 0.5	-
Aroclor-1232	0.5	mg/kg	< 0.5	-
Aroclor-1242	0.5	mg/kg	< 0.5	-
Aroclor-1248	0.5	mg/kg	< 0.5	-
Aroclor-1254	0.5	mg/kg	< 0.5	-
Aroclor-1260	0.5	mg/kg	< 0.5	-
Total PCB	0.5	mg/kg	< 0.5	-
Dibutylchlorendate (surr.)	1	%	101	-
Speciated Phenols				
2.4-Dichlorophenol	0.5	mg/kg	< 0.5	-
2.4-Dimethylphenol	0.5	mg/kg	< 0.5	-
2.4.5-Trichlorophenol	0.5	mg/kg	< 0.5	-
2.4.6-Trichlorophenol	0.5	mg/kg	< 0.5	-
Phenol	0.5	mg/kg	< 0.5	-
2-Methylphenol (o-Cresol)	0.5	mg/kg	< 0.5	-
3&4-Methylphenol (m&p-Cresol)	1	mg/kg	< 1	-
2-Chlorophenol	0.5	mg/kg	< 0.5	-

Client Sample ID			QC110	QC113
Sample Matrix			Soil	Soil
Eurofins | mgt Sample No.			S13-Se10280	S13-Se10281
Date Sampled			Sep 11, 2013	Sep 11, 2013
Test/Reference	LOR	Unit		
Speciated Phenols				
2-Nitrophenol	0.5	mg/kg	< 0.5	-
4-Chloro-3-methylphenol	0.5	mg/kg	< 0.5	-
Pentachlorophenol	1	mg/kg	< 1	-
Phenol-d5 (surr.)	1	%	89	-
Organophosphorus Pesticides (OP)				
Chlorpyrifos	0.5	mg/kg	< 0.5	-
Coumaphos	0.5	mg/kg	< 0.5	-
Demeton (total)	1	mg/kg	< 1	-
Diazinon	0.5	mg/kg	< 0.5	-
Dichlorvos	0.5	mg/kg	< 0.5	-
Dimethoate	0.5	mg/kg	< 0.5	-
Disulfoton	0.5	mg/kg	< 0.5	-
Ethoprop	0.5	mg/kg	< 0.5	-
Fenitrothion	0.5	mg/kg	< 0.5	-
Fensulfothion	0.5	mg/kg	< 0.5	-
Fenthion	0.5	mg/kg	< 0.5	-
Methyl azinphos	0.5	mg/kg	< 0.5	-
Malathion	0.5	mg/kg	< 0.5	-
Methyl parathion	0.5	mg/kg	< 0.5	-
Mevinphos	0.5	mg/kg	< 0.5	-
Monocrotophos	10	mg/kg	< 10	-
Parathion	0.5	mg/kg	< 0.5	-
Phorate	0.5	mg/kg	< 0.5	-
Profenofos	0.5	mg/kg	< 0.5	-
Prothiofos	0.5	mg/kg	< 0.5	-
Ronnel	0.5	mg/kg	< 0.5	-
Stirophos	0.5	mg/kg	< 0.5	-
Trichloronate	0.5	mg/kg	< 0.5	-
Triphenylphosphate (surr.)	1	%	91	-
Chromium (hexavalent)	1	mg/kg	< 1	< 1
% Moisture	0.1	%	12	15
Asbestos			see attached	see attached
Heavy Metals				
Arsenic	2	mg/kg	3.2	3.8
Beryllium	2	mg/kg	< 2	< 2
Boron	10	mg/kg	< 10	< 10
Cadmium	0.4	mg/kg	< 0.4	< 0.4
Cobalt	5	mg/kg	6.7	9.1
Copper	5	mg/kg	11	16
Lead	5	mg/kg	25	36
Manganese	5	mg/kg	480	470
Mercury	0.05	mg/kg	< 0.05	< 0.05
Nickel	5	mg/kg	9.0	15
Selenium	2	mg/kg	< 2	2.1
Zinc	5	mg/kg	33	120

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	Sep 18, 2013	14 Day
- Method: E004 Petroleum Hydrocarbons (TPH)			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Sep 18, 2013	14 Day
- Method: LM-LTM-ORG2010			
BTEX	Sydney	Sep 17, 2013	14 Day
- Method: E029/E016 BTEX			
Polycyclic Aromatic Hydrocarbons	Sydney	Sep 18, 2013	14 Day
- Method: E007 Polyaromatic Hydrocarbons (PAH)			
Organochlorine Pesticides	Sydney	Sep 18, 2013	14 Day
- Method: E013 Organochlorine Pesticides (OC)			
Polychlorinated Biphenyls (PCB)	Sydney	Sep 18, 2013	28 Day
- Method: E013 Polychlorinated Biphenyls (PCB)			
Speciated Phenols	Sydney	Sep 18, 2013	14 Day
- Method: E008 Speciated Phenols			
Organophosphorus Pesticides (OP)	Sydney	Sep 18, 2013	14 Day
- Method: E014 Organophosphorus Pesticides (OP)			
% Moisture	Sydney	Sep 17, 2013	28 Day
- Method: E005 Moisture Content			
Chromium (hexavalent)	Sydney	Sep 17, 2013	28 Day
- Method: E043 /E057 Total Speciated Chromium			
Heavy Metals	Sydney	Sep 17, 2013	180 Day
- Method: E022 Acid Extractable metals in Soils			

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Brisbane
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NATA # 1261 Site # 20794

Company Name: SMEC Australia Pty Ltd (ACT)
Address: Suite 2, Level 1, 243 Northbourne Avenue
Lyneham
ACT 2602

Client Job No.: OCB 3002369

Order No.:
Report #: 392824
Phone: 02 6234 1800
Fax:

Received: Sep 13, 2013 1:05 PM
Due: Sep 20, 2013
Priority: 5 Day
Contact Name: Nathalie O'Toole

Eurofins | mgt Client Manager: Jean Heng

Sample Detail					% Moisture	Asbestos	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	BTEX	Polychlorinated Biphenyls (PCB)	Speciated Phenols	Organophosphorus Pesticides (OP)	Total Recoverable Hydrocarbons	NEPM 2013 Metals : Metals M13
Laboratory where analysis is conducted														
Melbourne Laboratory - NATA Site # 1254 & 14271														
Sydney Laboratory - NATA Site # 18217					X		X	X	X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794														
External Laboratory						X								
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**										
QC110	Sep 11, 2013		Soil	S13-Se10280	X	X	X	X	X	X	X	X	X	X
QC113	Sep 11, 2013		Soil	S13-Se10281	X	X	X		X				X	X

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgment.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Units

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environment Protection Authority
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions E004 Petroleum Hydrocarbons (TPH)							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX E029/E016 BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions LM-LTM-ORG2010							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH C6-C10 less BTEX (F1)	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons E007 Polyaromatic Hydrocarbons (PAH)							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Organochlorine Pesticides E013 Organochlorine Pesticides (OC)							
4.4'-DDD	mg/kg	< 0.05			0.05	Pass	
4.4'-DDE	mg/kg	< 0.05			0.05	Pass	
4.4'-DDT	mg/kg	< 0.05			0.05	Pass	
a-BHC	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-BHC	mg/kg	< 0.05			0.05	Pass	
d-BHC	mg/kg	< 0.05			0.05	Pass	
Dieldrin	mg/kg	< 0.05			0.05	Pass	
Endosulfan I	mg/kg	< 0.05			0.05	Pass	
Endosulfan II	mg/kg	< 0.05			0.05	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endosulfan sulphate	mg/kg	< 0.05			0.05	Pass	
Endrin	mg/kg	< 0.05			0.05	Pass	
Endrin aldehyde	mg/kg	< 0.05			0.05	Pass	
Endrin ketone	mg/kg	< 0.05			0.05	Pass	
g-BHC (Lindane)	mg/kg	< 0.05			0.05	Pass	
Heptachlor	mg/kg	< 0.05			0.05	Pass	
Heptachlor epoxide	mg/kg	< 0.05			0.05	Pass	
Hexachlorobenzene	mg/kg	< 0.05			0.05	Pass	
Methoxychlor	mg/kg	< 0.2			0.2	Pass	
Method Blank							
Polychlorinated Biphenyls (PCB) E013 Polychlorinated Biphenyls (PCB)							
Aroclor-1016	mg/kg	< 0.5			0.5	Pass	
Aroclor-1232	mg/kg	< 0.5			0.5	Pass	
Aroclor-1242	mg/kg	< 0.5			0.5	Pass	
Aroclor-1248	mg/kg	< 0.5			0.5	Pass	
Aroclor-1254	mg/kg	< 0.5			0.5	Pass	
Aroclor-1260	mg/kg	< 0.5			0.5	Pass	
Total PCB	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Speciated Phenols E008 Speciated Phenols							
2.4-Dichlorophenol	mg/kg	< 0.5			0.5	Pass	
2.4-Dimethylphenol	mg/kg	< 0.5			0.5	Pass	
2.4.5-Trichlorophenol	mg/kg	< 0.5			0.5	Pass	
2.4.6-Trichlorophenol	mg/kg	< 0.5			0.5	Pass	
Phenol	mg/kg	< 0.5			0.5	Pass	
2-Methylphenol (o-Cresol)	mg/kg	< 0.5			0.5	Pass	
3&4-Methylphenol (m&p-Cresol)	mg/kg	< 1			1	Pass	
2-Chlorophenol	mg/kg	< 0.5			0.5	Pass	
2-Nitrophenol	mg/kg	< 0.5			0.5	Pass	
4-Chloro-3-methylphenol	mg/kg	< 0.5			0.5	Pass	
Pentachlorophenol	mg/kg	< 1			1	Pass	
Method Blank							
Organophosphorus Pesticides (OP) E014 Organophosphorus Pesticides (OP)							
Chlorpyrifos	mg/kg	< 0.5			0.5	Pass	
Coumaphos	mg/kg	< 0.5			0.5	Pass	
Demeton (total)	mg/kg	< 1			1	Pass	
Diazinon	mg/kg	< 0.5			0.5	Pass	
Dichlorvos	mg/kg	< 0.5			0.5	Pass	
Dimethoate	mg/kg	< 0.5			0.5	Pass	
Disulfoton	mg/kg	< 0.5			0.5	Pass	
Ethoprop	mg/kg	< 0.5			0.5	Pass	
Fenitrothion	mg/kg	< 0.5			0.5	Pass	
Fensulfothion	mg/kg	< 0.5			0.5	Pass	
Fenthion	mg/kg	< 0.5			0.5	Pass	
Methyl azinphos	mg/kg	< 0.5			0.5	Pass	
Malathion	mg/kg	< 0.5			0.5	Pass	
Methyl parathion	mg/kg	< 0.5			0.5	Pass	
Mevinphos	mg/kg	< 0.5			0.5	Pass	
Monocrotophos	mg/kg	< 10			10	Pass	
Parathion	mg/kg	< 0.5			0.5	Pass	
Phorate	mg/kg	< 0.5			0.5	Pass	
Profenofos	mg/kg	< 0.5			0.5	Pass	
Prothiofos	mg/kg	< 0.5			0.5	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Ronnel	mg/kg	< 0.5			0.5	Pass	
Stirophos	mg/kg	< 0.5			0.5	Pass	
Trichloronate	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Chromium (hexavalent)	mg/kg	< 1			1	Pass	
Method Blank							
Heavy Metals E022 Acid Extractable metals in Soils							
Arsenic	mg/kg	< 2			2	Pass	
Beryllium	mg/kg	< 2			2	Pass	
Boron	mg/kg	< 10			10	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Cobalt	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Manganese	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.05			0.05	Pass	
Nickel	mg/kg	< 5			5	Pass	
Selenium	mg/kg	< 2			2	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions E004 Petroleum Hydrocarbons (TPH)							
TRH C6-C9	%	87			70-130	Pass	
TRH C10-C14	%	90			70-130	Pass	
LCS - % Recovery							
BTEX E029/E016 BTEX							
Benzene	%	104			70-130	Pass	
Toluene	%	90			70-130	Pass	
Ethylbenzene	%	86			70-130	Pass	
m&p-Xylenes	%	79			70-130	Pass	
o-Xylene	%	87			70-130	Pass	
Xylenes - Total	%	82			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions LM-LTM-ORG2010							
Naphthalene	%	92			70-130	Pass	
TRH C6-C10	%	89			70-130	Pass	
TRH >C10-C16	%	96			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons E007 Polyaromatic Hydrocarbons (PAH)							
Acenaphthene	%	94			70-130	Pass	
Acenaphthylene	%	129			70-130	Pass	
Anthracene	%	127			70-130	Pass	
Benz(a)anthracene	%	86			70-130	Pass	
Benzo(a)pyrene	%	109			70-130	Pass	
Benzo(b&j)fluoranthene	%	115			70-130	Pass	
Benzo(g.h.i)perylene	%	128			70-130	Pass	
Benzo(k)fluoranthene	%	103			70-130	Pass	
Chrysene	%	118			70-130	Pass	
Dibenz(a.h)anthracene	%	128			70-130	Pass	
Fluoranthene	%	123			70-130	Pass	
Fluorene	%	118			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	119			70-130	Pass	
Naphthalene	%	110			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Phenanthrene	%	123			70-130	Pass	
Pyrene	%	123			70-130	Pass	
LCS - % Recovery							
Organochlorine Pesticides E013 Organochlorine Pesticides (OC)							
4.4'-DDD	%	90			70-130	Pass	
4.4'-DDE	%	95			70-130	Pass	
4.4'-DDT	%	97			70-130	Pass	
a-BHC	%	86			70-130	Pass	
Aldrin	%	95			70-130	Pass	
b-BHC	%	101			70-130	Pass	
d-BHC	%	90			70-130	Pass	
Dieldrin	%	92			70-130	Pass	
Endosulfan I	%	94			70-130	Pass	
Endosulfan II	%	92			70-130	Pass	
Endosulfan sulphate	%	93			70-130	Pass	
Endrin	%	98			70-130	Pass	
Endrin aldehyde	%	79			70-130	Pass	
Endrin ketone	%	89			70-130	Pass	
g-BHC (Lindane)	%	93			70-130	Pass	
Heptachlor	%	94			70-130	Pass	
Heptachlor epoxide	%	94			70-130	Pass	
Hexachlorobenzene	%	92			70-130	Pass	
Methoxychlor	%	90			70-130	Pass	
LCS - % Recovery							
Polychlorinated Biphenyls (PCB) E013 Polychlorinated Biphenyls (PCB)							
Aroclor-1260	%	104			70-130	Pass	
LCS - % Recovery							
Speciated Phenols E008 Speciated Phenols							
2.4-Dichlorophenol	%	111			30-130	Pass	
2.4-Dimethylphenol	%	112			30-130	Pass	
2.4.5-Trichlorophenol	%	89			30-130	Pass	
2.4.6-Trichlorophenol	%	85			30-130	Pass	
Phenol	%	111			30-130	Pass	
2-Methylphenol (o-Cresol)	%	107			30-130	Pass	
3&4-Methylphenol (m&p-Cresol)	%	114			30-130	Pass	
2-Chlorophenol	%	107			30-130	Pass	
2-Nitrophenol	%	110			30-130	Pass	
4-Chloro-3-methylphenol	%	93			30-130	Pass	
Pentachlorophenol	%	86			30-130	Pass	
LCS - % Recovery							
Organophosphorus Pesticides (OP) E014 Organophosphorus Pesticides (OP)							
Chlorpyrifos	%	98			70-130	Pass	
Coumaphos	%	89			70-130	Pass	
Diazinon	%	88			70-130	Pass	
Dichlorvos	%	104			70-130	Pass	
Dimethoate	%	91			70-130	Pass	
Disulfoton	%	86			70-130	Pass	
Ethoprop	%	90			70-130	Pass	
Fenitrothion	%	87			70-130	Pass	
Fensulfothion	%	72			70-130	Pass	
Fenthion	%	93			70-130	Pass	
Methyl azinphos	%	86			70-130	Pass	
Malathion	%	96			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Methyl parathion	%	110			70-130	Pass	
Mevinphos	%	99			70-130	Pass	
Monocrotophos	%	93			70-130	Pass	
Parathion	%	97			70-130	Pass	
Phorate	%	90			70-130	Pass	
Profenofos	%	92			70-130	Pass	
Prothiofos	%	92			70-130	Pass	
Ronnel	%	95			70-130	Pass	
Stirophos	%	87			70-130	Pass	
Trichloronate	%	92			70-130	Pass	
LCS - % Recovery							
Chromium (hexavalent)	%	105			70-130	Pass	
LCS - % Recovery							
Heavy Metals E022 Acid Extractable metals in Soils							
Arsenic	%	92			70-130	Pass	
Beryllium	%	94			70-130	Pass	
Boron	%	86			70-130	Pass	
Cadmium	%	94			70-130	Pass	
Cobalt	%	93			70-130	Pass	
Copper	%	79			70-130	Pass	
Lead	%	97			70-130	Pass	
Manganese	%	103			70-130	Pass	
Mercury	%	94			70-130	Pass	
Nickel	%	98			70-130	Pass	
Selenium	%	93			70-130	Pass	
Zinc	%	95			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	S13-Se10608	NCP	%	83			70-130	Pass	
TRH C10-C14	S13-Se11505	NCP	%	90			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	S13-Se10608	NCP	%	103			70-130	Pass	
Toluene	S13-Se10608	NCP	%	87			70-130	Pass	
Ethylbenzene	S13-Se10608	NCP	%	82			70-130	Pass	
m&p-Xylenes	S13-Se10608	NCP	%	76			70-130	Pass	
o-Xylene	S13-Se10608	NCP	%	82			70-130	Pass	
Xylenes - Total	S13-Se10608	NCP	%	78			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	S13-Se10608	NCP	%	83			70-130	Pass	
TRH C6-C10	S13-Se10608	NCP	%	84			70-130	Pass	
TRH >C10-C16	S13-Se11505	NCP	%	99			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	S13-Se10829	NCP	%	91			70-130	Pass	
Acenaphthylene	S13-Se10829	NCP	%	87			70-130	Pass	
Anthracene	S13-Se10829	NCP	%	92			70-130	Pass	
Benz(a)anthracene	S13-Se10829	NCP	%	54			70-130	Fail	Q08
Benzo(a)pyrene	S13-Se10829	NCP	%	88			70-130	Pass	
Benzo(b&j)fluoranthene	S13-Se10829	NCP	%	81			70-130	Pass	
Benzo(g.h.i)perylene	S13-Se10829	NCP	%	91			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzo(k)fluoranthene	S13-Se10829	NCP	%	92			70-130	Pass	
Chrysene	S13-Se10829	NCP	%	93			70-130	Pass	
Dibenz(a.h)anthracene	S13-Se10829	NCP	%	81			70-130	Pass	
Fluoranthene	S13-Se10829	NCP	%	74			70-130	Pass	
Fluorene	S13-Se10829	NCP	%	88			70-130	Pass	
Indeno(1.2.3-cd)pyrene	S13-Se10829	NCP	%	85			70-130	Pass	
Naphthalene	S13-Se10829	NCP	%	93			70-130	Pass	
Phenanthrene	S13-Se10829	NCP	%	82			70-130	Pass	
Pyrene	S13-Se10829	NCP	%	75			70-130	Pass	
Spike - % Recovery									
Polychlorinated Biphenyls (PCB)				Result 1					
Aroclor-1260	S13-Se09537	NCP	%	80			70-130	Pass	
Spike - % Recovery									
Speciated Phenols				Result 1					
2.4-Dichlorophenol	S13-Se10829	NCP	%	100			30-130	Pass	
2.4-Dimethylphenol	S13-Se10829	NCP	%	109			30-130	Pass	
2.4.5-Trichlorophenol	S13-Se10829	NCP	%	68			30-130	Pass	
2.4.6-Trichlorophenol	S13-Se10829	NCP	%	79			30-130	Pass	
Phenol	S13-Se10829	NCP	%	107			30-130	Pass	
2-Methylphenol (o-Cresol)	S13-Se10829	NCP	%	107			30-130	Pass	
3&4-Methylphenol (m&p-Cresol)	S13-Se10829	NCP	%	95			30-130	Pass	
2-Chlorophenol	S13-Se10829	NCP	%	101			30-130	Pass	
2-Nitrophenol	S13-Se10829	NCP	%	101			30-130	Pass	
4-Chloro-3-methylphenol	S13-Se10829	NCP	%	82			30-130	Pass	
Pentachlorophenol	S13-Se10829	NCP	%	81			30-130	Pass	
Spike - % Recovery									
Organophosphorus Pesticides (OP)				Result 1					
Chlorpyrifos	S13-Se05989	NCP	%	98			70-130	Pass	
Coumaphos	S13-Se05989	NCP	%	93			70-130	Pass	
Diazinon	S13-Se05989	NCP	%	92			70-130	Pass	
Dichlorvos	S13-Se05989	NCP	%	123			70-130	Pass	
Dimethoate	S13-Se05989	NCP	%	101			70-130	Pass	
Disulfoton	S13-Se05989	NCP	%	77			70-130	Pass	
Ethoprop	S13-Se05989	NCP	%	102			70-130	Pass	
Fenitrothion	S13-Se05989	NCP	%	99			70-130	Pass	
Fensulfothion	S13-Se05989	NCP	%	119			70-130	Pass	
Fenthion	S13-Se05989	NCP	%	90			70-130	Pass	
Methyl azinphos	S13-Se05989	NCP	%	76			70-130	Pass	
Malathion	S13-Se05989	NCP	%	97			70-130	Pass	
Methyl parathion	S13-Se05989	NCP	%	121			70-130	Pass	
Mevinphos	S13-Se05989	NCP	%	107			70-130	Pass	
Monocrotophos	S13-Se05989	NCP	%	92			70-130	Pass	
Parathion	S13-Se05989	NCP	%	97			70-130	Pass	
Phorate	S13-Se05989	NCP	%	93			70-130	Pass	
Profenofos	S13-Se05989	NCP	%	115			70-130	Pass	
Prothiofos	S13-Se05989	NCP	%	118			70-130	Pass	
Ronnel	S13-Se05989	NCP	%	93			70-130	Pass	
Stirophos	S13-Se05989	NCP	%	78			70-130	Pass	
Trichloronate	S13-Se05989	NCP	%	93			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S13-Se10616	NCP	%	77			70-130	Pass	
Cadmium	S13-Se10829	NCP	%	85			70-130	Pass	
Copper	S13-Se10616	NCP	%	86			70-130	Pass	
Lead	S13-Se10829	NCP	%	93			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Mercury	S13-Se10616	NCP	%	90			70-130	Pass	
Nickel	S13-Se10829	NCP	%	100			70-130	Pass	
Selenium	S13-Se10616	NCP	%	86			70-130	Pass	
Zinc	S13-Se10829	NCP	%	94			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Beryllium	S13-Se11442	NCP	%	92			70-130	Pass	
Boron	S13-Se11442	NCP	%	96			70-130	Pass	
Cobalt	S13-Se11442	NCP	%	76			70-130	Pass	
Manganese	S13-Se10843	NCP	%	100			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	S13-Se10608	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	S13-Se11505	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	S13-Se11505	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	S13-Se11505	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S13-Se10608	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	S13-Se10608	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	S13-Se10608	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	S13-Se10608	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	S13-Se10608	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	S13-Se10608	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	S13-Se10608	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	S13-Se10608	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C6-C10 less BTEX (F1)	S13-Se10608	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	S13-Se11505	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	S13-Se11505	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	S13-Se11505	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
4.4'-DDD	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	

Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
4.4'-DDE	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-BHC	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-BHC	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-BHC	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-BHC (Lindane)	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	S13-Se09537	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	S13-Se09537	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Duplicate									
Polychlorinated Biphenyls (PCB)				Result 1	Result 2	RPD			
Aroclor-1016	S13-Se09537	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Aroclor-1232	S13-Se09537	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Aroclor-1242	S13-Se09537	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Aroclor-1248	S13-Se09537	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Aroclor-1254	S13-Se09537	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Aroclor-1260	S13-Se09537	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Speciated Phenols				Result 1	Result 2	RPD			
2.4-Dichlorophenol	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
2.4-Dimethylphenol	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
2.4.5-Trichlorophenol	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
2.4.6-Trichlorophenol	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenol	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
2-Methylphenol (o-Cresol)	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
3&4-Methylphenol (m&p-Cresol)	S13-Se10829	NCP	mg/kg	< 1	< 1	<1	30%	Pass	
2-Chlorophenol	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
2-Nitrophenol	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
4-Chloro-3-methylphenol	S13-Se10829	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pentachlorophenol	S13-Se10829	NCP	mg/kg	< 1	< 1	<1	30%	Pass	
Duplicate									
Organophosphorus Pesticides (OP)				Result 1	Result 2	RPD			
Chlorpyrifos	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Coumaphos	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Diazinon	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dichlorvos	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dimethoate	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Disulfoton	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Ethoprop	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fenitrothion	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fensulfothion	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fenthion	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Methyl azinphos	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Malathion	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Methyl parathion	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	

Duplicate									
Organophosphorus Pesticides (OP)				Result 1	Result 2	RPD			
Mevinphos	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Monocrotophos	S13-Se05989	NCP	mg/kg	< 10	< 10	<1	30%	Pass	
Parathion	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phorate	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Profenofos	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Prothiofos	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Ronnel	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Stirophos	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Trichloronate	S13-Se05989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S13-Se10829	NCP	mg/kg	< 2	< 2	<1	30%	Pass	
Cadmium	S13-Se10829	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Copper	S13-Se10829	NCP	mg/kg	42	54	25	30%	Pass	
Lead	S13-Se10829	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Mercury	S13-Se10616	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Nickel	S13-Se10829	NCP	mg/kg	6.4	8.5	29	30%	Pass	
Selenium	S13-Se10829	NCP	mg/kg	< 2	< 2	<1	30%	Pass	
Zinc	S13-Se10829	NCP	mg/kg	8.4	11	26	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Beryllium	S13-Se11442	NCP	mg/kg	< 2	< 2	<1	30%	Pass	
Boron	S13-Se11442	NCP	mg/kg	< 10	< 10	<1	30%	Pass	
Cobalt	S13-Se11442	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Manganese	S13-Se11442	NCP	mg/kg	180	220	18	30%	Pass	

Comments

Asbestos was analysed by ASET. NATA accreditation number 14484. Report reference ASET35208/38388/1-2.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Organic samples had Teflon liners	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	Yes

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference

Authorised By

Jean Heng	Client Services
Bob Symons	Senior Analyst-Inorganic (NSW)
James Norford	Senior Analyst-Metal (NSW)
Ryan Hamilton	Senior Analyst-Organic (NSW)
Ryan Hamilton	Senior Analyst-Volatile (NSW)



Dr. Bob Symons

Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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7 November 2016

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Dickson ACT 2602

Subject: **Site Audit of Canberra Brickworks, ACT (LBJ 14/02)**
Interim Audit Advice #7 From Review of Canberra Brickworks Site Investigation, Canberra Brickworks, Yarralumla ACT, November 2016

Dear Irena,

1.0 INTRODUCTION

Geosyntec Consultants Pty Ltd (Geosyntec) was engaged to provide Accredited Site Auditor (auditor) services in accordance with the Australian Capital Territory (ACT) Environment Protection (EP) Act 1997 in relation to the proposed redevelopment of the former Canberra Brickworks site, Yarralumla, ACT (the site). As part of the provision of these auditor services, the auditor was engaged to provide an independent review of the following reports:

- SMEC Holdings Limited (SMEC), 2016a. Canberra Brickworks: Detailed Environmental and Geotechnical Site Investigation, Canberra Brickwork Precinct, Yarralumla, ACT (Reference 3002523, Rev.2) dated 31 October 2016; and
- SMEC, 2016b. Canberra Brickworks: Groundwater Investigation – Addendum Report, Canberra Brickwork Precinct, Yarralumla, ACT (ref. 3002523 – Groundwater Addendum Report, Rev. 2), dated 3 November 2016.

The reports, which document different aspects of the same site investigation program, are collectively referred to herein as the "SI report".

This letter has been provided as interim advice and, in keeping with guidelines endorsed under the EP Act 1997, you are advised that this letter does not constitute a Site Audit Report or Site Audit Statement and does not pre-empt the conclusion that may be made at the end of the audit process. This letter will be referred to by, and form an appendix to, the Site Audit Report. This interim advice is subject to the limitations as presented in Section 4.0.

2.0 SCOPE OF REVIEW

The auditor's review of the Report has included reference to the requirements/ provisions of the following policy and guidelines made or endorsed under the EP Act 1997:

- ACT Environment Protection Authority (EPA, 2009) Contaminated Sites, Environment Protection Policy (EPP);
- ACT EPA (2015) Contaminated Sites Information Sheet 4 – Requirements for the reuse and disposal of contaminated soil;
- ACT EPA (2014) Contaminated Sites Information Sheet 5 – requirements for the transport and disposal of asbestos contaminated wastes;
- ACT EPA (2014) Contaminated Sites Information Sheet 6 – Management of small scale, low risk soil asbestos contamination;
- NSW EPA (1995) Sampling Design Guidelines (the Sampling Guidelines);
- New South Wales (NSW) Department of Environment and Conservation (DEC) (April 2006) Guidelines for the NSW Site Auditor Scheme (2nd Edition) (the Auditor Guidelines);
- NSW Office of Environment and Heritage (OEH, 2011) Guidelines for Consultants Reporting on Contaminated Sites (the Reporting Guidelines);
- Western Australia Department of Health (WA DoH, 2009) Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (the Asbestos Guidelines);
- Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC & ARMCANZ, 2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality; and
- National Environment Protection Council (NEPC, 1999) National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM, as amended May 2013).

3.0 COMMENTS ON THE SI REPORT

The auditor considers that the scope of the SI report addresses many of the requirements of a detailed site investigation specified in the NEPM, the Reporting Guidelines and the Auditor Guidelines.

The auditor has reviewed several iterations of the SI report, and has provided detailed comments as interim audit advice (No.5 and No.6), as well as email advice and discussion in meetings.

The key outcomes of the auditor's review of the SI report are summarised below. Minor spelling and grammatical errors, where encountered, have only been addressed if the potential uncertainty arising from the error was deemed to be noteworthy.

1) The investigation program, comprising intrusive and surface geophysical investigation techniques, generally identified an extensive fill layer across the operational portion of the former brickworks, the majority of the former quarry pit area, and to a limited extent in the land to the south. The fill thickness ranged from <1m to ~5m thick, and generally consisted of bricks with various inclusions of concrete, ash, reworked material and trace amounts of metal pipe. The geotechnical suitability of the fill material for construction purposes falls outside the scope of the site auditor scheme, and does not form part of the "site suitability" considerations of the site audit.

2) The analytical results of the various sampled environmental media (fill, soil, sediment, kiln dust, surface water, groundwater), did not identify widespread chemical or asbestos contamination issues at the site (note the exception in Comment 3 below). A number of discrete contamination issues were identified, including elevated metals concentrations in kiln dust (and shallow fill in limited locations), the presence of an underground storage tank (UST), and limited occurrences of asbestos (bonded fragments on ground surface, and asbestos fines detected in one soil sample).

3) The auditor notes that the "asbestos dump" area at the western margin of the site was intentionally excluded from this stage of investigation. This area is the subject of a separate body of investigation reports, management plans and a Section B Site Audit Statement for an interim "cap-and-contain" management strategy.

4) The results of the investigation indicated that, with the exception of the localised contamination issues identified, the chemical quality of large portions of the site is suitable for residential land use. It is important to note that this conclusion acknowledges several important limitations to the investigations completed to date:

    a. Certain limitations applied to the design of the investigation program, including access limitations that prevented intrusive investigation beneath the footprints of most buildings and structures on the site, and heritage considerations that limited the type and density of investigation locations in

relatively large portions of the site. Accordingly, the characterisation of the contamination status in these areas is either preliminary or unaddressed, and will need to be considered in accordance with future development plans, if and when access becomes available.

b. While a reasonable density of investigation locations were completed within the former operational area of the brickworks, the investigation density in other portions of the site was much lower (partially for the reasons discussed in bullet point "a" above, and partially because the land use history suggested a lower contamination potential). This is most relevant to the former quarry area where the thickest fill occurrence was identified using geophysical techniques, and where the potential to encounter artefacts of archaeological significance was considered to be high.

In conclusion, the results of investigation to date have only identified a small number of discrete contamination issues, and the widespread presence of fill material does not appear to be associated with widespread chemical or asbestos impact (this comment excludes the asbestos dump area). Uncertainties remain at the site, and unexpected contamination issues may still exist despite a reasonable level of judgemental and systematic investigation, particularly given the inherent variability of fill material. Identified data gaps should be addressed if and when access constraints allow, and it is recommended that any future development should proceed under the guidance of an environmental management plan (EMP) with an unexpected finds protocol.

Any supplementary investigations (plans and results) or management plans addressing contamination at the site must be reviewed and endorsed by an accredited contaminated site auditor. Any remediation action plans prepared to address contamination issues at the site must also be submitted to ACT EPA for review and approval, following the auditor's review and endorsement, prior to implementation.

4.0 LIMITATIONS

This advice has been prepared in accordance with the Department of Environment and Conservation (DEC) NSW (2006) Contaminated Sites: Guidelines for the NSW Site Auditor Scheme, 2nd Edition, and other relevant guidelines made or endorsed under the EP Act 1997.

The comments and opinions provided in this document were based on the auditor's independent review of information prepared and provided by others. While applicable audit standards include a validation of reasonably verifiable information, not all of the information provided to the auditor can be reasonably verified. (For example, the accuracy of field logs, the location of samples, and the consistent compliance by third parties with applicable methodologies is not subject to reasonable verification.) The necessity to rely on third party

information results in an inherent level of uncertainty with respect to the audit that exists despite the auditor's compliance with appropriate professional standards of care. In addition, the documents supplied to the auditor for review as part of this audit may contain limitations statements. Accordingly, the opinions and advice developed on the basis of those documents is, by extension, subject to those same limitations.

It is also recognised that the guidelines regarding sampling design for site investigation and validation of remediation are statistically based, and it is possible for unidentified contamination to exist on a site where investigation and/or remedial validation has been performed despite compliance with applicable guidelines. The auditor accepts no responsibility for unidentified contamination encountered subsequent to investigation, remediation and validation that was performed in substantial compliance with the relevant guidelines made or endorsed under the EP Act 1997.

5.0 CLOSURE

Should you have any further queries please do not hesitate to contact the undersigned on 0447 249 250.

Sincerely,

Lange Jorstad, PhD, RPGeo
NSW EPA Accredited Site Auditor (No. 1001)

ARCADIS Design & Consultancy for natural and built assets

YARRALUMLA BRICKWORKS, ACT

Data Review and Gap Analysis and Sampling, Analysis and Quality Plan (SAQP)

26 JUNE 2017



Incorporating

Environmental Strategies

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BLOC (ACT) PTY LTD

Yarralumla Brickworks

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This report has been prepared for BLOC (ACT) Pty Ltd (ABN 80 149 091 592) in accordance with the terms and conditions of appointment for the project. Arcadis Australia Pacific Pty Limited (ABN 76 104 485 28976) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

REVISIONS

Revision	Date	Description	Prepared by	Approved by
V01	07/06/2017	Draft for Review	RPS	DJ
V02	20/06/17	Draft for Review	RPS, CG	DJ
V03	26/06/2017	Submitted to site Auditor for review.	RPS, CG	DJ

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1 INTRODUCTION

BLOC (ACT) Pty Ltd (BLOC), on behalf of Doma Group, engaged Arcadis Australia Pacific Pty Ltd (Arcadis), to prepare the following data review and gap analysis and Sampling and Analysis Quality Plan (SAQP) for the former Yarralumla Brickworks which comprises Blocks 1, 7 and 20, Section 102 Central Canberra, herein referred to as the site. The site location is shown on **Figure 1, Appendix A** and has an area of approximately 95,817 m^2.

The site is proposed to be redeveloped for both commercial and residential land uses. This includes the construction of a variety of residential buildings such as townhouses, apartment buildings and single dwelling houses and the reconditioning and fit out of existing brickworks buildings, where possible, for a variety of commercial uses including cafes and restaurants, retail stores, and office space.

The site is subject to a statutory audit being undertaken by Lange Jorstad of Geosyntec Consultants who is an ACT EPA approved NSW EPA Accredited Site Auditor. The site Audit is required prior to construction of the proposed development. This SAQP is required to be reviewed and endorsed by the Site Auditor prior to commencement of any sampling works.

The works being performed within this report are part of Arcadis' multi-staged approach, provided to BLOC, for the remediation of the Yarralumla Brickworks Precinct. This staged approach consists of:

- Stage 1: Data Review and Gap Analysis (Inclusive of SAQP).
- Stage 2: Infill Investigations.
- Stage 3: Preparation of a Remedial Action Plan (RAP).
- Stage 4: Monitoring and Tracking of Contaminated Material Movement.
- Stage 5: Validation Assessment.
- Stage 6: Preparation of Environmental Management Plan (EMP).

The SAQP is based by the findings of the data review and gap analysis for the forthcoming Stage 2 Targeted Site Assessment (TSA).

The purpose of the data review and gap analysis is to identify any Areas of Environmental Concern (AECs) at the site. It is noted that the previous environmental assessments for the site were completed without the proposed redevelopment's master plan. Therefore, several areas within the footprint of the proposed development have not been assessed for suitability.

The purpose of the SAQP is to present a clear and detailed description of the scope of work, data quality objectives, and criteria for which the environmental assessment would be assessed against prior to any field sampling commencing.

1.1 Background

The site is currently owned by THE DOMA GROUP (ACT) and is trading as DOMA GROUP. The site operated as the Yarralumla Brickworks intermittently since construction in 1913 through to closure in 1976. The following infrastructure is known to have been located at the site as part of the brickworks:

- Kilns for the manufacturing of bricks.
- Railway lines for the transport of bricks from the brickworks and into Canberra.
- Underground flues and subsurface workings.
- Accommodation buildings.

- Brickworks Hostel.
- Quarry.

The former brickworks buildings, for the past 23 years, are occupied by Thor's Hammer a wood recycling facility, with portions of the site remaining vacant.

Several environmental investigations have been completed on the site. The following list of reports were made available to Arcadis for review:

- Lovell Chen (2010) 'Canberra Brickworks – Denman Street, Yarralumla, Canberra - Conservation Management Plan'.
- SMEC (2014) 'Preliminary (Environmental) Site Investigation, Canberra Brickworks' (Reference: 3002219).
- Robson Environmental (2015) 'Stage 1 Environmental Site Assessment, Canberra Brickworks Remediation Project, Block 1 Section 102 Yarralumla, Canberra Central ACT' (Reference: 9623_EAR_Stage 1 ESA Report_20150312).
- SMEC (2016A) 'Canberra Brickworks: Detailed Environmental and Geotechnical Site Investigation, Canberra Brickworks Precinct, Yarralumla, ACT' (Reference: 3002523).
- SMEC (2016B) 'Canberra Brickworks: Groundwater Investigation-Addendum Report, Canberra Brickworks Precinct, Yarralumla, ACT' (Reference 3002523).

The above environmental investigations were completed without the proposed redevelopment's master plan. Therefore, several areas which are to be redeveloped have not been assessed for suitability for the intended redevelopment.

With the master plan now finalised, Arcadis intends to assess these locations which will intern direct the preparation of the Remedial Action Plan for Stage 3.

A detailed review of each historical report is provided in **Section 3**.

1.2 Objectives

The primary objectives of Stage 1 is as follows:

- To identify the currently understood data gaps in previous site investigations.
- To assess the land used suitability based on the data gaps identified.
- To provide the scope for Stage 2.
- To attain sufficient qualitative and quantitative information to allow for the preparation of Stage 3.

1.3 Scope of Work

The scope of work carried out in for Stage 1 included the following:

- Complete a detailed review, and provide a summary of each of the environmental investigation reports made available by BLOC.
- Perform a site visit for confirmatory purposes and understand the site layout and any potential access issues.
- Assessment of any data gaps and identification of uncertainties and issues that require further investigation to assist validation of the site as suitable for the proposed redevelopment in accordance with the master plan.
- Review the conceptual site model (CSM) and amend accordingly.

- Prepare a SAQP which presents additional sampling requirements to infill identified data gaps. The SAQP would comprise of the following details:
  - Summarise the sampling, analysis and quality objectives of the assessment program.
  - Summarise the CSM.
  - Investigation and sample methodologies.
  - Media to be sampled, sample frequency, analytes and parameters to be reported, laboratory reporting limits.
  - Summary of the field quality assurance and quality control methods.
  - Sample handling, storage and transport methods, including chain of custody procedures.
  - Summary of laboratory quality assurance procedures.

1.4 Structure

The sections within this report contain the following information:

- **Section 1 – Introduction:**
  - Background to the project, objectives of the works, and provides a brief overview of the DQOs.
- **Section 2 –Site Conditions:**
  - Site description, proposed redevelopment and master plan, summary of site conditions, and surrounding environment.
- **Section 3 – Previous Environmental Investigations:**
  - Summary of previous environmental investigations.
- **Section 4 – Contaminants of Potential Concern:**
  - Overview of the contaminants of potential concern (COPC) associated with site following a review of previous investigation findings and historical site use.
- **Section 5 – Conceptual Site Model:**
  - Amendment of CSM identifying areas of environmental concern (AEC) at the site potentially having been impacted by site activities, site conditions and/or specific features that could present an environmental concern with regards to potential contamination.
- **Section 6 – Data Gap Analysis:**
  - Discussion of the identified data gaps from previous investigations and details for additional information required to achieve the objectives of this document.
- **Section 7 – Sampling and Analysis Quality Plan**
  - Guidance:
    - Presents the local and national Acts, and policies with which the SAQP has been prepared in accordance with.
  - Data Quality Objectives:
    - Presents, describes, and addresses each of the seven steps of the DQO process used for each of the investigation components.
  - Assessment Criteria:

    - Investigation levels to be used to assess the field and analytical results, and includes summary tables for both soil and water investigation levels.
  - Proposed Sampling and Analytical Program:
    - Proposed sampling and analysis program to address data gaps and meet DQOs, and the Quality Assurance and Quality Control (QA/QC) requirements. Description of the proposed sampling strategy, sampling locations, and analytical suites.
  - Sampling Methodologies:
    - This section details the proposed water and soil sample collection techniques including sample preservation, storage, and handling procedures.
  - Quality Assurance / Quality Control (QA/QC):
    - QA/QC procedures used to include data quality indicators (DQIs), field logging, QA/QC sampling and frequency, and laboratory analysis specifications.
  - Reporting:
    - Preparation of report detailing the findings and any recommendations for further assessment or contingency options (if required).
- **Section 8 – References:**
  - References relating to this document.
- **Section 9 – Limitations:**
  - Statement of limitations relating to this document and proposed investigation.

2 SITE CONDITION

2.1 Site Description

The site identification details are provided in Table 2-1 below.

Table 2-1 Site Detail Summary

Site Characteristic	Detail
Street Address	Denman Street, Yarralumla, ACT
Approximate Coordinates	Latitude: 35.30855 S Longitude: 149.08741 E
Block, Section, Division	Block 1, 7, and 20 Section 102, Canberra Central
Land Zonings	CZ6 – Leisure and Accommodation. RZ1 – Suburban. PRZ2 – Restricted Access Recreation.
Historical Land use	Commercial/industrial land uses. • Yarralumla Brickworks, including: – Kilns for the manufacturing of bricks. – Railway lines for the transport of bricks from the brickworks and into Canberra. – Underground flues and subsurface workings. – Accommodation buildings. – Brickworks Hostel. – Quarry. • Thor's Hammer.
Current Land Use	Thor's Hammer.
Proposed Land Use	Commercial, open space, and residential land uses.
Site Area (approximately)	95,817 m^2

The general location is provided in **Figure 1**, **Appendix A**, while the current site boundary is shown in **Figure 2**, **Appendix A**. A figure with a surveyed site boundary will be provided within future works.

2.2 Site Condition

The site condition and surrounding environment described in previous reports is summarised in Table 2-2 below:

Table 2-2 Summary of Site Condition

Site Characteristic	Detail
Land-use	The Yarralumla Brickworks has had a disrupted operational period since it was first opened in 1913. The brickworks closed for the first time in 1931 as a result of the Depression and was reopened again in 1935. The brickworks were closed again temporarily between 1942 and 1944 as a result of World War II. After the brickworks were reopened in 1944, they operated until 1976 when the last bricks were unloaded from the kilns for the last time and the operation closed. - Infrastructure on the site has included the following: - Kilns for the manufacturing of bricks. - Railway lines for the transport of bricks from the brickworks and into Canberra. - Underground flues and subsurface workings. - Accommodation buildings. - Brickworks Hostel. - Quarry. For the past 23 years Thor's Hammer a wood recycling facility occupied the former brickworks buildings, while the remaining area of the site was left vacant. Currently Thor's Hammer still operates at the site.
Topography	The topography at the site is variable due to historical extraction works, infilling and operations at the site. However, it is noted that the generally slopes to the west north-west.
Conditions at Site Boundary	The southern and western site boundary consists of vegetated land. There is no access to the site via these boundaries. The eastern site boundary generally consists of Bentham Street, vegetated areas. and residential houses. The site is currently accessed via Denman Street. The northern site boundary is primarily fenced, and bound by a rock face, originating from quarrying works There is no access to the site via this boundary.
Visible Signs of Plant Stress	The vegetation of the Site and surrounds was characterised by areas of tree plantings (pine and deciduous trees) and open grassland (native and modified grassland). Areas within the former brickworks, former quarry and former workers accommodation contained dense grass and woody weed species (blackberry bush) with pine trees. The vegetation appeared to be in good health with no obvious signs of stress
Presence of Drums, Tanks, Wastes and Fill Material	Tanks:

Site Characteristic	Detail
	Based on information sourced from the SMEC (Sept 2016A) and Robson (2014), there are two (2) Underground storage tanks identified at the site. These are listed below: • Fuel UST, identified as AEC–7 (SMEC, 2016A) and AEC-2 (Robson 2006, 2010 - reports not provided for review) is located in the north-western portion of the site, adjacent to the Hardy Patent Kiln 2, and south of the former forklift shed. • Septic UST, identified as AEC 4 (Robson, 2015) is located within the asbestos dump. Three (3) additional locations were surveyed with ground penetrating radar (GPR) for the potential existence of USTs within SMEC (Sept 2016A). No indication of USTs, within the areas that could be accessed with GPR, were identified at these locations. Most sections that were surveyed indicated evidence of disturbance, consistent with holes that had been excavated and backfilled with debris and rubble including concrete and bricks. However, SMEC noted that GPR surveys in few locations were not successful due to access. The location of the abovementioned USTs are provided in **Appendix A**, **Figure 3.** <u>Fill Material:</u> Fill material is located across most the site, with the deepest sections located in the asbestos dump where the thickness of fill is up to approximately 4 m below ground level (m bgl). Fill material is noted to contain bricks (both whole and fragments), concrete slabs and fragments, ash, reworked material, slag, and some metal pipes. Additionally, both asbestos fibres and asbestos sheeting has been identified at the site, with the majority identified within the asbestos dump, in the north-western portion of the site. It is understood that the asbestos dump became apparent in the 1980, yet was likely initiated from the 1970s. It is furthermore likely that some of the material located within the asbestos dump came from sources external to the site. Within the asbestos dump the following quantities of fill material were identified by Robson (2015): • Known area of asbestos contaminated fill: 4,854 m^3. • Less impacted fill: 16,252 m^3. The above calculations are interpreted by Arcadis to refer to material that would be classified as asbestos waste, and material that would not. Beyond the Asbestos Dump, asbestos fibres were located within a surface sample located at TP61, which was identified as AEC-10 (SMEC, 2016A). Please refer to **Appendix A**, **Figure 4** for a contour map, generated from historical borehole and test pit logs provided in both Robson 2015 and SMEC, 2016A. <u>Dangerous Goods Storage</u>: A dangerous goods records search was performed for the site in SMEC 2014 stated the following: A search of the Dangerous Goods Act 1975 and Dangerous Substances Act 2004 maintained by Worksafe ACT did not indicate the presence of any stored dangerous goods or underground storage tanks (USTs). The search indicated that tanks containing diesel less than 50 000 litres were not required to be licensed with Worksafe. The following COPC relating to dangerous goods have been assessed within the historical reports:

Site Characteristic	Detail
	• PCBs - Associated with buried wastes from buildings and potential transformers and associated oils. • PAHs - Derived from partially combusted organic materials, also from coal used as fuel in the kilns and ash buried across the site. • Explosives residues - Possible explosives residues in soil from historical storage on site. • Hydrocarbons - Associated with the use of fuels and lubricants and former UST. • Asbestos – Associated with historical building materials. The following locations have been identified as being historically used for the storage of dangerous goods: • Explosives store - Shed-like structure observed west of the brickworks and north of the railway line, possible location of the explosives store. Identified in 1958 aerial photograph (SMEC, 2016A), and with the location indicated on Figure 6 (Robson 2015) to be west of the Extrusion Plant. However, within Lovell Chen (2010), it is noted that the explosives store was relocated at a point in time to be 180m south of the power house. • Oil storage facility - Historical ASTs identified to be where building 34 (model railway storage shed) now resides (Lovell Chen, 2010). • Oil and coal bunkers – A former oil storage facility /coal storage bay was located at building 33 (model railway workshop). Within Lovell Chen, 2010 it is stated that the model railway workshop was constructed in 1979, utilizing the brick walls of a former oil storage facility /coal storage bay. • Substation /control room and boiler house – Located west of Down Draft Kilns 4-6 (Lovell Chen, 2010). • The power house – Located at building 3 (Lovell Chen, 2010). • Temporary Kilns - (Lovell Chen, 2010). • Asbestos Dump – located within the north-western portion of the site (Robson 2015). • UST - Fuel UST, identified as AEC–7 (SMEC, 2016A) and AEC-2 (Robson 2006, 2010 - reports not provided for review). Based on the historical reports provided for review, it is the understanding of Arcadis, that no further storage of dangerous goods exists at the site apart from those outlined above. Within SMEC 2014, a review was performed on a report by RE titled Robson Laboratories Pty Ltd (March 2006), Survey to Determine the Extent and Condition of Hazardous Building Material at Yarralumla Brickworks, Yarralumla ACT. The following Hazardous material were identified as part of this non-destructive survey are: • Friable asbestos. • Bonded asbestos. • Lead-paint. • Synthetic mineral fibre. • PCB capacitors to fluorescent light fittings. <u>Wastes</u>:

Site Characteristic	Detail
	Based on the historical information provided for review little information is known about the wastes produced at the site. However, the following wastes are expected to have been generated at the site during operation as a brickworks: • Quarry tailings. • Brick waste. • Asbestos. • Demolition waste. • Ash. • Slag waste.
Odours	It was noted during the Robson (2015) assessment of the asbestos dump that while no odours or visual observations related to putrescible waste were made, the likelihood of landfill gases to be present in the still remains a possibility until the waste has been removed. No other mention of chemical, or hydrocarbon odours were provided within the historical reports for both soil and groundwater investigations. Furthermore, field headspace measurements of soil samples using a photo-ionisation detector (PID) reported marginal readings for all historical reports.
Quality of Surface Water	Surface water at the site exists as an ephemeral water body in the former quarry. This was constructed as a 'reflection pool' after the closure of the brickworks by A R Marr Pty Ltd. Surface water, assessed within SMEC 2016B, showed the following characteristics: • pH between 3.96 and 3.99. • Relatively oxygenated. • Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), Total Recoverable Hydrocarbons (TRH), Polycyclic Aromatic Hydrocarbons (PAH), Organochlorine and Organophosphate Pesticides (OCP/OPP), and Polychlorinated Biphenyls (PCB were below analytical detection limits. • zinc was the only analyte found to exceed the ASC NEPM Environmental Investigation Levels (EIL) (amended 2013) screening criteria for fresh water.
Quality of Ground Water	Groundwater was only assessed within the SMEC 2016B assessment. No comment has been made regarding and odour, colour, or sheens regarding the groundwater at the site. The following comment regarding groundwater was however made: • The variability in ground conditions and measured depth to groundwater across the site suggests that the connectivity between wells may be restricted or not be present and that depth to groundwater is reflective of ground conditions in the immediate vicinity of the monitoring wells. • pH was between 5.94 and 6.99. • Relatively oxygenated.

Site Characteristic	Detail
	) TRHs, PAHs, OCPs, OPPs, and PCBs were below analytical detection limits.) benzene above analytical detection limits at M-2 and M-7.) A number of exceedances for cadmium, copper, nickel, zinc, were recorded in the groundwater samples to exceed the ASC NEPM EIL (amended 2013) screening criteria for fresh water.) Groundwater was not intersected in M-1 and M-8.

2.3 Surrounding Land Uses

The surrounding land uses are as follows:

- North: Lane Poole Place and Bentham Street, residential properties surrounding the roads and beyond.
- East: Schomburgk Street, Woollis Street and, Bentham Street, and Denman Street with associated residential properties.
- South: vegetated land and Duntossil Drive.
- West: Vegetated land beyond which lies the Royal Canberra Golf Course to the west.

2.4 Proposed Development

The site is proposed to be re-developed for mixed use commercial, residential purposes. Based on the master plan provided to Arcadis the proposed mixed use residential and commercial development includes a variety of residential buildings are proposed across the site. This including townhouses, apartment buildings, and single dwelling houses, varying in access to surface soils. The existing brickworks buildings currently on the site will be maintained where possible and used for a variety of commercial uses including cafes and restaurants, retail stores and office space.

A key aspect to the development is the preservation of the heritage listed buildings and integration of these into the design of the new precinct such that the history of the brickworks is maintained for future generations to enjoy and explore.

2.5 Soils and Geological Setting

The Geology of Canberra 1:100,000 Sheet 8287 (1992) shows that the Canberra brickworks is underlain by calcareous and tuffaceous mudstone and siltstone of the Late Silurian Yarralumla Formation. The formation outcrops within and adjacent to the pit area of the site.

Soils encountered during the previous intrusive investigation works have been detailed in Table 2-3 below.

Table 2-3 Summary of Subsurface Conditions – Asbestos Dump

Profile	Description
ACM Fill	Average depth of 1.5m bgl, ranging from surface to 3m bgl. Consisting of Brick, concrete, ash, metal, plastic and asbestos sheeting.
Fill	No fill observed along the western side. From surface to 5.5m bgl along the northern portion. From surface to 4.5m bgl within the centre.
Natural Soil	Fill was underlain by natural sandy clay, orange to red, exhibiting medium plasticity with minor medium grained gravels or a yellow weathered granite from surface to beyond 5.5m bgl
Bedrock	Shale was identified from at 5.25 at a single location north east of the asbestos dump.

Table 2-4 Summary of Subsurface Conditions – Reminder of Site

Profile	Description
Fill	Fill generally terminated at depths less than 1m bgl, extending to beyond 3m bgl within the historical quarry. Fill consisted of reworked natural sandy to silty clays, ash, brick waste, shale with traces some glass, metal and bitumen.
Natural Soil	Natural soils were generally identified from surface to 1.0m bgl. generally comprised soft brown silty topsoils underlain by medium to stiff red-brown silty clays and clays. Variable components of sand, cobbles and weathered rock (shale and siltstone) were also identified.
Bedrock	Bedrock was identified from 0.17 to 1.9m bgl. Bedrock comprised of shale, dacite, siltstone or sandstone bedrock.

2.6 Hydrogeological Setting

Review of the 1:100,000 Hydrology of the Australian Capital Territory and Environs (1984) indicated that the groundwater beneath the Site is generally present in fractured rock. The quality tends to be variable and was described as 500 - 1,000 mg/l total dissolved solids (TDS). The yield was described as approximately 1.0 l/s.

2.6.1 Regional Bore Search

A regional bore search within a 2km radius of the site as summarised in the SMEC 2016B report, is presented in Table 2-6.

Table 2-5 Summary of Subsurface Conditions – Reminder of Site

Bore ID	Purpose	Construction Date	Depth (m)	Water Level (m)
WU36	Private	Unknown	43	35
WU105	Private	Unknown	Unknown	Unknown
WU609	Private	Unknown	Unknown	Unknown
Woden 3	Private	Unknown	Unknown	Unknown

No map or distances from the site was provided with the historic bore search. A review of the ACTmapi website identifies the closest bore to the site as being approximately 600 to 700m west by south west of the site.

2.6.2 Onsite Groundwater Wells

Groundwater monitoring bore construction details are provided in Table 2-6 below.

Table 2-6 Site Monitoring Well Construction Details

Well ID	Depth of Well (m bgl)	Zone of Screen (m bgl)	Screened Lithology	Well Elevation (TOCm AHD)	Standing Water Levels (m TOC)	Standing Water Levels (m AHD)
M1	8.5	5.5-8.5	BEDROCK	582.78	DRY	NA
M2	15.0	12.0-15.0	WEATHERED ROCK	577.40	4.091	473.31
M3	5.5	1.0-4.0	SANDY CLAY, CLAYEY SANDY GRAVEL, AND SANDY CLAY	577.61	2.741	574.67
M4	4.0	1.0-4.0	CLAY	577.95	1.198	576.75
M5	5.5	2.5-5.5	WEATHERED SILT STONE AND SILTY CLAY	584.82	1.965	582.86
M6	15	12.0-15.0	LIMESTONE	585.25	10.547	571.70
M7	14.7	11.7-14.7	ROCK	582.44	8.565	573.88
M8	15	12.0-15.0	HARD ROCK	587.43	DRY	NA

Based on the reported information in Table 2-6 above, water bearing zones were encountered within multiple zones which include:

- Limestone;
- Siltstone;
- Clays;
- Weathered bedrock.

Gauging of the monitoring wells completed by SMEC indicated that the standing water levels vary from 473.31 and 582.86m AHD. This variation may be attributed to the presence of perched water bearing units. The nature of the screened intervals of wells and the extent of connectivity of groundwater between each water bearing unit is not well understood. Arcadis notes that the monitoring well construction logs indicate that at each monitoring well, backfill sand has been used from the base of each well up to 1m bgl without consideration to the length of the screened interval. This could potentially cause preferential pathways to form between water bearing geological units and the standing water level (SWL) may not be representative of the screened interval.

Preliminary contours have been provided for groundwater in **Appendix A, Figure 5**. Given the variation in screened intervals the groundwater contours have been prepared for initial screening purposes only.

Regionally, groundwater is believed to flow to the north west towards Lake Burley Griffin.

Table 2-7 Groundwater Physical Parameters

Well ID	Date	pH	Temperature °C	Conductivity uS/cm	Dissolved oxygen ppm	Redox mV
M1	17/10/16			DRY		
M2	28/09/16	6.89	18.9	1923	2.25	94
M3	28/09/16	5.94	16.6	887	9.17	142
M4	17/10/16	6.60	15.5	633	2.94	115
M5	17/10/16	6.99	14.4	440	2.86	96
M6	17/10/16	6.91	15.2	2250	5.30	129
M7	17/10/16	6.50	20	455	7.83	136
M8	17/10/16			DRY		

Table 2-7 indicates the following most recent groundwater conditions across the site, however it is noted that groundwater sampling between M2 and M3 and the remainder of the monitoring wells were sampled approximately three (3) weeks apart:

- Temperature of the groundwater ranged between 14.4 and 21.6°C.
- The current pH ranged between 5.94 to 6.91 generally indicating a neutral groundwater condition.
- Dissolved oxygen in the groundwater ranged from 2.25 to 9.17 ppm indicating aerobic conditions.
- Oxidation reduction potential (ORP) levels measured from 94 to 172mV, which indicates oxidising conditions.
- Conductivity levels were between 440 and 2,250 uS/cm, indicating moderately freshwater groundwater conditions to slightly brackish conditions.

No information regarding turbidity, colour, odour, or presence of sheens were provided.

3 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

3.1 SMEC (2014) 'Preliminary (Environmental) Site Investigation, Canberra Brickworks'

SMEC was commissioned by the LDA to complete a preliminary geotechnical and environmental investigation for the site. The purpose of the environmental investigation was to provide preliminary contamination data to the LDA and assess whether additional assessment work would be required. Within this report a historical summary of previous environmental investigations was performed. The historical reports assessed are listed below:

- Lester Firth & Associates Pty Ltd (June1986), Old Canberra Brickworks, Conservation Plan, June 1986.
- Connell & Wagner (February 2001), Brickworks Contamination Report, Appendix F.
- Robson Laboratories Pty Ltd (October 2006), Environmental Investigation Audit, Yarralumla Brickworks Block 1 Section 102 Yarralumla, Canberra Central, ACT.
- Robson Laboratories Pty Ltd (March 2006), Survey to Determine the Extent and Condition of Hazardous Building Material at Yarralumla Brickworks, Yarralumla ACT.
- Lovell, Chen – Architects & Heritage Consultants (March 2010), Conservation Management Plan – Canberra Brickworks, Denman Street, Yarralumla, Canberra.
- Robson Environmental Pty Ltd (May 2010), Review of Past Site Works and Indicative Costings for Further Assessment and Remediation, Yarralumla Brickworks, Yarralumla, ACT.
- Robson Environmental Pty Ltd (October 2010), Hazardous Material Survey & Management, Denman St Yarralumla Brickworks, Yarralumla ACT.
- Robson Environmental Pty Ltd (February 2012), Hazardous Material Survey & Management, Yarralumla Brickworks, Yarralumla ACT.

The sampling program was conducted at the site to provide both a preliminary geotechnical data for future development within the site (TP01 to TP13) to target previous soil data (confirmatory) or to fill data gaps (TP14 to TP28) to better inform recommendations.

Twenty-eight (28) test pits were advanced across the site and forty two (42) samples were submitted to a National Association of Testing Authorities (NATA) accredited laboratory for the analysis of the following COPCs:

TRH	Heavy Metals (arsenic, calcium, chromium, copper, nickel, lead, zinc, and mercury).
BTEX	Nutrients.
PAH	Herbicides.
Creosote	OCP/OPP.
Explosives	Phenols.

- Oil and Grease.
- PCB

Fill material was encountered in eighteen (18) test pits and the following observations were made:

- Brickworks and Quarry Area: fill contained brick, ash, shale with traces of anthropogenic inclusions comprising of glass, metal and bitumen. The depth of fill was up to 3m bgl which was the limit of the excavators reach. The nature of fill at depths greater than 3 m bgl was not known.
- Surrounding Areas: Sandy to silty clay which was assessed as probably reworked natural material to a depth of approximately 1 m bgl.
- Area adjacent to Cotter Road: Silty cobbles to gravelly sand with traces of brick and bitumen. Test pit TP2 refused on concrete at a depth of 2.0 m bgl

Concentrations of COPCs in samples submitted for analysis were below the adopted site criteria which are listed below:

- Health Investigation Levels (HIL) - Residential (HIL A).
- Health Safety Levels (HSL) - Low to high density residential (HSL A).
- Ecological Investigation Level (EIL) - Urban residential and public open space.

SMEC note that the sample density adopted for the assessment was less than the number of samples that would be collected for a detailed assessment. Groundwater was not assessed as a part of the preliminary investigation.

Based on the results of the investigation, SMEC stated that the potential risk to ecological receptors and human health associated with the brickworks, quarry, and former worker's accommodation was moderate to low. The remainder of the site typically comprised of natural soil grading to weathered rock. As analytical results were below the adopted site criteria, SMEC considered the potential for contamination to be present as low.

3.2 Robson Environmental (2015) 'Stage 1 Environmental Site Assessment, Canberra Brickworks Remediation Project, Block 1 Section 102 Yarralumla, Canberra Central ACT'

Robson Environmental was engaged by Capcorp Constructions Pty Ltd to complete an environmental site assessment of the Asbestos Dump located along the western boundary of the site.

The scope of the investigation comprised of the following:

- Remove vegetation across the investigation area.
- Excavation of twenty-five (25) test pits on a grid based sample pattern, of this sixteen (16) locations were within the understood boundary of the asbestos dump.
- Excavation of four (4) trenches across the Asbestos Dump.
- Analysis of soil samples for:

- TRH
- Heavy Metals.
- BTEX
- Speciated Phenols

PAH	OCP/OPP.
PCB	Asbestos

A summary of the results of the investigation is as follows:

- Asbestos sheet material was identified in five (5) test pits.
  - TP3, TP5, TP6, TP8, and TP13.
- Fibrous Asbestos and Asbestos Fines were identified in two (2) test pits.
  - TP8 and TP13.
- Concentrations of TRH and PAHs were detected at concentrations above the laboratory limit of reporting (LOR) at two (2) test pit locations.
  - TP11 and TP13.
- Concentrations of benzo(a)pyrene TEQ exceeded the site assessment criteria at one (1) test pit.
  - TP13
- Concentrations of lead and nickel were present at elevated concentrations within other sample locations, but were below the adopted commercial/industrial criteria in the event the material was disposed at the West Belconnen Resource Management Centre (WBRMC).

The primary contaminant of concern identified in the asbestos dump was asbestos sheet material. The depth of the asbestos material ranged from 0.5 m bgl to 3.2 m bgl and was generally mixed with high amounts of other anthropogenic waste including brick, tile, metal, glass, wood, ash, slag and concrete. Parts of the dump which did not have visible asbestos sheet material was noted to contain high volumes of other anthropogenic waste.

Based on the results of the investigation, Robson calculated the following volumes of waste material:

- Known area of asbestos contaminated fill: 4,854 m^3;
- Less impacted fill: 16,252 m^3.

Based on these results, Robson recommended that a Remedial Action Plan be prepared for the remediation of the asbestos dump in preparation for making the site suitable for future residential land uses.

3.3 SMEC (2016A) ‘Canberra Brickworks: Detailed Environmental and Geotechnical Site Investigation, Canberra Brickworks Precinct, Yarralumla, ACT’

The LDA commissioned SMEC to complete a detailed environmental and geotechnical investigation of the Yarralumla Brickworks. The purpose of the detailed investigation was to determine the suitability of the site for the proposed land use for low to medium density housing.

The scope of the investigation was as follows:

- Excavation of sixty-three (63) test pits across the site to a maximum of 3.0 m bgl.
- Drilling of eighteen (18) soil bores to a depth of 3.0 m bgl.
- Collection of twenty (20) samples from surface locations across the site.

- Collection of three (3) sediment samples from the creek/water course in the pit area.
- Drilling, installation and sampling of eight (8) groundwater monitoring wells between 5.5 and 15 m bgl utilising wash boring methods.
- The COPCs identified for the site are:
  - TRH, BTEX, PAH, OCP/OPP, PCB, heavy metals, explosives, and asbestos.
- Samples collected were analysed for TRH, BTEX, PAH, OCP/OPP, PCB, heavy metals, and asbestos.

Results of the investigation indicated the presence of fill consisting of bricks (both whole and fragments) with concrete slabs and fragments, ash, reworked material and some metal pipes. Based on the Arcadis' interpretation of the logs, it is understood that the fill is located across the majority of the site, with the deepest sections located in the asbestos dump where the thickness of fill is up to approximately 4 m.

Bedrock occurred across the site from between 0.1 to 2.9m bgl.

The analytical criteria adopted for this assessment are listed below:

- HIL – A.
- HSL – A.
- EIL – Urban residential and public open space.
- Ecological Screening Levels (ESL) - Urban residential and public open space.
- Simpson SL, Batley GB and Chariton AA (2013). Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines. CSIRO Land and Water Science Report 08/07. CSIRO Land and Water.

Analytical results indicated that concentrations of BTEX, OPP, OCP and PCBs across the majority of the site were below the laboratory LORs.

The following contaminant concentrations were recorded above the laboratory LOR:

- Concentrations of TRH C_{15}-C_{28} and C_{29}-C_{36} were reported at concentrations above the laboratory LOR with a maximum concentration of 800 mg/kg.
- Concentrations of PAH in sixteen (16) samples were above the LOR with a maximum concentration of 6.7 mg/kg which was below the assessment criteria of 300 mg/kg. The concentration of the calculated benzo(a)pyrene TEQ was below the 3 mg/kg criteria.
- Concentrations of total phenols were detected in thirty-seven (37) samples from across the site with a maximum concentration of 47 mg/kg and were below the criteria of 3,000 mg/kg.
- Lead concentrations exceeded the HIL A criteria of 300 mg/kg at four (4) locations with exceedance concentrations ranging between 430 mg/kg and 4,300 mg/kg. These exceedances were from samples collected from the ground surface and kiln dust in the vicinity of the existing brickworks buildings.
- Concentrations of zinc were reported above the EIL criteria in three (3) samples. Other than this, all other concentrations of heavy metals were below the site acceptance criteria.

Based on the results of the assessment, SMEC identified ten (10) AECs. The AECs are summarised in Table 3-1 below along with recommendations made by SMEC.

Table 3-1: Summary of AECs and recommendations made by SMEC.

AEC	Description	Recommendation
AEC-1	Interior of Kilns around SS-4. Heavy Metals.	Further Assessment
AEC-2	Surface samples located to the west of the brickworks kilns. Heavy metals.	Further Assessment
AEC-3	Interior of Kilns around SS-10. Heavy metals, PAHs and TRH.	Further Assessment
AEC-4	Pit Area	Further Assessment
AEC-5	Areas under concrete slabs and buildings	Further Assessment
AEC-6	Areas under concrete slabs and buildings	Further Assessment
AEC-7	Underground Storage Tank	Remove tank and validation of the excavation. Groundwater water sampling may be required
AEC-8	Surface area in the vicinity of TP34A where non-friable asbestos was encountered	Further Assessment
AEC-9	Area around TP12 where elevated lead was detected	Further Assessment
AEC-10	Area around TP61 where fibres of chrysotile was detected	Further Assessment

SMEC noted that access to some areas of the site was not available and that further works should be completed to provide a comprehensive data set to allow for the LDA to make effective decisions.

Based on the results of the assessment, SMEC considered the southern portion of the site would be suitable for residential land use. The remainder of the site however would require further investigation.

3.4 SMEC (2016B) 'Canberra Brickworks: Groundwater Investigation-Addendum Report, Canberra Brickworks Precinct, Yarralumla, ACT'

As a part of the detailed environmental and geotechnical investigation that the LDA commissioned SMEC to complete, a groundwater assessment across the site was completed to determine the suitability of groundwater and surface water for the proposed residential land uses.

The scope of the groundwater and surface water assessment was as follows:

- Installation of eight (8) groundwater monitoring wells across the site.
- Sampling of groundwater wells and collection of surface water samples from ephemeral creeks.
- Analysis of water samples for TRH, BTEX, PAH, OCP/OPP, PCBs, and heavy metals.

The monitoring wells were installed to depths between 4.6 m and 15.7 m. Sampling of the monitoring wells indicated that concentrations of TRH, PAH, OCP/OPP and PCB

were below the groundwater investigation levels. Benzene concentrations were detected in two (2) monitoring wells (M-2 and M-7) but were well below the groundwater investigation level of 950 µg/L.

Based on Arcadis' review the bearing zones, in which the monitoring wells were installed, were across multiple strata. These include:

- Limestone.
- Siltstone.
- Clays.
- Weathered bedrock.

Groundwater across the site varies between 473.31 and 582.86m AHD. The extent of connectivity of groundwater between each monitoring well is uncertain. Additionally, Arcadis notes that the monitoring wells construction logs show that at each monitoring well, filter sand has been used from the base of each well up to 1m bgl irrelevant of the length of the screened interval. Furthermore, monitoring wells M-1 and M-8 are dry and did not intersect groundwater.

Concentrations of cadmium, copper, nickel and zinc exceeded the freshwater groundwater investigation levels in M-2, nickel and zinc in M-6 and M-7 and zinc in M-3 and M-7. Based on the results of the groundwater sampling, SMEC considered the concentrations of metals recorded unlikely to pose a significant environmental risk.

Concentrations of TRH, BTEX, PAH, OCP, OPP, and PCB in the samples collected from surface water were below the laboratory LORs. Concentrations of zinc were detected above the groundwater investigation levels in samples W-2 and W-3. Other than this, concentrations of other heavy metals were below the assessment criteria.

Based on the results of the surface water and groundwater assessment SMEC recommended additional surface and groundwater monitoring to further investigate the presence of benzene in water.

4 CONTAMINANTS OF POTENTIAL CONCERN

Based on a comprehensive review of the site history and previously reported soil and groundwater results, the following COPCs are considered:

- TRH;
- BTEX;
- PAH;
- OCP/OPP;
- PCB;
- Dioxins (within the kilns);
- Heavy metals;
- Asbestos both non-friable and friable.

5 CONCEPTUAL SITE MODEL

The site was historically assessed for residential land use with access to soil. This was performed prior to the proposed redevelopment's master plan having been generated. Now with the master plan the site can be divided into several sections specific to land use. These land uses are provided below and are outlined in **Figure 6, Appendix A**.

- Zone 1 A/B – Low density residential.
- Zone 2 – Medium density residential.
- Zone 3 A/B – High density residential.
- Zone 4 A/B – Recreational.
- Zone 5 – Commercial.

All historical samples have been reassessed in accordance with the zones that they are now located within. Analytical criteria selected for the assessment of each zone is provided in **Table** 7-2.

5.1 Summary of Soil and Sediment Conditions

Robson (2015):

It is noted that all samples collected within Robson (2015) are generally located in Zone 2, specifically in the north-western portion of the site.

Exceeding the NEPM 2013 HSL A – Bonded asbestos:

TP6 0.9-1.0: - 0.06 %W/W	TP5 1.9-2.0 – 0.12 %W/W
TP13 0.0-0.0: – 1.17 %W/W	TP13 0.4-0.5: – 0.42 %W/W
TP13 1.9-2.0: – 0.64 %W/W	TP13 2.9-3.0: – 0.30 %W/W

Exceeding the NEPM 2013 HSL A – All forms of asbestos:

TP3 – Observed at surface	TP8 – Observed at surface

Exceeding the NEPM 2013 HSL A – FA and AF:

- TP8 9-1.0m:
  - - 0.028 %W/W >2mm to <7mm AF/FA
- TP13 0-0.1
  - 5.7 %W/W >2mm to <7mm AF/FA
  - 0.37 %W/W <2mm AF/FA
- TP13 0.9-1.0
  - FA 0.046 %W/W >2mm to <7mm AF/
  - 0.053 %W/W <2mm AF/FA

Exceeding the NEPM 2013 HIL A – Residential:

- TP13 0-0.1
  - Benzo(a)pyrene (BaP) 9.5 mg/kg
  - Carcinogenic PAH's (As BaP TEQ) 15 mg/kg

Exceeding the NEPM 2013 EILs for urban residential fine soil:

- TP8 9-1.0m:
  - Zinc – 470mg/kg
- TP6 1.9-2m.
  - Zinc 520mg/kg.

Exceeding the NEPM 2013 ESLs for urban residential:

- TP13 0-0.1
  - Benzo(a)pyrene (BaP) 9.5 mg/kg
  - Carcinogenic PAH's (As BaP TEQ) 15 mg/kg

Concentrations of TRH and PAHs were detected at concentrations above the laboratory limit of reporting (LOR) at TP11 and TP13 but below the adopted assessment criteria.

SMEC (2016A):

Zone 4B.

Exceeding the NEPM 2013 HSL A – All forms of asbestos:

- Adjacent to TP-34A
  - Observed at surface

Zone 1A

Exceeding the NEPM 2013 HSL A – FA and AF:

- TP-61_0.2m:
  - - >0.01 %W/W <2mm AF/FA

Zone 5

At or Exceeding the NEPM 2013 HIL D – Commercial Industrial:

- SS-06 (surface) – Adjacent fan house for Kiln 1
  - Lead 4300 mg/kg
- SS-07 (surface) – Adjacent fan house for Kiln 1
  - Lead 1500 mg/kg

Exceeding the NEPM 2013 EILs for commercial industrial soil:

- SS-04 (surface)
  - Zinc 2100 mg/kg
- SS-06 (surface)
  - Lead 4300 mg/kg
  - Zinc 5400 mg/kg
- SS-07 (surface)
  - Zinc 1800 mg/kg

TRH (C_{15} -C_{28} and C_{29} -C_{36}), which was reported in ten (10) samples were below criteria. A maximum concentration of 800 mg/kg was identified in surface sample SS-10.

PAHs were reported in sixteen (16) samples and were below criteria. The maximum concentration was reported in TR-11_0.15m (6.7 mg/kg).

Total phenols were identified in thirty-seven (37) samples and were below criteria. A maximum concentration of 47 mg/kg was reported for sample SS-10.

It is noted that no sediment samples exceeded the relevant analytical criteria for the zone in which they are located.

The above mentioned COPCs have, where relevant, exceeded the Zone 1A, 2, 4B, and 5 land uses. Due to these concentrations, a number of exposure pathways are complete and pose an unacceptable risk to both human health and for the environment. Additional works are required to make these portions of the site suitable for the proposed use.

5.2 Summary of Groundwater and Surface Water Conditions

The COPCs within groundwater, which exceeded relevant Groundwater Acceptance criteria (GAC) are discussed below:

Exceeding the NEPM 2013 freshwater GIL:

- M-2
  - Cadmium 1.3 µg/L
  - Copper 4 µg/L
  - Nickel 20 µg/L
  - Zinc 67 µg/L
- M-3
  - Zinc 21 µg/L
- M-6
  - Nickel 13 µg/L
  - Zinc 18 µg/L
- M-7
  - Nickel 12 µg/L
  - Zinc 8 µg/L

The concentrations of heavy metals identified to date within groundwater across the site are not considered to represent a significant environmental risk. This is due to the concentrations of dissolved metals being considered representative of background concentrations within the screened water unit/s.

Concentrations of all other COPCs (TRH, PAH, OCP, OPP, and PCBs) were below laboratory LORs.

Benzene was identified above LORs from samples collected from wells M-2 and M-7. These concentrations were however, below the adopted GACs for the site. The low levels of benzene in groundwater are therefore not considered to represent a significant health and or environmental risk. However, the source for benzene has not yet been confirmed.

The extent of the groundwater SWLs connectivity across the site is uncertain, and has been measured between 473.31 and 582.86m AHD. Monitoring wells M1 and M8 were identified as not having intersected a water baring unit and were dry.

The most recent groundwater measurements (**Table 2-6**) identified that the proposed basement depths are unlikely to intersect the groundwater with the exception of the medium density residential developments located at the asbestos dump (zone 2 – north western portion of the site). Perched water between 1.9 and 4.6m bgl (Robson 2014) was measured within the asbestos dump and could potentially intersect the proposed basement of the proposed developments in this area. Furthermore, the groundwater well (MW2) adjacent to the asbestos dump shows groundwater to have been measured at 4.091m TOC (SMEC 2016B). Due to these groundwater levels, there is a potential for future basement users or construction workers to groundwater contamination. Arcadis however notes that no design has been provided for review which stipulate basement depths. The exposure pathway for direct human contact to seepage water is potentially complete yet is considered to pose a low risk to human health with the currently available data.

Arcadis notes that no groundwater monitoring wells have been installed immediately adjacent to or within the brickworks facility, or within the pit area. Therefore, the groundwater assessment to date, within these areas, is considered insufficient and that additional temporal and spatial coverage of groundwater is required.

The scope of additional groundwater assessment is provided in **Section 7.4.4**.

The COPCs within surface water that exceeded the GAC are discussed below:

Exceeding the NEPM 2013 freshwater GIL:

- W-1
  - Zinc 25 µg/L
- W-3
  - Zinc 22 µg/L

The concentrations of zinc identified in the onsite surface water body, exceeding the adopted GIL for freshwater are not considered to represent a significant environmental risk. This is due to:

- The onsite surface waterbody was observed as being isolated with no immediate receiving sensitive environments (e.g. wetland).
- Concentrations are considered to be representative for the background for the onsite surface water body. It is likely that the identified zinc concentrations are derived from the natural soils of the site.
- The spread of concentrations of zinc within groundwater are generally similar to those within the surface water body.

Concentrations of all other COPCs (TRH, BTEX, PAH, OCP, OPP, and PCBs) were below laboratory LORs.

Based on the proposed development layout the relevant complete exposure pathway to surface water would be through direct contact to surface water. No drinking water guidelines are available for zinc in the ASC NEPM (2013) and it is unlikely that the proposed development will use the surface water as a drinking water resource in the future. The future infrastructure regarding boardwalk or fencing for the surface water body at the site in unknown. The exposure pathway for direct human contact to surface water is potentially complete yet is considered to pose a low risk to human health.

Arcadis does not propose any further surface water assessment.

Locations of monitoring wells are provided in **Appendix A**, **Figure 5**, while the location of surface water samples are provided in **Figure 7**.

5.3 Assessment of the Chemical Degradation Products

Given the identified COPCs and results of historical investigations at the site degradation products are unlikely to pose an unacceptable risk to human health or the environment.

5.4 Assessment of Potential Transport Mechanisms

Transport mechanisms are the manner in which contaminants move away from the source area. Based on the proposed master plan and historical site investigations the following transport mechanism are noted.

Soils:

- Leaching and downwards migration through the soil profile into groundwater is considered potential complete. There is a potential for leaching to occur unless impacted natural soil and fill, proposed to remain onsite, is appropriately handled, disposed of offsite, and or capped. Furthermore, additional assessment is required due to the potential for an unidentified source to exist within unassessed areas of the site.

- Volatilisation of volatile contaminants originating from petroleum hydrocarbons and VOC impacted soil is considered potentially complete. Additional assessment is required due to the potential for an unidentified source to exist within unassessed areas of the site.
- Inhalation of asbestos fibres by onsite construction workers, and future site workers and residents is considered to be a complete pathway. Potential for this to occur unless impacted natural soil and fill, proposed to remain onsite, is appropriately handled, disposed of offsite, and or capped.
- Direct contact with surface and subsurface impacted soils to onsite construction workers, and future site workers and residents is considered to be a complete pathway. Furthermore, additional assessment is required due to the potential for an unidentified source to exist within unassessed areas of the site.

Groundwater:

- Migration of contaminated groundwater from potential up gradient source locations to beneath the site is not considered to be a complete pathway. This is considered unlikely after a review of historical works and land uses surrounding the site.
- Migration of groundwater to down-hydraulic gradient locations is considered a potentially complete pathway. Additional assessment is required due to the potential for an unidentified source to exist at locations previously unassessed.
- Vapours originating from petroleum hydrocarbons and VOC impacted groundwater is considered to be a potentially complete pathway. Additional assessment is required due to the potential for an unidentified source to exist at locations previously unassessed.
- Direct contact (direct or indirect) through extraction of groundwater either on or off-site is considered to be potentially complete pathway. Though considered likely it is considered to pose only a low risk to construction workers and future site residents and worker. Construction workers will be working under a site environmental management plan and basements installed within the north-western portion of Zone 2 will be sealed from seepage water.

Surface water:

- Migration of contaminated surface water from potential up gradient source locations to beneath the site is not considered to be a complete pathway. This process is considered unlikely after a review of historical works and land uses surrounding the site.
- Migration of surface water to down-hydraulic gradient location is not considered to be a complete pathway s. After a review of COPCs in surface water and that the surface water body is isolated with no immediate receiving sensitive environments it is considered to pose a low risk to the environment.
- Direct contact with the surface waterbody is considered to be a potentially complete pathway. However, after a review of COPCs it is considered to pose only a low risk to construction workers and future site residents and worker.

5.5 Assessment of Potential Exposure Routes and Exposed Populations

Exposure routes for soil, surface water, and groundwater contaminants include dermal, ingestion, and inhalation.

Exposed populations may include the following:

- Human: Workers and residents on the site, users of groundwater (actual and potential) in the local area and future site occupants.

- Ecological: plants, micro and macro invertebrates, small reptiles and small mammals.

5.6 Potential Receptors, Exposures, and Pathways

Based on the available background information, site history, site inspection, ESA works and proposed development the following conceptual site model has been developed. The AECs are sections of the site that have potentially been impacted by site activities, site conditions and/or specific features that could present an environmental concern with regards to potential contamination. The AEC and corresponding COPC are presented in **Table 5-1** below.

Table 5-1 AECs and Associated COPCs

AEC	Description and Comment	COPCs
1	**Sands, dust, surface areas located within site Kilns**. This AEC incorporates SMEC (2016A) AEC 1 and 3. This material exceeded for and EIL for commercial/industrial guidelines for lead and zinc. A complete pathway for this material currently exists for: - Leaching to the environment and groundwater.	Heavy metals, PAHs, TRH, BTEX, and Dioxins.
2	**Surface soils adjacent fan house for Kiln 1.** This AEC incorporates SMEC (2016A) AEC 2. This material exceeded for HIL D and EIL commercial/industrial guidelines for lead and zinc. A complete pathway for this material currently exists for: - Direct contact to construction workers and future site workers. - Leaching to the environment. A potentially complete pathway for this material currently exists for: - Leaching to groundwater.	Heavy metals.
3	**Pit area fill.** No guidelines have been exceeded with historical samples. However extensive fill has been identified within this location. The extent of fill has not been delineated vertically or horizontally. Potentially complete pathways exist for leaching to the environment and groundwater from fill material.	Heavy metals, TRH, BTEX, PAHs, OCP/OPPs, PCBs, Asbestos.
4	**Groundwater below the pit area.** Insufficient historical assessment has been performed at this AEC. A potentially complete pathway for this material currently exists for: - Vapours originating from petroleum hydrocarbons and VOC impacted groundwater. - Migration of groundwater to down-hydraulic gradient locations.	Heavy metals, TRH, BTEX, PAHs, PCBs.

AEC	Description and Comment	COPCs
5	**Soils below brickworks infrastructure.** This AEC incorporates SMEC (2016A) AEC 5, 6. Insufficient historical assessment has been performed at this AEC. A potentially complete pathway for this material currently exists for: - Direct exposure to construction workers. - Leaching to the environment and groundwater. - Vapours originating from petroleum hydrocarbons and VOC impacted soils.	Heavy metals, TRH, BTEX, PAHs, PCBs, Asbestos.
6	**Groundwater below brickworks infrastructure.** Insufficient historical assessment has been performed at this AEC. A potentially complete pathway for this material currently exists for: - Vapours originating from petroleum hydrocarbons and VOC impacted groundwater. - Migration of groundwater to down-hydraulic gradient locations.	Heavy metals, TRH, BTEX, PAHs, PCBs.
7	**UST.** This AEC incorporates SMEC (2016A) AEC 7. Insufficient historical assessment has been performed at this AEC. A potentially complete pathway for this material currently exists for: - Direct exposure to construction workers. - Leaching to the environment and groundwater. - Vapours originating from petroleum hydrocarbons and VOC impacted groundwater. - Migration of groundwater to down-hydraulic gradient locations.	Lead, PAHs, TRH, and BTEX.
8	**Asbestos dump.** A potentially complete pathway for this material currently exists for: - Direct exposure to construction workers, future site workers and residents. - Potential for seepage water to enter basements. - Potential for leaching to groundwater.	Heavy metals, TRH, BTEX, PAHs, OCP/OPPs, PCBs, Asbestos.
9	**Fill material**. Extensive fill material has been identified across the site. However extensive fill has been identified across the site. Where known impacts have been identified, separate AECs have been nominated (see above). Potentially complete pathways exist for:	Heavy metals, TRH, BTEX, PAHs, OCP/OPPs, PCBs, Asbestos.

AEC	Description and Comment	COPCs
	- Leaching to the environment and groundwater from fill material. - Direct exposure to construction workers, future site workers and residents.	
10	**Unassessed Footprints of low to high density residential buildings.** Insufficient historical assessment has been performed at this AEC. A potentially complete pathway for this material currently exists for: - Direct exposure to construction workers, future site workers and residents. - Potential for seepage water to enter basements. Potential for leaching to groundwater.	Heavy metals, TRH, BTEX, PAHs, OCP/OPPs, PCBs, Asbestos.
11	**Benzene in groundwater (M2 and M7).** Temporal and spatial variation of benzene concentrations within groundwater at the site have not been fully assessed. Groundwater will need to be appropriately assessed against the relevant future land use guidelines.	BTEX.

6 DATA GAP ANALYSIS

Based on a review of the previous environmental investigations, the following data gaps were identified:

- **Surface soils adjacent fan house for Kiln 1.**
  - Extent of lead impact laterally and vertically within location of SS-06 and SS-07. These surface samples were in exceedance of the HIL-D guidelines for Lead and the extent of unacceptable material should be delineated.
- **Pit area fill.**
  - Vertical and lateral extent of fill material. Since these soils are proposed to be disturbed they will need to be appropriately assessed against the relevant future land use guidelines.
- **Groundwater below the Pit area.**
  - This area has not previously been assessed for the presence of COPC. Therefore, there is insufficient data with which to assess the suitability for future use.
- **Soils below brickworks infrastructure.**
  - This area has not previously been assessed for the presence of COPC. Therefore, there is insufficient data with which to assess the suitability for future use.
- **Groundwater below brickworks infrastructure.**
  - This area has not previously been assessed for the presence of COPC. Therefore, there is insufficient data with which to assess the suitability for future use.
- **UST.**
  - This area has not previously been assessed for the presence of COPC. Therefore, there is insufficient data with which to assess the suitability for future use.
- **Asbestos dump**
  - The nature of waste material in the asbestos dump has not yet been fully characterised.
- **Unassessed Footprints of low to high density residential buildings.**
  - This area has not previously been assessed for the presence of COPC. Therefore, there is insufficient data with which to assess the suitability for future use.
- **Benzene in groundwater (M2 and M7).**
  - Temporal and spatial variation of benzene concentrations within groundwater at the site have not been fully assessed. Groundwater will need to be appropriately assessed against the relevant future land use guidelines.

7 SAMPLING AND ANALYSIS QUALITY PLAN

7.1 Guidance:

The SAQP has been prepared in accordance with the following current industry best practice guidelines and standards:

- AS 4482.1-2005 Guide to the investigation and sampling of sites with potentially contaminated soil - Non-volatile substances.
- AS 4482.2-1999 Guide to the sampling and investigation of potentially contaminated soil - Volatile substances.
- ASTM D4547 – 15 Standard guide for sampling waste and soils for volatile organic compounds.
- NEPC (2013) National Environment Protection (Assessment of Site Characterisation) Measure.
- NSW EPA (1995) Guidelines for Consultants Reporting on Contaminated Sites.
- AS 5667.11-1998 Water quality - Sampling - Guidance on sampling of groundwaters.
- ASTM D6452 – 99 (2012) Standard guide for purging methods for wells used for groundwater quality investigations.
- ANZECC & ARMCANZ (2000) Australian and New Zealand guidelines for fresh and marine water quality.

7.2 Data Quality Objective

The data quality objectives (DQOs) process is a systematic planning tool based on the scientific method for establishing criteria for data quality and for developing data collection designs. The data quality objectives define the experimental process required to test a hypothesis. The DQO process was developed to ensure that efforts relating to data collection are cost effective, by eliminating unnecessary, duplicative or overly precise data whilst at the same time, ensuring the data collected is of sufficient quality and quantity to support defensible decision making.

It is recognised that the most efficient way to accomplish these goals is to establish criteria for defensible decision making before the data collection begins, and then develop a data collection design based on these criteria. By using the DQO process to plan the investigation effort, the relevant parties can improve the effectiveness, efficiency and defensibility of a decision in a resource and cost effective manner.

DQOs have been developed to detail the type of data that is needed to meet the overall objectives of this project. The DQOs presented in this document have been developed consistent with the following published guidance:

- National Environment Protection Council (1999) National Environmental Protection Measure 1999 as amended 2013 – Assessment of Site Contamination. Schedule B(2) Guideline on Site Characterisation;
- Australia Standards, AS4482.1-2005, Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil, Part 1: Non-Volatile and Semi-Volatile Compounds;
- Australia Standards, AS4482.2-1999, Guide to the Sampling and Investigation of Potentially Contaminated Soil, Part 2: Volatile Substances;
- AS 4482.1-2005 Guide to the investigation and sampling of sites with potentially contaminated soil - Non-volatile substances

- AS 4482.2-1999 Guide to the sampling and investigation of potentially contaminated soil - Volatile substances
- ASTM D4547 – 15 Standard guide for sampling waste and soils for volatile organic compounds
- NSW EPA (1995) Guidelines for Consultants Reporting on Contaminated Sites

The DQO process is a seven-step method to optimise the design of the sampling and analysis plan to ensure that all objectives of the investigation are met. The seven steps are outlined as follows:

- **Step 1:** State the Problem – concisely describe the problem to be studied. Review prior studies and existing information to gain a sufficient understanding to define the problem.
- **Step 2:** Identify the Decision – identify what questions the study will attempt to resolve, and what actions may result.
- **Step 3:** Identify the Inputs to the Decision – identify the information that needs to be obtained and the measurements that need to be taken to resolve the decision statement.
- **Step 4:** Define the Study Boundaries – specify the time periods and spatial area to which decisions will apply. Determine when and where data should be collected.
- **Step 5:** Develop a Decision Rule – define the statistical parameter of interest, specify the action level, and integrate the previous DQO outputs into a single statement that describes the logical basis for choosing among alternative actions.
- **Step 6:** Specify Tolerable Limits on Decision Errors – define the decision maker's tolerable decision error rates based on a consideration of the consequences of making an incorrect decision.
- **Step 7:** Optimise the Design – evaluate information from the previous steps and generate alternative data collection designs. Choose the most resource-effective design that meets all DQOs.

The DQOs proposed for this project are as follows:

Table 7-1 *Data Quality Objectives*

Item	Description
State the Problem	Insufficient characterisation of both soil and groundwater conditions has been performed in previous environmental investigations. Therefore, additional soil and groundwater assessment at several locations is required. This further assessment will allow for a statement on the extent of impact and or each areas suitability for future use.
Identify the Decision	The goal of the study is to determine: • The nature and extent (lateral and vertical) of impacts to soil and groundwater on-site. • Any potential unacceptable risks to human health and/or ecological receptors on or off-site. • Is further investigation/management required on-site or off-site to delineation the identified contamination.
Identify the Inputs to the Decision	• Inputs to the decision include: – The conceptual site model. – Current data gaps. – Analytical suite. – Assessment criteria.

	– Data acceptance criteria. – Measurements from the site.
Define the Study Boundaries	The study boundaries will be restricted to: • The cadastral boundary of the site. The study area is shown in **Figure 2, Appendix A**.
Develop a Decision Rule	Soil and groundwater data will be assessed with respect to the human health and ecological assessment criteria listed in **Section 7.3**. The requirement for further investigation/management will be triggered based on comparison of the data to the screening criteria adopted. Statistical analysis of the data may be applied in cases where minor exceedance of screening criteria is observed.
Specify Tolerable Limits on Decision Errors	The acceptable limits for samples are as follows: • Data complies with laboratory quality standards. • The following relative percentage difference (RPD) criteria will apply: – RPD of 50 % or less, for concentrations > or = 10 times estimated quantitation limit (EQL). – RPD of 75 % or less, for concentrations between 5 and 10 times the EQL. – RPD of 100 % or less, for concentrations < 5 times EQL. Where acceptable limits for field duplicates are not met, a discussion on low biased error will be provided.
Optimise the Design	The plan for obtaining representative data is provided in **Section 7.4**.

7.3 Assessment Criteria

Due to differing land uses, as noted within the master plan, at the site the assessment criteria will vary. Zones, identifying these areas a provided below and outlined in **Figure 6, Appendix A**.

- Zone 1 – Low density residential.
- Zone 2 – Medium density residential.
- Zone 3 – High density residential.
- Zone 4 – Recreational.
- Zone 5 – Commercial.

If the master plan is amended, then the zone locations will be required to be amended. Furthermore, the surveying of each of the above land uses will be require at a later date to ensure the integrity of each zone. The specific assessment criteria for each zone is provided in **Table 7-2**.

Due to the incomplete understanding of the sites hydraulic nature, the water bearing units, and the potential for preferential pathways between units the groundwater at the site will be assessed against the most conservative proposed land use.

All assessment criteria for the site are summarised and tabled below with additional discussion provided in the following sections.

Soil:

- ASC NEPC (2013):
  - EIL:
    - Urban residential and public open space – generated from data sourced from Robson (2015).
    - Commercial/industrial – generated from data sourced from Robson (2015).
  - ESL (fine soil texture):
    - Urban residential and public open space.
    - Commercial/industrial.
  - Management Limits (MLs) for TPH fractions F1-F4 in soil (fine soil texture):
    - Residential, parkland and public open space.
    - Commercial and industrial.
  - HSLs (Clay):
    - HSL A and HSL B – low to high density residential.
    - HSL C – recreational/open space.
    - HSL D – commercial/industrial.
  - HILs:
    - HIL A – residential – accessible soil.
    - HIL B – residential – minimum soil access.
    - HIL C – recreational.
    - HSL D – commercial/industrial.

Groundwater:

- ASC NEPC (2013):
  - Groundwater Investigation Levels (GILs) – Freshwater.
  - Health Screening levels (HSL-A Clay) for vapour intrusion based on groundwater concentrations for residential land-use with access to soil.
- ACT Department of the Environment, Climate Change, Energy and Water Environmental Guidelines for Services Station Sites and Hydrocarbon Storage, September 2011 (ACT Service Stations).
- ACT Planning and Land Authority (2009) 'Water Use and Catchment General Code' ACT Water Quality Guidelines Regulation – Aquatic habitat – Urban drains and streams (AQUA-4).

Table 7-2 *Zone Appropriate Assessment Criteria*

Zone	Soil	Groundwater
1 and 2	• EIL - Urban residential and public open space. • ESL - Urban residential and public open space. • MLs -residential, parkland and public open space. • HSL A and HSL B – low to high density residential. • HIL A – residential – accessible soil.	• GILs – Freshwater. • HSL-A Clay • ACT Service Stations. • AQUA-4.
3	• EIL - Urban residential and public open space. • ESL - Urban residential and public open space. • MLs -residential, parkland and public open space. • HSL A and HSL B – low to high density residential. • HIL B – residential – minimum soil access.	
4	• EIL - Urban residential and public open space. • ESL - Urban residential and public open space. • MLs – Commercial and industrial. • HSL C – recreational/open space. • HIL C – recreational.	
5	• EIL – Commercial-Industrial. • ESL - Commercial-Industrial. • MLs -residential, parkland and public open space. • HSL D – commercial/industrial. • HSL D – commercial/industrial.	

7.3.1 Rationale for Selection Soil Assessment Criteria

Both the EIL and ESL (fine grained) guidelines were selected to evaluate the risk of historical practices at and surrounding the site to terrestrial ecosystems within the initial 2m bgl. However, EILs will not be considered relevant where below sealed surfaces (e.g roadways and buildings).

EILs used within this report were generated from data sourced from the Robson (2015) report and are considered suitable for the proposed works. EIL ASC NEPM (2013) toolbox calculations are provided in **Appendix B**. Arcadis further notes that the EILs will be amended as additional data will be sources as part of additional intrusive investigation.

MLs have been adopted due to AEC 7 at the site, as well as other minor hydrocarbon concentrations in historical soil samples. MLs are used to consider the potential formation of light non aqueous phase liquids, fire and explosion risks and damage to

buried infrastructure. Fine grained soil was selected due to the soil types observed at the site during intrusive works.

Soil concentrations have been assessed against the ASC NEPM (2013) HILs due to the multiple proposed future uses of the site.

Soil concentrations have also been assessed against the HSLs to evaluate the risk posed from vapour intrusion. The ASC NEPM (2013) has generally adopted the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC Care) HSLs for soil with some minor deviations. The soil HSLs are based on depth of impacts, overlying soil type and land use. The selection of HSL A was based on the intended use of the site, the potential receptor/s onsite and the exposure that may be experienced. After a review of subsurface conditions the HSLs for media material will be selected once clay is considered to be the most appropriate for soils identified during intrusive works at the site. Furthermore, the HSLs for the assessment for asbestos has additionally been selected.

Soil analytical results and guideline criteria are provided below in Table 7-3.

Yarralumla Brickworks, ACT
Table 7-3 SACs mg/kg

Analyte	HSL A and B	HSL C	HSL D	HSL Depths	ML - Res	ML - Com	HIL A	HIL B	HIL C	HILD	ESL - Res	ESL - Com	EIL - Res	EIL - Com
Benzene	3	NL	4	0 to <1m							65	95		
	3	NL	6	1m to <2m										
	3	NL	9	2m to <4m										
	3	NL	20	4m+										
Toluene	NL	NL	NL	0 to <1m							105	135		
	NL	NL	NL	1m to <2m										
	NL	NL	NL	2m to <4m										
	NL	NL	NL	4m+	-				-				-	
Ethylbenzene	NL	NL	NL	0 to <1m							125	185		
	NL	NL	NL	1m to <2m										
	NL	NL	NL	2m to <4m										
	NL	NL	NL	4m+										
Xylenes	230	NL	NL	0 to <1m							45	95		
	NL	NL	NL	1m to <2m										
	NL	NL	NL	2m to <4m										
	NL	NL	NL	4m+										
	260	NL	310	0 to <1m	800	800					120	170		

Yarralumla Brickworks, ACT

Analyte	HSL A and B	HSL C	HSL D	HSL Depths	ML - Res	ML - Com	HIL A	HIL B	HIL C	HILD	ESL - Res	ESL - Com	EIL - Res	EIL - Com
F1 (Total TRH C6-C10 less BTEX)	370	NL	480	1m to <2m										
	630	NL	NL	2m to <4m										
	NL	NL	NL	4m+										
F2 (TRH >C10-C16 less Naphthalene)	NL	NL	NL	0 to <1m	1000	1000					120	170		
	NL	NL	NL	1m to <2m										
	NL	NL	NL	2m to <4m										
	NL	NL	NL	4m+										
F3 TRH >C16-C34	-	-	-	-	3500	5000					1300	2500		
F4 TRH >C34-C40	-	-	-	-	10000	10000					5600	6600		
Naphthalene	NL	NL	NL	0 to <1m	-						-		170	370
	NL	NL	NL	1m to <2m										
	NL	NL	NL	2m to <4m										
	NL	NL	NL	4m+										
Arsenic	-						500	500	300	3000	-		100	160
Cadmium							150	150	90	900			-	-
Chromium							500	500	300	3600			380	620
Copper							30,000	30000	17000	240000			380	620
Lead							1200	1200	600	1500			1131	1800
Nickel							1200	1200	1200	6000			170	280
Zinc							60,000	60000	30000	400000			430	650

Yarralumla Brickworks, ACT

Analyte	HSL A and B	HSL C	HSL D	HSL Depths	ML - Res	ML - Com	HIL A	HIL B	HIL C	HILD	ESL - Res	ESL - Com	EIL - Res	EIL - Com
Mercury							120	120	80	730			-	-
Benzo(a)pyrene (BaP TEQ)							4	4	3	40	0.7	0.7	-	-
Total PAH							300	400	300	4000	-		-	
Asbestos % w/w FA and AF*	No visible asbestos at surface. -						-				-		-	
	0.001 to 0.04	0.02	0.05	-										
	0.01%													
DDT	-												180	640

* The screening level of 0.001% w/w asbestos in soil for FA and AF (i.e non-bonded/friable asbestos) only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not appropriate to free fibres. As yet there is no validated method, readily available in Australia, of reliably estimating the concentration of free fibres in soil. Soil contamination by free asbestos fibres should therefore be simply determined according to the presence or absence of fibres, in accordance with AS4964-2004.

7.3.2 Rationale for Selection of Groundwater Assessment Criteria

ASC NEPM (2013) GILs have been selected as an initial screening level as they provide concentrations which once exceeded require further investigation into points of extraction and use. With respect to use of groundwater for human purposes, the site is located within a residential area that has ready access to a potable reticulated water source. As such, the groundwater at the site, and within the immediate region, is considered unlikely to be used for drinking water. Given these factors the drinking water guidelines are not considered to be applicable to the site. The GIL for freshwater aquatic ecosystems are applicable as they apply to typically slightly too moderate disturbed systems, of which the site is located. Furthermore, as an abstraction bore is located approximately 600 to 700m west by south west of the site the GIL for irrigation is not considered to be relevant.

Hydrocarbon concentrations in groundwater (if present) have also been assessed against the HSL to evaluate the risk posed from vapour intrusion. Due to the unknown hydraulic nature the sites water bearing units and the potential for preferential pathways between units groundwater at the site will be assessed against the most conservative proposed land use. After a review of subsurface conditions the HSLs for clay are considered to be the most appropriate for soils at the site.

The ACT Service Station Hydrocarbon Guidelines provide groundwater monitoring guidelines which are relevant to the site as they are designed to achieve appropriate pollution controls to assist sites which have had underground petroleum storage systems. Furthermore, the guidelines provide criteria which once exceeded, state that notification must be provided to the ACT EPA. Due to the presence of a UST at the site this guideline is suitable for assessment.

The site is located within an urban area, the Lower Molonglo catchment and is considered a urban area. After a review of the sites location and likely discharge options, Arcadis believes the most relevant groundwater criteria for the site is Aquatic habitat – Urban drains and streams (AQUA/4). The objectives of the ACT water quality guidelines is to:

- Protect and conserve the water quality of groundwater resources of the Territory.
- Ensure that the stream flow and quality of discharges from the catchment are consistent with the protection of downstream environment values.
- Ensure that water and catchment land uses are consistent with maintaining the predominant drainage function and other values of the catchment.
- Make provision for a range of other non-drainage water uses and environmental values that are compatible with the drainage function of the catchment.
- Make provision for urban, open space and rural drainage as the predominant water use.

The adopted screening levels for groundwater criteria are tabled below in Table 7-4.

Table 7-4 GACs

Analyte	HSL A for Clay mg/L		GIL – Freshwater µg/L	AQUA 4 µg/L	ACT Service Station µg/L
Benzene	5	2 to <4m	950	300	950
	5	4m to <8m			
	5	8+			
Toluene	NL	2 to <4m	-	300	300
	NL	4m to <8m			
	NL	8+			
Ethylbenzene	NL	2 to <4m	-	140	140
	NL	4m to <8m			
	NL	8+			
Xylenes	NL	2 to <4m	200	-	350 (m &P) 200 (o)
	NL	4m to <8m			
	NL	8+			
F1 (Total TRH C_6-C_{10} less BTEX)	NL	2 to <4m	-	-	-
	NL	4m to <8m			
	NL	8+			
F2 (TRH >C_{10}-C_{16} less Naphthalene)	NL	2 to <4m	-	-	-
	NL	4m to <8m			
	NL	8+			
TRH C_{10}-C_{40}	-	-	-	-	600
Naphthalene	NL	2 to <4m	16	-	-
	NL	4m to <8m			
	NL	8+			
Arsenic	-		13	50	-
Cadmium	-		0.2	0.2	-
Chromium	-		1	2	-
Copper	-		1.4	2	-
Lead	-		3.4	1	3.4
Nickel	-		11	25	-
Zinc	-		8	5	-
Mercury	-		0.06	0.1	-
Benzo(a)pyrene (BaP TEQ)	-		-		0.7
Total PAH	-		-	3	-
DDT	-		0.006	0.001	-

7.4 Proposed Sampling and Analytical Program

7.4.1 Overview

This section of the SAQP discusses the sampling and analysis program for the proposed investigation strategy. It has been developed in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013 (NEPC, 2013), the NSW EPA Sampling Design Guidelines (NSW EPA, 1995) and the Guidelines for Consultants Reporting on Contaminated Sites (OEH, 2011).

The sampling program will be carried out in accordance with technical procedures outlined in this section. To the extent possible all fieldwork will be performed in accordance with the Australian Standard, Guide to the Sampling and Investigation of Potentially Contaminated Soil (AS4482.1/2005).

7.4.2 Pre-Planning

Prior to intrusive works including test pitting and groundwater well installation all locations will be cleared of underground services as follows:

- Prepare occupational health and safety documentation for the proposed investigative works.
- The Dial-Before-You-Dig plans will be reviewed and will be available on site.
- Any available as-built plans will be reviewed and will be available on site.
- An experienced and suitably qualified underground service locator will mobilise to site to mark out the locations of all sub-surface infrastructure.

7.4.3 Soil Investigation

The following soil investigation scope will be performed at the site:

- Engage a suitably qualified and experienced excavation contractor to excavate/drill approximately:
    - Thirty-two (32) test pits/300mm boreholes across previously unassessed areas below proposed residential buildings. Samples would be collected from the surface, 0.5m bgl, 1.0 m bgl and then each metre thereafter until the target depth or at changes in lithology or lenses of contamination.
    - Five (5) test pits/300mm boreholes across the pit area to horizontally and vertically assess fill material. Samples would be collected from the surface, 0.5m bgl, 1.0 m bgl and then each metre thereafter until the target depth or at changes in lithology or lenses of contamination.
    - Three (3) 150mm boreholes across the footprint of the brickworks facility to assess soil conditions. These holes would be converted to groundwater monitoring wells. Samples would be collected from the surface, 0.5m bgl, 1.0 m bgl and then each metre thereafter until the target depth or at changes in lithology or lenses of contamination.
    - Five (5) test pits within the Asbestos Dump area to further characterise the nature of waste material in the dump and provide information regarding the potential bulking factor of this material.
        - As any test pits excavated into the dump area will need to consider the risk of asbestos fibres being released into the atmosphere, a licensed Asbestos Assessor would be engaged to undertake air monitoring for

airborne fibres during the excavation and sampling of test pits. The filter membranes would be analysed by a NATA accredited laboratory in accordance with the NOHSC: 3003 (2005) '*Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust*'.

- As it is understood that that there is a clean capping layer of soil across the dump, the capping layer would be carefully removed and stockpiled separately before excavating the waste material in the dump. At the completion each test pit, the excavated material would be backfilled in reverse order with the capping material placed on top and track rolled.
- The surface of each test pit after backfilling would be inspected by a licensed asbestos assessor for fragments of ACM.

- Six (6) samples collected from within the kilns to assess for lead impacted soils.

- A suitably qualified and experienced environmental scientist would supervise the excavation of each test pit/borehole. Each test pit/borehole would be logged in general accordance with the Universal Soil Classification System (USCS) and samples collected at regular intervals, changes in geology or in zones of gross contamination. The coordinates of each test-pit sample location would recorded with a hand held GPS unit.
- Each test pit/hope hole will be advanced to at least 0.5m into natural material where practicable.
- Soil samples would be sent to a NATA accredited laboratory for analysis. Each sample would be analysed dependant on AEC for select COPCs as identified in **Table 5-1** above.
- The COPCs selected for analysis may be subject to variation depending upon the potential risks of these contaminants being present within the sample area.
- Each test pit/borehole, where not being converted into a groundwater monitoring well will be backfilled upon completion and track rolled with the excavator or back hoe.

Sample locations are provided on **Figure 8, Appendix A**.

7.4.4 Groundwater Investigation

The following groundwater investigation scope will be performed at the site:

- Engage a suitably qualified and experienced drilling contractor to drill and assist with the installation of approximately:
  - Four (4) groundwater monitoring wells converted from boreholes across the footprint of the brickworks facility.
  - One (1) groundwater monitoring well converted from a borehole within the pit area.
- A suitably qualified and experienced environmental scientist would supervise the excavation of each test pit/borehole. Each test pit/borehole would be logged in general accordance with the Universal Soil Classification System (USCS) and samples collected at regular intervals, changes in geology or in zones of gross contamination.
- All five (5) of the bores will be converted to groundwater wells and developed using a stainless-steel bailer.

- A suitably qualified environmental scientist would be mobilised to the site no sooner than five (5) days after development with the appropriate equipment for collecting groundwater samples, using low flow techniques.
- Each monitoring well located on site would be gauged to measure the depth of groundwater beneath the site and allow the calculation of the groundwater flow direction.
- A suitably qualified and experienced surveying contractor will be engaged to survey in all the new monitoring wells.
- Samples would be collected from ten (10) wells across the site.
- Samples would be submitted to a NATA accredited laboratory where each sample would be analysed for:
- Existing monitoring wells (M2 to M7) – Heavy metals and BTEX
- Additional monitoring wells - Heavy metals, TRH, BTEX, PAHs, and PCBs.

Sample locations are provided on **Figure 8, Appendix A**.

7.5 Sampling Methodologies

7.5.1 Soil Sampling Methodology

The target depth of each test pit would be either 1.0 m bgl or where fill is encountered, the test pit would be terminated at least 0.5 m below the boundary between fill and the natural soil.

Soil samples would be collected at the surface, 0.5 m bgl, 1 m bgl and then each metre thereafter until the target depth or at changes in lithology (e.g. at the interface between capping material and landfill material) or lenses of contamination.

Soil will be removed from each test pit using an excavator or backhoe and sampled by hand from the inside of the bucket. Soil samples will be sampled by hand using new, disposable nitrile gloves.

Part of the soil sample will then be placed into snap lock plastic bags for screening with a Photo-ionisation Detector (PID). The remainder of the sample will be placed directly into a laboratory prepared 250 ml glass jar with the details of the sample, including the sample name, the job number, the date of sampling and the sample depth.

7.5.2 Groundwater Sampling Methodology

Groundwater monitoring wells will be sampled as follows:

- All wells will be gauged for depth to groundwater and depth to the base of the wells with an oil-water interface probe prior to sampling.
- Groundwater will be purged using Low-flow micro purge pumps using HDPE tubing, connected to an in-line flow cell. The in-line flow cell will house probes to measure groundwater physico-chemical parameters including pH, temperature, electrical conductivity, reducing/oxidising potential and dissolved oxygen concentration. Purging will continue at a rate of less than 0.1L/min, the rate will be adjusted to ensure the water level does not fall more than 25% of the initial standing water level.
- Purging will continue until groundwater physico-chemical parameters stabilize to within +/- 10% for three consecutive readings.

- Once the physico-chemical parameters have stabilized groundwater samples will be collected in laboratory supplied and preserved sample bottles. Samples for dissolved metals analysis will be passed through a 0.45 micron in-line filter.

7.5.3 Sampling Handling, Preservation, and Storage

Samples will be collected in accordance with standard operating procedures, based on the NEPM Australian Standard (AS4482.1-2005, AS4482.2-1999) and NSW EPA Requirements.

This will include sample logs to describe the media collected, use of chain of custody procedures, and dispatching samples with appropriate preservation. Samples will be placed in chilled containers, and refrigerated if not dispatched to the laboratory on the day of sampling. All samples will be analysed within holding times.

7.5.4 Decontamination

Where items are reused between sample locations (e.g. interphase ptobes prior to being used at the next sampling location they will be was sprayed with a mix of phosphate free detergent, scrubbed, and rinsed with potable water.

7.6 Analytical Plan

The proposed analytical plan for soil and groundwater samples collected is summarised in Table 7-5 below.

Area	Description	No Primary Samples	Analytes
AEC 1	Kiln Sand inside kilns	6	TRH, BTEX, PAH, Heavy Metals, Dioxins (2 Samples)
AEC 3	Fill in former clay pit	10	Heavy metals, TRH, BTEX, PAHs, OCP/OPPs, PCBs, Asbestos.
AEC 5	Soil beneath Brickworks infrastructure	10	Heavy metals, TRH, BTEX, PAHs, PCBs, Asbestos.
AEC 8	Asbestos Dump	Nil	No sampling Proposed
AEC 10	Infill sampling of low density and high density housing	64	Heavy metals, TRH, BTEX, PAHs, OCP/OPPs, PCBs, Asbestos.
AEC11	Groundwater	10	TRH, BTEX, PAH, Heavy Metals

7.7 Quality Assurance / Quality Control (QA/QC)

For the DQO process, the principal data quality indicators (DQIs) are precision, accuracy, representativeness, comparability and completeness. For completeness,

these DQIs are defined below. Laboratory DQOs are the acceptance thresholds for site data based on the individual DQIs for each matrix and analyte group or analyte:

- Accuracy is a measure of the agreement between an experimental determination and the true values of the parameter being measured.
- Precision is a measure of the agreement between duplicate or replicate samples.
- Representativeness is a measure of how closely the measured results reflect the actual concentration or distribution of the chemical constituent in the matrix sample.
- Comparability is a qualitative assessment made to express the confidence with which one data set may be compared with another.
- Completeness is defined as the percentage of total measurements made that are judged to be valid.

A field QA/QC program must be conducted in accordance with the NEPC (2013) and Australian Standard AS4482.1-2005 requirements to measure the precision of the field and laboratory analyses and to determine the accuracy of the analytical results. All samples will be analysed by NATA accredited laboratories. Field QA will include compliance with appropriate standard operating procedures. QC samples will be undertaken at the frequencies shown below:

Precision

- Field duplicates ≥ 5%
- Inter-laboratory duplicates ≥ 5%
- Laboratory duplicates ≥ 10%

Accuracy

- Surrogate spikes All organics by GC
- Matrix spikes ≥ 1/media type
- Laboratory control samples ≥ 1/lab batch

Representativeness

- Rinsate samples ≥ 1/field batch
- Trip blanks ≥ 1/field batch (volatiles)
- Laboratory blanks ≥ 1/lab batch

The QA/QC program will also include an assessment of comparability and completeness. No additional samples will be collected for these quality attributes, rather their assessment will focus on consideration of relevant field and laboratory factors.

Evaluation of the field DQI compared to the DQOs will be completed as follows:

Documentation completeness:

- Chain-of-custody forms completed and appropriate.

Data completeness:

- All samples received by the laboratories and analytical results reported including laboratory QA/QC.

Data comparability:

- Arcadis standard operating procedures (SOPs), Australian Standards and industry best practice followed during sediment sampling.
- Consistent field conditions and staff used during sampling.

- Standard analytical methods used by the laboratories for all analyses.
- The limits of reporting are appropriate and consistent from each laboratory.

Data representativeness:

- Rinsate samples indicate that decontamination procedures adequate.
- The frequency of laboratory blanks acceptable and the results are within specified ranges.

Precision:

- Field duplicates collected at a minimum rate of 1:20 for soil and groundwater samples. These rates are within the Australian Standard (AS1482.1 1997) and Arcadis' QA frequency ranges.
- Inter-laboratory duplicates collected at the same rate as intra-laboratory duplicates.
- Laboratory duplicates are collected at the expected rate.

Relative percent difference (RPD) between primary samples and complementary field and laboratory duplicates shall be within appropriate limits. Recoveries of laboratory surrogates, spikes and control samples shall be within appropriate limits.

The acceptable limits for sediment are as follows:

- %RPD for laboratory duplicates is less than 60%.
- Recovery of matrix spikes and surrogate spikes is as per the laboratory's Quality Assurance targets accepted under their NATA accreditation.

Precision is measured using the standard deviation 'SD' or Relative Percent Difference '%RPD'. Replicate data for field duplicates of organics is expected to be as follows:

- RPD criteria of 50% or less, for concentrations > or = 10 times PQL.
- RPD criteria of 75% or less, for concentrations between 5 and 10 times the PQL.
- RPD criteria of 100% or less, for concentrations < 5 times PQL.

Where acceptable limits for field duplicates are not met, a discussion on low biased error will be provided.

7.8 Reporting

Preparation of an assessment report detailing the following:

- Investigation and sampling methodology.
- Laboratory and field QA/QC.
- Comparison of soil and water analytical results against assessment criteria adopted for the protection of beneficial uses.
- Figures indicating sample locations.
- Discussion, conclusions and recommendations.

8 REFERENCES

ANZECC & ARMCANZ (2000) Australian and New Zealand guidelines for fresh and marine water quality

AS 4482.1-2005 Guide to the investigation and sampling of sites with potentially contaminated soil - Non-volatile substances.

AS 4482.2-1999 Guide to the sampling and investigation of potentially contaminated soil - Volatile substances.

AS 5667.11-1998 Water quality - Sampling - Guidance on sampling of groundwater

ASTM D4547 – 15 Standard guide for sampling waste and soils for volatile organic compounds.

ASTM D6452 – 99 (2012) Standard guide for purging methods for wells used for groundwater quality investigations

Lovell Chen (2010) 'Canberra Brickworks – Denman Street, Yarralumla, Canberra - Conservation Management Plan'.

NEPC (2013) National Environment Protection (Assessment of Site Characterisation) Measure.

NSW EPA (1995) Guidelines for Consultants Reporting on Contaminated Sites.

Robson Environmental (2015) 'Stage 1 Environmental Site Assessment, Canberra Brickworks Remediation Project, Block 1 Section 102 Yarralumla, Canberra Central ACT' (Reference: 9623_EAR_Stage 1 ESA Report_20150312).

SMEC (2014) 'Preliminary (Environmental) Site Investigation, Canberra Brickworks' (Reference: 3002219).

SMEC (2016A) 'Canberra Brickworks: Detailed Environmental and Geotechnical Site Investigation, Canberra Brickworks Precinct, Yarralumla, ACT' (Reference: 3002523).

SMEC (2016B) 'Canberra Brickworks: Groundwater Investigation-Addendum Report, Canberra Brickworks Precinct, Yarralumla, ACT' (Reference 3002523).

9 Limitations

The findings of this report are based on the Scope of Work described in this report. Arcadis Australia Pacific Pty Limited (Arcadis) performed the services in a manner consistent with the level of care and expertise exercised by members of the environmental profession.

No warranties, express or implied, are made. Subject to the Scope of Work, Arcadis' assessment is limited strictly to identifying typical environmental conditions associated with the subject property.

While normal assessments of data reliability have been made, Arcadis assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of Arcadis, or developments resulting from situations outside the scope of this project

Arcadis prepared this report for the sole and exclusive benefit and use of the client. Notwithstanding delivery of this report by Arcadis or the client to any third party, any copy of this report provided to a third party is provided for informational purposes only, without the right to rely.

Information from samples collected by Arcadis personnel relating to soil, water, groundwater, waste, air or other matrix conditions in this document is considered to be accurate at the date of issue. Surface, subsurface and atmospheric conditions can vary across a particular site or region, which cannot be wholly defined by investigation. As a result, it is unlikely that the results and estimations presented in this report will represent the extremes of conditions within the site that may exist. Subsurface conditions including contaminant concentrations can change in a limited period of time and typically have a high level of spatial heterogeneity.

From a technical perspective, there is a high degree of uncertainty associated with the assessment of subsurface, aquatic and atmospheric environments. They are prone to be heterogeneous, complex environments, in which small subsurface features or changes in geologic conditions or other environmental anomalies can have substantial impact on water, air and chemical movement.

Arcadis' professional opinions are based upon its professional judgment, experience, and training. These opinions are also based upon data derived from the limited testing and analysis described in this report. It is possible that additional testing and analysis might produce different results and/or different opinions. Arcadis has limited its investigation(s) to the scope agreed upon with its client.

That standard of care may change and new methods and practices of exploration, testing and analysis may develop in the future, which might produce different results.

APPENDIX A

Figures



Legend

Site Boundary

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User CommunityESRI Street Maps, Near Maps 2017

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Site Location:
Yarralumla Brickworks, 2600, ACT

17152

Figure 1:
Site Location

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ID	Descriptio
2	Concrete Retaining Wall
3	Pow er House
4	Staffordshire Kiln (Kiln 1)
5	Fan House for Kiln 1 (Fanhouse 1)
6	Chimney Stack for Kiln 1 (Stackhouse 2)
7	Offices
8	Hardy patent Kiln (Kiln 2)
9	Fan House for Kiln 2 (Fanhouse 2)
10	Chimney Stack for Kiln 2 (Stackhouse 3)
11	Amenities Block
12	Hardy Patent Kiln (Kiln 3)
13	Chimney Stack for Kiln 3 (Stackhouse 4)
14	Machine Bay I for Kiln 1
15	Machine Bay II for Kiln 2
16	Machine Bay III for Kiln 3
17	Workshop
18	Small Crusher House (Crusher House 1)
19	Larger Crusher House (White Pan Room / Crusher House II)
20	Primary Crusher House (Crusher House III)
21	Elevator / Converyor
22	Dow ndraft Kilns (Kiln 4 - 6)
23	Dow ndraft Kiln Control Room
24	Chimney Stack for Kilns 4 - 6 (Stackhouse 1)
25	Toilet Block
26	Amenities Block
27	Substation / Control Room
28	Boiler House
29	Ancillary Storage Building
30	Remnant of Extrusion Plant (Concrete Pad)
31	Ancillary Storage Building
32	Storage Shed
33	Model Railw ay Workshop
34	Model Railw ay Storage Shed
35	Forklight Shed (Former)
36	Weighbridge (Former)
37	Sleeping Quarters 2
38	Sleeping Quarters 2
39	Hut
40	Hut
41	Hut
42	Hut
43	Latrine
44	Kitchen and Mess Hall

Legend

- Site Boundary
- Former Brickwork
- Timber Storage
  - Unsealed Ground Surface
  - Sealed Ground Surface

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User CommunityESRI Street Maps, Near Maps 2017

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0 25 50 75 100 m

Site Location:
Yarralumla Brickworks, 2600, ACT

17152

Figure 2:
Site Description

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Legend

- Site Boundary
- Proposed Sampling Locations
- Proposed GW Well
- Proposed Kiln Sample
- Proposed Asbestos Dump Test Pit

N

0 25 50 75 100 m

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User CommunityESRI Street Maps, Near Maps 2017

Site Location:
Yarralumla Brickworks, 2600, ACT

17152

Figure 3: Proposed Land Uses

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Legend

- Site Boundary
- Fill Contours (0.4m interval)

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User CommunityESRI Street Maps, Near Maps 2017

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0 25 50 75 100 m

Site Location:
Yarralumla Brickworks, 2600, ACT

Figure 4:
Fill Contours

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Legend

- SMEC_Monitoring Wells
- Site Boundary

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User CommunityESRI Street Maps, Near Maps 2017

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0 25 50 75 100 m

Site Location: Yarralumla Brickworks, 2600, ACT	Figure 5: Groundwater Contours
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Legend

- Site Boundary
- Proposed Sampling Locations
- Proposed GW Well
- Proposed Kiln Sample
- Proposed Asbestos Dump Test Pit

N

0 25 50 75 100 m

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User CommunityESRI Street Maps, Near Maps 2017

Site Location:
Yarralumla Brickworks, 2600, ACT

Figure 6:
Proposed Sampling Locations

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Legend

- Site Boundary
- SMEC_
  - SMEC_PSI
  - Trench
  - Test Pits
  - Surface Sample
  - Monitoring Wells
- Hand Auger
- Grab Sample
- Bore Holes
- Robsons_
  - Test Pits
  - Transect

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User CommunityESRI Street Maps, Near Maps 2017

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0 25 50 75 100 m

Site Location:
Yarralumla Brickworks, 2600, ACT

Figure 7:
Existing Monitoring Locations

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May 2020 Ref. EIS201900047 Contamination Summary

David Murphy

Senior Design Manager

BLOC ACT

Dear David,

Canberra Brickworks EIS201900047
Contamination Summary

Introduction

Agon Environmental Pty Ltd (Agon) has prepared this Contamination Summary to address relevant conditions of the EIS20190047 for inclusion in the EIS being prepared by Umwelt Australia. The conditions addressed by the summary are as follows:

1. *Undertake a detailed contamination assessment of the 10 Areas of Environmental Concern (AEC) identified and in accordance with EPA guidelines.*
2. *Describe the composition and source of all fill intended for use at the site.*
3. *Provide details of any contaminants within fill to be used on site and identify additional areas of concern for assessment in accordance with Phase 2 investigations.*
4. *Provide a Remediation Action Plan for the proposed remediation works in accordance with EPA guidelines.*
5. *Provide an Unexpected Finds Protocol (UFP) for all earthworks and construction activities on site.*
6. *The site must be assessed and remediated in accordance with the guidelines endorsed by the EPA by a suitably qualified environmental consultant.*
7. *The adequacy of the assessment and remedial works must be independently audited by an EPA approved environmental auditor.*
8. *Prior to the commencement of remediation works the remedial action plan (RAP) for the proposed remediation works must be reviewed and endorsed by the auditor with a copy of the RAP endorsement provided to the EPA.*
9. *Prior to the commencement of development works Auditor interim advice indicating that the commencement of development will not impact on the on-going assessment and remedial works at the site must be reviewed and endorsed by the EPA.*
10. *Prior to the area being used for other purposes the findings of the independent audit into the site's suitability for its proposed and permitted uses from a contamination perspective must be reviewed and endorsed by the EPA*
11. *Consider the potential for contaminants within soils to impact on water quality as a result of soil disturbance.*

The Canberra Brickworks has been subject to Detailed Site Investigation (DSI) undertaken by SMEC Australia in 2016[1,2,6]. The DSI outlines the assessment of Areas of Environmental Concern (AECs) in accordance with the relevant guidelines endorsed by the ACT Environment Protection Authority (EPA) in the ACT EPA (2017) *Contaminated Sites Environment Protection Policy* (CSEPP). The scope of the DSI was derived from the following documents:

- AECOM (2016) *Sampling Analysis and Quality Plan.*
- Robson Laboratories (2006) *Environmental Investigation Audit Report Yarralumla Brickworks Block 1 Section 102 Yarralumla Canberra Central ACT*.
- Robson Environmental (2010) *Review of Past Site Works and Indicative Costings for Further Assessment and Remediation, Yarralumla Brickworks, Yarralumla, ACT*.
- Robson Environmental (2016) *Contaminant Management Plan (CMP) Canberra Brickworks Remediation Project Portions of Blocks 1 and 20 Section 102 and Block 1, Section 127 Yarralumla, ACT 2600*.
- SMEC (2014) *Preliminary (Environmental) Site Investigation. Canberra Brickworks.*

The DSI built upon earlier intrusive investigations (SMEC 2014 PSI) and included the advancement of 63 test pits (TP01-TP63), collection of 20 surface samples, 18 boreholes (BH01-BH18) and installation (and sampling) of eight groundwater monitoring wells (MW01-MW08) in accordance with the AECOM (2016) SAQP. The findings of the SMEC (2016) DSI can be summarised as follows:

- **FILL**[2,11] – FILL across the brickworks was observed to be variable across the site and was dependent on the location (i.e. thicker FILL in the former quarry). Dominant features of the FILL included discarded brick waste incorporating reworked natural soils (clays and siltstone/shale cobbles). To a lessor extent minor anthropogenic were observed including concrete pieces, glass, bitumen, ash and other anthropogenic.

  Concentrations of contaminants were typically low in the FILL and met the adopted land use criteria for low density residential uses. In the absence of widespread contamination, the FILL could be reused within the site, as required, provided its geotechnical quality was considered.
- **Natural Soils** –No evidence of contamination in natural soils (Clay and bedrock) were reported.
- **AECs** – The AECs were assessed to the extent defined in the SMEC (2016) DSI, further assessment of the AECs was recommended and is described in the Arcadis (2017) *Data Review and Gap Analysis and Sampling, Analysis and Quality Plan (SAQP), Yarralumla Brickworks.*
- **Groundwater**[11] – The SMEC (2016) DSI did not identify the presence of organic groundwater contamination exceeding the adopted assessment criteria at the sample locations assessed. Elevated metals (cadmium, nickel and zinc) were reported at some groundwater monitoring locations and was hypothesised to be of natural origin but may also include an anthropogenic component.

  Further monitoring of groundwater is proposed in the Arcadis (2017) SAQP. Given the overall absence of contamination in soils at the site the movement (and/or removal) of soils during development is not expected to contribute to groundwater contamination.

The DSI was subject to review by ACT EPA accredited Contaminated Land Site Auditor Mr Lange Jorstad of Geosyntec Consultants (reference LBJ 14/02)[6,7,9]. Interim Audit Advice (IAA#07) provided by the Site Auditor following review of the DSI concluded:

In summary, the results of investigation to date have only identified a small number of discrete contamination issues, and the widespread presence of fill material does not appear to be associated with widespread chemical or asbestos impact (this comment excludes the asbestos dump area). Uncertainties remain at the site, and unexpected contamination issues may still exist despite a reasonable level of judgemental and systematic investigation, particularly given the inherent variability of fill material. Identified data gaps should be addressed if and when access constraints allow, and it is recommended that any future development should proceed under the guidance of an environmental management plan (EMP) with an unexpected finds protocol.

Any supplementary investigations (plans and results) or management plans addressing contamination at the site must be reviewed and endorsed by an accredited contaminated site auditor. Any remediation action plans prepared to address contamination issues at the site must also be submitted to ACT EPA for review and approval, following the auditor's review and endorsement, prior to implementation.

IAA#07 indicates that the development of the site could occur provided an EMP (inclusive of unexpected finds protocol) is prepared and implemented. Further assessment (if required) of the data gaps could occur throughout development as access permits. On the basis of the IAA#07 the following documents have been (or will be) prepared:

1. **Arcadis (2017)** *Data Review and Gap Analysis and Sampling, Analysis and Quality Plan* (SAQP[3]), *Yarralumla Brickworks* - Outlines the further assessment of the AECs. The additional data to inform the management and/or remediation of soils during construction including categorisation in accordance with ACT EPA Information Sheet 4 for offsite reuse and/or disposal. The SAQP is subject to review and endorsement by the Site Auditor. The scope of the SAQP will be:
    a. Advancement of an additional 40 test pit or borehole locations.
    b. Installation of an additional 5 groundwater monitoring wells.
    c. An additional sampling event of all groundwater wells.
2. **Placeholder Agon (2020)** *Site (Environmental) Management Plan, Canberra Brickworks* (SMP[5]) – Outlines the management of soils and unexpected finds during construction. The SMP requires data from the SAQP assessment scheduled to occur in late 2020. The SMP is subject to review and endorsement by the Site Auditor.
3. **Placeholder Agon (2020)** *Remediation Action Plan Canberra Brickworks (*RAP[4,8]) – Outlines the management of contaminated soils including evaluation of onsite encapsulation options during construction. The RAP requires data from the SAQP assessment scheduled to occur in late 2020. The RAP is subject to review and endorsement by the Site Auditor.

In the absence of widespread contamination in soils (FILL and/or Natural) and groundwater, development can occur subject to the implementation of the SAQP, SMP and RAP. This approach is consistent with IAA7. These documents outline the requirements for further assessment (in discrete areas), management of soils and remediation (where required) throughout development and provide a framework for development to occur from a contamination perspective.

The implementation of these documents is expected to be a condition of development via a Notice of Decision (NOD). The adequacy of implementation would be measured by a compliance review by the Site

Auditor prior, during and post development. This Site Auditor review would be the basis of the Section A Site Audit Statement (SAS), prepared by the Site Auditor, which will conclude the site to be suitable for the proposed land uses from a contamination perspective. The Section A SAS is subject to review and endorsement by the ACT EPA prior to occupancy of the site for the proposed land uses[10].