

28th March 2017

Waverley Council
Level 6
55 Grafton Street
BONDI JUNCTION NSW 2022

Attn: Tobias Kuchta

Dear Sirs

**BRONTE SURF LIFE SAVING CLUB
STRUCTURAL CONDITION REPORT**

Council has requested a structural review of the club and amenities buildings and options for remedial work. The buildings were inspected over the period from 9th to 26th March 2018.

1 OBSERVATIONS

1.1 Overall

The club house is:

-) 2 storeys with masonry brick walls
-) Concrete floor and roof slabs
-) Concrete awnings and fascia

The amenities area is of similar construction, but single storey.

The buildings are located directly fronting onto Bronte Beach and are fully exposed to surf spray. The buildings were extensively altered and extended in 2002.

Photographs and location site plans of the various structural defects are attached in the Appendix.

1.2 Exterior

The exposed concrete awnings are badly affected by reinforcement corrosion and concrete spalling. The brickwork has vertically cracked at many of the corners, in some areas has lost mortar from the joints and shear cracked at brick returns.

The roofing membranes have failed in many locations, water is leaking through the roof slabs and bubbling on the slab soffits.

The building is built up hard against the northern park embankment with both ground water and stormwater is penetrating the building. The northern wall of the Auditorium partially retains soil (without any visible cavity drainage).

The Roof slab over the first floor female toilets does not have adequate outlets or overflow capacity. Debris accumulates in this area blocking the roof outlets causing water to pond and penetrate the areas below.

The external stairs are in poor condition with cracked treads, cracked supporting brickwork and separation between the stairs and brickwork.

The grated drains on the northern side of the Gym are not operational with disjointed connections and blockages.

1.3 Interior

The roof slabs have cracked, and the roof membrane has not had sufficient elasticity to bridge the cracks. The resulting roof cracks are leaking which is exacerbated by water ponding on the roof.

Water has been seeping through the Auditorium northern wall, which has been plasterboard lined (to assist in forming a cavity) and this has been repaired due to water damage.

The caretakers room has a plasterboard ceiling which is also damp with vents to assist in drying.

The Gym has severe cracking which are leaking and calcifying.

The Boat store steel mezzanine platform has corrosion to the stair treads and rock wall fixings. The rock wall cavity is blocked with stored materials and the drainage is not operational.

The club toilet walls are cracked in the corners with outward displacements. This is likely to be caused by thermal movement of the roof slabs.

The external stairs have a store underneath and the stairs leak badly. A corrugated steel ceiling has been installed to deflect leaking water away from the stores and the sheeting is badly corroded.

2 STRUCTURAL ASSESSMENT

The buildings are in poor structural condition. The significant defects are as follows:

2.1 Reinforcement Corrosion and Concrete Spalling

The exposed concrete areas (awnings, parapets and roofs) have been coated with a membrane system. It is not known when this system was applied but some would appear to be relatively recent in that it covers already spalled concrete.

The membrane has not been sufficient to prevent spalling and corrosion (see Photos B12, B14 & C6).

The concrete has not been tested, however, from experience we believe the concrete will be suffering chloride intrusion caused by salt water spray. The corrosion is continuing (under the membrane) and there is little that can be done to arrest this corrosion once the chlorides have entered the concrete matrix. It is possible to apply migratory corrosion inhibitors which will slow the corrosion process but not prevent on-going corrosion. Application of an inhibitor could be trialled in combination with localised patch and repair methods, but these will only be a stop gap solution and in some areas far too late for practical use.

Such work would be contingent upon renewal of the roof membranes.

Some parapets have partly spalled concrete which presents a public safety danger. Two areas on the eastern face of the upper roof are loose and held in position by the signage (refer Photos C20 & 21). There may be other areas not observed in this review. As a priority all parapets must be promptly made safe by removal of any loose spalling concrete.

2.2 Leaking Roof Membranes

The roof membranes are leaking in many locations allowing salt water to soak into the slabs, entering through various cracks and causing reinforcement corrosion. Some slab soffit membranes have bubbled and have rust marks in numerous locations (see Photos C2 to C5).

In the long term the roof slab reinforcement will corrode, spall the concrete and compromise the structural adequacy of the slabs.

2.3 Brickwork Cracks

Some of the brickwork has vertically cracked at the wall corners. This is due to the phenomena of brick growth, which takes place as clay bricks absorb moisture over time and expand. However, given the 15-year period since reconstruction, most of the brick growth will be complete and the bricks should be relatively stable. These vertical cracks have formed weakened planes in the wall panels and allowed the bricks to displace (laterally shear) due to concrete slab shrinkage and thermal effects (see Photo A16).

2.4 Drainage

Poorly functioning roof drainage is contributing to water penetration into the building. The Auditorium roof outlets do not directly connect to the water tanks allowing stormwater to discharge directly against the building. The rainwater tanks do not have adequate overflow connections and can discharge on the ground.

The grated drains are not operational and do not collect overland flow from the park. Water will pond against the building and enter the boat storage area.

The roof over the female toilets does not have any overflows and the outlets are easily blocked by accumulated debris.

3 REMEDIAL WORK OPTIONS

3.1 Reinforcement Corrosion and Concrete Spalling

3.1.1 Patch and Repair

The spalled areas can be treated by cutting back, splicing new reinforcement and patch repairing the spalls with high build cementitious render.

The high-risk parapets and awnings should have the membrane removed by grit blasting or high pressure water. Unsound areas patch repaired as above, and the concrete surface applied with a migratory corrosion inhibitor.

Together with the roof membrane, all exposed concrete then resealed.

3.1.2 Partial Demolition

The parapets and awnings could be demolished and replaced. These areas would be saw cut, new reinforcement grouted and extended, and new parapets constructed. The new concrete must be suitable for a marine environment, with high strength (50MPa) and with low permeability (e.g. Boral Envisia).

The new parapets would then be waterproofed with the new roof system.

Alternatively, the awnings or balustrades could be reconstructed using a bolt-on stainless steel system.

3.2 Roof Waterproofing

3.2.1 Applied Membrane

Any areas of reinforcement corrosion should be patch repaired as 3.1.1 above. A new membrane should be applied which is suitable for medium duty traffic with crack-bridging capacity. Specialist advice would need to be sought regarding compatibility with the existing membranes. A sheet membrane should have superior flexibility in bridging the roof cracks.

The existing roof slabs pond and hold up to as much as 20mm of water. It would appear that the roof slabs do not have a topping slab which would have been graded to fall. Ideally a topping slab should be formed to fall over the existing membrane and then that topping waterproofed with a new membrane.

Any membrane system should include the parapets and awnings.

3.2.2 Over-roofing

A new metal deck could be built over the leaking roofs and form a new fascia system. This work would be undertaken in combination with demolition of the parapets. This option would not prevent on-going corrosion of the roof slab reinforcement but should significantly slow the process. Any roofing and supporting steelwork would need to have a corrosion protection suitable to a high marine environment.

3.3 Brickwork Cracks

The brickwork cracked corners should be locally demolished and rebuilt. In doing so, the cavities should be inspected to ensure that the cavity ties are still effective. If the cavity ties were not R4 durability (to AS2699.1) then they are highly likely to be corroded or non-existent. In this case new stainless steel mechanically fixed ties would need to be installed (Helifix or similar).

3.4 Drainage

The Auditorium roof drainage needs to be adequately connected to the stormwater system so that overflows do not spill onto the northern embankment. All roof areas must have overflow capacity to accommodate 1:100 ARI events without ingress into the building.

The grated drains on the northern park embankment need to be reconstructed with an additional cut-off placed upslope to intercept and divert overland flow away from the building.

3.5 Demolition and Reconstruction

In many respects the building has reached a point where the fundamental problems of concrete spalling and water penetration cannot be prevented. The above repair options will extend the operational use of the building, but the exact period is not well defined.

Depending on timing for funding, it would be possible to undertake some repair on a priority basis to extend the building use for say 5 years. The priorities would be:

- a) Patch and repair spalled parapets and awnings, re-apply membrane
- b) Renew roof membranes
- c) Connect Auditorium roof drainage
- d) Install overflow to female toilets roof

It would be possible in a redevelopment of the site to re-roof the amenities block and retain the fabric of that building (provided the wall cavity ties are effective).

4 RECOMMENDATIONS

There are many options in undertaking the remedial works for the building. These will increase in cost with the degree of replacement and as the replacement level increases so will the building life expectancy.

Ultimately the demolition and rebuilding will provide the long-term solution for this building which is reaching the end of its commercial life.

The remedial work options for the building are:

Item	Priority	Comment	Description
1	Immediate	Public safety) Remove all parapet signs) Hammer check any cracked areas and remove spalls) Paint to match) Replace signs) Repair broken tiles at ramp
2	High	Water penetration) Connect roof drainage to Auditorium tanks and ensure overflows are connected to stormwater) Install roof outlets and adequate overflow to female toilet roof) Reconstruct grated drains over the boat store to collect overland flow from park) Remove debris from rock wall cavity space and ensure drainage is operational
3	Medium	Patch and repair) Remove all spalled concrete and areas with corroding reinforcement) Cut back corroding reinforcement & reinstate, as required) Repair spalls with high build cementitious render
) Apply new membrane to all roof areas and parapets
) Renew mortar brickwork joints

		Partial rebuild) Saw cut and remove parapets and spalled slab edges) Reconstruct with high strength low permeability concrete (Envisia)
) Cut out corroding roof slab reinforcement and reinstate, as required) Repair with high build cementitious render
) Apply screed topping to eliminate ponding) Apply new sheet membrane to all roof areas and parapets) Ensure all outlets and overflows operational) Check and replace any leaking/broken skylights and vents
) Renew mortar brickwork joints) Repair cracked brickwork and re-render
) Demolish slab over rock cavity ventilation space, external stairs and adjacent stores) Reconstruct with high strength low permeability concrete (Envisia)
		Major rebuild with over-roofing) Cut back corroding roof slab reinforcement & reinstate, as required) Repair with high build cementitious render
) Saw cut, remove parapets and spalled slab edges
) Install new marine grade metal deck roofing and fascias on steel frame with marine grade corrosion protection
) Renew mortar brickwork joints and rebuild cracked corners) Review and install new stainless steel cavity ties) Repair cracked brickwork and re-render
) Remove the rainwater tanks, excavate to form a walkway with retaining wall to park and install drainage
) Install new surface cut-off drainage at park above boat store
) Demolish slab over rock cavity ventilation space, external stairs and adjacent stores) Reconstruct with high strength low permeability concrete (Envisia)
4	Long term	Partial rebuild) Demolish clubhouse building
) Remove amenities roof slab and build new marine grade metal deck roof and fascia on steel frame with marine grade corrosion protection
) Build new clubhouse building, offset from park embankment and subsoil drainage issues
) Demolish external stairs and stores under) Reconstruct with high strength low permeability concrete (Envisia)
		Complete rebuild) Demolish clubhouse and amenities) Reconstruct to suit marine environment

The medium priority options will have limited life with on-going problems due to further concrete spalling and water penetration. These issues being caused by continuing chloride corrosion of the reinforcing steel and water penetration from the adjacent embankment. It is our recommendation that any repairs be considered a temporary solution whilst redevelopment of the site is prepared.

Should Council have any further queries concerning this review, please contact the undersigned on 4573 0746.

Yours faithfully
ducros design Pty Ltd



Mark du Cros
BE CPEng 60450
Director

APPENDIX

OVERALL SITE PHOTOGRAPHS



Southern Elevation



Eastern Elevation



Northern Elevation

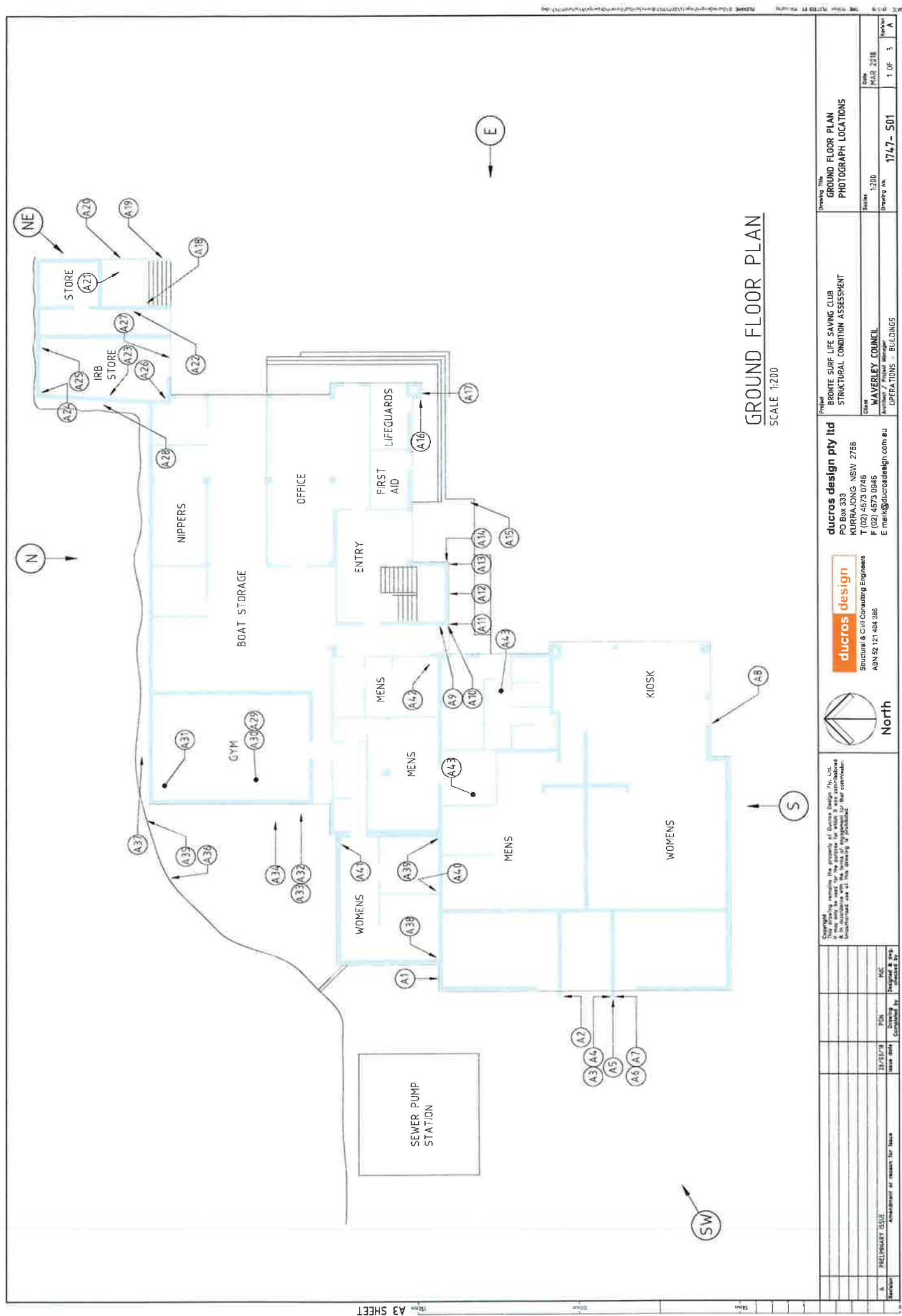


South West Elevation



North East Elevation

PHOTOGRAPH LOCATION PLANS

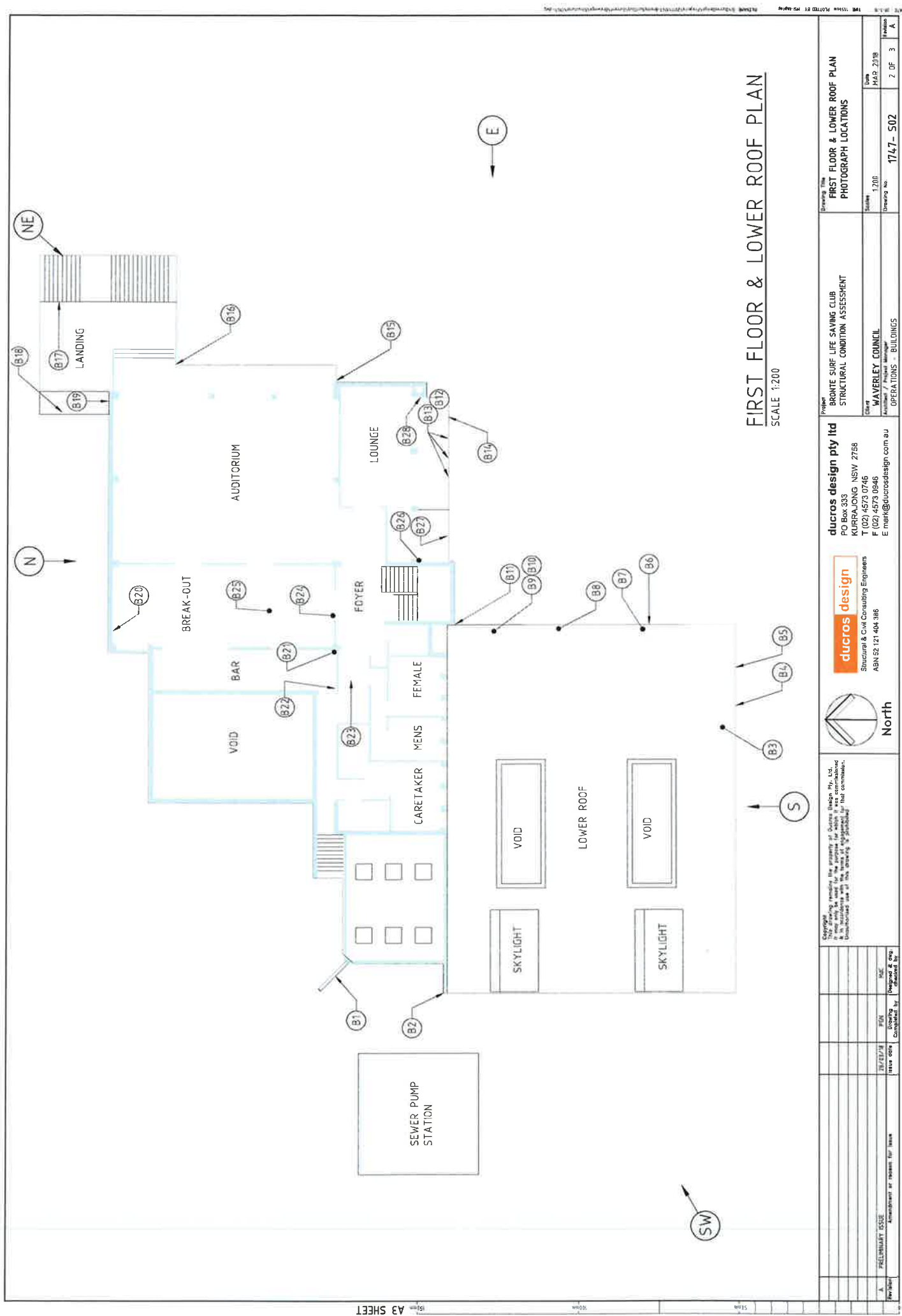


GROUND FLOOR PLAN
SCALE 1:200

Drawing Title		Project		Drawing No.	
GROUND FLOOR PLAN		BRONTE SURF LIFE SAVING CLUB		1747-501	
PHOTOGRAPH LOCATIONS		STRUCTURAL CONDITION ASSESSMENT		1 OF 3	
Scale		Client		Date	
1:200		WAVERLEY COUNCIL		MAR 2018	
Author / Project Manager		Drawing No.		Revision	
OPERATIONS - BUILDINGS		1747-501		A	

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Drawing No.		1747-501		1 OF 3	
Revision		A		Date	
MAR 2018		Author / Project Manager		WAVERLEY COUNCIL	
OPERATIONS - BUILDINGS		1747-501		A	

A		PRELIMINARY ISSUE		Completed or ready for issue					
13/03/18		P20		Designed by					
17/03/18		1747-501		Checked by					
17/03/18		1747-501		Approved for issue					
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Date									
14/02/2018									
Author / Project Manager									
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OPERATIONS - BUILDINGS									



FIRST FLOOR & LOWER ROOF PLAN
SCALE 1:200

Revision		Project		Drawing Title	
A		duccos design pty ltd		BRONTE SURF LIFE SAVING CLUB	
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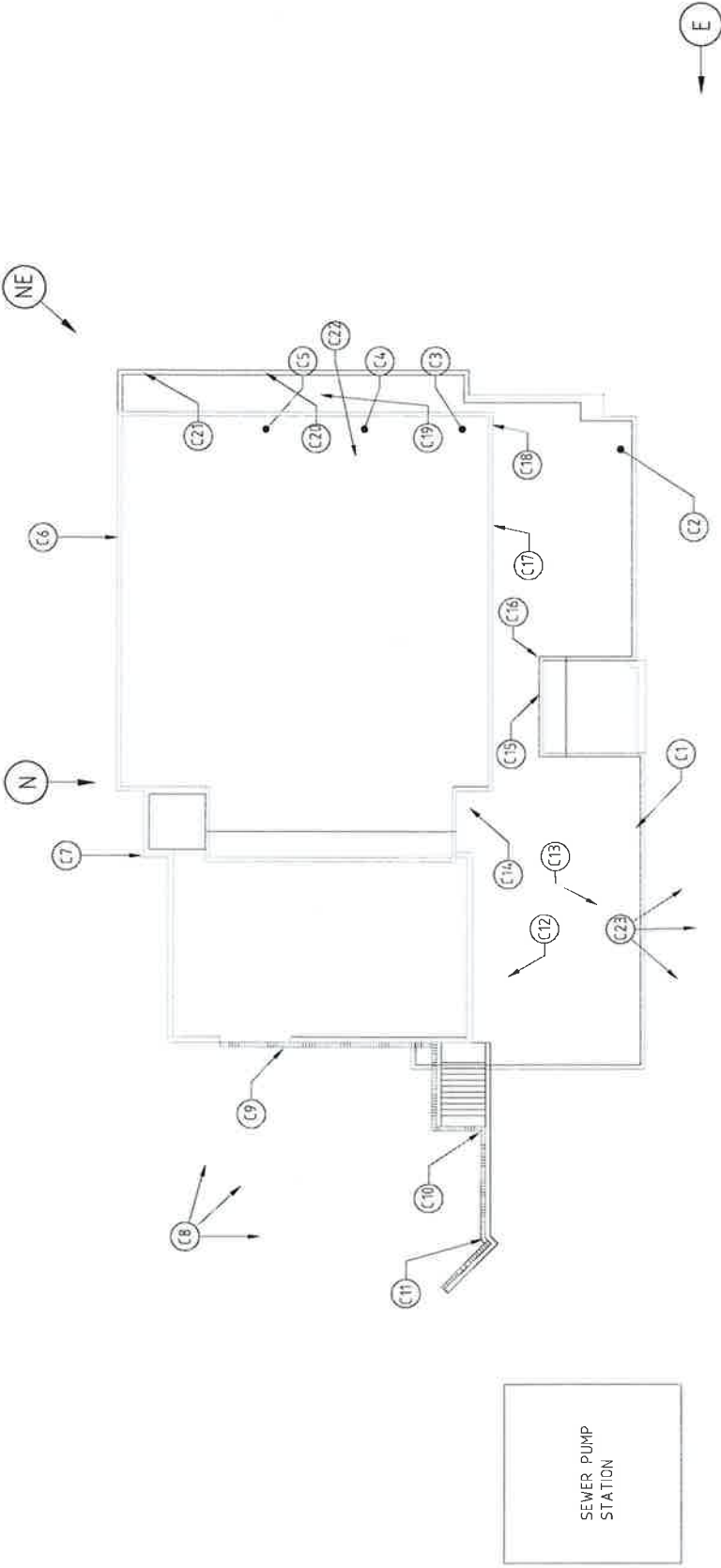
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174.7-502

Structural Condition Assessment

174.7-502

174.7-502



UPPER ROOF PLAN

SCALE 1:200

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GROUND FLOOR PHOTOGRAPHS:

A1



Brickwork mortar loss
bed joints & perpends








A2



0.7mm vertical
crack at cavity







<p>A3</p> <p>3mm vertical crack</p> <p>2mm horizontal displacement</p>	 <p>A close-up photograph of a brick wall corner. A vertical crack is visible in the mortar joint between two bricks. A horizontal displacement of approximately 2mm is also visible in the mortar joint. Callout lines point from the text labels to the specific defects.</p>
<p>A4</p> <p>3mm vertical crack</p> <p>2mm horizontal displacement</p>	 <p>A photograph of a brick wall corner. A vertical crack is visible in the mortar joint. A horizontal displacement of approximately 2mm is also visible. A broom is visible in the foreground. Callout lines point from the text labels to the specific defects.</p>



<p>A5</p> <p>3mm cracks</p>	
<p>A6</p> <p>2mm vertical crack</p>	




<p>A7</p> <p>0.3mm cracking</p> <p>Loose bedding bricks, offset 50mm from face</p>	
<p>A8</p> <p>0.5mm crack in slab</p> <p>0.5mm crack around beam</p>	
<p>A9</p> <p>Water staining down wall</p>	

<p>A10</p> <p>2.5mm vertical crack</p>	
<p>A11</p> <p>2mm vertical crack</p>	




<p>A12</p> <p>Brickwork mortar loss bed joints & perpend</p>	
<p>A13</p> <p>2mm vertical crack</p>	



<p>A14</p> <p>3mm vertical crack</p>	
<p>A15</p> <p>Broken tiles and bedding</p>	




<p>A16</p> <p>Vertical crack with 10mm displacement</p>	
<p>A17</p> <p>3mm vertical crack with 10mm outward displacement</p>	




<p>A18</p> <p>Cracked stair tread</p>	
<p>A19</p> <p>Cracked wall and stair slab soffit</p>	
<p>A20</p> <p>Cracked wall and stair slab soffit</p>	

<p>A21</p> <p>Leaking cracked joint</p> <p>Corroded roof sheeting lining under landing</p>	
<p>A22</p> <p>Cracked beam at bottom reinforcing layer</p> <p>Cracking between wall and slab</p>	
<p>A23</p> <p>Severe cracking and corrosion</p>	

<p>A24</p> <p>Severe cracking and spalling</p>	
<p>A25</p> <p>Cracking between wall and slab</p> <p>Cracking down the wall</p>	
<p>A26</p> <p>Leaking conduit fixing and under roofing</p>	

<p>A27</p> <p>Spalling over roller shutter</p>	
<p>A28</p> <p>Severely corroded reinforcement and concrete spalling</p> <p>Acrow prop supports</p>	

<p>A29</p> <p>Cracking with attempted patch repair</p> <p>Leaking calcification</p>	
<p>A30</p> <p>Leaking calcification, not rust stained</p>	
<p>A31</p> <p>Leaking cracked slab</p>	

<p>A32</p> <p>Long-term leaking between brick wall and roof slab</p>	
<p>A33</p> <p>Long-term leaking between brick wall and roof slab</p>	
<p>A34</p> <p>Corroded stair treads</p>	

<p>A35</p> <p>Severely corroded mezzanine floor support brackets</p>	
<p>A36</p> <p>Severely corroded mezzanine floor support brackets</p>	

A37


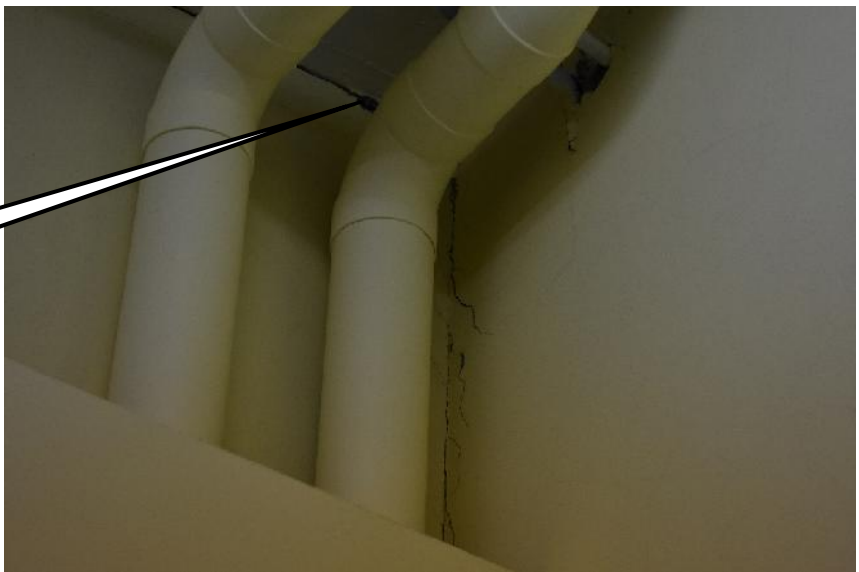

Poorly maintained and
partly blocked
drainage cavity






A38

Cracked wall corner,
5mm outward
displacement



<p>A39</p> <p>Cracked wall corner, 5mm outward displacement</p>	
<p>A40</p> <p>Cracked wall corner</p>	
<p>A41</p> <p>Cracked wall corner, 3mm outward displacement</p>	

<p>A42</p> <p>0.3mm crack</p> <p>0.3mm crack</p>	 A photograph showing a blue electrical meter mounted on a light-colored wall. Two cracks are visible: one horizontal crack above the meter and one vertical crack below it. Two callout boxes, each containing the text '0.3mm crack', point to these cracks with black lines.
<p>A43</p> <p>0.5mm crack</p>	 A photograph of a ceiling area. A crack is visible in the concrete ceiling, and there are several dark, circular spots (possibly mold or water stains) nearby. A callout box containing the text '0.5mm crack' points to the crack with a black line. The wall below is made of yellow bricks.
<p>A44</p> <p>Various leaking cracks</p>	 A photograph of a ceiling with significant water damage. Multiple cracks are visible, along with large, irregular water stains. A callout box containing the text 'Various leaking cracks' points to the damaged area with a black line. A fluorescent light fixture is visible on the left, and a blue object is partially visible in the bottom right corner.

FIRST FLOOR AND LOWER ROOF PHOTOGRAPHS:

B1

Debris cast into
concrete during pour





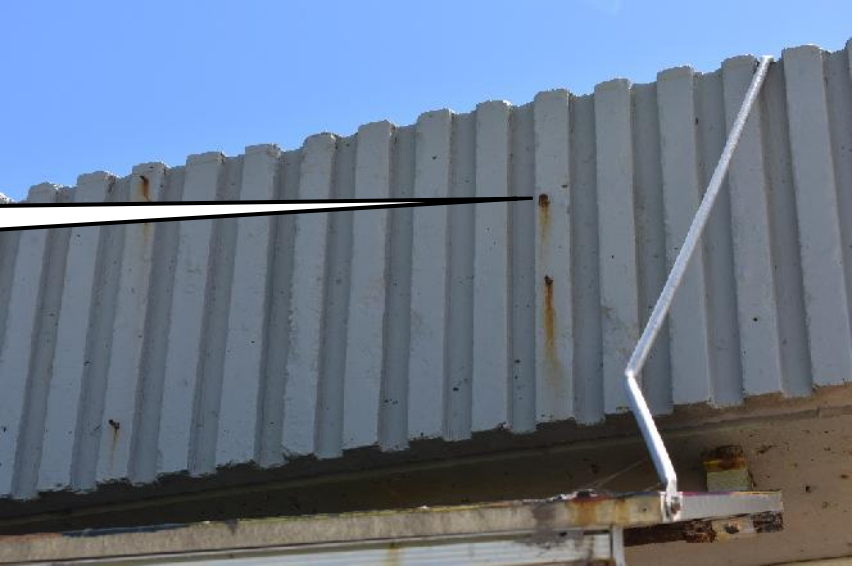


B2



Heavily spalled
concrete and corroded
reinforcement



Missing concrete
parapet









<p>B3</p> <p>Poorly installed core plug</p> <p>Cracked slab with signs of leakage</p>	
<p>B4</p> <p>Rust staining</p> <p>Cracked slab with signs of leakage</p>	




<p>B5</p> <p>Rust staining from old anchor bolts</p>	
<p>B6</p> <p>Large spalled area of concrete with loss of reinforcement</p> <p>Corroding reinforcement</p>	
<p>B7</p> <p>Spalled concrete</p>	


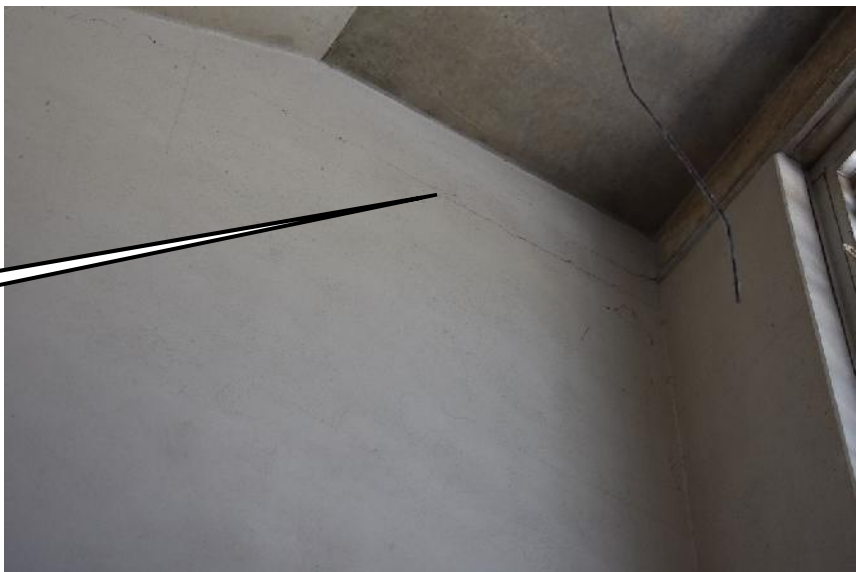

<p>B8</p> <p>Poorly installed core plug</p>	 A photograph of a concrete wall. A dark, irregularly shaped core plug is visible, which appears to be poorly installed. A white pipe runs vertically on the left side of the wall. The wall is light-colored and shows some signs of weathering. A brick wall is visible in the background on the right.
<p>B9</p> <p>Cracked slab with signs of leakage</p> <p>Corroding reinforcement</p>	 A photograph of a concrete slab. The slab is dark and shows signs of moisture or leakage. A crack is visible in the slab. Reinforcement bars are visible along the bottom edge of the slab, showing signs of corrosion. The background shows a blue sky.


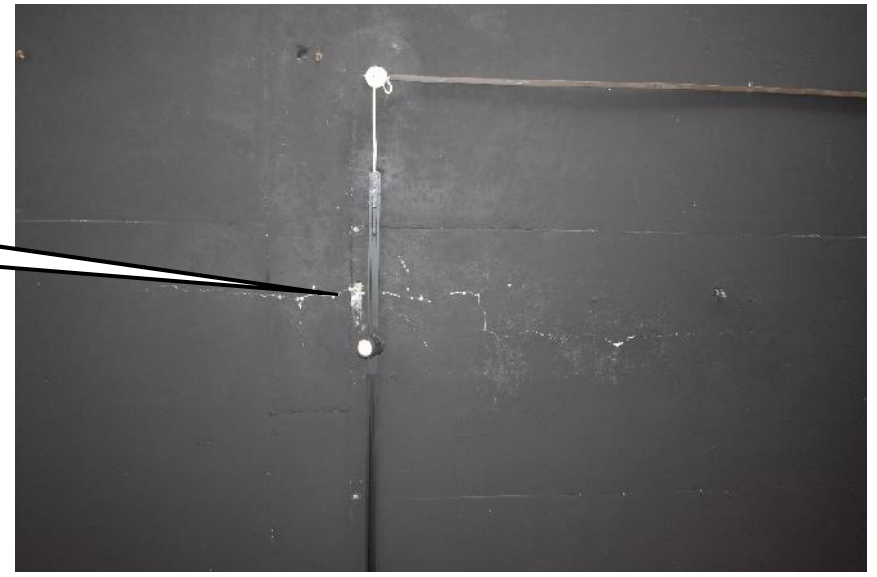
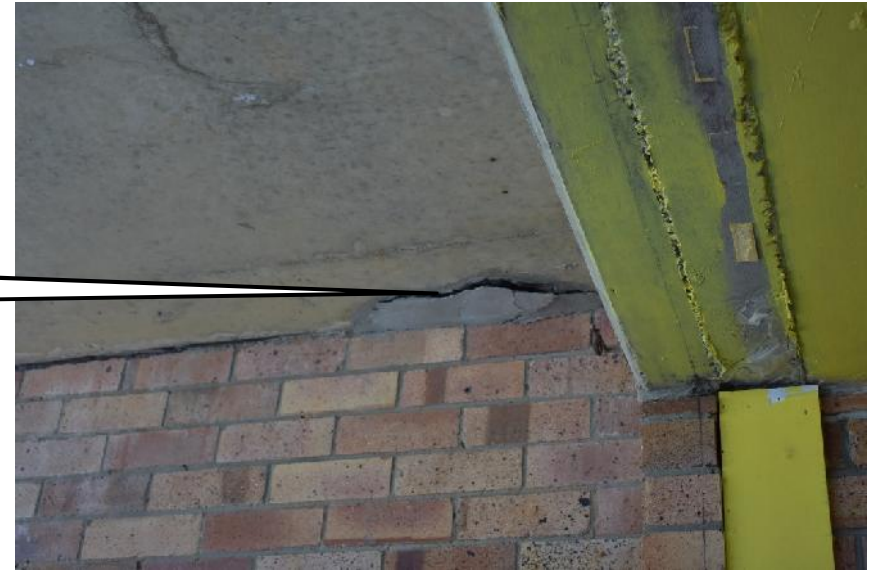
<div>B10</div> <div> <div>Slab cracks</div> <div>Slab cracks</div> <div>Corroding reinforcement</div> <div>Water penetration</div> </div>	
<div>B11</div> <div> <div>Cracked parapet</div> <div>Rust staining from old anchor bolts</div> </div>	




<p>B12</p> <p>Spalling concrete and corroded reinforcement</p> <p>Spalling concrete and corroded reinforcement</p>	
<p>B13</p> <p>Heavily corroded reinforcement</p>	
<p>B14</p> <p>Corroding reinforcement</p>	

<p>B15</p> <p>Cracked parapet</p>	
<p>B16</p> <p>5mm crack at brick wall and concrete parapet</p>	
<p>B17</p> <p>Crack between concrete stair and wall</p>	

<p>B18</p> <p>Roof water tanks Lack of overflow from roof and tanks</p> <p>Embankment retained by first floor wall</p> <p>Propped slab, refer Photo A28</p>	
<p>B19</p> <p>Mortar loss in bed joints and perpend</p>	
<p>B20</p> <p>Plasterboard wall lining with water damage</p>	

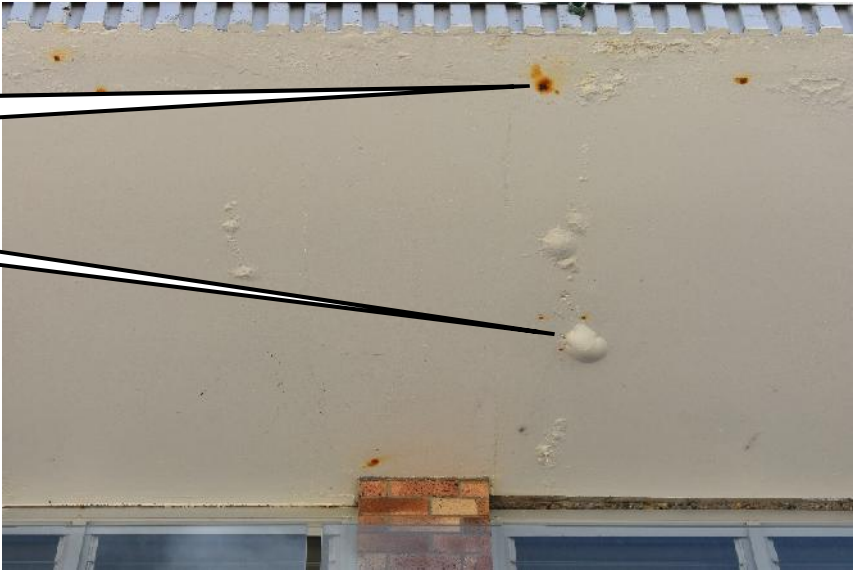


<p>B21</p> <p>Leaking roof slab with calcification</p>	
<p>B22</p> <p>0.3mm crack</p>	
<p>B23</p> <p>Water damaged ceiling tiles</p>	

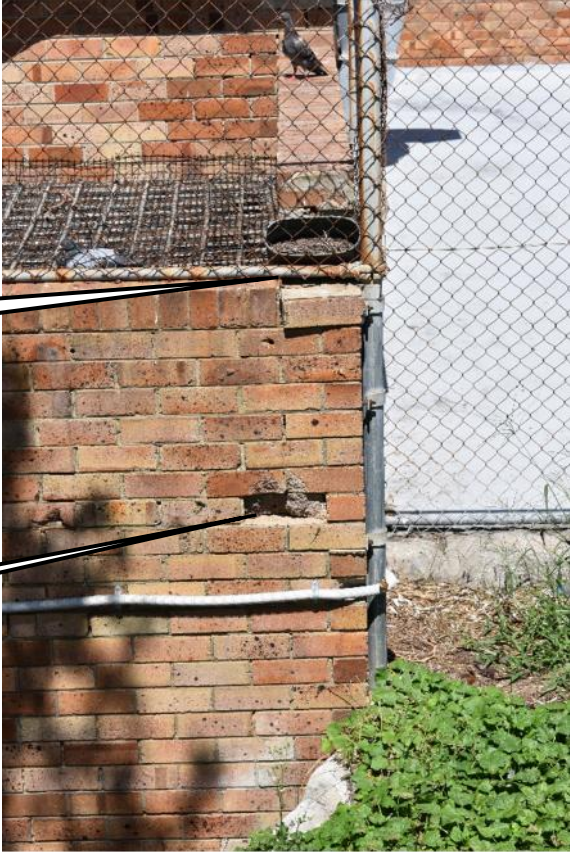

<p>B24</p> <p>Leaking roof slab with calcification</p>	
<p>B25</p> <p>Leaking roof slab with calcification</p>	
<p>B26</p> <p>Spalled concrete with previous patch</p>	




<p>B27</p> <p>Concrete spalled edge</p>	
<p>B28</p> <p>Concrete spalling</p> <p>Displace brickwork</p>	
<p>B29</p> <p>Rust staining</p> <p>Previously spalled concrete with membrane</p>	




UPPER ROOF PHOTOGRAPHS:




<div>C1</div> <div>Severe concrete spalling and reinforcement corrosion</div>	<p>This photograph shows a close-up of the roof edge where a white corrugated metal sheet is attached to a brick wall. There is significant concrete spalling and exposed, rusted reinforcement bars. A white downspout is visible on the brick wall.</p>
<div>C2</div> <div>Water leakage and corroding reinforcement</div>	<p>This photograph shows the underside of a concrete roof slab. There are visible signs of water leakage and rusted reinforcement bars. A white downspout is also visible.</p>
<div>C3</div> <div>Parapet cracking at slab connection</div> <div>Corroding reinforcement</div>	<p>This photograph shows the underside of a concrete roof slab. There is visible cracking at the parapet connection and rusted reinforcement bars. A white downspout is also visible.</p>




<p>C4</p> <p>Corroding reinforcement</p> <p>Water leakage</p>	
<p>C5</p> <p>Water leakage</p> <p>Corroding reinforcement</p>	
<p>C6</p> <p>Severe concrete spalling</p> <p>Corroding reinforcement and bar loss</p>	




<p>C7</p> <p>Missing brickwork and loose brick</p> <p>Brick missing</p>	
<p>C8</p> <p>Blocked and mis-aligned grated drains</p> <p>Blocked and mis-aligned grated drains</p>	


<p>C9</p> <p>Ineffective grated drain</p>	
<p>C10</p> <p>Blocked grated drain</p>	
<p>C11</p> <p>Missing brick</p> <p>Blocked grated drain</p>	

<p>C12</p> <p>Patch repair</p>	
<p>C13</p> <p>Cracked membrane with over-patch</p>	
<p>C14</p> <p>Ponding water</p>	

<p>C15</p> <p>Large concrete spall with complete bar loss</p>	
<p>C16</p> <p>Concrete spall with complete bar loss</p>	
<p>C17</p> <p>Large concrete spall with complete bar loss</p>	

<p>C18</p> <p>Large concrete spall with complete bar loss</p>	
<p>C19</p> <p>Water ponding</p>	
<p>C20</p> <p>Severe cracking Signage holding spall in place</p>	

<p>C21</p> <p>Large concrete spall with complete bar loss</p> <p>Large concrete spall with complete bar loss</p>	
<p>C22</p> <p>Water ponding</p>	
<p>C23</p> <p>Debris</p> <p>Water ponding</p>	

<div>C24</div> <div>Water ponding No overflow</div> <div>Broken skylight</div>	
<div>C25</div> <div>Water ponding No overflow</div> <div>Outlet vulnerable to blockage</div>	