



Worker's Accommodation, Golden Valley Tree Park,
164 Old Padbury Road, Balingup WA
Structural Engineering Services Assessment

Prepared for:

Department of Biodiversity, Conservation and Attractions

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Peter Baxendale Consulting Engineer

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1. Introduction

Peter Baxendale Consulting Engineer (PBCE) was commissioned by the Department of Biodiversity, Conservation and Attractions (DBCA) to investigate and advise on the structural condition of the Worker's Accommodation building at Golden Valley Tree Park (GVTP) at 164 Old Padbury Road, Balingup.

The intent of this report is to provide professional guidance on the necessary scope of remedial and maintenance works required to enable the existing building structures to continue to perform their current tasks and be safe in operational use into the foreseeable future. The report principally relates to the building's chimney structure in its scope.

Structural Engineering services site inspection and appraisal was undertaken by Peter Baxendale in November 2022.

1.1 Background Summary

DBCA engaged heritage architects Stephen Carrick Architects (SCA) in 2022 to prepare a Conservation Management Strategy (CMS) for the heritage place. The CMS recommended use of the place as a shelter for visitors to GVTP and for hikers on the Bibbulman Track passing through the Park and set out appropriate proposed conservation works towards this goal.

Recommended Immediate Actions included the appointment of a *Structural Engineer to assess the stability and adequacy of the load bearing structures, chimney, footings, and sub-floor structures. Outcomes arising from this assessment would inform further Immediate and Urgent works.*

PBCE was engaged by DBCA to provide the required input on these items. DBCA Acting PVS Operations Officer Natasha Moore (NM) facilitated the inspection and assisted with responses to PBCE queries.

Prior to this detailed report, and interim verbal summary report was provided to SCA in December 2022.

2. Scope of Work

2.1 Requirements

The following scope of work was agreed:

- Study existing documentary evidence for the building such as may exist, including any Conservation Plan and Inherit database information.
- Visual inspection of the structure from ground level and at higher levels as may be facilitated by ladder, plus from accessible floor and ceiling spaces.
- Direct any opening up works as may be deemed important to understanding of building behaviour during the course of the inspection (client to supply operator if required).
- Interview any individuals with long association or knowledge of the building's maintenance history.
- Report findings of the inspections and provide recommendations for appropriate action, attributing a priority ranking to actions using the Heritage Council's recommended ranking scale

for Building Condition Assessment Reports.

2.2 Qualifications

The following qualifications apply to this report:

- Defects noted in this report were correct at the time of inspection. Due to the present condition, the building could deteriorate further due to exposure post inspection.
- It should be noted that some areas of the building could not be visually examined. As such it is probable that the inspection cannot identify all of the potential defects or shortcomings of the buildings.
- No intrusive investigation was undertaken within the survey. The findings of this report are based on the visual inspection only.
- No testing of material samples was carried out. Similarly, comments on specialist services not included in our areas of expertise have been excluded.
- No geotechnical or sub-surface investigations were carried out.
- No engineering measurement or calculations have been performed.
- This report has been prepared on behalf of and for the exclusive use of the Client and is subject to and issued in connection with briefing from the Client. No liability or responsibility is accepted in respect of any use or reliance upon this report by any third party.
- The report will specifically exclude the following aspects:
 - Geotechnical issues and environmental considerations.
 - Hazardous substances.
 - Acoustics.
 - Occupational Health and Safety Considerations.
 - Conformance with Disability Discrimination Act.
 - BCA compliance issues outside of the services inspected.
 - Landscape Reticulation.

The client should consider the need to engage specialist consultants to report on the above.

2.3 Available Documents

The following documents were available at the time of inspection:

- Conservation Management Strategy – SCA, 25 October 2022.

3. Observations & Recommendations

3.1 Building Structure

3.1.1 General

The building structure and its finishes has been described in depth in SCA's Conservation Management Strategy of 2022. Reference should be made to this source as the reader requires.

Key historical events relating to the site and building structure as far as can be discerned are ;

- 1880s Construction of the Worker's Accommodation as the original homestead on the GVTP site (then private farm).
- 1895 Construction of present brick Homestead on higher ground, 80m to the north.

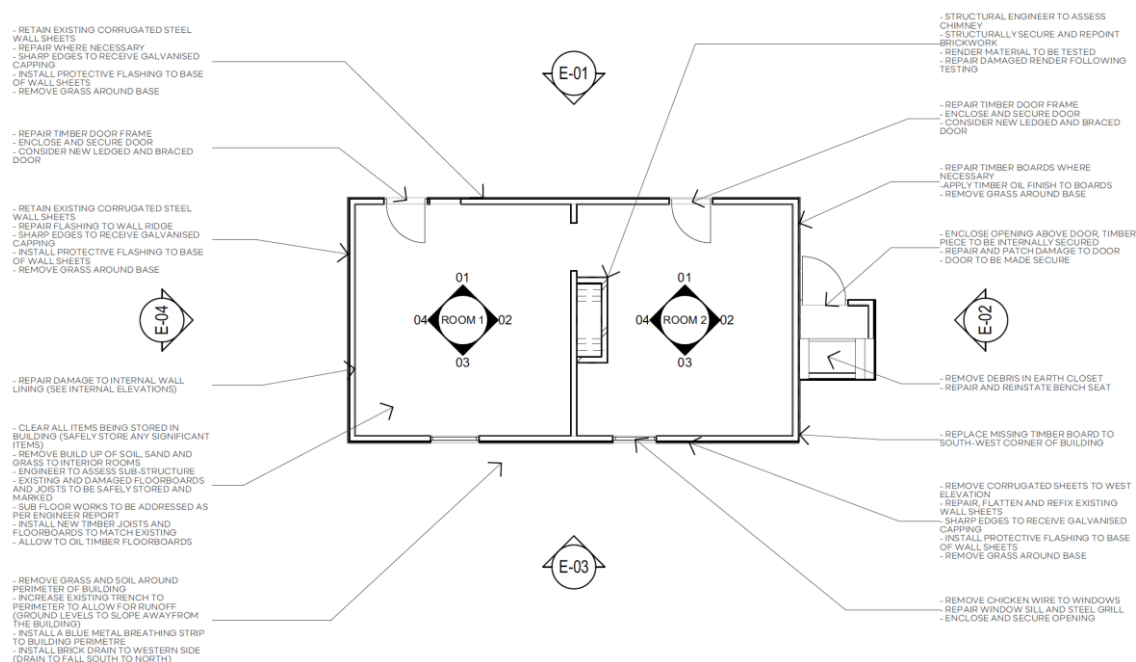
The timber-framed structure is a two-room building orientated north-south with attached closet on the south side. A timber-framed internal wall separates the two rooms. Built into the south side of this wall framing is a brick chimney breast which occupies the central third of the wall length. The breast rises and tapers to a brick central stack which penetrates the roof ridge. The fireplace and hearth faces north to serve the northern room (Room 1).

3.1.2 Zones of Heritage Significance

The Worker's Accommodation building is a state registered heritage place. As set out in the 2022 CMS, all areas and finishes in the two room structure, other than doors and windows, are of primary significance. Doors and windows are of secondary significance. All existing fabric is to be conserved with accepted conservation practice.

3.1.3 Ground Floor Plan

SCA's ground floor plan from the 2022 CMS is provided below for ease of reference. Numbering and referencing of rooms, elements and elevations are maintained in this report for sake of continuity. The north elevation is the short side of the building labelled E-04 on the plan.



3.2 Internal

3.2.1 Chimney

- The brickwork of the chimney breast is recessed into the timber framing of the internal wall to present a flush surface on the Room 1 side. Each side wall of the breast recess around a heavy post. These two posts extend up above door height where they tenon into a transverse heavy beam spanning from eaves to eaves across the width of the building. The front wall of the breast, above the fireplace mantle, is built up to the underside of the beam. These elements can be discerned in the wall finishes in elevation, refer to photograph from Room 1 below.



- This arrangement of interlock, as well as presenting a flat wall face to Room 1, also aids stability of the building well in the east-west direction, using the chimney brickwork as a self-stable mass.
- As reported in the CMS and clear to any visitor, the chimney breast is displaying stability issues in the north-south direction with a 5 degree lean to the north developed over time. The movement has inflicted a horizontal bending failure in the transverse beam at the mortice receiving the western post – the tear in the fibrous plaster sheet on the beam face in the photograph indicates this location, the jagged tear in sheets above also a symptom of the failure.
- As the chimney breast has undertaken the rotation, the stack above has followed its movement but has been resisted by the abutting roof ridge framing. The result is a sizeable diagonal tear in the base of the stack brickwork.



- The condition in the lower brickwork of the chimney, including the fireplace, is poor. It has suffered heavy mortar loss and material degradation through the effects of rising damp and poor maintenance. The photographs below are taken before and after clearance of debris from fireplace and threshold slab.



- The cause for movement in the chimney is considered a combination of factors. Key to the structure's stability is the wellbeing of fireplace cheek walls, both the condition of the masonry and the condition of support, ie. foundation and supporting soil to foundation. Each of these components has deteriorated such that self-compaction is able to take place. Historic moisture hold up in the soil has impacted on soil strength and the material health of the brickwork and mortar loss. Construction detail is simple reflecting the time of construction, there is no damp proof course, foundations will be simple continuation of wall brickwork below ground. Rabbit or other wild life burrowing is clearly a further action affecting the site. Any of these factors causing a small settlement within or below the cheek walls can produce a large rotation in the tall structure above. Soil erosion or undermining below the threshold slab has induced a significant slab crack.
- Previously independent, the chimney has progressively and inadvertently taken a level of lateral support from the timber wall and roof framing of the building. This level has increased and continues to increase as masonry deterioration continues. It is now time to slow this process with concerted conservation works to the lower masonry and assistance to the timber frame in its contributory role in stability.
- Masonry conservation works comprise a combination of local deep re-pointing, local rebuilding, local brick re-setting, crack filling and some replacement of heavier eroded brick units. Consideration also to be given to benefits or otherwise of returning render to areas where lost. All works to be considered in conjunction with proposed interpretation scheme for the site.
- Assistance to the timber frame should seek as priority to reinstate and improve the action of the (presently failed) transverse beam on the Room 1 side of the chimney. An honest permanent solution for this which minimises impact on the compressed plaster finish and room generally, is to transform the beam into a horizontal bow truss with the introduction a profiled tension cable fixed off the face of the beam and visible in the room. The sketch below gives a sense the scheme. *This action is recommended with 12 months. An alternative temporary action may be to prop the beam with raking props on to the floor of Room 1 until bow truss and masonry conservation are executed together within 24 months.*



- After this work, the necessary repairs required to external wall framing, and requirements associated with roof and external wall sheeting (see section below), the rigidity and stability of the external envelope will be sufficient to provide assistance to the chimney. *This action is recommended with 24 months.*

3.2.2 Roof and wall framing

- The roof over both rooms is an open 'cathedral' roof structure throughout (no separate no ceiling structure), the loss of the compressed fibrous plaster sheet lining reveals construction to differ between rooms. Room 2 comprises widely spaced opposing rafter pairs spanning from top wall plates to a ridge board. The pairs have a single horizontal tie below the ridge and battens to the underside of rafters and ridge ties are employed for fixing of the lining. The battens provide a side benefit to the roof structure by enhancing roof stiffness. Room 1 comprises closer spaced rafters pairs, again with a horizontal tie below the ridge. Only every other rafter pair spans to the ridge board, intermediate pairs stop some 200 mm short of the ridge. The room did not use battens on rafters for fixing of the lining, lining sheets were fixed directly to rafters.
- The condition of Room 2 roof timbers is fair, the roof sheeting here appearing to provide reasonable protection. Roof framing in Room 1 has seen more movement due to its lower stiffness but also due to decay in some areas of supporting wall framing, the west wall in particular. The roof covering here also has more patch repairs. One short reaching rafter on the west wide has seen heavy termite damage at its lower end and has fallen off the wall plate, hanging in place from the ridge tie above. Although not an original feature, the Room 1 roof would benefit from the introduction of battens to its underside. The wider builder would also benefit as the battens could also be used in roof tie-down needs (see 3.3 External). *This action is recommended with 24 months.*
- The damaged rafter marks a central area of wall framing below through which termite action has taken place. The area includes the window opening. The pressed metal internal wall lining below the window has crumpled and detached here. There is no alternative here but to exposed the wall frame and replace affected timbers. The impact on linings can be minimized with care taken in the methodology of working, whether from the exterior or interior or both. *This action is recommended with 24 months.*
- Due to heavy debris build up in the floor zone and the debris and vegetation externally, it is difficult to discern clearly how walls are supported at ground level. There is evidence that some corner posts to wall continue to depth in the ground. Elsewhere, the remains of timber stumps to sole plate exist, occasional remedial piers of concrete or stone are present below plates. In reality, due to decades of environmental action on buried timbers and increasing soil build up, it is likely that much of the building perimeter wall sole plate now take support directly off the soil. It is time now to improve this situation for the future of the building. A full perimeter re-support exercise using closely spaced single stone piers inserted tightly below sole plates is recommended. The gaps between stones should be soil free to min 100 mm below the sole plate to promote ventilation the plate and bottom of wall studs. *This action is recommended with 12 months.*

3.2.3 Floors

- It is difficult to discern the arrangement of the original timber floor structure, remnants of floor boarding only remain in the rooms, large areas have been lost to decay. A very high build up of soil, mostly likely wind blown, within the sub-floor space has now become the floor surface in these parts and was highly likely a key factor in degradation of the timber present. Although unclear, our suspicion is that timber floor bearers seated directly onto the earth were used at

regular centres to support floor boards. Whatever the case, it is suspected that floor structure were independent of the wall framing.

- Given the intended future use of the place as a heritage shelter, there appears good potential to learn more of the building's history and fabric through archaeological investigation of the floor void material.
- There are many options and considerations for proposed floor works under the new use, all of which require heritage architect input. Whatever the selected scheme, it should promote ventilation to base of wall framing, or at least avoid hindering it.

3.3 External

3.3.1 Roof and wall sheeting

- Such is the fragility of all timber framing, the removal of existing roof sheeting is not encouraged due to risk of causing further damage by doing so. There are heritage reasons for retaining in any case. Structurally, they also serve a stiffening benefit and the distorted roof profile will not accept new sheeting easily. Over-sheeting the roof with a second layer of sheeting is encouraged instead. Timber battens, set to receive new sheeting, will be laid on top of the existing sheeting. These battens should be tied down through the old sheeting to new or existing ceiling battens in the rooms using deep J-bolt or similar connectors. The new sheeting can be then fixed to the new battens in a normal manner. The new sheets may be recycled sheets and fixings may be clouts rather than screws, subject to heritage choices.
- A good deal of the wall sheeting needs re-fixing or re-setting or both. This is not just for weather tightness, the structure overall needs the bracing enhancement that well fixed wall cladding brings.
- *These actions are recommended with 24 months.*

3.4 Site & General

3.4.1 Site Drainage

- The natural topography falls approximately 10 degrees from west to east, the building is positioned on a shallow 'cut and fill' area of this embankment. The ground to the west takes a sharper fall to this cut at about a metre from the building. The base of the west wall is therefore a naturally vulnerable area where debris and water can accumulate or get held up and impact on the structure.
- Consideration to providing a permanent spoon drain along this wall is encouraged. This should be set at least 100mm below the underside of wall sole plate. A permanent drain surface will have additional benefits to disposing of storm water – it help achieve the required clearance levels and stop vegetation growth against the wall face. *This action is recommended with 24 months.*

3.4.2 Roof Drainage

- There are no present gutters serving the building, storm water is allowed to fall to the foot of the east and west walls and seep into the soil here. Whilst there are heritage and maintenance issues surrounding the introduction of gutters, downpipes, gullies and soak wells etc, the building structure is better protected with the swift removal of water from site that these bring. *This action is recommended with 24 months.*