

Memorandum

To	[s 9(2)(a)] (LINZ), [s 9(2)(a)] (LINZ), [s 9(2)(a)] (LINZ)	From	[s 9(2)(a)]
Copy	[s 9(2)(a)] (Aurecon)	Reference	500946
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Subject	Watts Peninsula – Initial Structural Observations		

Hello [s 9(2)(a)]

This memorandum has been written to provide an overview of the structural inspections of existing historical defence structures on the Watts Peninsula conducted by Aurecon ([s 9(2)(a)]) on 16/03/20 and 17/03/20. These inspections were carried out for Land Information New Zealand in order to identify structural risks on the Crown-Owned land. Where applicable this memorandum also comments on non-structural health and safety issues present also.

At the time of the inspection one structure within Fort Balance was judged to be unsafe to enter. Aurecon have carried out a review of the feasibility of conducting this inspection using a remote access drone.

The inspections were captured on GIS and the full logged data will be provided to LINZ at the completion of the project. This data will include GPS co-ordinates, photo graphs and site notes.

1 Structural Inspections - Method & Limitations

Aurecon conducted non-destructive visual inspections of the structures on Crown-owned land, as outlined in green in Figure 1, on the Watts Peninsula in Wellington.

All inspections were conducted from ground level because the site terrain made it impractical to carry a ladder.

As the inspections were visual and non-destructive, the accuracy of the inspections is limited to aspects that can be observed or inferred from accessible surfaces of the structure. Where more comprehensive site investigation is deemed appropriate it is recommended in the findings and recommendations below.

Based on the limitations of the non-destructive visual inspections, Aurecon can assume no responsibility for structural defects that are not visible on the buildings' accessible surfaces at the time of inspection.

At the time of the inspection one subterranean area of Fort Ballance was judged to be unsafe to access as it constituted a confined space. Aurecon have carried out a review of the feasibility of conducting this inspection using a remote access drone and are currently awaiting further instruction.

Aurecon's current scope was limited to on-site inspection of the structures and is intended to comment on the current condition of the structure only. This level of inspection cannot assess compliance with the current the Building Act. It is noted that all of the older historical structures inspected were built prior to the publication of the current New Zealand Building code and Standards.

To confirm the structural safety of these structures against modern structural standards would require desktop calculations. This would require investigation of the as-built structure including, the review of

historic drawings, and if not available, then site measuring, ferro scanning, material testing and destructive site investigations.



Figure 1 – Watts Peninsula (Crown Land Outlined in Green)

2 Structures Inspected

The inspections were conducted in the presence of a heritage consultant ([s 9(2)(a)]) and all sites understood to still be in existence and accessible were inspected (some original structures have been demolished).

The red dots on Figure 2 below show the inspected structures. The sites are also grouped into collective site names.



Figure 2 – Watts Peninsula Inspected Sites and Place Names

An overview of the sites is provided below:

- Gua dhouse – Timber house like structure of modern construction, low heritage value
- Magazines – 12 brick structures built used for munitions storage. Some heritage value (heritage consult has expressed a desire to retain some but not all magazines).
- Haswell AA Battery – four gun pits and a fire control bunker built in the 1940's.
- Kau Point – Observation post and gun battery below built in the 1890's. Gun pit has been filled in. Battery also has subterranean magazine rooms.
- Fort Ballance – Complex of gun pits, barracks, magazines and observation posts built in the 1880's. Much of the original fortifications have been demolished.
- Minor Masonry Wall – Wall was logged on onto system does not represent a structural concern and so has not been covered further in this memorandum.

3 Findings

The key inspection findings are provided in the following sections.

3.1 Tree Risk

The hill areas surrounding the magazines and Kau Point structures are forested in pine trees. These trees pose a risk of collapsing onto the structures. Several of the magazine buildings currently have pine trees which have rolled on to the buildings walls.

Besides the risk to the structures, the trees are also a health and safety risk to people visiting the structures. Pine trees were observed falling in the area of the Kau Point battery during the time of the inspections (which expedited a speedy withdrawal from the area).

To protect the structures, the felling of trees which could fall on the buildings is recommended. This is likely part of a larger area for visits to the peninsula and a much more widespread de-forestry effort may be required.

3.2 Guardhouse

The guard house is a timber building with concrete entry steps

Timber rot is evident in some of the weatherboard cladding. Based on the condition of the weatherboards, water ingress and framing rot is also likely.

Based on site conversations with the heritage consultant, the building is understood to have little or no heritage value and demolition is recommended

3.3 Magazines 1 to 12

The peninsula has 12 magazine buildings, 11 which are of identical design. It is our understanding, based on site conversation with the heritage consultant, that these buildings are not of high heritage value in themselves, but have some value in expressing the history of the area. Consequently the heritage consultant would like to retain some, but not all, for posterity.

The buildings feature unreinforced masonry walls typically with a timber roof, although the roofs have been removed from some of the magazines. The buildings have double skin walls with a large accessible void 500mm wide between the walls.

Many of the Magazines have been marked with council earthquake prone notices. This is likely related to the masonry walls for in-plane and out-of-plane capacity.

The buildings are structurally stable, in terms of gravity, in their current condition. Most of the walls have mortar cracks near the roof at the corners. This is likely to be related to foundation settlement.

If some of the magazine buildings are to be retained, seismic structural strengthening will be required in line with earthquake Prone Building legislation.

3.4 Fire Water Reservoir

The fire water reservoir is an inground water retention pool constructed in the 1940s and is located close to Magazine no. 9.

The concrete structure is generally in good condition. The original steel access ladder rungs were cast into the concrete wall. These have corroded and not much of the ladder is left.

While the structural condition is good, edge protection will be needed around the reservoir edge. The edge is currently protected by a temporary 1m high waratah and wire mesh fence.

3.5 Point Haswell AA Battery and Fire Control Post

Point Haswell AA Battery consists of four gun pits and a control post constructed of reinforced concrete.

The concrete structures are in good condition with no structural concerns.

The structures have numerous bolts cast into the walls which are now corroded and could pose a snagging hazard for visitors. It may be best to grind these off for safety.

The gun pits also have cast-in gun mountings in the floor which could be seen as trip hazards.

3.6 Kau Point Observation Post and Battery

Kau Point consists of an uphill Observation Post (OP) and a downhill Battery with gun pit and subterranean Magazine.

The OP has a small concrete room built into the hill. The room's roof is reinforced with exposed steel railway-type rail irons. This is a common construction method on defence structures of this vintage.

The OP is generally in good condition. Although there is some corrosion on the exposed steel rails, this appears to be superficial. If the cast-in steel was corroded within the concrete, spalling might be expected, but none is present.

Although the condition appears to be good, the room does have a soil surcharge on the roof and a more detailed assessment should be conducted for the long-term stability of the roof.

The battery gun pit has been filled in with soil and as such is stable and safe.

The battery magazine is subterranean with more than one metre of fill over the top. The roof is reinforced with rail irons which all have significant corrosion to the bottom exposed flanges. As no concrete spalling exists around the rail irons the heads may be un-corroded but further invasive investigation and a desktop assessment would be required to ensure the stability and safety of the roof.

Access to the magazine by the public is prevented by a padlocked steel door, however should the Magazine roof collapse there is a risk to any persons on the top at the time.

3.7 Fort Ballance

Fort Ballance consists of a range of 1880's structures. The layout of the site is shown in Figure 3 below:

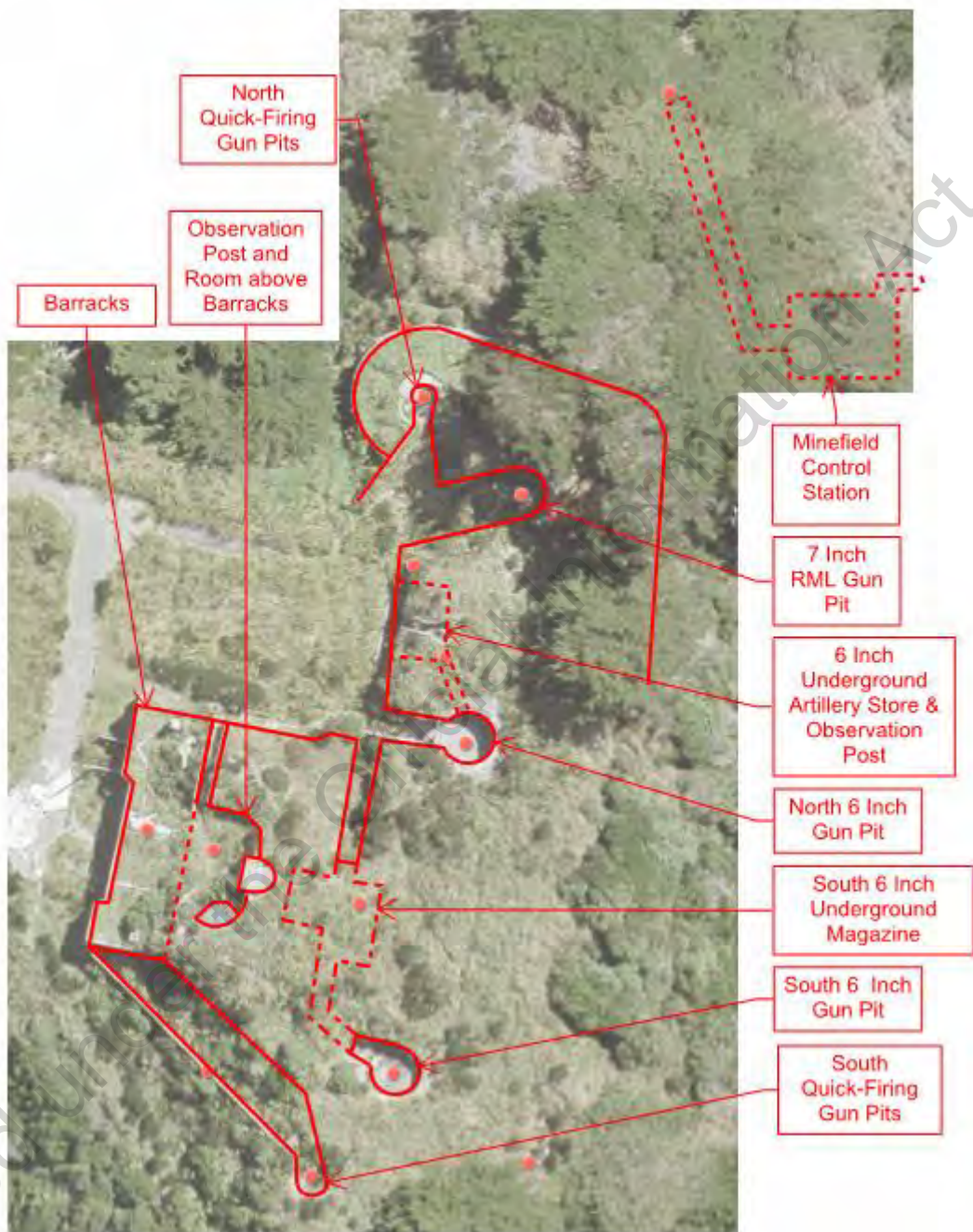


Figure 3 – Fort Ballance Layout

3.7.1 Minefield Control Station

The Minefield Control Station is accessed through a tunnel beneath the fort. The tunnel ends in a large rectangular room and a smaller observation slit. The station is buried under several metres of soil. The station is of concrete construction with rail iron reinforcement in the flat roofs.

The entry tunnel has no obvious defects.

The main room and observation slit both have some corrosion of the rail iron reinforcement. Further destructive investigation of the extent of corrosion to the rail irons is needed. A desktop assessment of roof stability is recommended, which will require additional information gathering (soil depth, concrete thickness, original drawing search).

3.7.2 Wing Walls & Flanking Walls

The fort has large concrete retaining walls to the north and south. Both walls have large ~30mm vertical cracks in the downslope sections of the wall suggesting some slope movement downhill in the last 130 years.

There is a flanking wall to the south of the fort between the barracks and south quick-firing gun pit and the remnants of a flanking wall off the north quick-firing gun pit. These walls are constructed of corrugated iron sheets fixed to rail iron internal framing. The space between the corrugated iron is filled with concrete.

The corrugated iron sheets are badly corroded. The walls do not appear to be in immediate risk of collapse or toppling, however may not be stable in an earthquake.

3.7.3 North & South Quick-Firing Gun Pits

Two small quick-firing gun concrete pits are located at the north and south of the fort.

There are some vertical cracks in gun pit walls, related to the wing wall cracks, however these cracks are not a concern for the structural stability of the pits.

The pits have central steel gun mounting remnants which may pose a trip hazard.

3.7.4 7-Inch RML Gun Pit

Concrete gun pit and adjoining ammunition rooms previously housing a 7-inch RML gun. The gun pit is in good condition with no structural concerns.

One concrete fragment (~30mm long) was observed to be loose over one of the adjoining room entrances. It is recommended that this is removed to avoid the risk of falling.



Figure 4 – 7 Inch RML pit door concrete fragment

3.7.5 North 6-Inch Gun Pit

Concrete gun pit previously housed a 6-inch disappearing gun. No structural concerns were noted.

3.7.6 North 6-Inch Gun Underground Artillery Store & Observation Post

Artillery store rooms adjoining the north 6" gun. The store has two levels. The lower level is beneath ground level and has not been accessed due to H&S concerns relating to confined space entry. The lower rooms had previously been closed off by the installation of a steel plate over the ladder, however it seems taggers have cut an opening with a grinder - see figure 5.



Figure 5 – Entry to lower level of 6" artillery store

This opening will need to be closed over for safety relating to public access.

To provide a full assessment of the structural safety it would be necessary to review the roof and walls of the lower level. Aurecon have reviewed the possibility of conducting the inspection remotely using a drone and are currently awaiting further instruction.

The upper level roof is reinforced with rail irons. Corrosion was present on the exposed flange of the rail irons which were previously covered in plaster.

A horizontal crack was observed at the edge of the roof of the tunnel leading from the main room to the 6-inch gun pit. This crack is likely to have been caused by corrosion of reinforcement within the roof. Remedial work is required to prevent spalling from causing the concrete soffit of the roof falling in this localised area.



Figure 6 – Crack in 6" artillery store roof soffit

3.7.7 South 6-Inch Gun Pit and Underground Magazine

The south 6-inch gun pit is accessed through an underground corridor with a concrete roof reinforced with rail irons.

Several patches of spalling are present on the underside of the concrete roof caused by rail iron bottom flange corrosion. There are other patches on concrete spalling on the soffit (up to ~30mm thick) which appear likely to fall. Given the difficulty of stopping taggers from accessing the tunnels it may be best to pre-emptively remove spalling concrete from the roof.

The gun pit is in relatively good condition. One horizontal crack was observed on the lintel of a disused door in the pit. This crack is likely to drop some fragments of concrete in the future.



Figure 7 – Crack in 6" gun pit horizontal door crack

The purpose of this door is unknown. It may have been a door intended for a future tunnel or a door leading to a tunnel that has been filled in or disused.

3.7.8 Barracks

The barracks consists of a series of rooms at the west of the site. As the rooms were used for living quarters, fire places were provided with brick chimneys.

The roof of the barracks has been reinforced with rail irons which show signs of bottom flange corrosion.

The chimneys on the roof are brick and likely to be earthquake prone.

3.7.9 Observation Post and Room above Barracks

An observation post and room of unknown use are located adjacent to the barracks roof (not over the barracks roof proper).

The observation post roof has been constructed with rail irons serving as both a central beam and cantilever observation pit ceiling. These rail irons are severely corroded. It is recommended that the observation post is cordoned off for safety and repair.



Figure 8 – OP Roof Corrosion

The second room also has corroded rail irons in the roof, however does not appear to be in imminent danger. However, repair is recommended.

The observation post and room are accessed via concrete stairs with brick ramparts on either side. These rampart walls are likely to be earthquake prone due to the brick construction. Further assessment is needed.

3.8 General Historical Construction Issues

3.8.1 Rail Iron Roof Reinforcement

The structures from the late 19th century at Kau Point and Fort Balance typically use a form of early concrete construction in which roof spans were reinforced with steel rail irons cast into the bottom of the roof with the lower flange either exposed or covered in plaster.

For all the underground tunnels and rooms, corrosion exists on the bottom flanges of the rail iron. The level of corrosion varies but is quite severe in some locations.

Despite the bottom flange corrosion, the webs and top rod may still be relatively uncorroded. Corrosion in these areas may be expected to cause spalling which is not currently present.

Generally, the roofs don't appear to be in imminent risk of collapse, however invasive investigation to assess the level of reinforcement corrosion and loss in the webs would be necessary to fully ascertain the extent of damage. This would involve locally breaking out concrete around sample rails at a limited number of locations.

As the concrete sections were not designed to modern standards, a desktop calculation-based assessment of the roofs would be required to assess compliance with the Building Act. To conduct this level of assessment, additional site investigations would be required to ascertain concrete thicknesses and soil surcharge.

3.8.2 Brick Wall and Ceilings

The magazines, Kau Point and Fort Balance sites all feature brick construction in the form of both walls and vaulted ceilings.

Unreinforced masonry brick generally performs poorly in earthquakes and many of the brick elements at the Watts Peninsula sites are likely to be earthquake prone.

Desktop assessment of the brick elements would be required to confirm if the unreinforced masonry elements are earthquake prone to the current Building Act.

4 Recommendations

Aurecon recommend the following actions which should be considered in conjunction with the recommendations of the project's heritage and asbestos consultants:

- Guard Post – Demolish structure subject to final recommendations of heritage consultant.
- Magazines – Conduct desktop assessment and strengthening design. Retain structures as recommended by the heritage consultant.
- Haswell Point AA Battery – Remove snag hazards from wall for safety of visitors.
- Kau Point – Conduct intrusive investigation of roof reinforcement. Conduct desktop assessment of roof and brick structural elements.
- Fort Ballance General – Conduct intrusive investigation of roof reinforcement. Conduct desktop assessment of roof and brick structural elements.
- Fort Ballance 7-inch RML Gun Pit – Remove concrete fragment from entrance to adjoining room (see 3.7.4).
- Fort Ballance North 6-inch Gun Underground Artillery Store & OP – Close off access to lower level for safety. Break out and reinstate concrete roof soffit below crack (see 3.7.6)
- Fort Ballance South 6-inch Gun Pit and Underground Magazine – Remove loose spalling concrete from roof soffit, repair as appropriate
- Fort Ballance Observation Post and Room above Barracks – Cordon off observation post room and strengthen roof.