ROGER DUFF WING ALTERATION
VIEWS TO THE BOTANIC GARDEN

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View towards the Port Hills with Peacock Fountain in foreground

The cafe is positioned to prioritizes the public experience and offer great views to the surrounding gardens, Arts Centre, RMG and Port Hills. It is located on the current Cafe floor. Many successful precedence were studied during the design process, such as the Auckland Art Gallery Cafe (facing Albert Park) and the Suter Gallery Cafe in Nelson.

View towards the Botanic Gardens from Level 2

View towards the Botanic Gardens with RMG roof visible

ROGER DUFF WING ALTERATION
CAFE PRECEDENTS

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Suter Art Gallery, Nelson

Auckland Art Gallery

Suter Art Gallery, Nelson

ROGER DUFF WING ALTERATION
PROPOSED SOUTH ELEVATION

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Concept Design Report
Final for Resource Consent
25th November 2020

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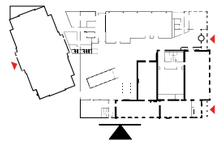

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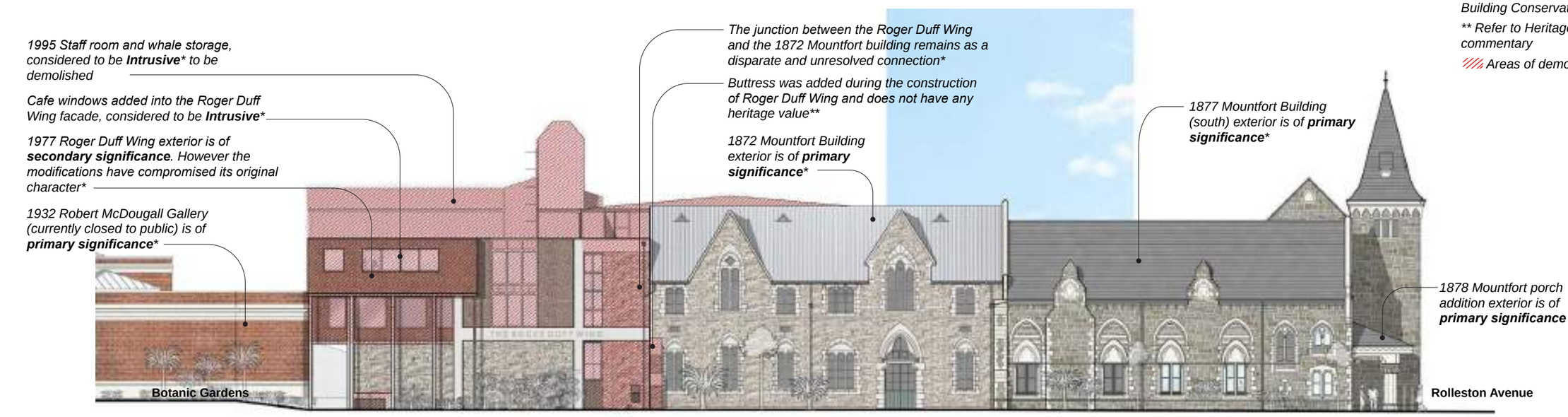
** Refer to Canterbury Museum Building Conservation Plan*

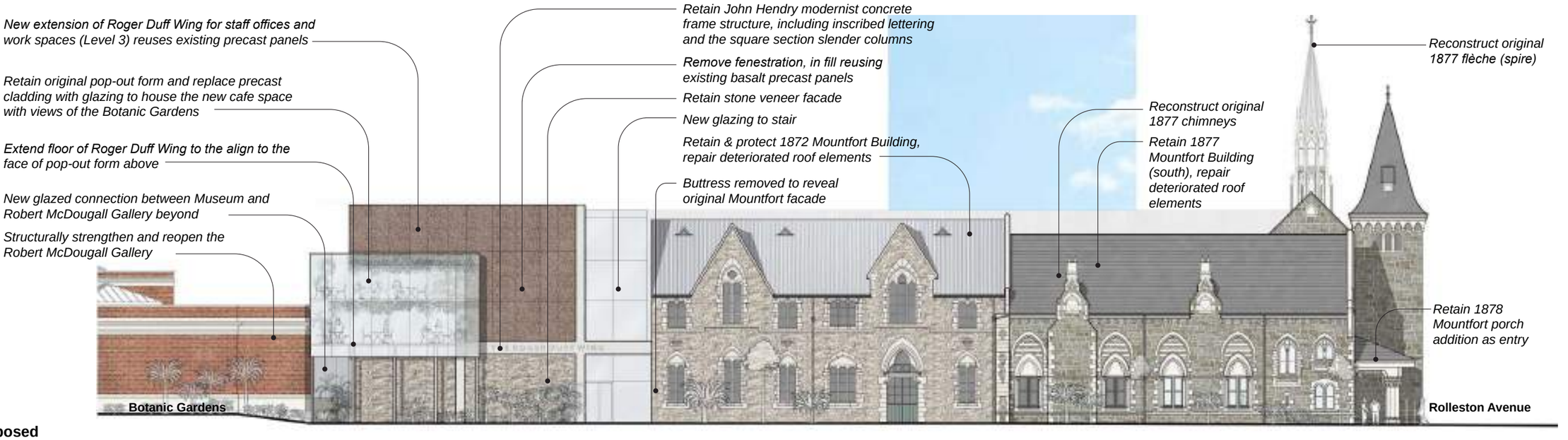
*** Refer to Heritage Architect's commentary*

Areas of demolition

Current condition



Proposed



ROGER DUFF WING ALTERATION
PROPOSED WEST ELEVATION

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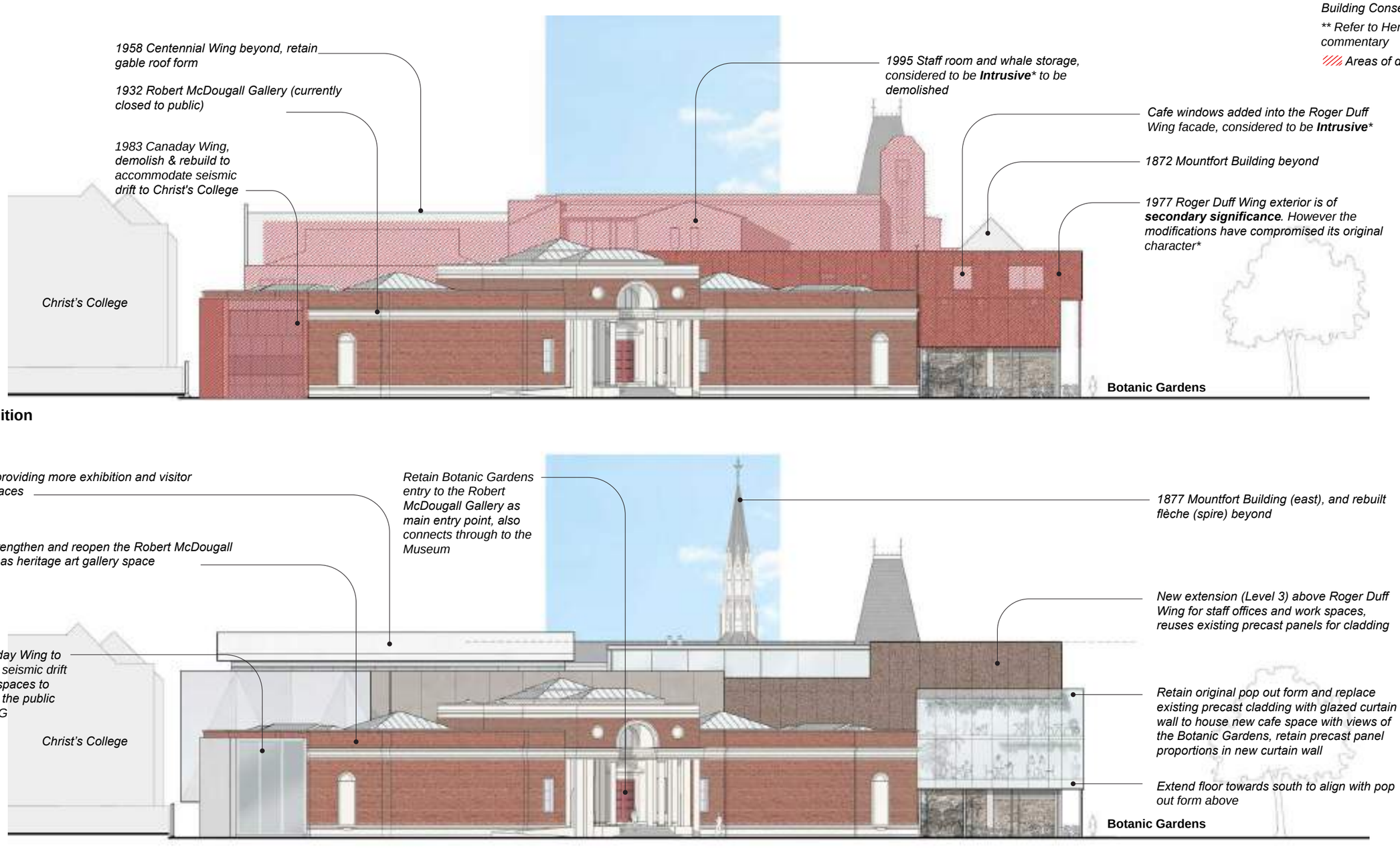
Areas of demolition

Current condition



Proposed

ROGER DUFF WING ALTERATION
EXISTING & PROPOSED PERSPECTIVE VIEWS

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Current conditions - South Elevation

Proposed intervention

Views of existing and proposed south elevation shows

- The facade glazing over existing stairwell between Roger Duff Wing and 1872 Mountfort building. This address the issue of facade treatment and roof termination identified in the Building Conservation Plan.
- Removal of the buttress added to the end of 1872 Mountfort building during the construction of Roger Duff Wing.
- Vertical extension above existing building.
- Floor area extended to the line of existing columns on level 2.

Current conditions - West Elevation

Proposed intervention

Views of existing and proposed west elevation shows

- Vertical extension of the Roger Duff Wing
- Glazing to the existing 'pop-out' on levels 2-3.
- Floor area extended to the line of existing columns on level 2.
- Glazing at ground floor, allowing pedestrians to 'peek' into the Museum exhibitions.

ROGER DUFF WING ALTERATION
EXISTING & PROPOSED PERSPECTIVE VIEWS

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Current condition

Proposed

Views of RMG and Roger Duff Wing viewed from "pine mount" in the Botanic Garden

- The flat roof of new additional Level 3 can be seen from the Botanic Gardens. It compliments the existing language of the RMG roof forms while recedes into the background.
- The staff room, whale store room and the lift machine can be seen here, which will be replaced the new addition, which provides the much needed staff work areas.
- Glazing opens up Roger Duff Wing up to the Botanic Gardens. Views of the active cafe interior can be seen from the footpath, which may entice more public visits.

ROGER DUFF WING ALTERATION
ARTIST'S IMPRESSION OF CAFE INTERIOR

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ROBERT MCDOUGALL GALLERY

ROBERT MCDOUGALL GALLERY
CURRENT CONDITIONS

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RMG forecourt & entrance looking from Botanic Gardens

Robert McDougall Gallery (RMG) - Christchurch's first public art gallery

The Gallery is situated in a corner of the Botanic Gardens at the rear of the Museum. It was completed in 1932, designed by the prominent Christchurch architect Samuel Hurst Seager. RMG is identified in the Christchurch City Council City Plan as a Group 1 building, it is also listed as Category One building within the New Zealand Historic Places Trust - Pouhere Taonga (Refer to RMG Conservation Plan).

The RMG building became vacant upon the opening of the new Christchurch Art Gallery in May 2003. It was permanently closed after the September 2010 earthquake. It presented as a wonderful opportunity for the Museum to be the custodian to the Gallery. The Christchurch City Council has resolved to lease the RMG to the Canterbury Museum Trust Board.

As a part of the Museum Redevelopment project, RMG will be upgraded with much needed earthquake strengthening, base isolation and heritage restoration. A new walkway is proposed to connect the RMG to the current Museum, via a glazed link. The RMG building will be returned, as far as practical, to its original form and design; this includes the removal of the 1960's Night Entry and Workshop to uncover heritage fabric, as these programs can now be shared with the extended Museum back-of-house areas. New climate control upgrades will see the removal of external roof plants, which will also be shared with the Museum.

RMG workshop, entry from Museum service lane

RMG night entry

RMG roof

ROBERT MCDOUGALL GALLERY
HISTORICAL PHOTOS

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Newly completed Gallery landscape 1932

Ex Tenebris Lux in its original position in the centre of the sculpture court. The Ernest Fillick sculpture remained there until 1980 when it was moved into the gardens next the Gallery (source: RMG Conservation Plan)

Centennial Court during construction, back of the RMG brick walls can be seen here, without the Night Entry, Workshop and services

RMG FLOOR PLANS
RMG BASEMENT LEVEL
MUSEUM BASEMENT LEVEL 0

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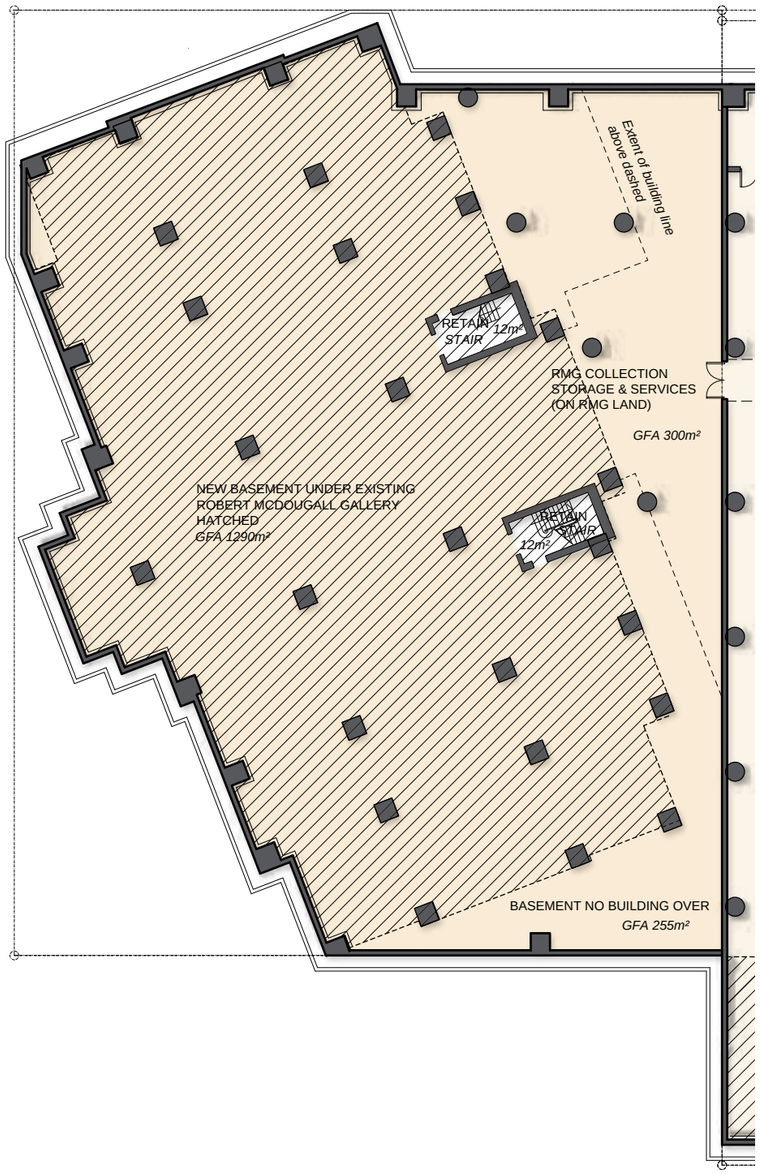
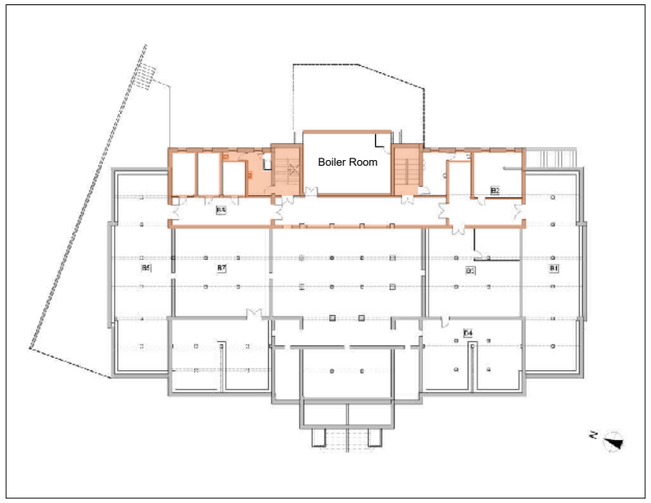
Demolition floor plan



Proposed floor plan

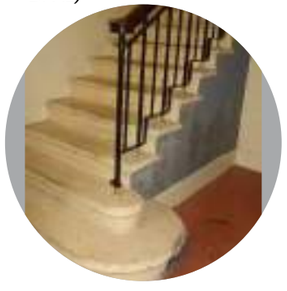


Robert McDougall Art Gallery Basement (DPAL), RMG Conservation Plan Highlighted areas with "Some significance - Fabric having some significance makes a minor contribution to the overall significance and understanding of the heritage values of the place."

Boiler room (image: DPAL)

Female toilet (image: DPAL)

B1 Basement area (image: DPAL)



Stair to basement (image: DPAL)

RMG FLOOR PLANS
RMG BASEMENT LEVEL CONTINUED.
MUSEUM LEVEL 1

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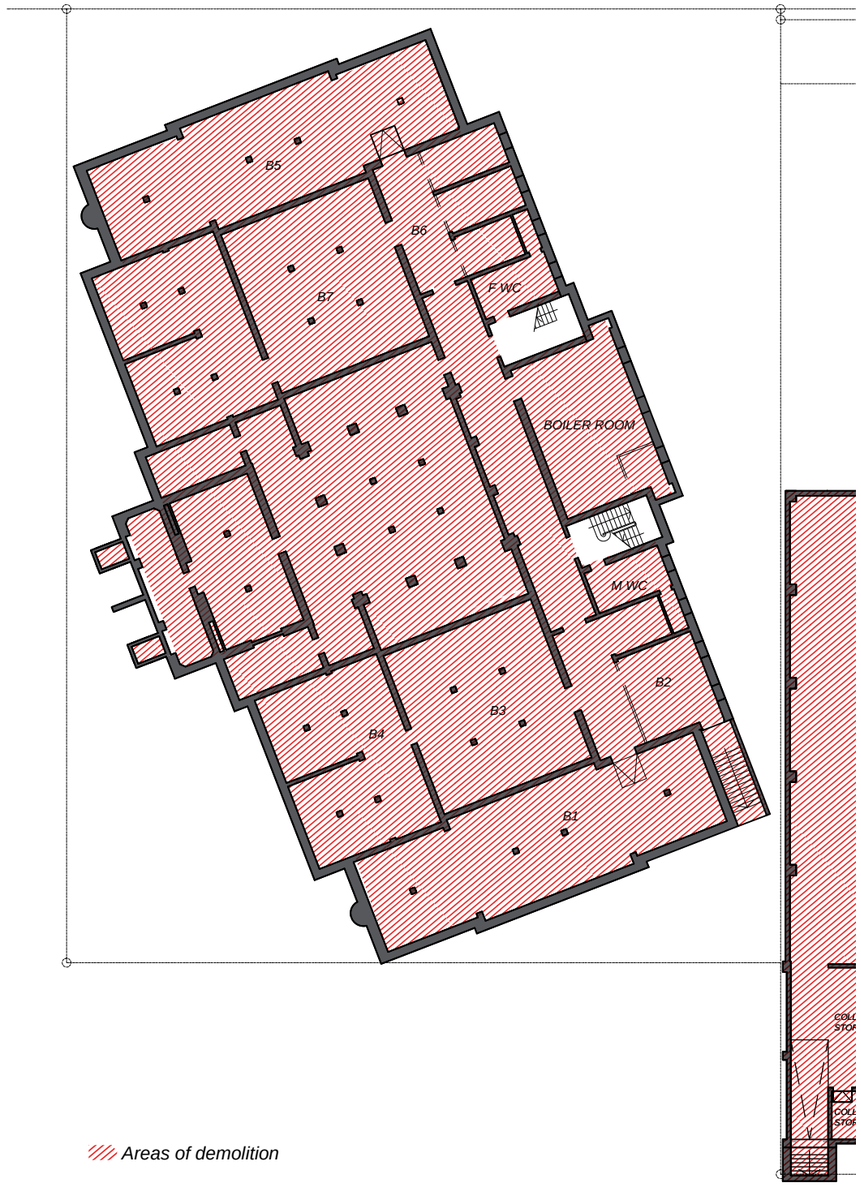
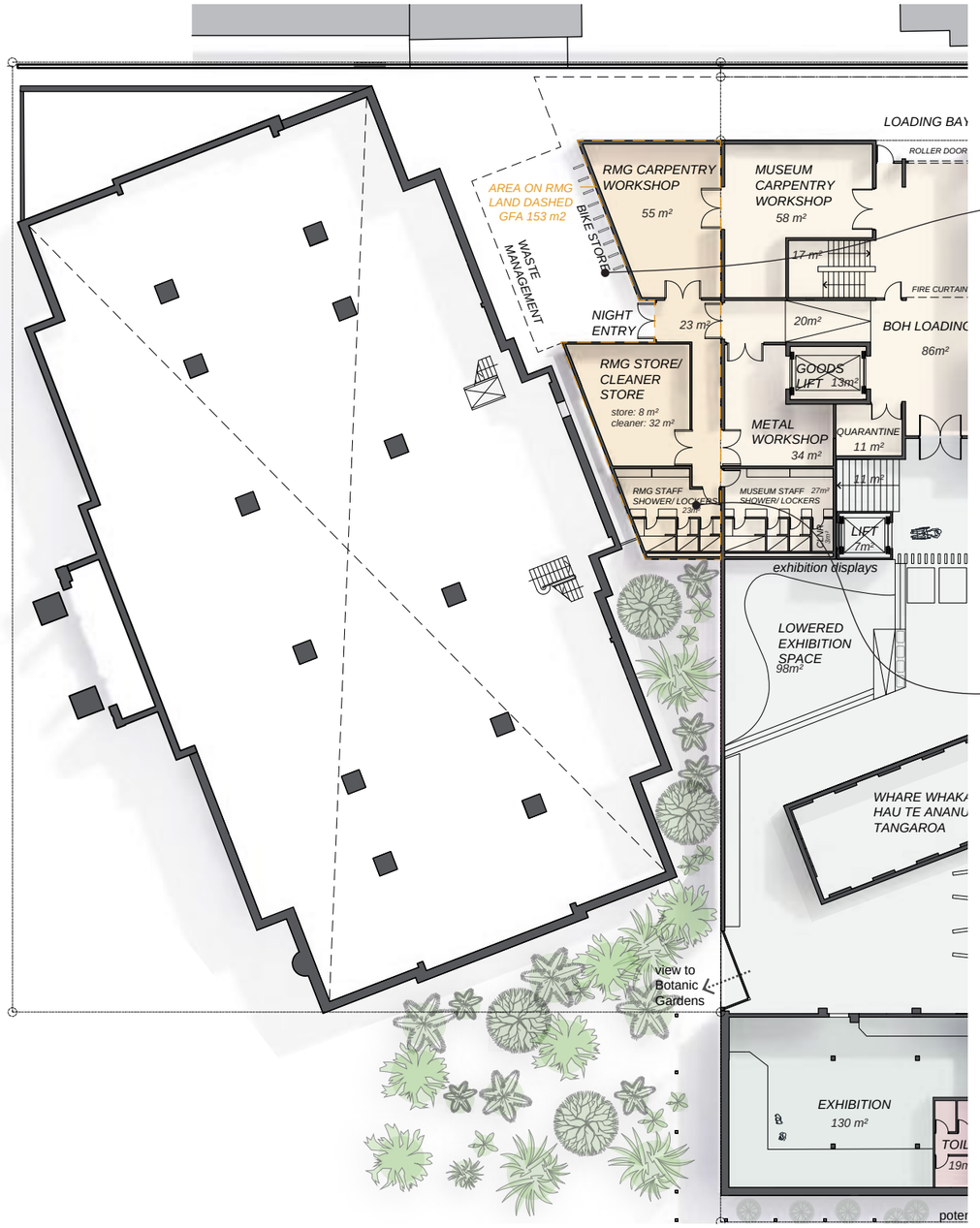


Demolition floor plan



Proposed floor plan

Bike parking

Staff locker room

RMG FLOOR PLANS
RMG LEVEL 1
MUSEUM LEVEL 1.5 MEZZANINE

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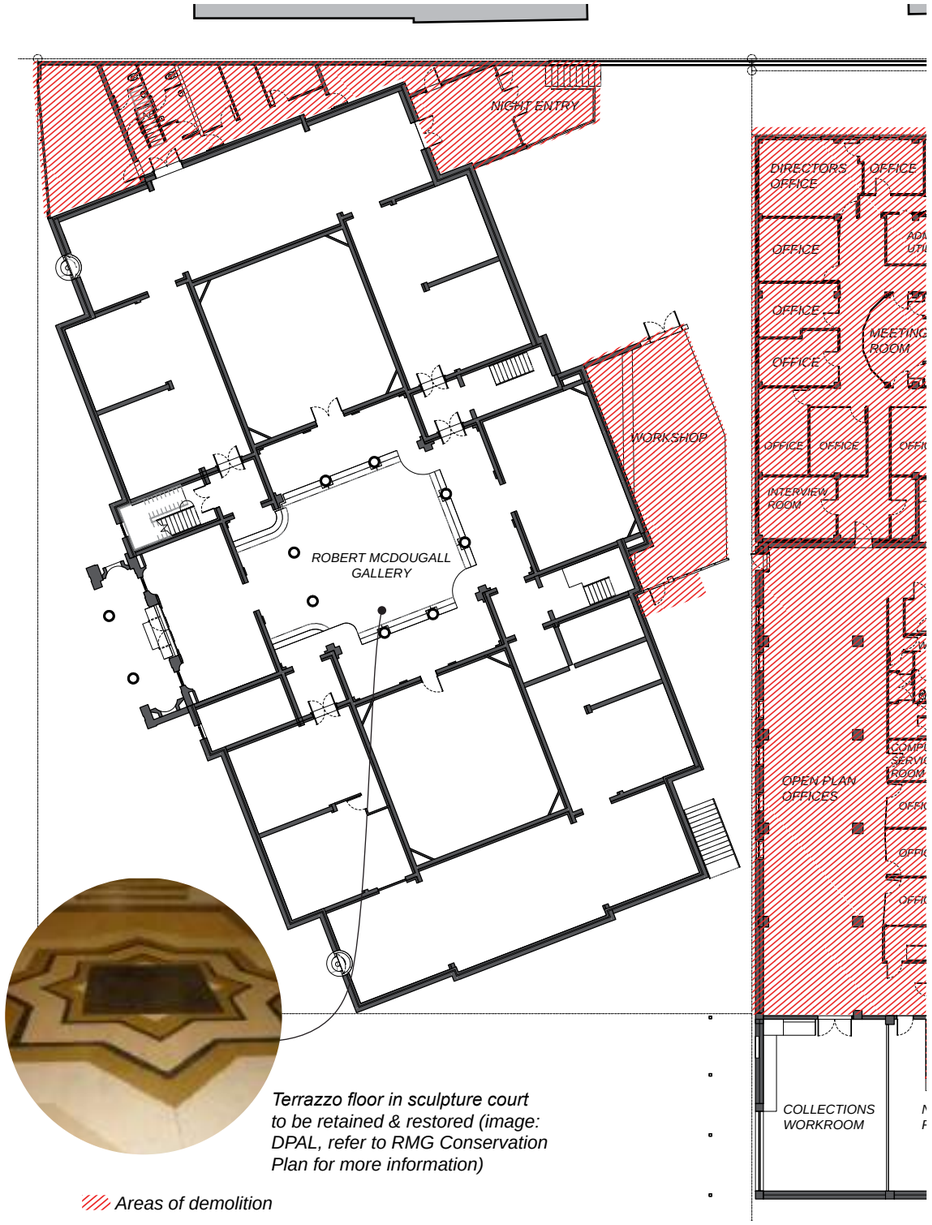
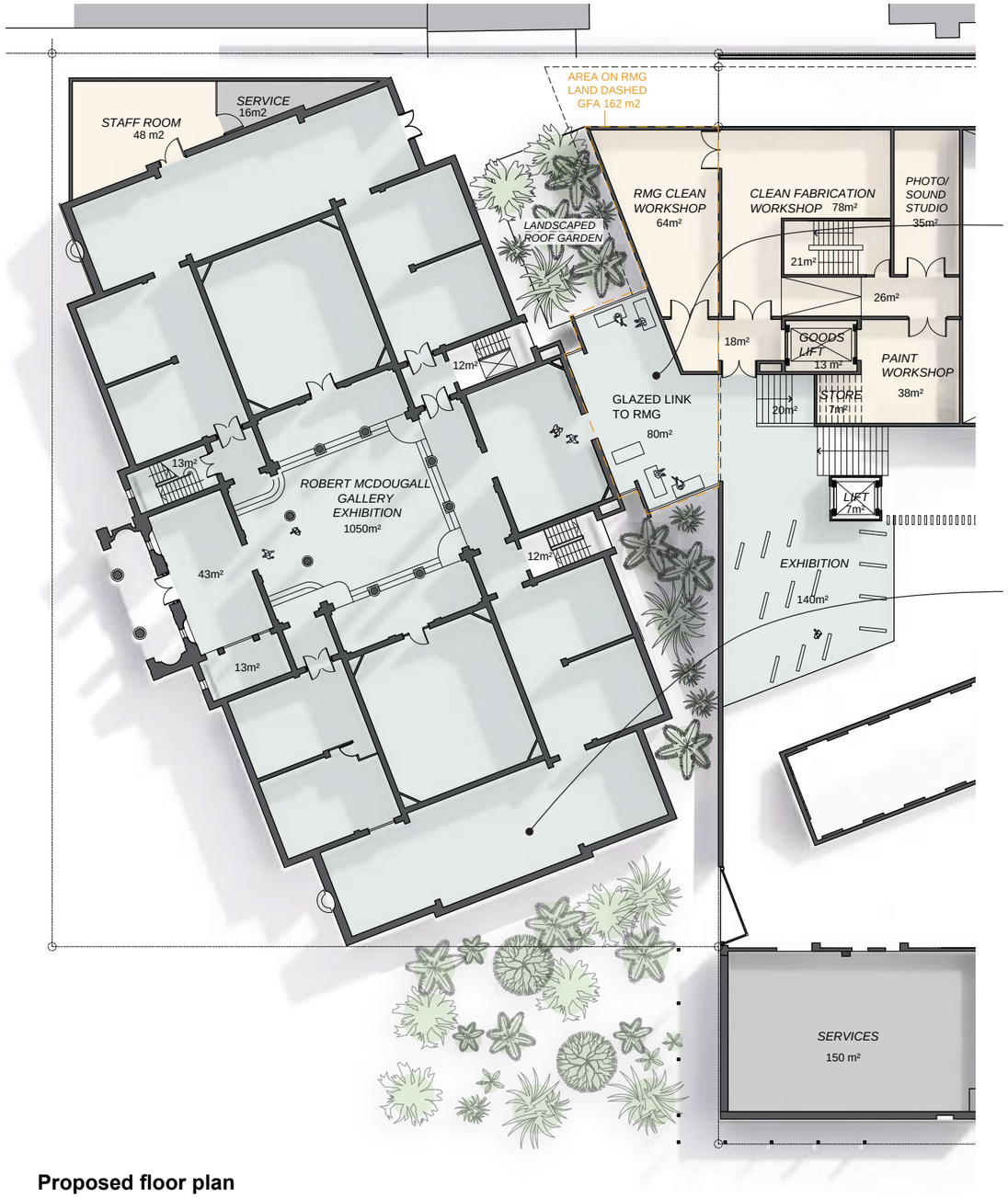


Terrazzo floor in sculpture court to be retained & restored (image: DPAL, refer to RMG Conservation Plan for more information)

Areas of demolition

Demolition floor plan



Proposed floor plan

Auckland City Art Gallery

Restore RMG gallery spaces, such as the Gallery room shown in the historical photo with top-side lighting system.

Gallery room current condition (image: DPAL, refer to RMG Conservation Plan for more information)

RMG FLOOR PLANS
RMG LEVEL 2
MUSEUM LEVEL 2

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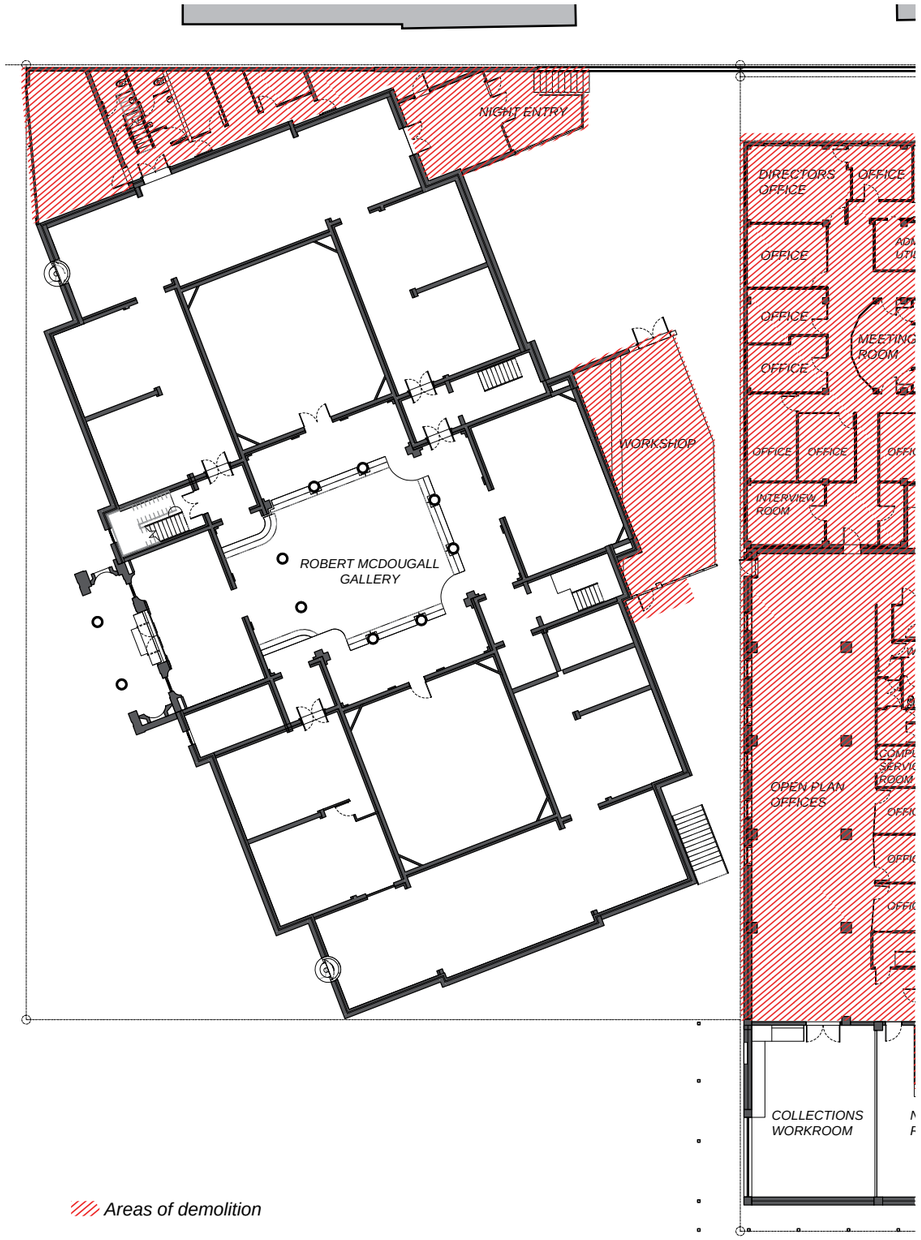

Demolition floor plan

Proposed floor plan

Antarctic History Exhibition focussed on Antarctic art collection

Restore Boardroom with Tasmanian Blackwood panelling and picture rail, architraves and door (image: DPAL, refer to RMG Conservation Plan for more information)

RMG FLOOR PLANS
RMG ROOF LEVEL
MUSEUM LEVEL 2.5 MEZZANINE

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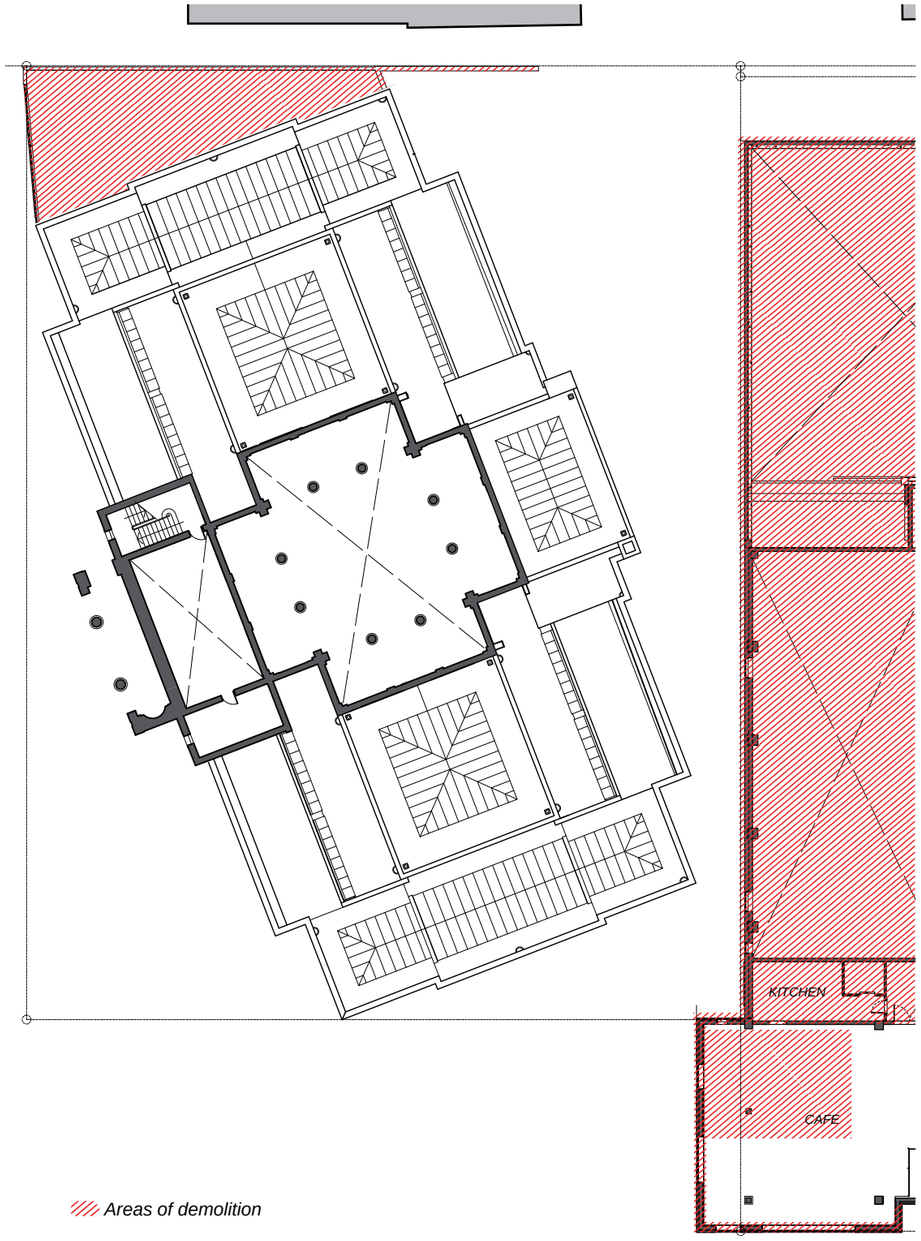
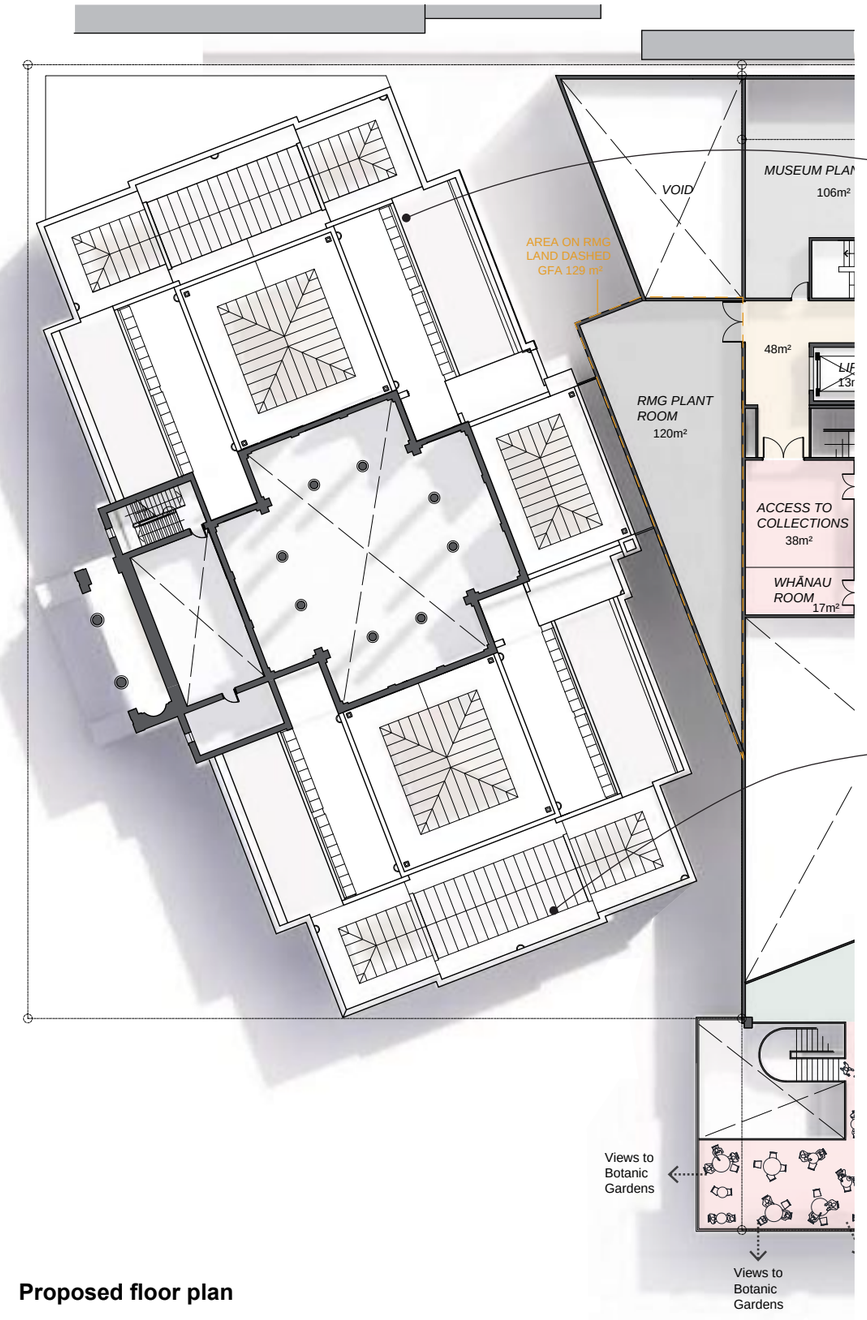


Demolition floor plan



Proposed floor plan

Restore RMG heritage fabric such as damage to parapet with erosion evident (RMG Conversation Plan 2013)

The roof lights is of High Significance heritage value, known as 'top side" lighting which was the brain-child of another architect, Samuel Hurst Seager. They have generally survived, although some have been overlaid with corrugated steel. Proposed work includes restoration of these skylights, and removal of air-conditioning plant which was deemed Intrusive (RMG Conservation Plan 2013)

RMG FLOOR PLANS
PROPOSED NEW LINK TO MUSEUM

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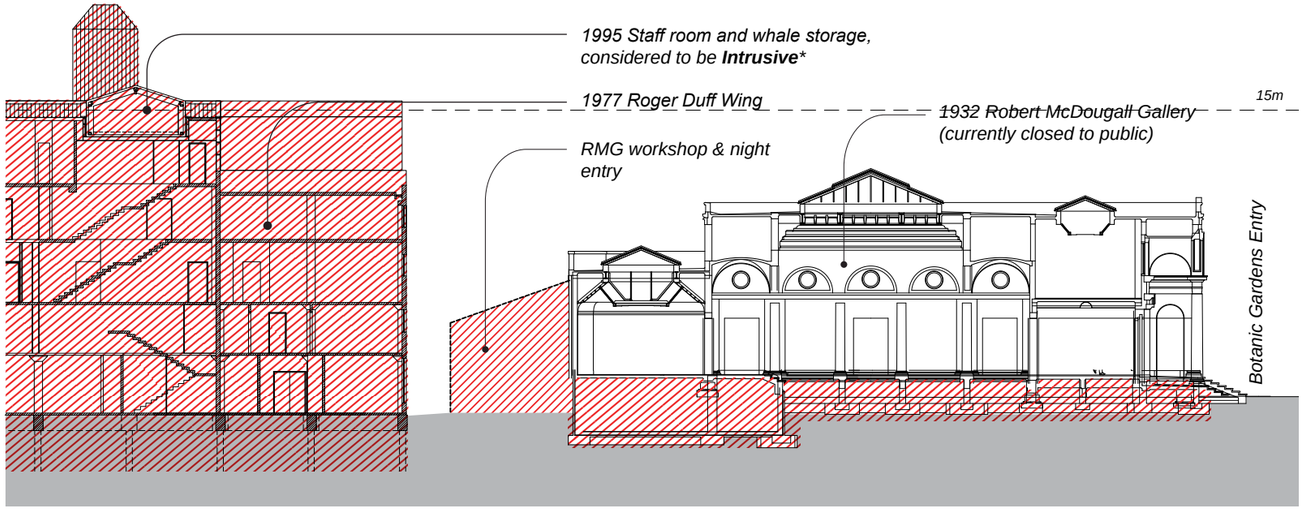
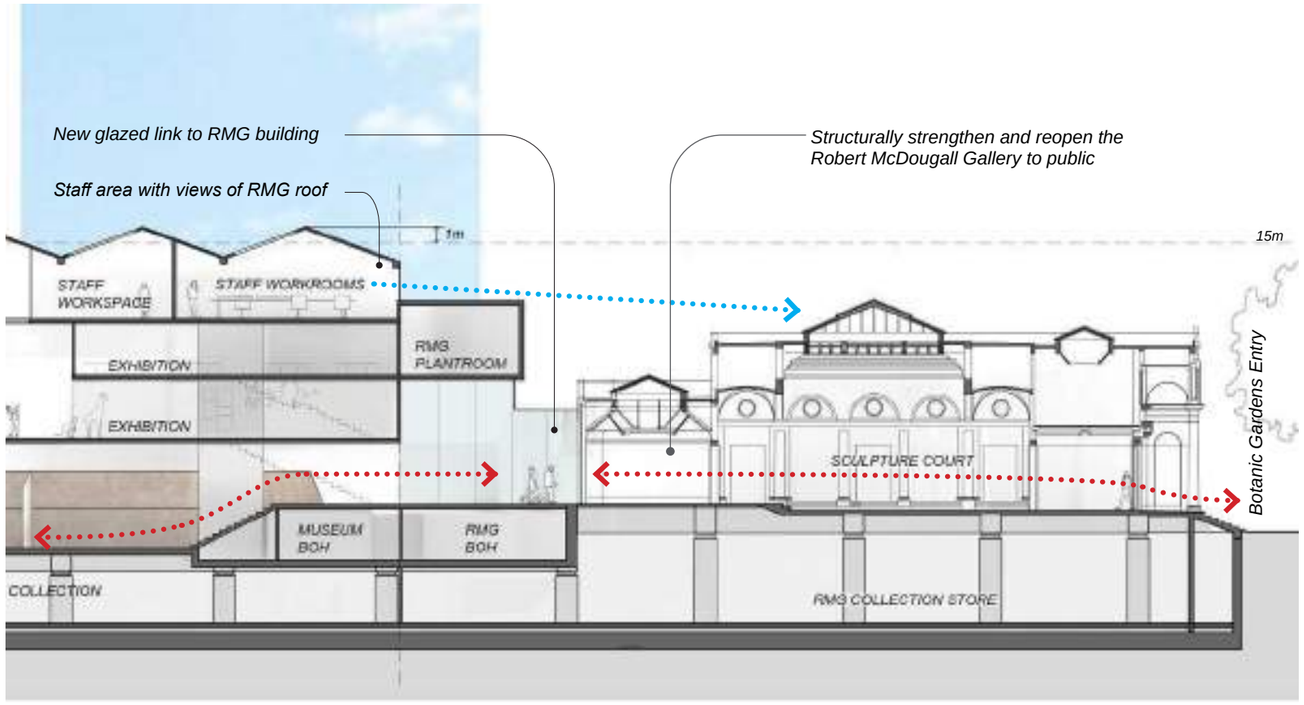
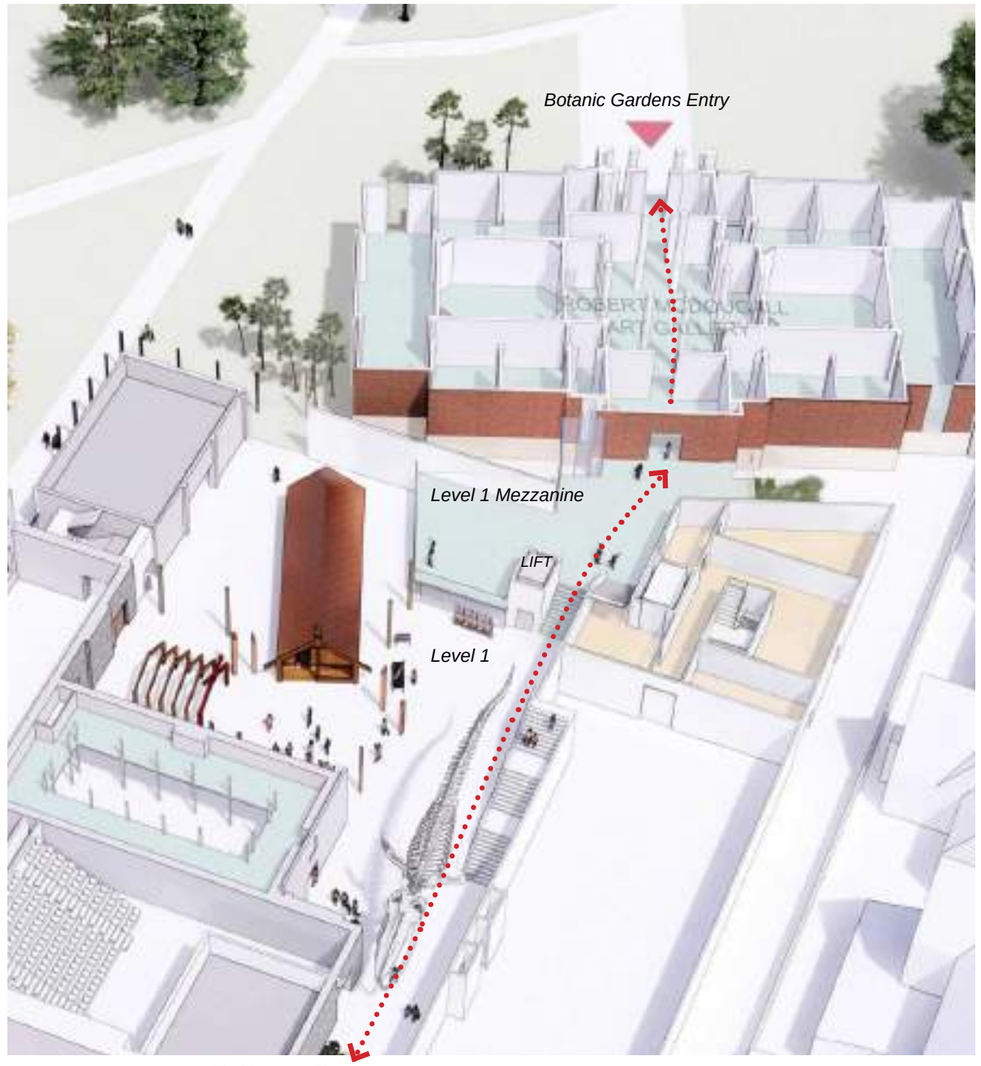
*** Refer to Heritage Architect's commentary*
Areas of demolition



Current & proposed demolition



Proposed



RMG ELEVATIONS
FACADE TREATMENTS

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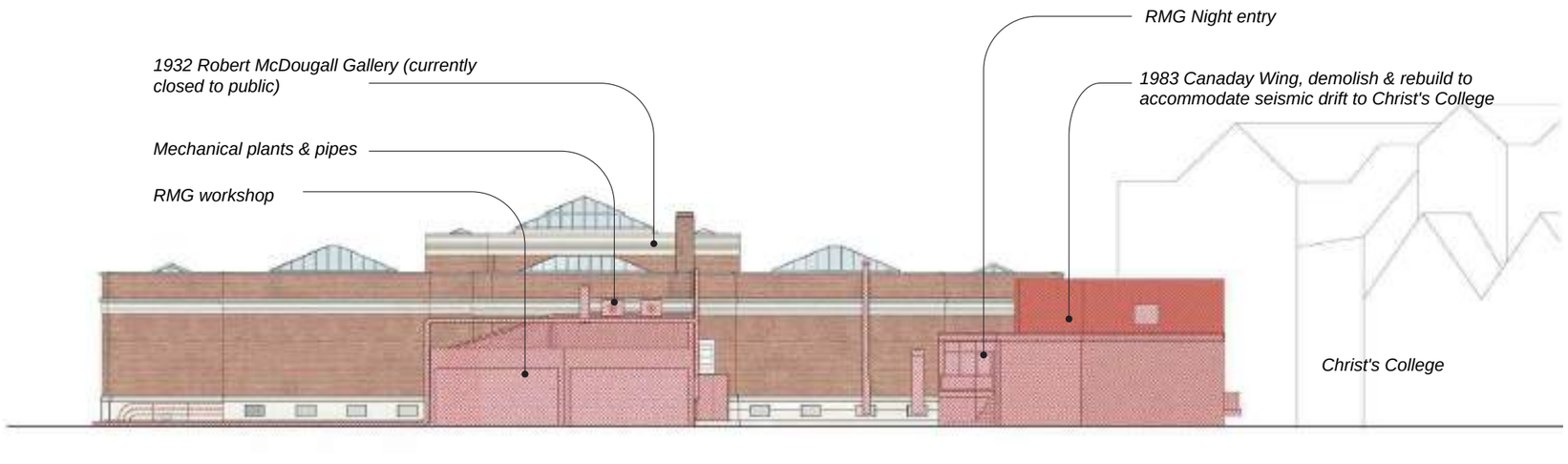
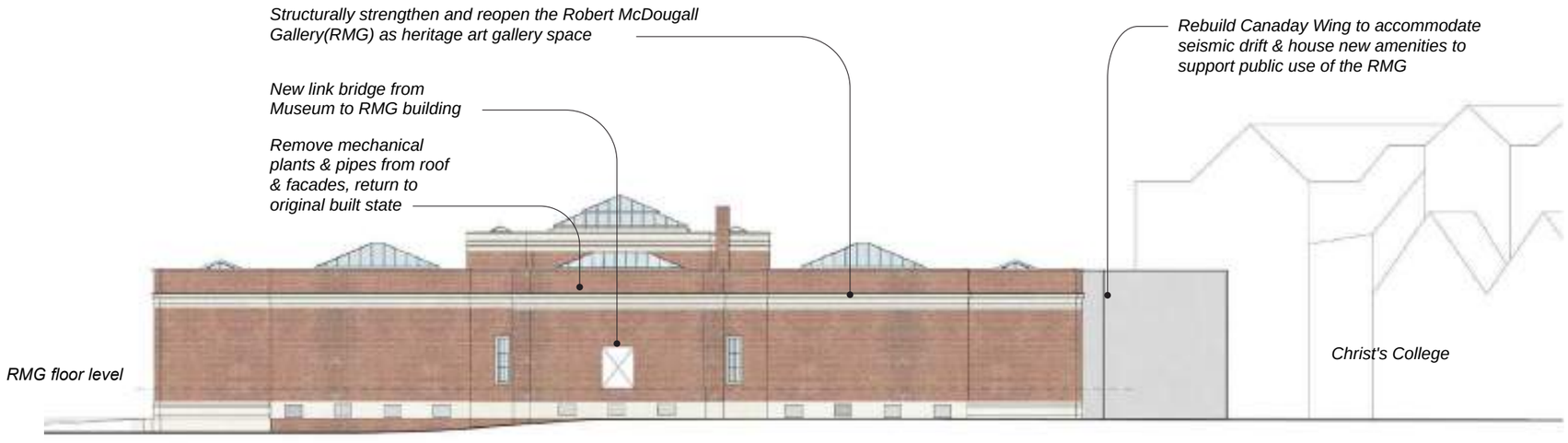
Areas of demolition



Current & Proposed demolition - East Elevation



Proposed - East Elevation

RMG ELEVATIONS
FACADE TREATMENTS

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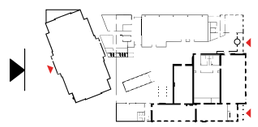

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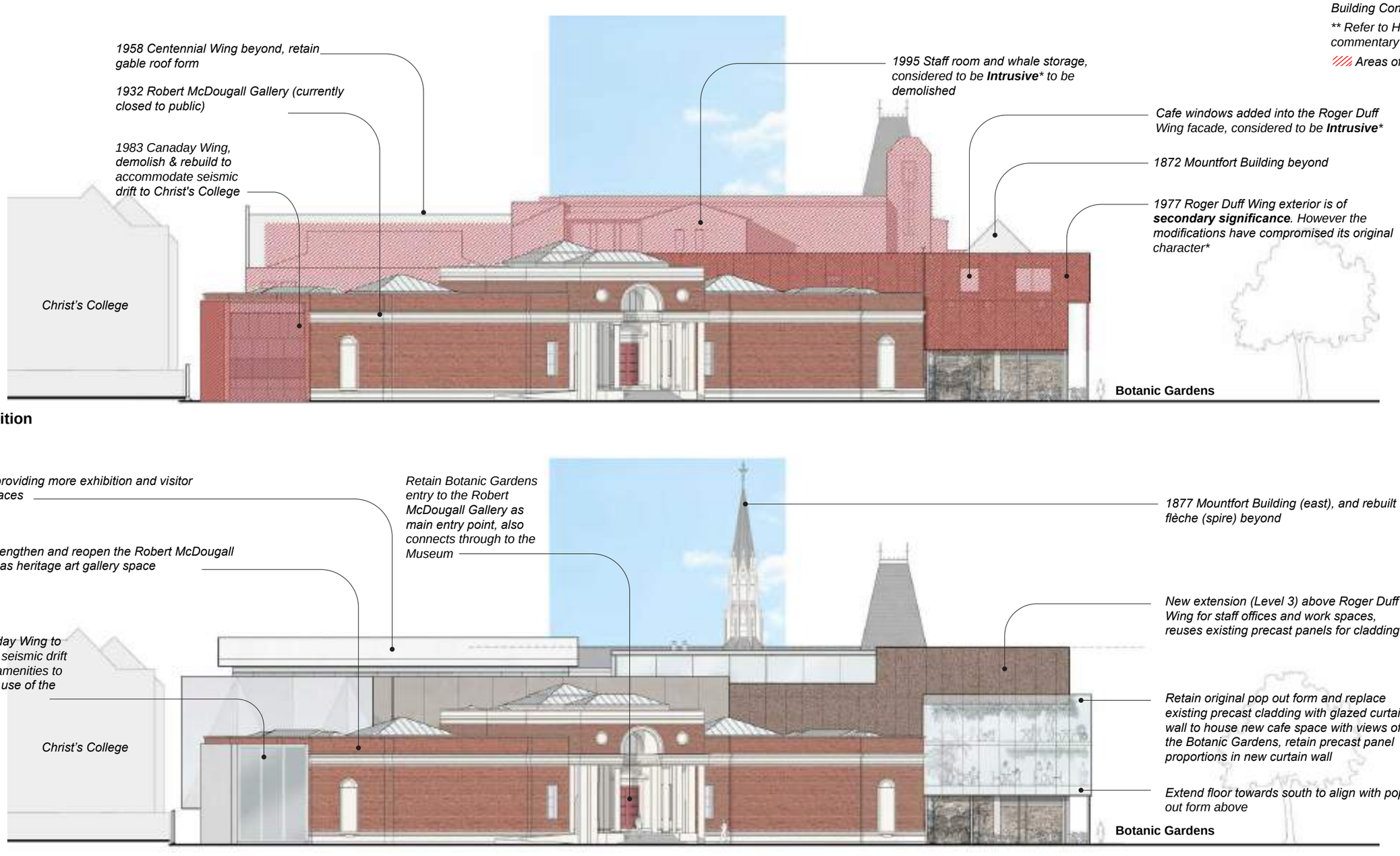
Areas of demolition

Current condition



Proposed

RMG ELEVATIONS
FACADE TREATMENTS

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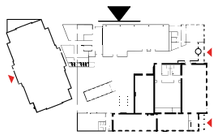

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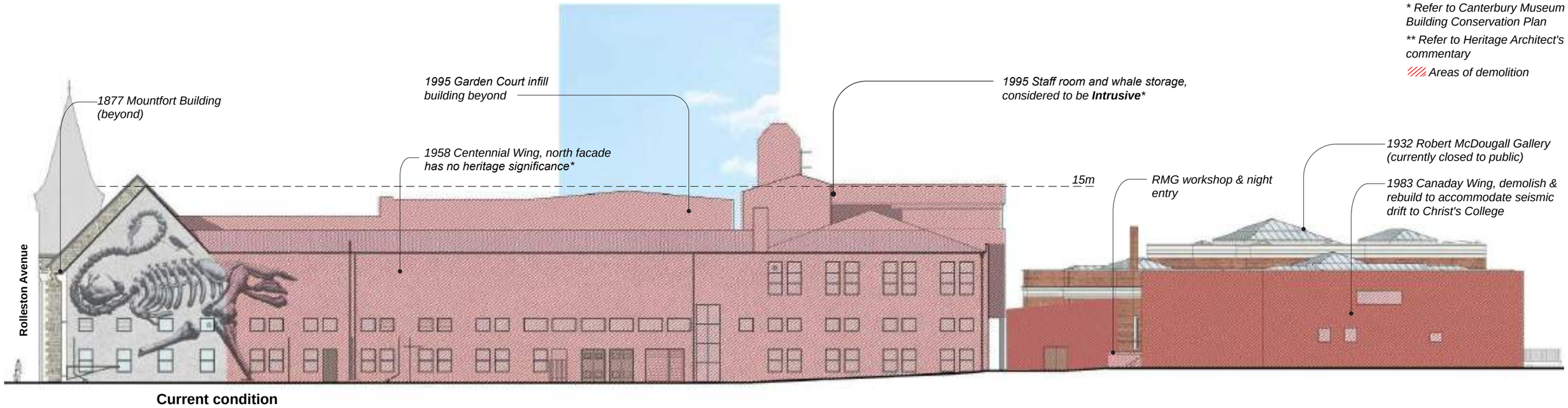
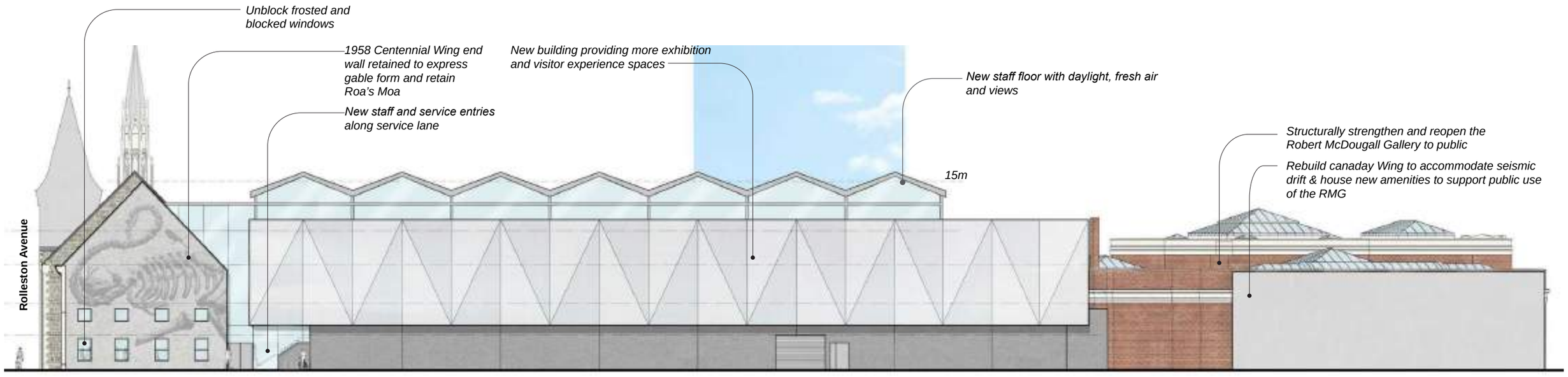
Areas of demolition



Current condition



Proposed

ROBERT MCDOUGALL GALLERY
BOTANIC GARDENS SPATIAL PLAN

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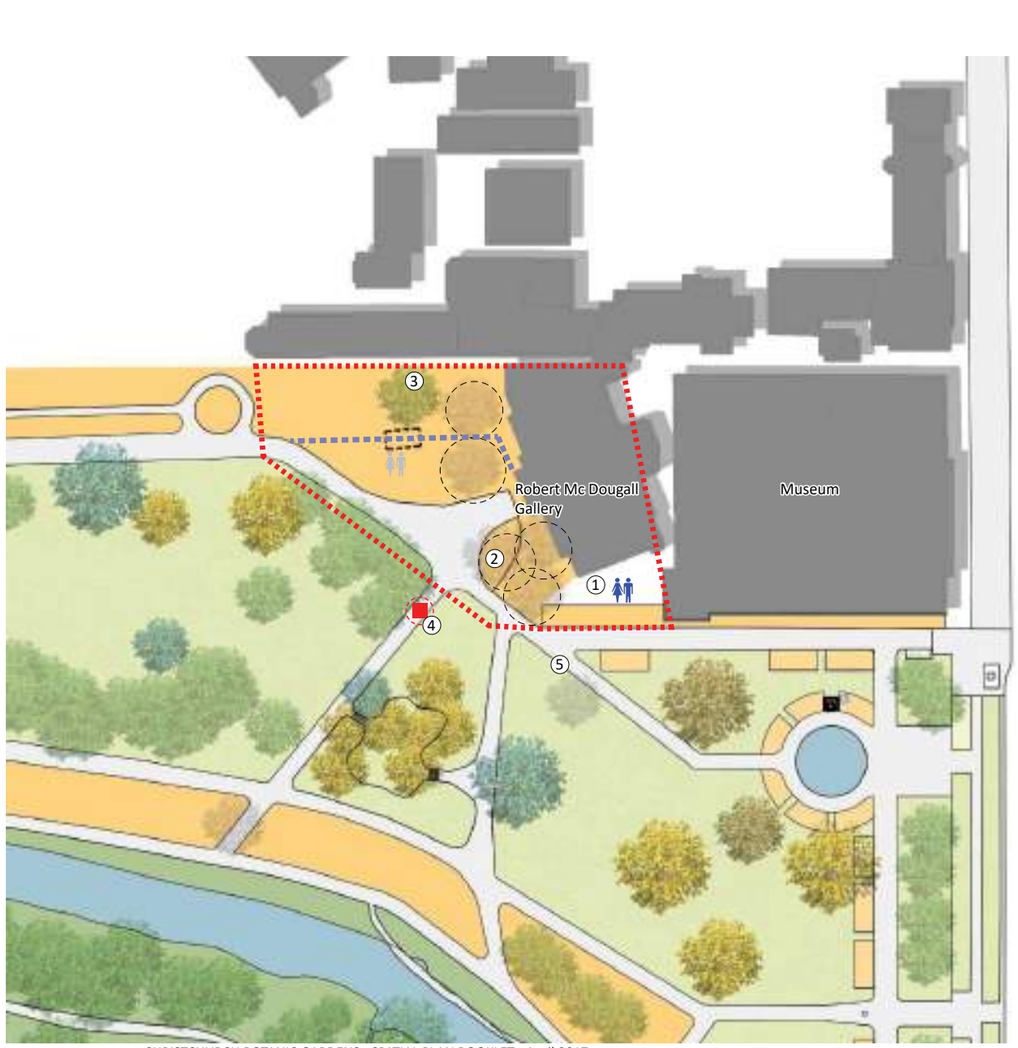
Robert McDougall Art Gallery



KEY

- Existing buildings to be retained
- Buildings for staged removal - existing toilet facilities
- Possible future path -3m - including accessible ramp
- Envelope for future concept design to confirm detailed spatial configuration - planting and paving, toilet facilities

Garden Themes

- Garden Craft
- The Evolution of Canterbury Plants
- Plants + People
- River Habitat / Cloak
- River Gateways
- Lawn areas
- Water Bodies
- Commemorative Trees
- Play Trees
- Notable Trees
- Lime Avenue Trees
- Trees for staged for removal /no succession tree planting for improved circulation / sightlines

1. Possible shared toilet facilities as part of future redevelopment of Robert McDougall/Museum complex
2. Staged removal of tree species. Garden Craft planting to ensure clear sightlines to building frontage
3. Tree species to be retained as identified in the Gallery Conservation Plan - horse chestnut, northern red oak and lawson cypress
4. Statue - For staged removal. Evelyn Couzins Memorial Gateway. 1950. Some/Local value. Path extension to emphasise connection/ views to gathering space in front of
5. Path alignment improved to building frontage as hub/gathering space

Note:
- Staged removal of buildings to be coordinated with development of new replacement facilities + further consultation to include associated community groups/ families

Current condition

Post vegetation removal will bring the RMG back to its original appearance

Historical photo of the RMG, showing forecourt visible from the Botanic Gardens

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ROOF & BUILT FORMS EXTERNAL VIEWS

ROOF & BUILT FORMS
STREET PERSPECTIVE VIEWS MAP

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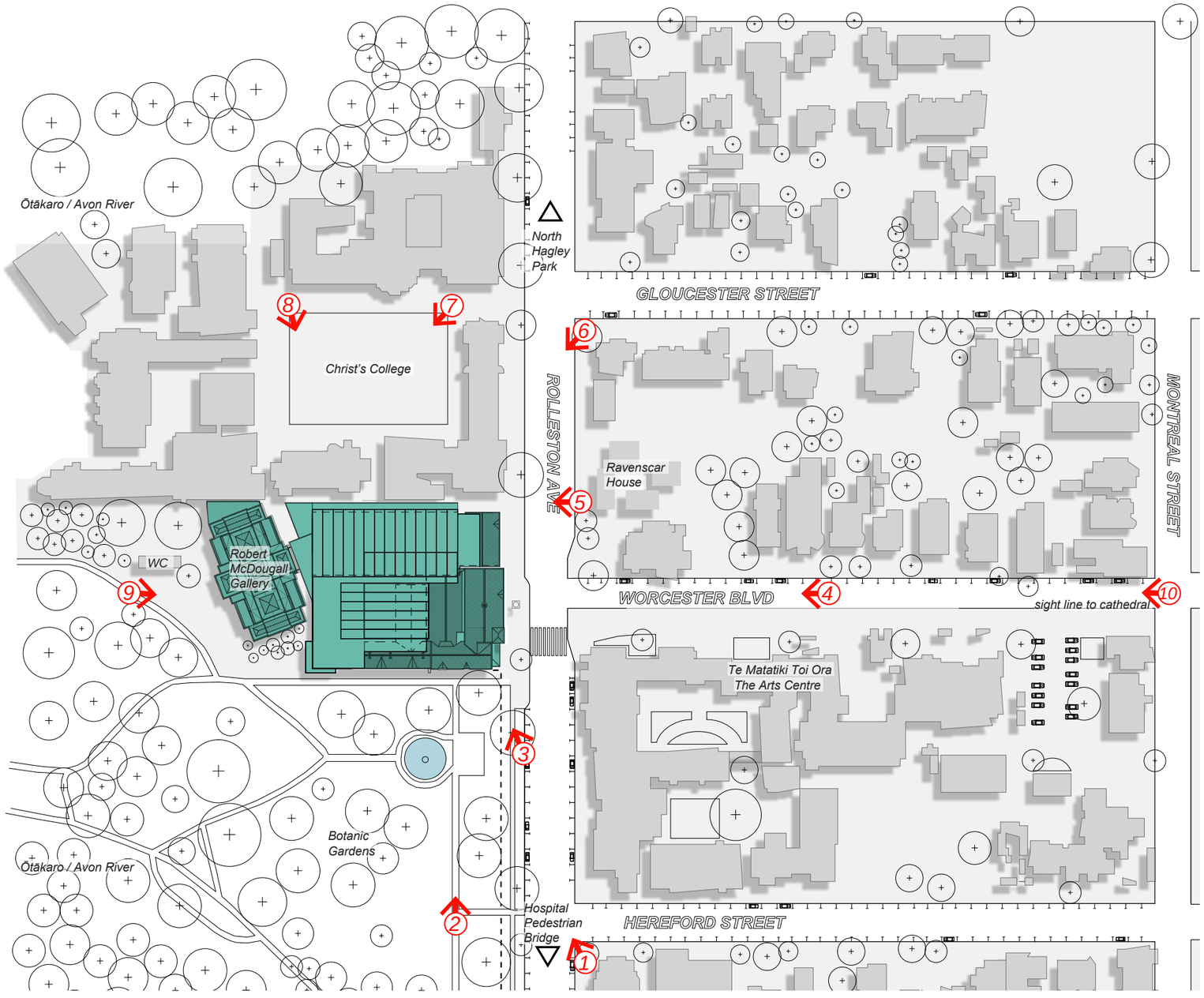

ROOF & BUILT FORMS
VIEW 1 - ROLLESTON AVENUE, HEREFORD STREET CORNER

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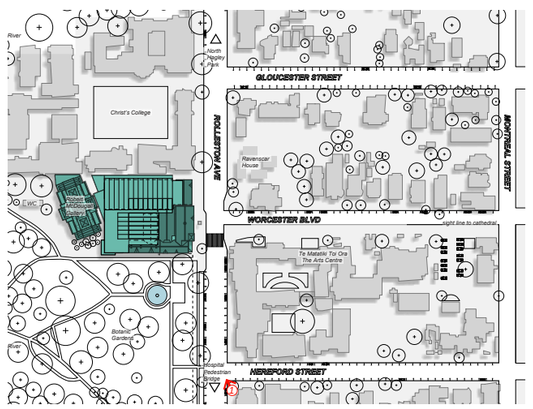
Existing

Proposed



ROOF & BUILT FORMS
VIEW 2 - BOTANIC GARDENS PATH

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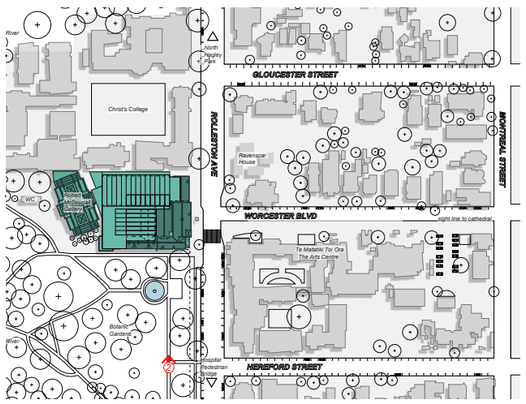
Existing

Proposed



ROOF & BUILT FORMS

VIEW 3 - ROLLESTON AVENUE SOUTH-WEST CORNER

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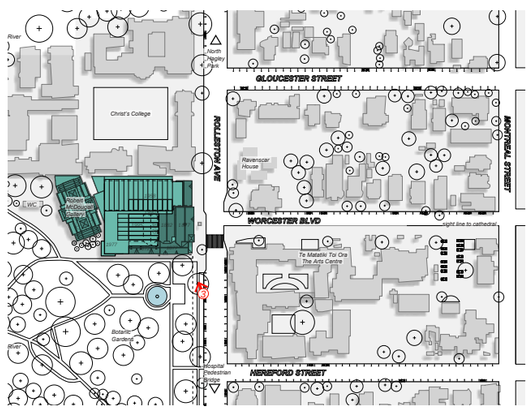
Existing

Proposed



ROOF & BUILT FORMS
VIEW 4 - FROM WORCESTER BOULEVARD

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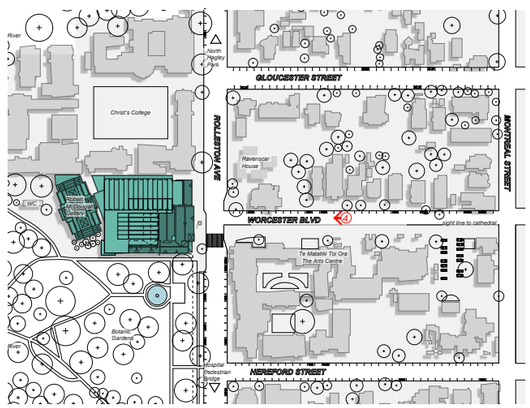
Existing

Proposed



ROOF & BUILT FORMS
VIEW 5 - FROM ROLLESTON AVENUE TOWARDS SERVICE LANE

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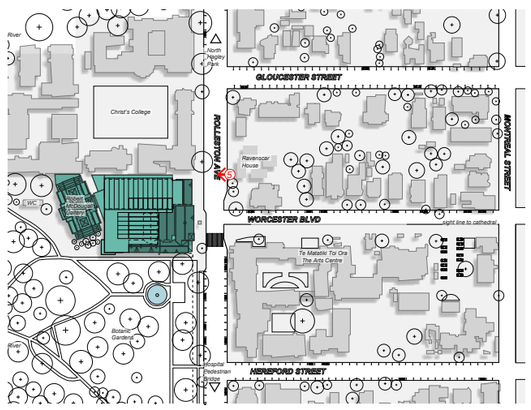
Existing

Proposed



ROOF & BUILT FORMS

VIEW 6 - CORNER OF ROLLESTON AVENUE & GLOUCESTER STREET

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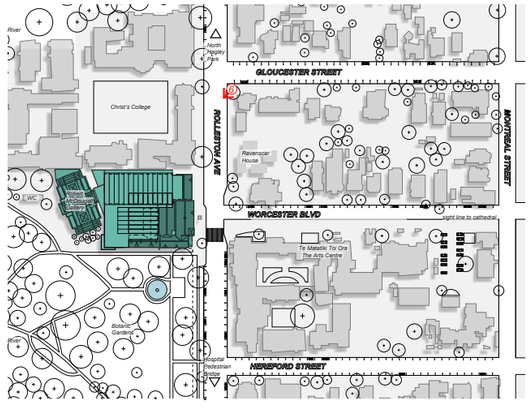
Existing

Proposed



ROOF & BUILT FORMS
VIEW 7 - CHRIST'S COLLEGE COURTYARD NORTH-EAST CORNER

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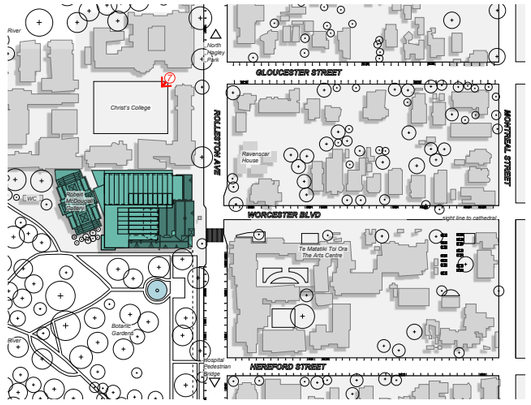
Existing

Proposed



ROOF & BUILT FORMS
VIEW 8 - CHRIST'S COLLEGE COURTYARD NORTH-WEST CORNER

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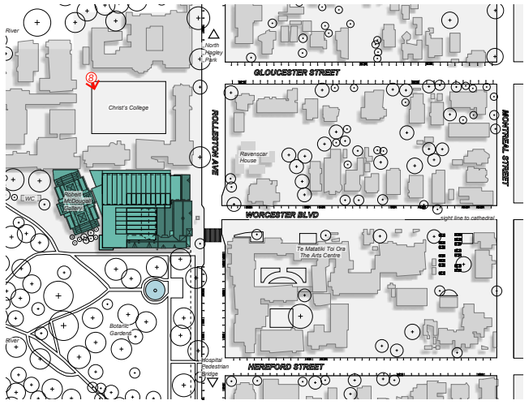
Existing

Proposed



ROOF & BUILT FORMS
VIEW 9 - BOTANIC GARDENS TOWARDS ROBERT MCDOUGALL GALLERY

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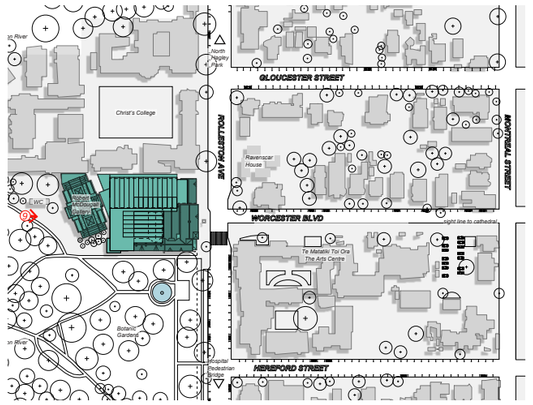
Existing

Proposed



ROOF & BUILT FORMS
VIEW 10 - CORNER OF MONTREAL STREET & WORCESTER BOULEVARD

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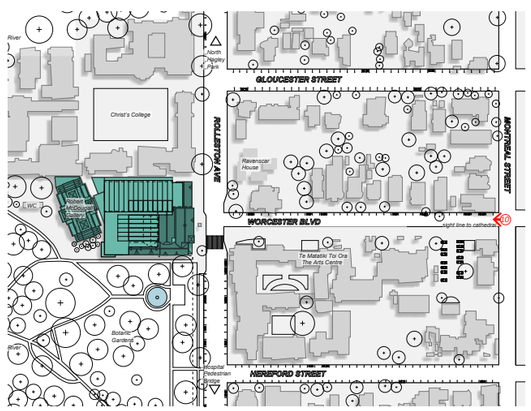
Existing

Proposed

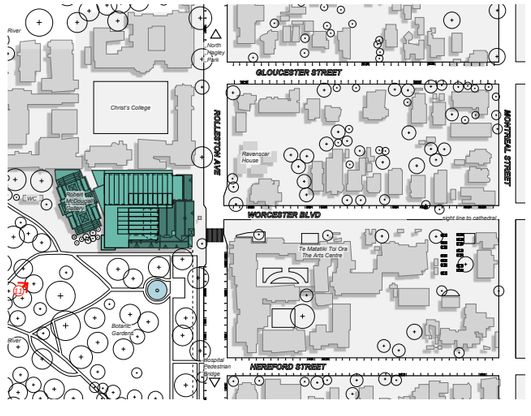


ROOF & BUILT FORMS
VIEW 11 - FROM BOTANIC GARDENS PINE MOUNT

athfield architects limited

Existing

Proposed



ROOF & BUILT FORMS

VIEW 12 - AERIAL VIEW FROM SOUTH-EAST CORNER

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Aerial view of proposed redevelopment seen from Southeast corner

ROOF & BUILT FORMS
HEIGHT PLANES

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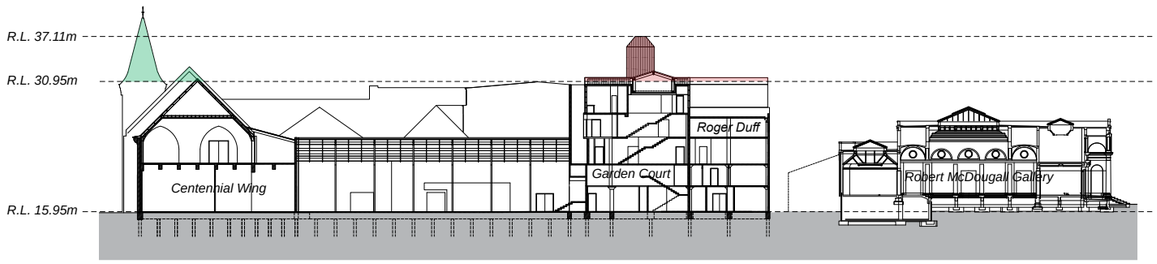
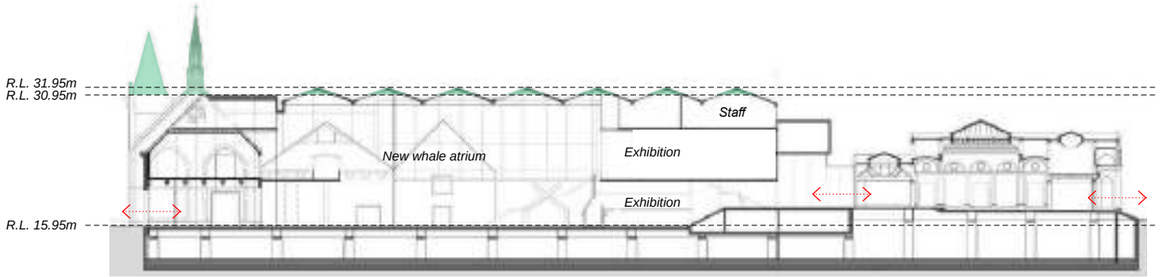
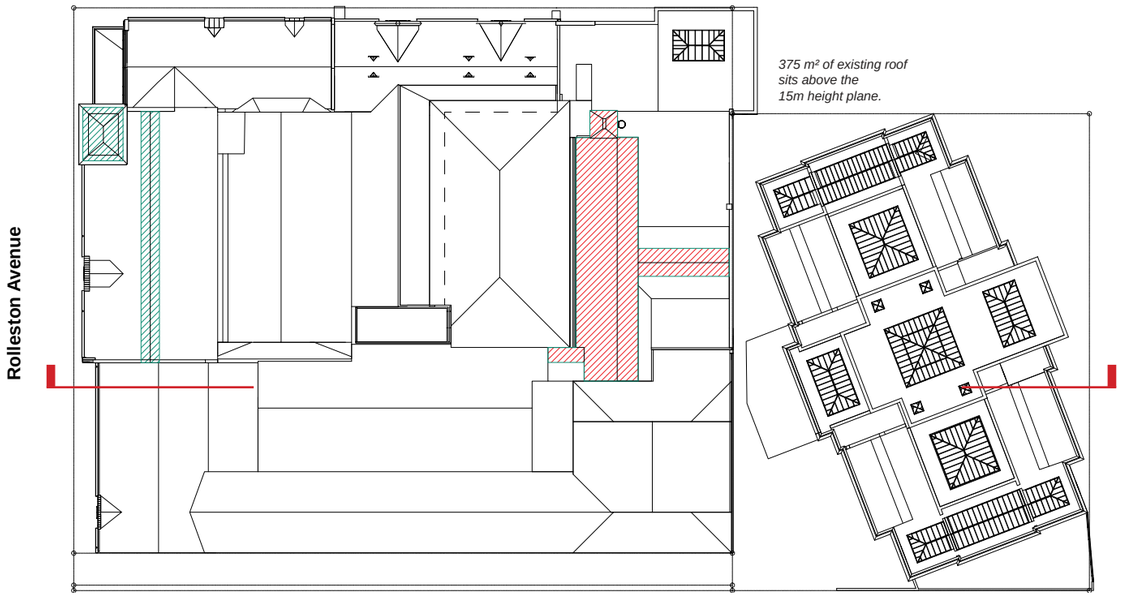


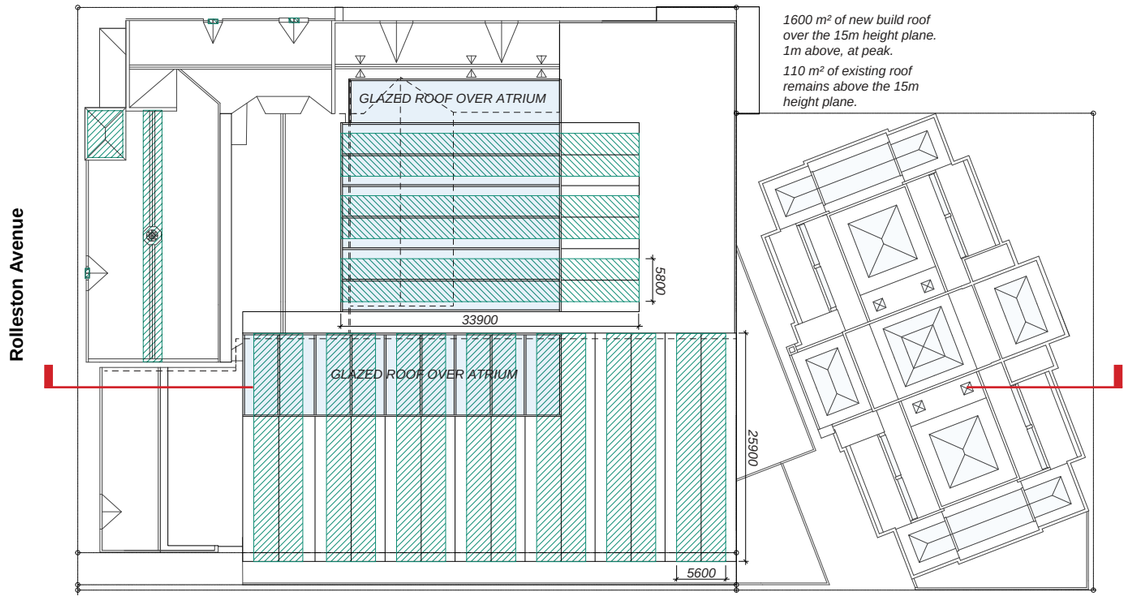
Existing Section, shading shows area breaching height plane



Proposed Section, shading shows area breaching height plane



Existing Roof Plan, shading shows area breaching 15m height plane



Proposed Roof Plan, shading shows area breaching 15m height plane

Resource consent required for breach of maximum height rules.

The current District Planning rule restricting the height plane at 15m over the Museum site. Parts of the existing building structure already breaches this height plane, this includes the 1877 Mountfort Tower and gable ridge (to be retained); Whale storage room, Staff Room and Lift Motor Room above the Roger Duff Wing (all to be demolished).Integral part of the proposed design is to reinstate the flèche above 1872 Mountfort building. The roof over the new building is designed to reflect the local Gothic revival and contemporary architecture. The design opted for a fine-grained folded roof plane in-lieu of a single pitched flat roof over the atria and staff areas on Level 3. Due to the height limitation of the site, priority was given to the exhibition spaces on the lower two levels to provide minimum clear height for the exhibitions, however this limited the height of the staff area on the upper floor. By extending the apex of the new folded roof through the height plane (maximum 1m at the highest point), we are able provide functional spaces for the staff work areas as well as additional height over the Atea atrium.

APPENDIX

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TECHNICAL DESIGN - BASEMENT WATERPROOFING

BASEMENT WATERPROOFING
OVERVIEW OF BUILDING STANDARDS

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Although while it is important to acknowledge no basement construction can be considered truly waterproof in its own right, there are extremely efficient levels (or layers) of waterproofing which can bring water ingress complete under control. As of current time there are no New Zealand building standard which addresses this technically, however the British Standard BS8102:2009 (‘Code of practice for protection of below ground structures against water from the ground’) introduced new Chapter 5.4 'Waterproofing of basements and other below ground structures', is a meaningful benchmarks and supporting technical guidance for a range of situations where "the structure is required to resist the ingress of water from the ground and other sources". The Standard recognises that, for a below ground project to be successful, strategies for dealing with groundwater, soil gases and contaminants are considered from the very earliest stages of the design process. A 'Waterproofing Specialist' should be included as a part of the design team, so that an integrated solution can be created.

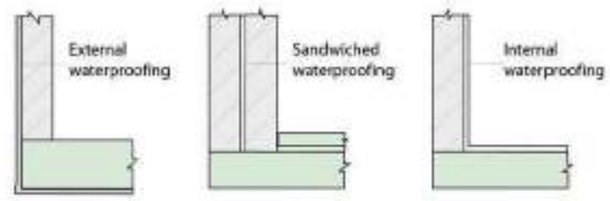
The BS8102:2009 defines three types of systems as; Type A (Barrier) system, Type B (Structurally Integral) system and Type C (Drained) system. Their application is influenced by the ground conditions and proposed building use. Table 2 is shown below and gives guidance as to the performance required from structural waterproofing; depending on the intended end use the basement. The Museum basement falls under Grade 3 for Collection storage and Grade 2 for Plant room areas. It is recommended to use a combination of systems to achieve the desired waterproofing performance.

Combination waterproofing system types should be considered where:
– The likelihood of leaking is high
– The consequences of leakage is unacceptable
– Unacceptable water vapour transmission could otherwise occur

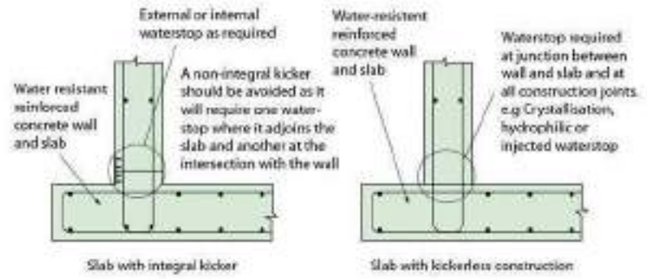
"In our experience which ever combination of waterproofing is chosen to achieve the Grade 3 environment, in most cases the safest combination will include a Type C internal cavity drain membrane system as one of the forms of waterproofing." - Stuart Tansey, Technical Manager, John Newton & Company Ltd.

GRADE 1	GRADE 2	GRADE 3	ADDITIONAL REQUIREMENTS (FORMERLY GRADE 4)
Basic utility Some seepage and damp areas tolerable*	**Better utility** No water penetration, some damp areas tolerable*, ventilation may be required	**Habitable** No water penetration acceptable, ventilation and dehumidification are required	**As Grade 3 plus:** ■ No water vapour penetration ■ Totally dry environment ■ Protection against chemical attacks ■ Gas barrier ■ etc.
* Dependent on use	* Dependent on use		
			
■ Underground car parks ■ Plant rooms ■ Workshops	■ Underground car parks ■ Storage areas ■ Plant rooms ■ Workshops	■ Ventilated residential units and offices ■ Restaurants and commercial areas ■ Leisure facilities	■ Residential areas ■ Computer rooms ■ Archives ■ Special purpose facilities and areas

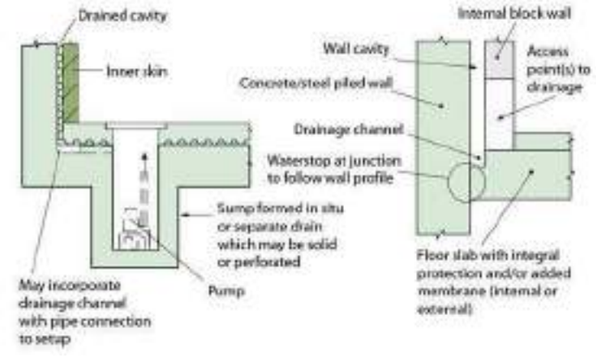
TYPE A: barrier
Relies totally on the effectiveness of waterproofing membrane system to keep water out, it has no integral protection again water penetration. With a high water table, any defects in the waterproofing barrier will allow water to penetrate.



TYPE B: strucutral integral protection
Requires that the structure itself be constructed as an intefral water-resistant shell, i.e. installation of waterstops, prestressed concrete, crystalline additives etc. Defects can be minimised by correct specification and design and by careful construction. The most common defects are: permeable concrete and honeycombing through lack of compaction; contamination of, or cold, construction joints; cracking due to thermal contraction and shrinkage. With a high water table, minor defects in the concrete usually result in only small amounts of water penetrating.



TYPE C: drained protection
Relies on water being resisted by the structural elements and any water that penetrates the external shell of the structure being collected in a cavity formed between the external wall and an internal lining/wall. Backup pumps and alarms should be included most situations. Type C systems require a maintenance schedule, as failure of mechanical pumps could result in flooding; the design of the system should allow for clearing of silt (lime or other contaminants) should blockages occur in the system.



BASEMENT WATERPROOFING
PROPRIETARY SYSTEMS

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Example below are proprietary systems offered by Sika, just one of many systems available on the market. At feasibility stage of the project it is difficult to identity the required level of system without completed structural requirements and the ground condition assessments. The aim for the next stage of design is to work closely with engineers and waterproofing specialists to identify an appropriate, reliable and cost efficient system.

	SikaTop® / SikaSeal® / Sika® Igolflex®	**Sika White Box**	**Sikalastic®**	**SikaProof®**	**Sikaplan®**
					
Technology / Type of system	Mortars & Coatings	Watertight Concrete	Liquid Applied Membranes	Fully bonded Sheet Membrane	Compartmentalized Membrane System with integrated control- and Injection back-up
Waterproofing Concept / Strategy	Externally applied	Integral	Externally applied	Externally applied	Externally applied
Grade of watertightness	Grades 1–2	Grades 1–3	Grades 1–3 plus additional requirements	Grades 1–3 plus additional requirements	Grades 1–3 plus additional requirements
Concrete protection	Limited	Low	Very high	High	Very high
Water resistance level	■ Seepage / percolating water ■ Rising capillary water	■ High hydrostatic pressure ■ Seepage / percolating water ■ Rising capillary water	■ Medium hydrostatic pressure ■ Seepage / percolating water ■ Rising capillary water	■ High hydrostatic pressure ■ Seepage / percolating water ■ Rising capillary water	■ Very high hydrostatic pressure ■ Seepage / percolating water ■ Rising capillary water
Performance characteristics	Crack-bridging: n.a. Water vapour tighness: + Chemical resistance: + Gas barrier: + Durability: +	Crack-bridging: n.a. Water vapour tighness: + Chemical resistance: + Gas barrier: + Durability: +++	Crack-bridging: ++ Water vapour tighness: +++ Chemical resistance: ++ Gas barrier: ++ Durability: +	Crack-bridging: ++ Water vapour tighness: ++ Chemical resistance: ++ Gas barrier: ++ Durability: ++	Crack-bridging: +++ Water vapour tighness: +++ Chemical resistance: +++ Gas barrier: +++ Durability: +++
Safety level / Reliability	Low	Low to medium	Medium	Medium to high	Very high
Excavation method	Only open excavation	Open excavation and piled walls	Only open excavation	Open excavation and piled walls	Open excavation and piled walls
Repair in the event of leaks	By crack or area injection	By local injection of limited areas. Damage is easy to locate	By crack injection	By crack injection	By injection of leaking compartments trough integrated back-up system. Easy to control and locate due to control sockets or active control system. Re-injection possible.
Conditions of application	■ Controlled conditions required (temperature, water, humidity) ■ Substrate preparation required	■ Limited to suitable temperatures for concreting works. ■ No substrate preparation required	■ Controlled conditions required (temperature, water, humidity) ■ Substrate preparation required	■ Controlled conditions required (temperature, water, humidity). ■ Substrate preparation required ■ Limited exposure time before concreting ■ Membrane to be cleaned before concreting	■ Substrate preparation required
Advantages	■ Very cost effective ■ Simple & fast to apply	■ Very cost effective ■ No protection required (walls) ■ Simple & fast construction ■ High durability	■ High performance ■ Easy detailing solutions ■ High durability	■ Highly efficient ■ High performance ■ Easy to apply ■ Low risk ■ High durability	■ High waterproofing security ■ Very high performance ■ Simple and fast to repair ■ High durability / reliability ■ Integrated system redundancy

BASEMENT CASE STUDY
WELLINGTON TOWN HALL

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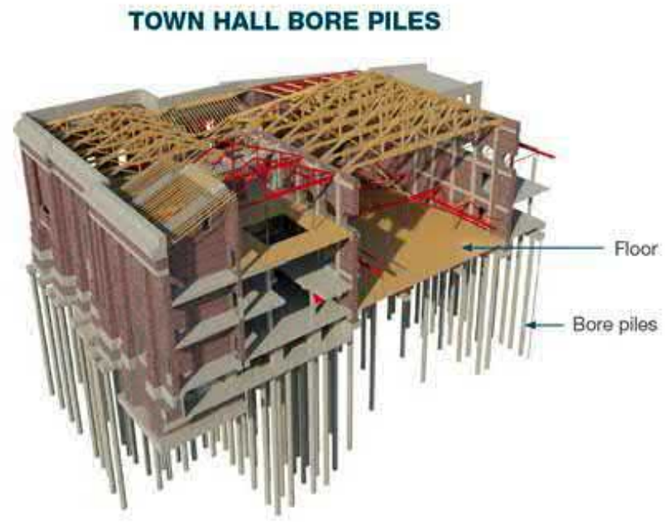


Location - Wellington
Year completed - Under construction
Relevant design intervention - Seismic strengthening to heritage building; Basement base isolation and waterproofing
Heritage Category - Grade 1
Architect - Athfield Architects
Structural Engineer - Holmes Consulting Group
Basement waterproofing supplier - Newton

The town hall sits on ageing, unreinforced concrete piles on reclaimed land (on the waterfront) making the structure unreliable in an earthquake. The building, one of the city's most important from a heritage viewpoint, will be undergo major strengthening and a comprehensive re-fit.

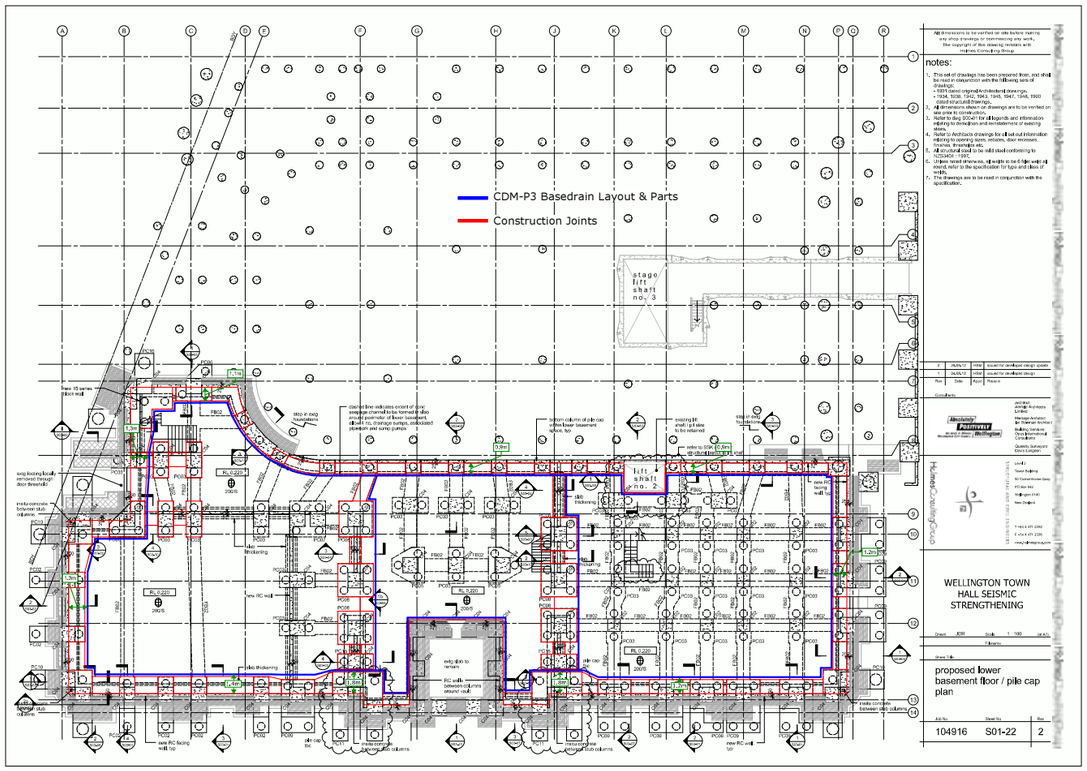
A brand new recording space and film scoring stage will be installed in the basement. The estimated costs of the work is $112.4 million plus a contingency allowance.

Type C drainage system, Newtown Basedraing detail

Basement waterproofing solution

- Basement waterproofing design: Newton Basedrain system
- 1. Structure/design & **Type B** structural integral system
- 2. Trench voids - are to provide an unimpeded area/ void for the Isolator bearings to move in the event of an earthquake.
- 3. **Type C** Cavity drain membrane, sumps and drainage. Contingency planning for dealing with any localised defects or system failure that arise should be included as part of the overall water resisting design of the structure.
- 4. Lift pit with existing draining and new internal membrane tanking.

Wellington Town Hall is being strengthened and upgraded.
View from Civic Square of Wellington Town Hall, as it looks in 2013.



Basement construction joints and basedrain layout

BASEMENT CASE STUDY
AUCKLAND ART GALLERY

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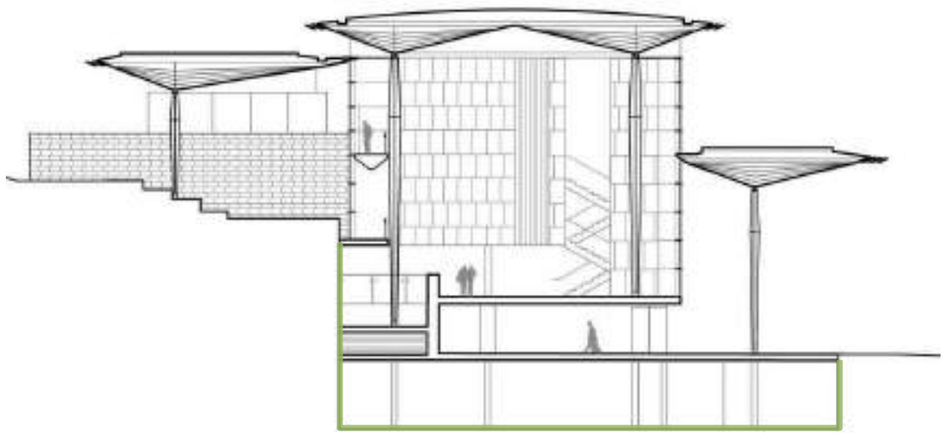
Toi o Tāmaki Auckland Art Gallery. (image: ArchDaily)



Toi o Tāmaki Auckland Art Gallery section. (image: ArchDaily)

Location - Auckland
Year completed - 2011
Relevant design intervention - Basement under new building & Basement waterproofing.
Architect - Archimedia / FJMT
Structural Engineer - Holmes Consulting Group
Basement waterproofing supplier - Allco

The $121 million award winning restoration and expansion of the 1887 Auckland Art Gallery heritage building included the addition of a basement below the new build. Basement houses general storage and back of house functions.

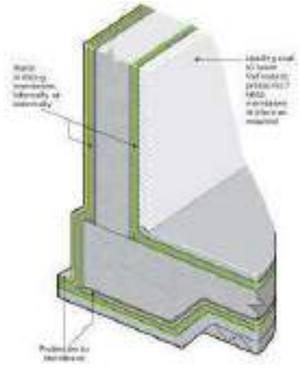
While not in a high seismic zone, so not requiring base isolation, the Albert Park site posed its own challenges to the basement integrity. The site was wet and muddy, and the slope meant high hydrostatic pressure was constantly present.

The basement excavation and construction involved retention piling, soil nails and ground anchors, as the earth was removed between the heritage buildings. While the retention structure involves it's own drainage, the internal waterproofing system is barrier only.

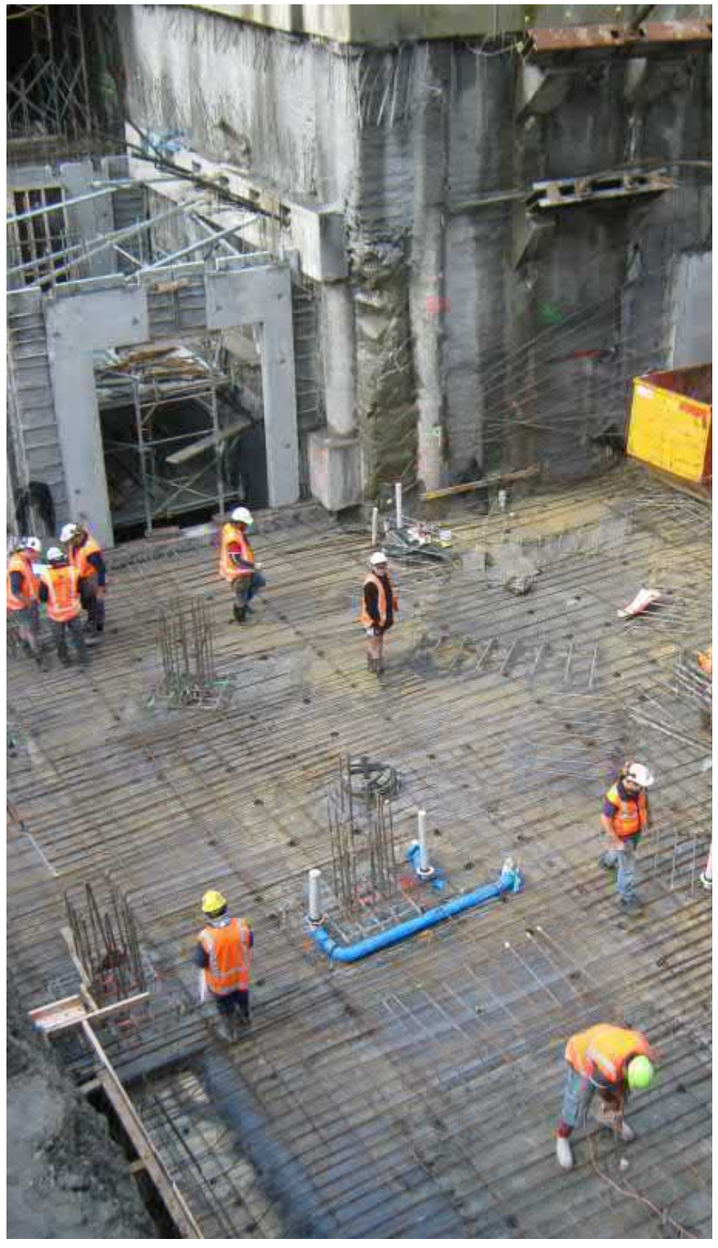
The project does not deal with retrofitting a basement under the heritage buildings, as the basement is only below the new build.

Basement waterproofing solution

- **Type A** a barrier system & shotcrete structure design.
- Retention structural drained separately.
- Two levels of below ground retaining and waterproofing and one level of full basement.
- An Allco swelling, self healing membrane (Volclay Voltex DS Bentonite Membrane and Volclay Swelltite Bentonite Membrane) is pinned to the shotcrete retention structure.
- Volclay RX101T Waterstop was installed in all joints.



Type A barrier system, typical detail



Auckland Art Gallery basement construction. (image: Allco)

BASEMENT CASE STUDY
AUCKLAND WAR MEMORIAL

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Auckland War Memorial Museum basement construction. (image: Allco)

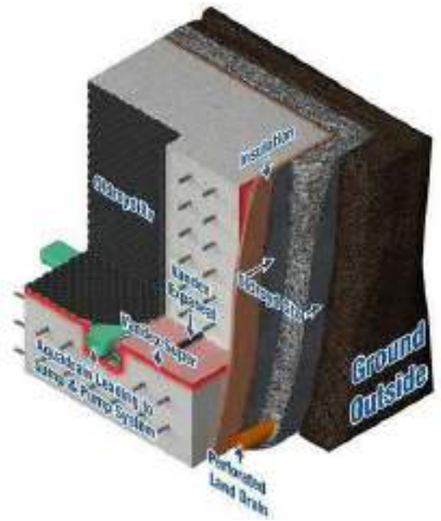
Location - Auckland
Year completed - 2006
Relevant design intervention - Basement addition to a heritage and new build building. Basement waterproofing.
Architect - Noel Lane Architect and Peddle Thorp
Structural Engineer - Holmes Consulting Group
Basement waterproofing supplier - Allco

The 2006 restoration and expansion of the 1960 Rear Southern Courtyard of the Auckland War Memorial Museum included six new floors, two of those below ground. With the basement providing collection storage for valuable items. The environment designed to be controlled and moisture free.

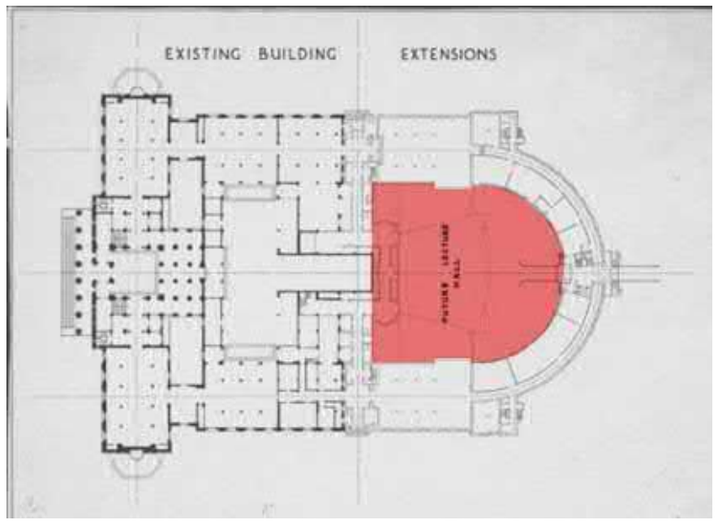
The 12m deep basement had shotcrete sprayed to the rock as formwork, Allco membrane was pinned to the formwork while structural steel was laid before the insitu concrete was poured. Large pipe penetrations provide drainage around the perimeter of the slab, and a membrane system works over the top.

Basement waterproofing solution

– 1. Structure/design & combination **Type A** a barrier system and **Type C** a drained protection system.
– An Allco swelling, self healing membrane (Volclay Voltex DS Bentonite Membrane) is pinned to the shotcrete retention structure.
– Volclay RX101T Waterstop was installed in all joints.
– Pipe penetrations around the perimeter of the slab through the membrane allow drainage into wall drains around the perimeter.



Auckland War Memorial Museum after renovation. (image: Holmes Consulting)



Auckland War Memorial Museum extant of new basement. (image: Auckland Museum)

BASEMENT CASE STUDY
WATERPROOFING SYSTEMS ON THE MARKET

New Zealand made, ARDEX WPM 1500 is normally used as a single layer membrane in horizontal or vertical applications for waterproofing in below ground applications. It is primarily applied to the outside of a sub-structure of a building, such as a foundation or basement, to prevent water ingress or as a gas barrier to prevent the ingress of toxic gases. ARDEX WPM 1500 can also be used in other applications including under floor slabs, behind masonry walls, the lining of substrates of in-situ or precast concrete; retaining walls, lift shafts and tunnels. ARDEX WPM 1500 can also be used in combination with other ARDEX WeldTec products. ARDEX WPM 1500 may be used in various combinations to produce a variety of specifications tailored to suit the individual waterproofing needs.

Ardex WPM 1500 and hydro stop were used in the Green Island Naval Base 1500mm below the Sydney Harbour waterline. (image: Ardex)

Green Island Naval Base Weldtec membrane application. (image: Ardex)

HIGH PERFORMANCE, CRACK-BRIDGING AND FULLY CONTROLLED

Highly flexible waterproofing systems using Sikaplan PVC based or FPO based sheet waterproofing membranes are installed externally and cover the entire basement structure in contact with the ground. The waterproofing layer is divided into 'compartments' with a network of cast in place compatible waterstops that are welded to the membrane. This allows very significant reduction of risk as in the event of any leaks (i.e. from damage to the membrane), the position of the leak is easy to locate by the control and injection sockets and remedial action (i.e. injection) can be taken to ensure continued watertightness and concrete protection of the system at any time during its service life.

USE

- As waterproofing solutions for Grades 1 – 3+
- For high demands and harsh ground conditions
- Protection against radon or methane gas
- For structures in aggressive groundwater like coastal areas

MAIN ADVANTAGE

- Watertightness is controlled and secured at any time
- Highly crack bridging
- Easily repaired in case of leaks due to direct access of compartment
- Secure full protection of concrete

TYPICAL PROJECTS

- Underground car parks
- All types of buildings residential, commercial, Public etc.)
- Industrial facilities
- Containment areas
- Civil engineering structures (e.g. Metro stations)

SIKA PRODUCTS AND SYSTEM SOLUTIONS

Sikaplan® WP 1100 series	Homogeneous and plasticized PVC sheet waterproofing membranes and gas-tight barriers for general use, loose laid with the membrane overlaps connected by heat welding.
Sikaplan® WT 1200 series	FPO sheet waterproofing membranes and gas-tight barriers for use against aggressive groundwater, loose laid with the membrane overlaps connected by heat welding.
Sika® Waterbar WP/WT	Cast-in-place external waterstops, based on PVC or FPO, connected with similar based sheet waterproofing membranes by heat welding, for compartmentalized waterproofing systems.
Control- and Injection Sockets	Preformed pieces based on PVC or FPO, connected with flexible injection pipes to allow access to compartments for the control of watertightness and injection in the event of leaks.
Complementary sealing system solutions:	
Sikaplan® WT Tape 200	Adhesive sealing tape based on FPO, compatible with Sikaplan WT sheet membranes for waterproofing the terminations of post-applied compartment systems.
Sika® Dilatec E/ER	Adhesive sealing tapes based on plasticized PVC, compatible to Sikaplan WP sheet membranes for water proofing terminations of post applied compartment systems.

Description

Xypex is a unique chemical treatment for the waterproofing, protection and repair of concrete. XYPEX CONCENTRATE consists of Portland cement, finely graded sand and active proprietary chemicals; it is applied as a cementitious slurry to the pre-saturated surface of existing above and below-grade structures. The active chemicals diffuse into the substrate and react with moisture and the constituents of hardened concrete to cause a catalytic reaction. This reaction generates a non-soluble crystalline formation throughout the pores and capillary tracts of the concrete, as well as cracks, permanently sealing the concrete and preventing the penetration of water and other liquids from any direction, even under high hydrostatic pressure. Xypex Concentrate is also mixed in a Dry-Pac form for sealing strips at construction joints, or for the repairing of leaking cracks, faulty construction joints and other defects.

Recommended for:

- Reservoirs
- Sewage and Water Treatment Plants
- Underground Vaults
- Secondary Containment Structures
- Foundations
- Tunnels and Subway Systems
- Swimming Pools
- Parking Structures

Advantages

- Resists extreme hydrostatic pressure
- Becomes an integral part of the substrate
- Can seal static hairline cracks up to 0.4 mm
- Can be applied to the positive or the negative side of the concrete surface
- Allows concrete to breathe
- Highly resistant to aggressive chemicals
- Non-toxic / no VOCs
- Does not require a dry surface
- Cannot puncture, tear or come apart at the seams
- No costly surface priming or leveling prior to application
- Does not require sealing, lapping and finishing of seams at corners, edges or between membranes
- Does not require protection during backfilling or during placement of steel, wire mesh or other materials
- Less costly to apply than most other methods
- Not subject to deterioration
- Permanent
- Available in white for enhanced illumination

BASE ISOLATION CASE STUDY
CHRISTCHURCH WOMEN'S HOSPITAL

athfield architects limited

Christchurch Women's Hospital (Image: Holmes).

Christchurch Women's Hospital base isolator between foundation slab and basement (Image: Holmes).

Location - Christchurch
Year completed - 2005
Relevant design intervention - Base isolated basement, high water table zone
Architect - Chow Hill Architects
Structural Engineer - Holmes Consulting Group

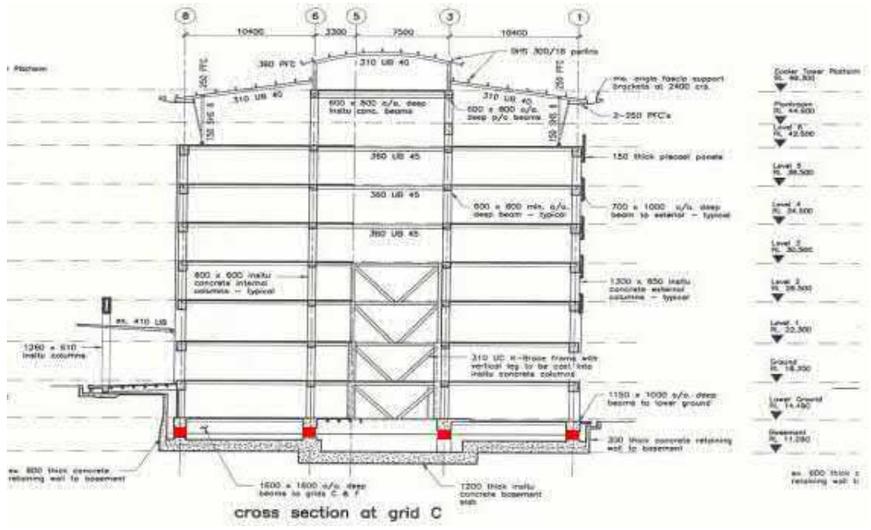
Though designed and built before the 2010 and 2011 Christchurch earthquakes, the 2005 $79 million Christchurch Women's Hospital was designed in the knowledge that the Alpine Fault Line was overdue for a significant seismic event. The CDHB required it to be resilient enough to continue to operate after such an event.

The 10 storey base isolated building, on a site sloping back towards the rear of the building, includes a basement and 1 below ground functioning level.

Basement solution

- The base isolators are between the concrete raft foundation slab (anchored by four 6.5m deep caisson piles) and the superstructure. The lower ground floor (underground) is not base isolated from the above ground superstructure.
- The lift pits are suspended from the lower ground floor superstructure floor. So they can move independently from the foundation slab with the superstructure.
- The foundation slab is constructed with a perimeter retaining wall, this forms a water proof concrete tank for the superstructure to be housed within. The 'tank' used **Type B** structural integral protection waterproofing. PVC construction joints were used, and the slab was carefully cured to ensure the 'tank' was waterproof without requiring membrane or drainage.
- A high water table meant six dewatering wells were used during basement construction to lower the water table to below the slab. This continued until the two lowest floor slabs were constructed to provide enough weight to prevent buoyancy forces lifting the basement out of the ground.

Christchurch Women's Hospital lift pits suspended into the basement from the superstructure.



Christchurch Women's Hospital section showing basement base isolated (isolators shown in red) from foundation slab.

BASE ISOLATION CASE STUDY
RANKINE BROWN BUILDING

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The Rankine Brown Library (image: Te Herenga Waka)

New Zealand Parliament building base isolators being retrofitted. Section swer cut from the existing foundation columns. (image: 1993 Dominion Post)

Location - Wellington
Year completed - 2002 / 2019
Relevant design intervention - Base isolated basement retrofitted.
Architect - Athfield Architects / Architectus
Structural Engineer - Beca

The 10 storey 1960s Te Herenga Waka Library building has undergone two seismic strengthenings. The first in 2002 retrofitted base isolators between the foundations and superstructure columns. Repairs and strengthening following the 2016 Kaikoura earthquake addressed the issues with secondary elements conflicting with the isolation plane. I.e pinned, not isolated, periphery columns, and a fixed lift shaft.

In 2002 the two smaller footprint basement levels were excavated and extended to meet the southern perimeter of the superstructure. this allowed access to the base of all columns. Base isolators were retrofitted to the base of the internal columns on level 0, a used storage space. The floors were hydraulically propped and a section of the column cut out and the base isolator 'slid' in.

Following the 2016 earthquake a seismic gap was included around the lift shaft. And base isolators were fitted to the tops of the periphery columns that had previously been pinned. This changed the isolation plane from Fig A, to Fig B (right). Apart from periphery columns at level one and basement walls and the foundation slab, the building moves as one super structure.
Other buildings retrofitted with base isolators include:

– New Zealand Parliament building and Parliament Library
– The Old Bank Arcade in Wellington
– The Christchurch Art Gallery Te Puna o Waiwhetū

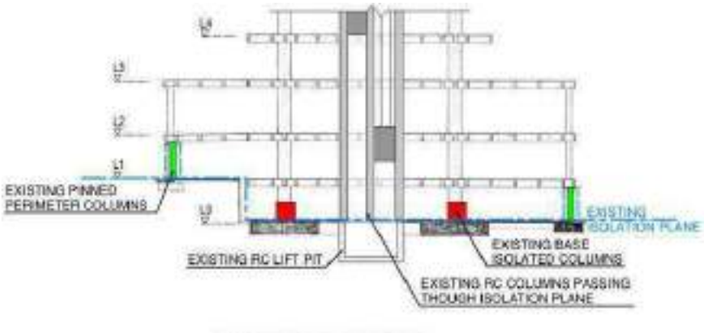

Fig A. Building isolation plane pre 2016 earthquake (image: Levi Grady, Beca)

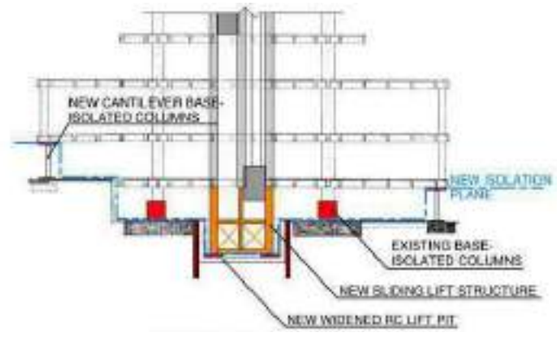

Fig A. Building isolation plane post 2016 earthquake repairs (image: Levi Grady, Beca)

Level 0 props and jacks used while cutting the columns (image: 2004 NZSEE conference)