Engineering and Technology Precinct (ETP) – Stage 1
Construction Management Plan

Document and revision history

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Management reviews

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Terms and definitions

The following terms, abbreviations and definitions are used in this plan.

Abbreviation	Meaning
BCA	Building Code of Australia
CC	construction certificate
CIP	Campus Improvement Program
CIS	Campus Infrastructure Services
CMP	Construction Management Plan
CSC	City of Sydney Council
DA	development application
DfMA	Design for Manufacture and Assembly
EPA	Environment Protection Authority
ETP	Engineering and Technology Precinct
FEIT	Faculty of Engineering and Information Technology
FFE	fittings, furniture and equipment
ICT	Information and Communications Technology
MSB	main switchboard
PNR	Peter Nicol Russell
RMS	Roads and Maritime Services
TCP	Traffic Control Plan
the University	University of Sydney
TPMP	Traffic and Pedestrian Management Plan

Table 1: Terms and definitions used in this plan

Contents

1. Introduction

This Construction Management Plan (CMP) forms part of the suite of project management plans developed for the Engineering and Technology Precinct (ETP) – Stage 1 project. It outlines the key management systems, procedures and controls that Laing O'Rourke will use to:

- Achieve all project objectives
- Deliver the University of Sydney (the University) value for money
- Give certainty of delivering the project on schedule
- Provide innovative solutions that align with the overall project objectives
- Achieve exceptional and demonstrable outcomes in safety, whole of life, environment, sustainability and quality.

The CMP is a dynamic document and will be updated throughout delivery of the project, as required.

1.1 Scope of work

The University is transforming its ETP into an environment that fosters scholarship at the highest standard possible and delivers a positive experience to all of its staff, students and stakeholders. The ETP Stage 1 works involve delivering high-quality infrastructure that accommodates maximum research opportunities while being flexible enough to respond to new education pathways in the future.

A new Micro Engineering Building will incorporate approximately 11,000m² of new and shell space and 6,000m² of refurbished facilities. The building will include research and teaching labs, office areas and teaching spaces. The project also involves the associated demolition works and infrastructure upgrades, as well as staging and decanting works in adjacent buildings.

1.2 Project objectives

The University's objectives for the project are to deliver:

- An improved reputation as an innovative and modern engineering faculty
- Fit-for-purpose research facilities
- Increased research productivity and quality
- An enhanced student learning experience and quality of learning resources, such as learning spaces, computer labs, and teaching labs
- Iconic engineering innovations in design, construction and operation
- Improved integration between research and teaching
- Lower (rate of increase) operating and maintenance costs
- Improved safety and security processes.

1.3 Construction objectives

Laing O'Rourke has a proven track record in delivering complex projects in busy operating environments and we understand the potential impacts on staff, students and other stakeholders. We have developed our construction methodology based on the following objectives:

- Safety for all: Ensuring the safety of staff, students, visitors, construction personnel and the public throughout construction
- Operational continuity: Maintaining the operational building with minimal disruptions alongside the new build

- Access: Maintaining and coordinating access for the University and construction personnel throughout the construction phase
- Segregation: Ensuring construction site works and operational University areas are separate
- Minimum disruption: Mitigating all necessary and planned disruptions to the University and key stakeholders.

2. Roles and responsibilities

The key construction roles and responsibilities are outlined in the following table.

Role	Responsibility
Project Director/ Project Leader (Refer to org chart)	• Maintains overall responsibility for the project to deliver to client contractual obligations. • Acts as the primary point of contact attending all client meetings and key project forums and managing all reporting requirements. • Implements construction sequencing solutions that minimise disruption to operations and maximise delivery efficiency. • Defines constructability reviews and processes for a seamless interface from design to construction. • Oversees the project construction programme, work health and safety (WHS), quality and environmental aspects of the project to meet contractual delivery obligations. • Key focus on 'Next Gear' ethos on the project
Commercial Manager (Refer to org chart)	• Oversees the procurement process with subcontractors and suppliers. • Manages the cost and financial aspects of the project, including project reporting for management and the client. • Key focus on 'Next Gear' ethos on the project
Construction Manager (Refer to org chart)	• Maintains the operation of the construction side of the works, in particular the day-to-day management of on-site progress, work health and safety (WHS) and client liaison through the Project Leader. • Ensures management plan requirements are implemented. • Ensures all personnel are inducted and trained. • Key focus on 'Next Gear' ethos on the project
Engineering Lead (Refer to org chart)	• Oversees the coordination between construction and design. • Liaises with the Design Manager to resolve design issues. • Key focus on 'Next Gear' ethos on the project
Design Manager (Refer to org chart)	• Manages the coordination of all design consultants • Ensures coordination and progression of design in line with the contract programme. • Key focus on 'Next Gear' ethos on the project
Services Manager (Refer to org chart)	• Oversees the services subcontractors and ensure they execute the works in accordance with the design and contractual requirements. • Manages the design of the services to ensure coordination between various disciplines. • Key focus on 'Next Gear' ethos on the project
Senior Project Engineer (Refer to org chart)	• Oversees the engineering team, providing technical coordination link between the construction and design. • Oversees the Project/Site Engineers and coordinate between all of the packages of works. • Implements the Quality Management System with the Project/Site Engineers. • Key focus on 'Next Gear' ethos on the project
WHS Manager	• Oversees all work, health, safety (WHS) and environmental matters on the project. • Key focus on 'Next Gear' ethos on the project

Table 2: Roles and responsibilities

A copy of Laing O'Rourke's organisational chart for delivery of the ETP Stage 1 works is provided in Appendix 1.

2.1 Meetings

The following construction meetings will be held during delivery of the ETP Stage 1 works:

- Client: A fortnightly meeting will be convened with the University to provide a status update on the project and discuss any current issues
- Subcontractors: A weekly meeting will be convened with the subcontractors to coordinate the construction works, monitor the works against the construction programme and discuss any current issues
- Construction programme: A weekly construction programme meeting will be convened with the Laing O'Rourke project team to update the status of the construction programme and plan upcoming works.

3. Site details

The existing Building J03 site, which occupies approximately 3,000m², is located within the University's Faculty of Engineering and Information Technology (FEIT) campus (as shown in Figure 1, below). The campus is bounded by City Road, Cleveland Street and Shepherd Streets and the University's internal road, Maze Crescent.

The construction site's immediate neighbours are:

- Seymour Centre to the north
- Aeronautical Engineering, Mechanical Engineering and Engineering Link Buildings to the east
- Cadigal Green to the west
- Peter Nicol Russell (PNR) Building and Rose Street Building to the south.

There are also residential dwellings on the eastern side of Shepherd Street (approximately 100m from the site) and to the north of Cleveland Street (approximately 150m from site).

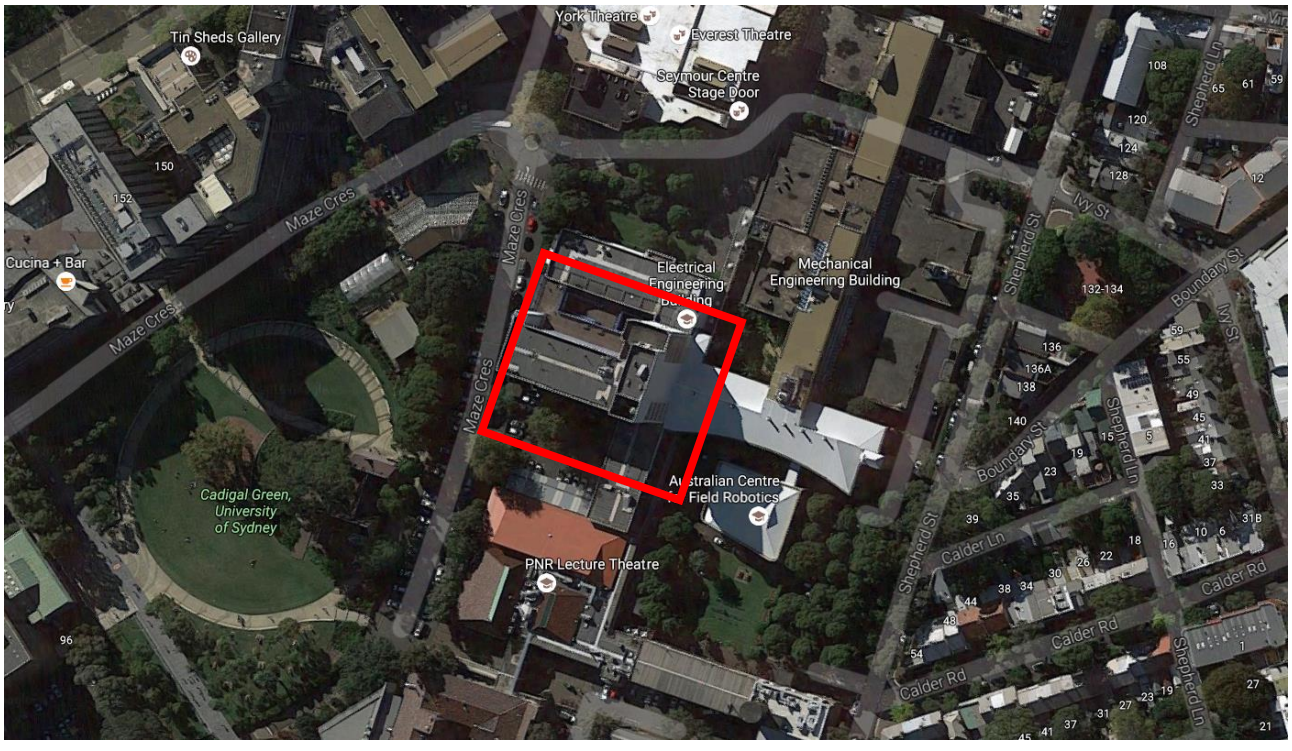


Figure 1: Location of the existing Building J03

3.1 Road access

The main access to Building J03 is via Maze Crescent from Butlin Avenue. Maze Crescent is the only access road in and out of the site for large loads and has an overhead pedestrian bridge with a height restriction of 4.5m.

The road network around the site is heavily congested with:

- Vehicles during morning and afternoon peak times
- Pedestrians between these peaks.

As such, site deliveries may experience delays at various times of the day. A nearby stand-by area, from where trucks will be called-in via two-way radio, will be critical for a just-in-time delivery approach and avoiding congestion within the dedicated work zones. Due to the high pedestrian activity, traffic control will be implemented at pedestrian crossings.

The following Figure 2 illustrates our vehicle access plan for the project.

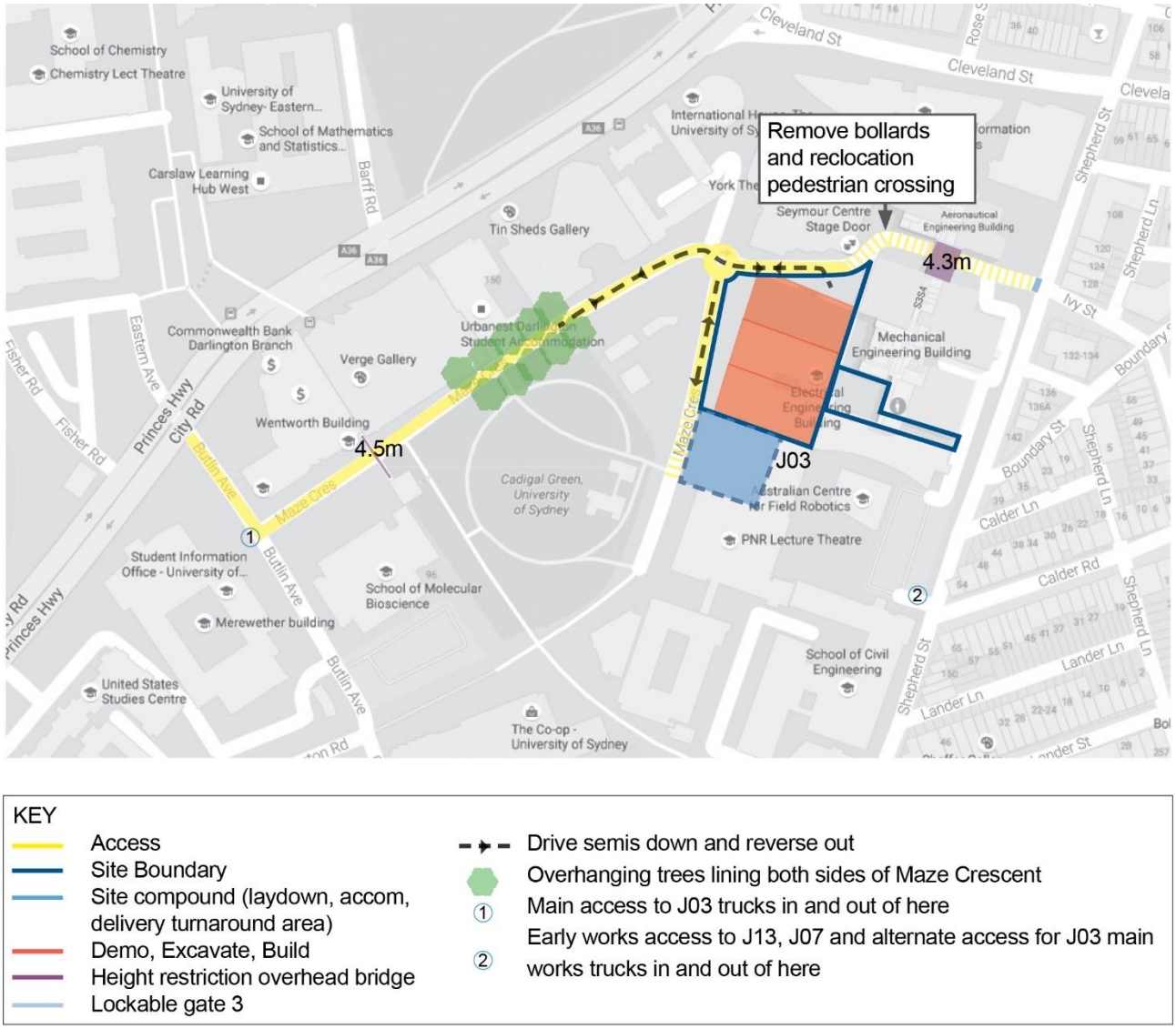


Figure 2: Vehicle access plan

To reduce congestion further a one way road approach may be considered entering the campus from Butlin Avenue and exiting on Shepherd Street (construction traffic only).

3.1.1 Building J03

The existing J03 building South Tower contains an anechoic chamber in room 820 which is used for teaching and research purposes. The effective use of the chamber requires extremely low internal ambient noise levels.

A Management plan is to be agreed as the anechoic chamber will remain in use during the enabling, demo and construction periods.

3.2 Existing utilities

There are a number of existing utilities on the site, including electricity, water, sewer, stormwater, and gas and telecommunication infrastructure.

3.2.1 Electricity

The University is an Ausgrid low-voltage customer; the three existing substations within the precinct are owned and maintained by Ausgrid. Figure 3 below illustrates Ausgrid infrastructure within the precinct.

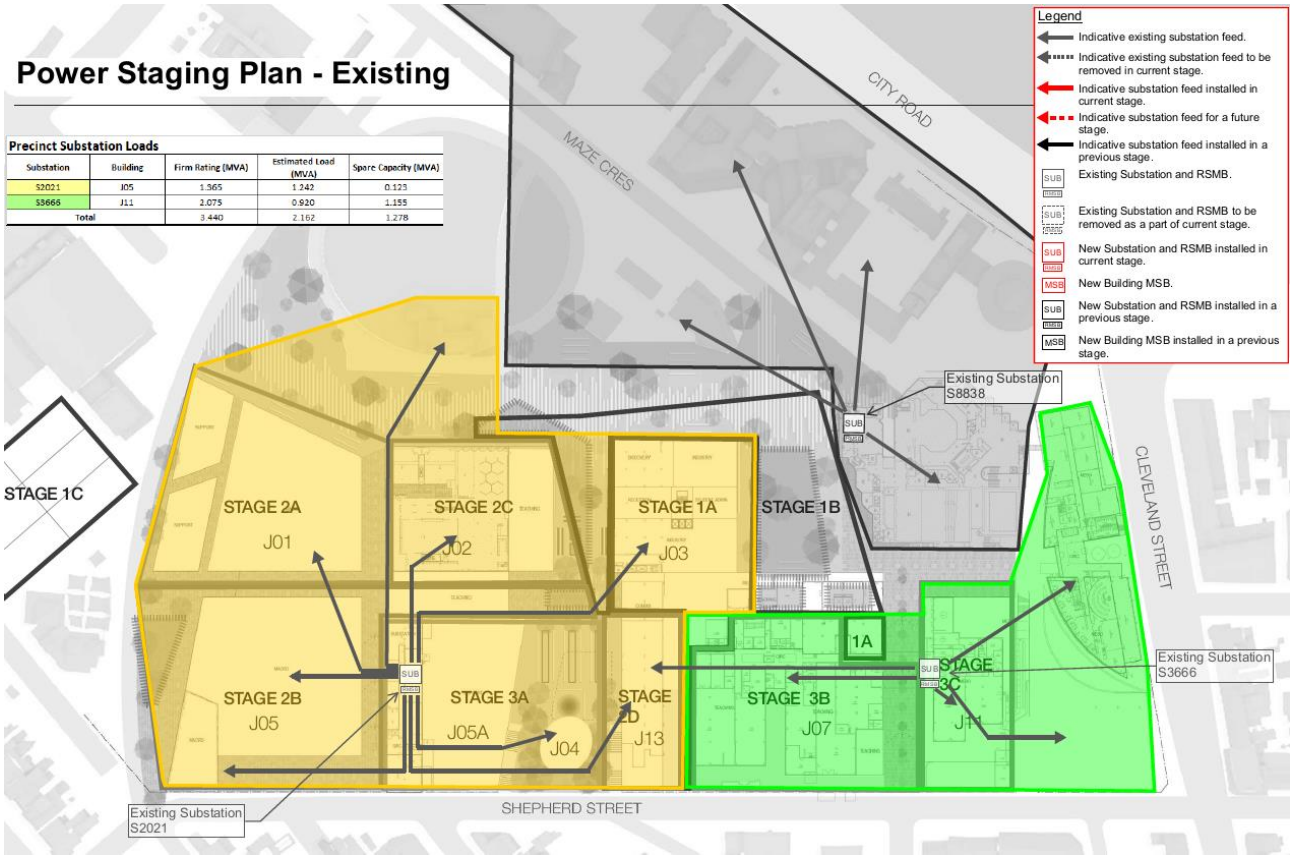


Figure 3: Ausgrid infrastructure

3.2.2 Water

The existing water service infrastructure for the ETP comprises a mix of University-owned water mains and Sydney Water mains (see Figure 4, below).

Water is supplied to the existing Building J03 via a 200mm diameter water main from Maze Crescent. The pump set is currently undergoing an upgrade under a separate project; a new Sydney Water meter and University-owned backflow prevention device are being installed as part of this work.

Based on the survey drawings, the water main that branches off the Maze Crescent main and runs down Blackwattle Creek Lane is located outside the construction site and will not likely require diversion for excavation. A branch of the Blackwattle Creek Lane water main that runs north up Engineering Walk will be required to be cut back and capped off, along with an external hydrant fed from this water main.

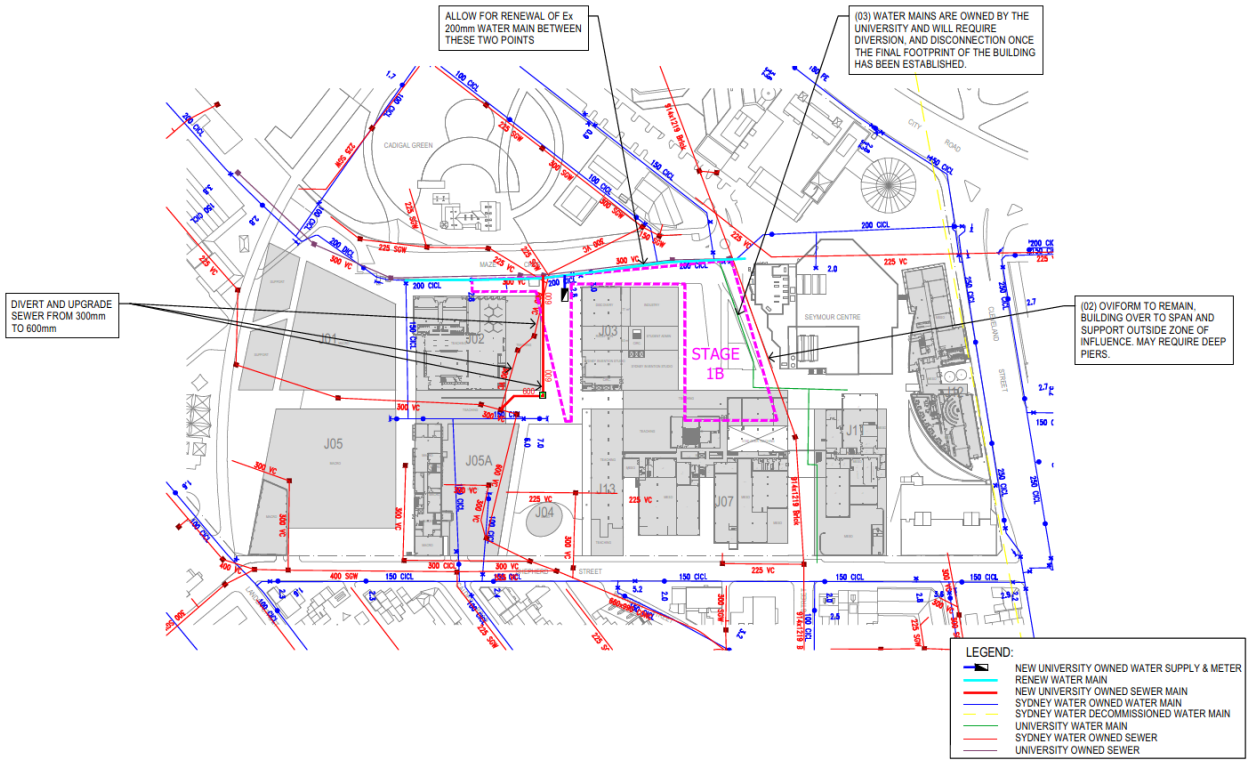


Figure 4: Existing water infrastructure

3.2.3 Sewer

There are a number of Sydney Water sewer mains within the engineering precinct (see Figure 5, below). Based on the survey drawings, no diversions are likely to be required to the sewer mains to service the new Micro Engineering Building. Sydney Water also has a number of sewer assets located under the Engineering Link Building and Engineering Walk.

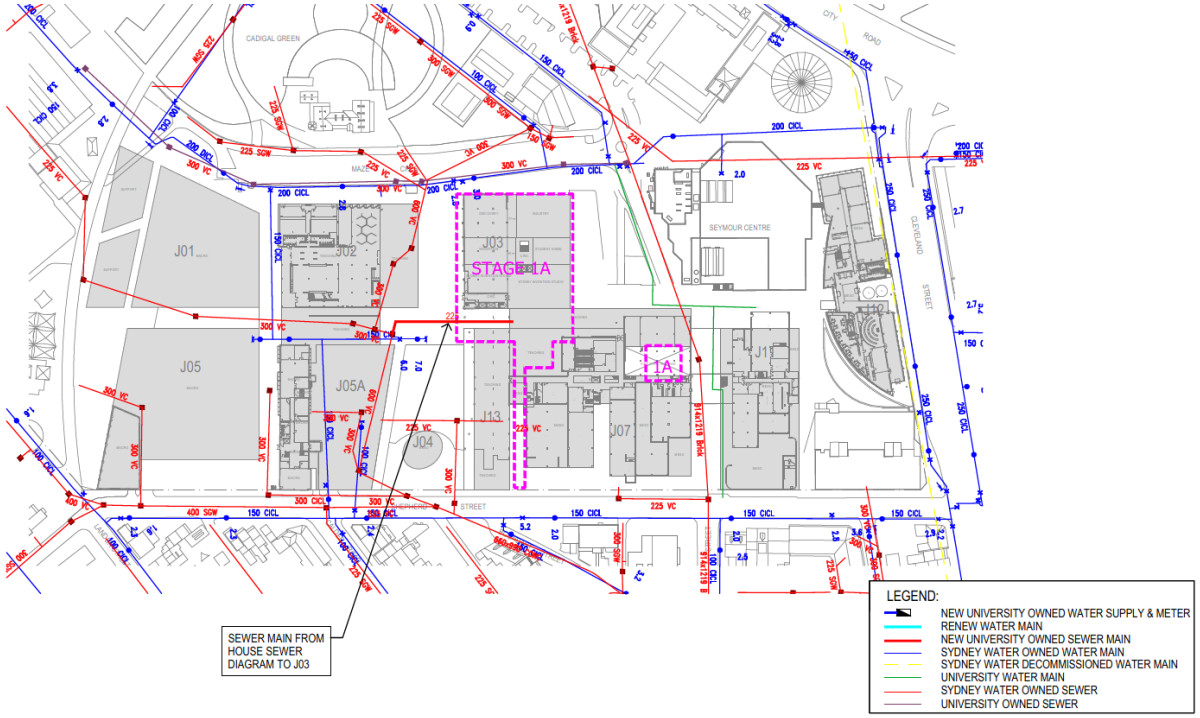


Figure 5: Existing sewer infrastructure

3.2.4 Stormwater

A 900mm diameter stormwater main runs 2–2.5m under the Building J03 carpark. It is intended that this will remain and based on user group feedback, it is assumed that a reduced cover of 900mm will be accepted by the University and Sydney Water.

The existing building rainwater system will require modification to allow for the new building and façade upgrade to existing building.

3.2.5 Natural gas

The natural gas infrastructure was originally owned by Jemena. However, it is now supplied from the University gas meter and therefore Laing O'Rourke understands that this is a University-owned service within the property boundary. The natural gas supply for Building J03 is connected to the 100kPa University gas main in Maze Crescent, which is supplied from the main high pressure gas meter set located near the School of Molecular Bioscience (Building G08) car park entry off Butlin Avenue.

3.2.6 Telecommunication

The ETP will be served by the network subcentre in Building J13. Each building in the precinct will be served via two diverse fibre optic pathways for redundancy.

The ETP Stage 1 works will require temporary diversion of the University's Information and Communications Technology (ICT) fibre-optic network during construction, as well as permanent relocation of the network in the finished design.

The University's ICT team will perform the design and construction of the fibre optic cabling and diversion. Laing O'Rourke will provide temporary cable pathways for diversions as required and permanent pathways for the ETP Stage 1 works, in accordance with the ICT master plan for the precinct.

The final logistics of these works will be agreed with USYD, CIS and clients ICT contractor before enabling works are started.

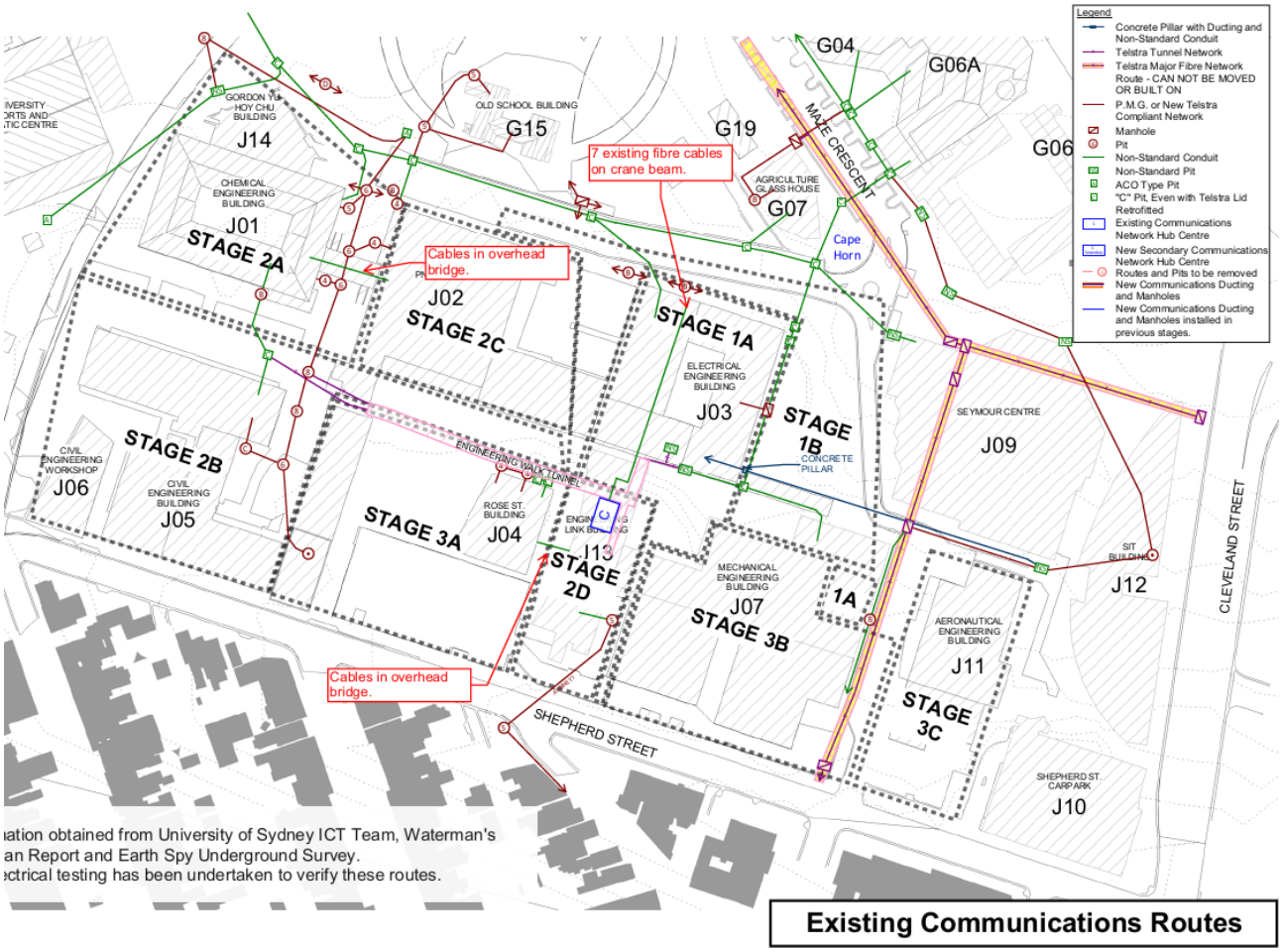


Figure 6: Existing communications infrastructure

3.3 Geotechnical conditions

Laing O'Rourke's construction methodology is based on the geotechnical information provided in the Douglas Partners October 2014 report based on its study of the site.

Depending on the depth, excavations are likely to involve the removal of filling, clay and shale of varying strengths. The filling, clay and extremely low- to low-strength shale, expected within the top 3–4m depth, will be readily excavated using conventional earthmoving equipment. Excavation will require medium to heavy ripping within the medium- and high-strength bedrock, which could occur below approximately 4–5m. The use of large hydraulic rock breakers may be required in areas where widely spaced fracturing is present within medium or higher strength bedrock. The use of hydraulic rock breakers and possibly a rock saw is anticipated for excavation of footings and trenches in the medium to high strength bedrock.

After excavation, the exposed surface is expected to comprise clay or shale. Both of these materials quickly deteriorate when wet and do not provide a good working area. To this end, Laing O'Rourke will install working platforms over the clay and shale, using granular materials such as recycled concrete or ripped rock.

A perched groundwater table could be expected on the top of rock. Groundwater has been encountered in one of the boreholes on the site at approximately 4m deep. Borehole 4 (BH4) (as shown in see Figure 7 and Figure 8, below) which is closest to the site, indicates no free groundwater encountered.

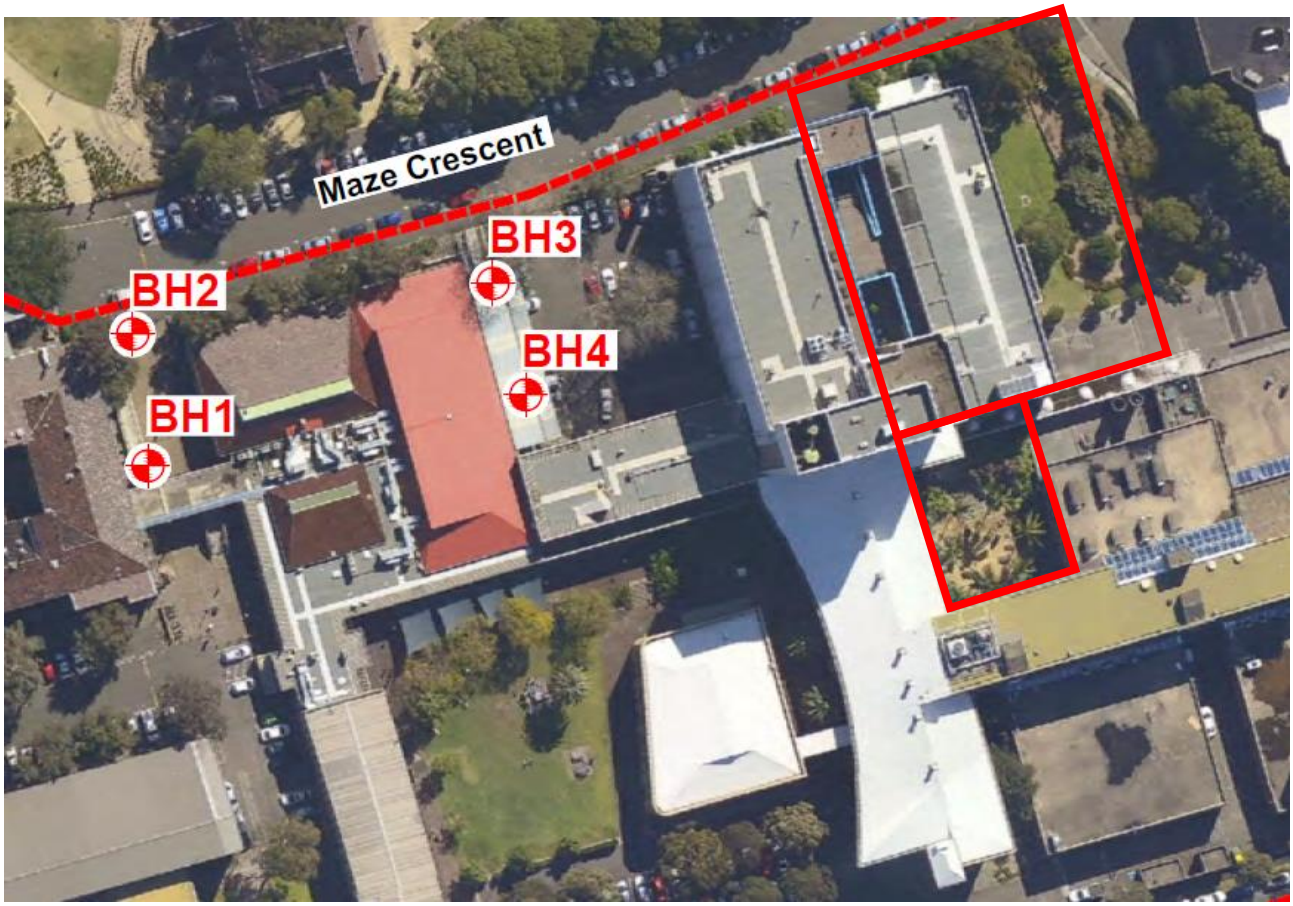


Figure 7: Location of boreholes drilled during geotechnical investigation near site and areas to be excavated

BOREHOLE LOG

CLIENT: The University of Sydney
PROJECT: Proposed Extensions
LOCATION: PNR Building, The University of Sydney

SURFACE LEVEL: 19.5 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/–

BORE No: 4
PROJECT No: 72278.03
DATE: 1/3/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - grey and red clay and brown silty sand filling with a trace of rootlets, humid		A/E	0.1				
				A/E	0.5				
	0.7	SILTY CLAY - stiff, grey and brown, silty clay, humid		E	1.0				
				S			6,7,9 N = 16		
	1.4	CLAY - very stiff, brown and red clay, damp			1.45				
	2.0	CLAY - very stiff, grey and red clay with some ironstone bands, damp							
		2.5m: hard			2.5				
				S			4,9,11 N = 20		
					2.95		High drilling resistance from about 3.0m		
	3.8				3.0				
	4.0	SHALY CLAY - hard, grey and red, shaly clay with some ironstone bands (extremely low strength shale)							
		Bore discontinued at 4.0m - TC-bit refusal possibly on ironstone band							

RIG: Bobcat **DRILLER:** SY **LOGGED:** PAV **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 4.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SURVEY DATUM:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▮	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

Figure 8: Borehole 4 is near the near the proposed development site

The NSW Acid Sulphates Risk Map prepared by the Department of Infrastructure Planning and Natural Resources indicates that the site is not located within an area of potential risk for acid sulphate soils.

3.4 Contamination and hazardous materials risk assessment

Laing O'Rourke will carry out the ETP Stage 1 works within the following buildings:

- Electrical Engineering Building (J03), built 1966 (Demo areas and full refurbishment)
- Mechanical Engineering Building (J07), built 1971 (Tea point area)

A summary of the contaminated and hazardous materials within these buildings is provided below.

3.4.1 Electrical Engineering Building

A hazardous materials risk assessment was carried out by Noel Arnold and Associates on 8 February 2016. The findings of that assessment are shown below.

Area	Asbestos		Hazardous Materials			
	Friable	Non-friable	SMF	PCBs	Lead Paint	Heavy Metals-Lead Dust
Building J03						
Level Two	✓	✓	✓	✓	-	-
Level Three	✓	✓	✓	✓	-	-
Level Four	✓	✓	✓	-	-	-
Level Five	-	✓	✓	-	-	-
Level Six	✓	✓	-	-	-	-
Level Seven	✓	✓	✓	-	-	-
Level Eight	✓	✓	-	-	-	-
Level Nine	✓	✓	-	-	-	-
Level Ten	✓	✓	-	-	-	-
Level Eleven	✓	✓	-	-	-	-
Level Twelve	✓	✓	-	-	-	-
Roof Level	-	-	-	-	-	-

Figure 9: Building J03 high-risk hazards and recommendations

Redundant stored electrical panels, noted to be in a poor condition, were identified within the cupboard of Room 1201. These will need to be removed as soon as reasonably practical, or within the next six months, by an appropriately licensed contractor.

Redundant stored gaskets, noted to be in a fair condition, were identified within the cupboard of Room 1202. These will need to be removed as soon as reasonably practical, or within the next 6-12 months, by an appropriately licensed contractor.

Only demolition areas / full refurbishment areas to have hazardous materials removed.

3.4.2 Mechanical Engineering Building

The findings of a hazardous materials risk assessment was carried out by Noel Arnold and Associates on the Mechanical Engineering Building on 10 March 2016 are shown below:

Area	Asbestos		Hazardous Materials			
	Friable	Non-friable	SMF	PCBs	Lead Paint	Heavy Metals
Building J07						
Level One	✓	✓	✓	-	-	-
Level Two	-	✓	-	-	-	-
Level Three	-	✓	-	-	-	-
Level Four	-	✓	-	-	-	-
Level Five	-	✓	✓	-	-	-
Level Six	-	-	✓	-	-	-

Figure 10: Building J07 high-risk hazards and recommendations

The location of the tea point is to be finalised. Only areas of refurbishment will be removed.

4. Site establishment

4.1 Contact details

Contact details for key site personnel, as shown in Table 3 below, will be displayed on site in a manner that is clearly visible and legible from any public place adjoining the site.

Role	Name	Company	Number
Project Leader	James Last	Laing O'Rourke	0467 762 120
Construction Manager	Refer to org chart	Laing O'Rourke	TBC
24-hour emergency contact:	TBC	Laing O'Rourke	TBC
24-hour demolition contact	TBC	To be appointed	TBC
24-hour excavation contact	TBC	To be Appointed	TBC

Table 3: Contact details

Any changes to these contact details will be reflected first on site displays and then in any subsequent updates of this plan.

4.2 Site establishment activities

Laing O'Rourke will conduct the ETP Stage 1 works in the following phases, as outlined in the following table:

Phase	Timeframe
1: Enabling works	February 2018
2: Soft strip and removal of ACM	May 2018
3: Demolition and excavation works	July 2018
4: Main construction works	December 2018
5: Commissioning	October 2019
6: Practical Completion	June 2020
7: Demobilisation (Cabins etc.)	July 2020

Table 4: Phases of the ETP Stage 1 project

The site establishment activities carried out in each of these phases are outlined below.

4.2.1 Enabling works

During delivery of the enabling works, the following site establishment activities will be carried out:

- A compound for site accommodation, amenities and storage will be established in the existing Building J03 car park to the south of the building. Approximately 18 existing car parking spaces will be relinquished in this area, which will form part of the future site-wide stormwater management system
- Perimeter "A" class hoarding will be installed around the site compound and the various enabling works areas. Temporary wayfinding and site signage will be deployed as necessary
- A small site office, first aid shed and welfare facilities will be located within the Building J03 car park; these will include temporary services connections
- Site sheds will be installed approximately 2m from the face of the existing building to allow for access around the building. As requested by the University during the user group sessions, we have maintained access to Building J02.
- Subcontractors carrying out service terminations and diversion works will install temporary barricading to their work areas
- Trees will be removed or protected in accordance with an arborist assessment and report (refer Section 4.2.5)
- The existing roundabout and traffic islands at the Maze Crescent and Blackwattle Creek Lane intersection will be modified to suit construction traffic (exact modification to be agreed).
- New facilities for the decanting of existing spaces will be constructed. Coordinated decanting of spaces will follow completion of these new spaces (Tea room only - exact requirements / location to be agreed - J07)

During this phase, the estimated on-site resources will comprise 30 workforce personnel and six staff.

4.2.2 Soft strip, demolition and excavation works

The site establishment works carried out during this phase will include:

- Installation of "A" class hoardings on Blackwattle Creek Lane, incorporating truck access gates
- Installation (by the demolition contractor) of a full perimeter protection scaffold around the existing northern portion of Building J03.

Shoring and excavation works will be carried out following demolition. During this phase, the estimated on-site resources will comprise 30 workforce personnel and six staff.

4.2.3 Main construction works

Main construction works will begin following completion of the shoring and excavation works. The site establishment works in this phase will include:

- Enlargement of the main welfare facilities to cater for growing manpower levels
- Installation of tower crane, builder's hoist and loading bays
- Installation of on-site ablutions.

During this time, the estimated resources will comprise 180 workforce personnel and 24 staff.

4.2.4 Demobilisation

Demobilisation will progressively occur from October 2019. Suitably-sized office space will be retained in the new building during this time for Laing O'Rourke's commissioning personnel and the Independent Commissioning Agent.

During this time, the estimated resources will comprise 20 workforce personnel and 18 staff.

Phases	Approx. Staff	Approx. Workforce
Enabling Works	6	30
Soft Strip / Demo / Excavation	6	30
Main works	24	180
Demobilisation	18	20

4.2.5 Removal and protection of trees

Laing O'Rourke will engage a specialist arborist with Australian Qualifications Framework Level 5 qualifications to provide a comprehensive survey and report on existing trees on the site. The report will provide advice (e.g. protection of existing trees) and information for the consultant design team. The arborist will provide supervision during the construction works, including tree protection measures, tree removal and construction activities within tree protection zones.

All tree protection will be implemented in accordance with the arborist's advice and relevant Australian Standards.

Figure 11 Example of a tree protection zone

4.2.6 Site offices and amenities

The Laing O'Rourke project office and site welfare facilities will be established within the Building J03 car park (see Figure 12 below), which will include:

- Site offices and meeting rooms
- First-aid office
- Amenities, including male and female toilets, lunch rooms, change rooms and showers.

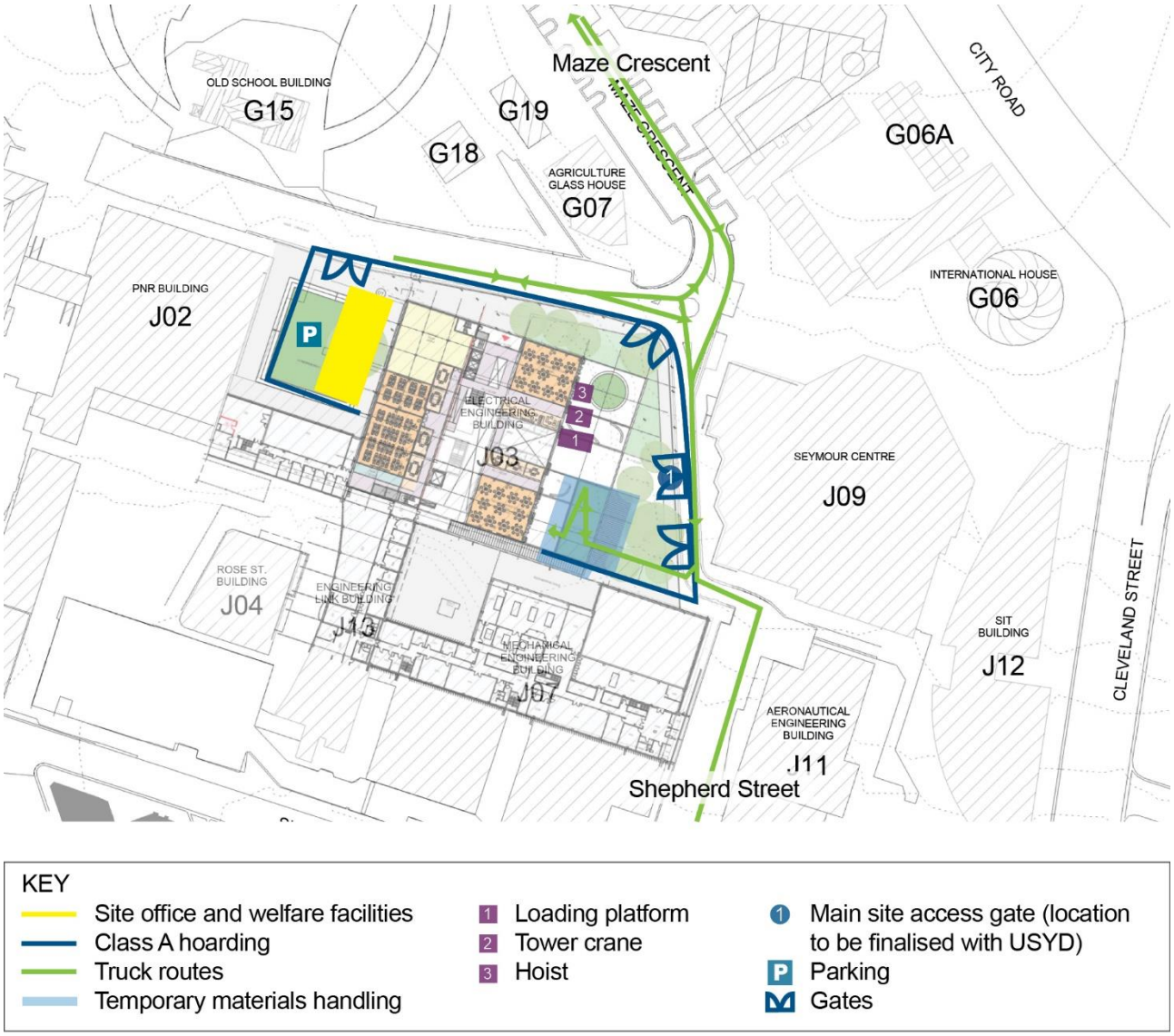


Figure 12: Location plan of the ETP Stage 1 site office and welfare facilities

The following figures indicate the extent of the site amenities at the different stages of the site establishment phases.

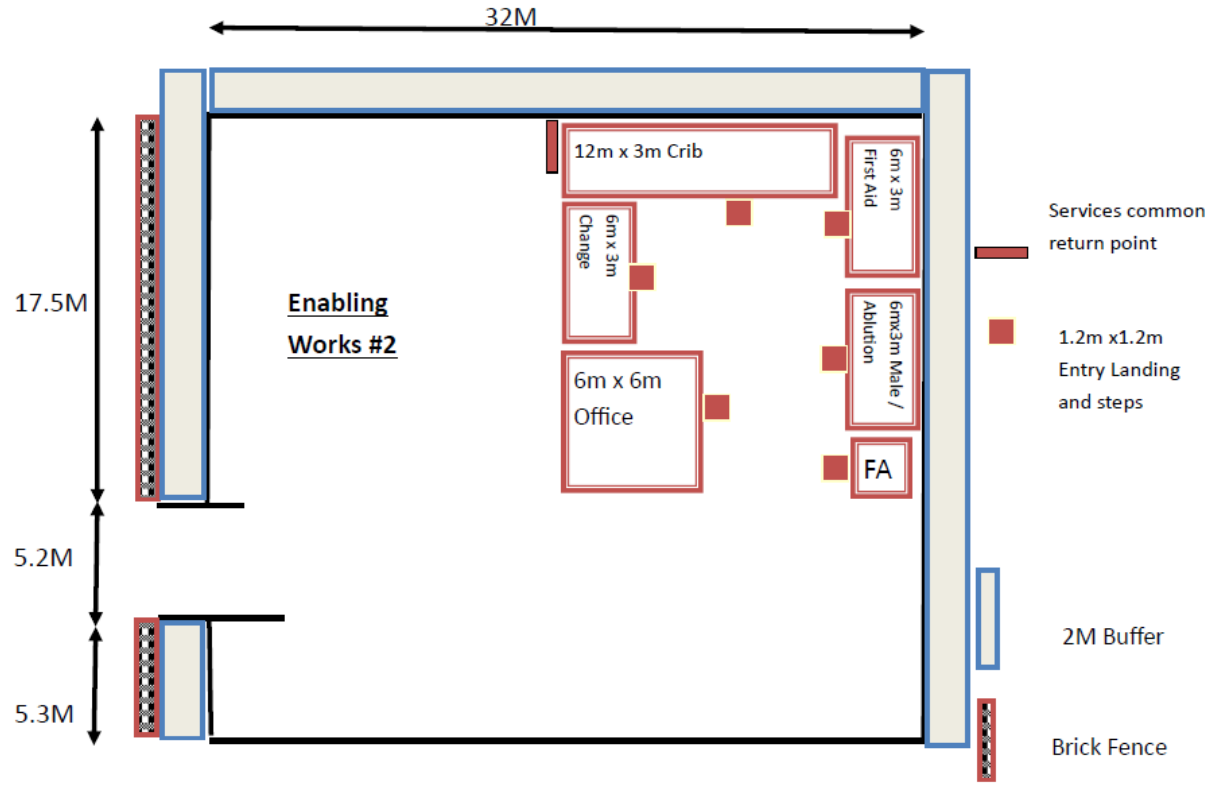


Figure 13: Site compound during the enabling, demolition and excavation works

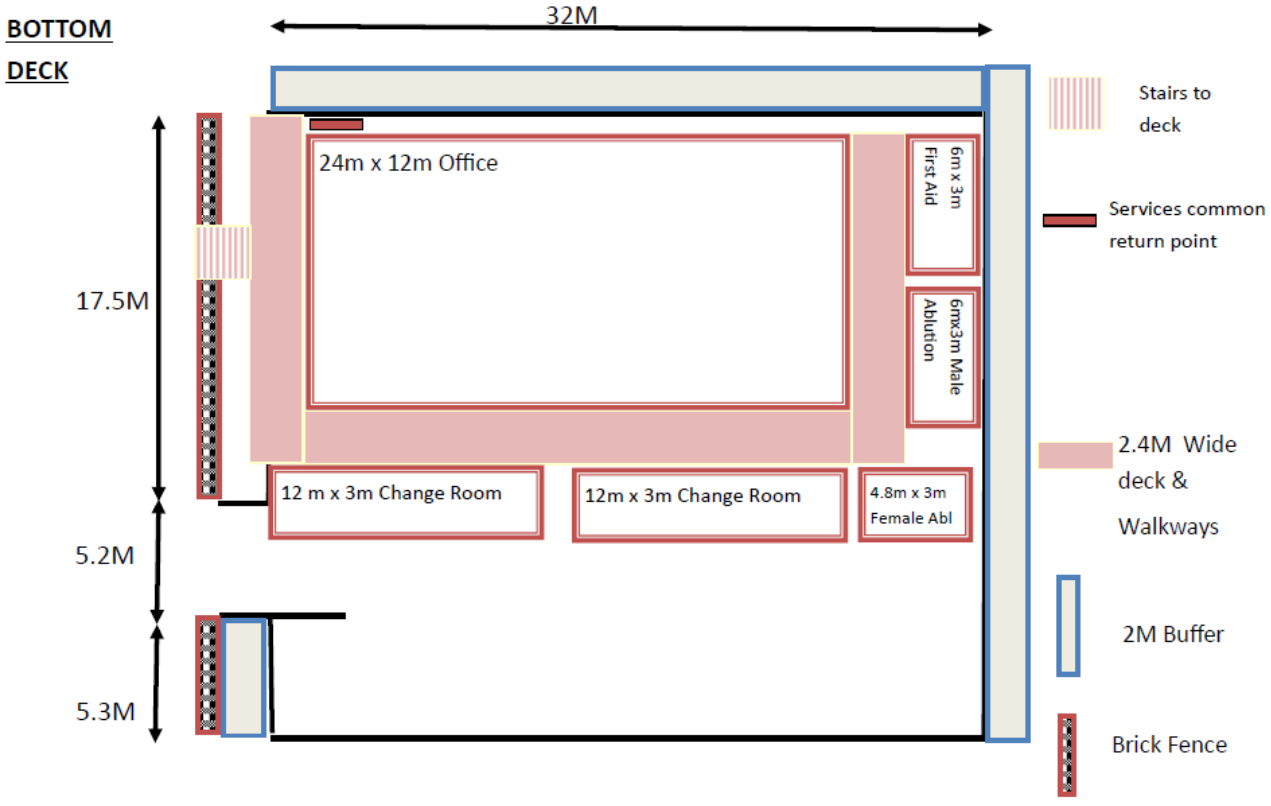


Figure 14: Site compound Bottom Deck – main works

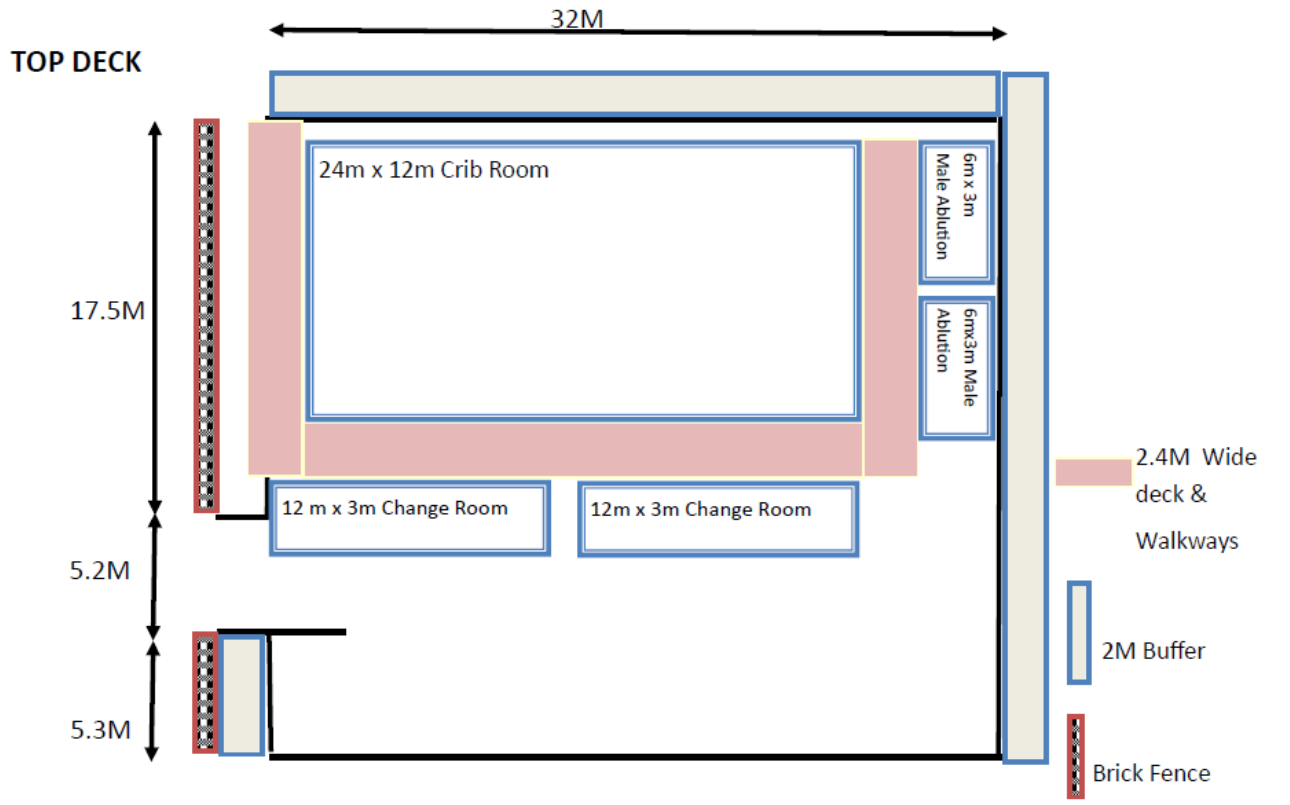


Figure 15: Site compound top deck –main works

4.3 Hoardings

Hoardings will be installed around the ETP Stage 1 project site, and within Buildings J03, J07 and J13, as described below.

4.3.1 External hoardings

Laing O'Rourke will install hoardings around the project site in the following areas:

- **Building J03 car park:** The Building J03 car park welfare facilities will have an "A" class hoarding installed along the perimeter of the compound, approximately 70m long. This hoarding will incorporate two truck access gates and three pedestrian gates. Access from Maze Crescent into the PNR building via the walkway adjacent to the car park and Building J03 will be maintained throughout the construction period
- **Maze Crescent:** "A" class hoardings will be installed along Maze Crescent, from the welfare facilities in the Building J03 car park to the corner of Blackwattle Creek Lane. The hoarding will incorporate construction access gates. Fire egress from the western elevation of the existing J03 building at street level will be maintained throughout the construction phase
- **Blackwattle Creek Lane:** Blackwattle Creek Lane will have an "A" class hoarding installed, which will incorporate two truck gates and one pedestrian gate
- **Engineering Walk:** An "A" class hoarding will be installed to the Engineering Walk. This will maintain pedestrian access into the Mechanical Engineering Building (J07) from Blackwattle Creek Lane.

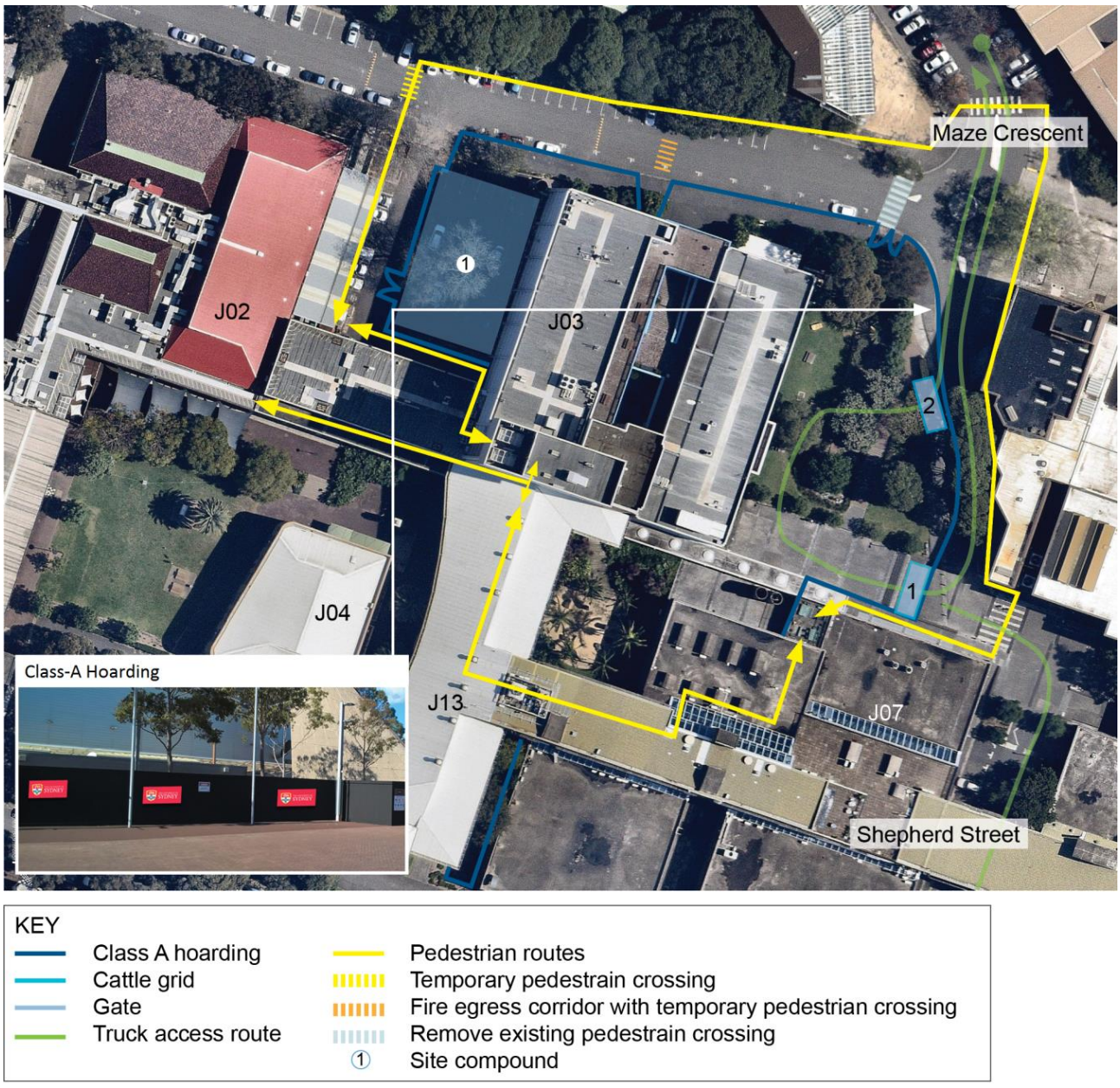


Figure 16: Site hoardings

4.3.2 Internal hoardings

Please refer to marked up drawings un Appendix 2: Hoarding drawings for further information

"A" Class hoardings will be installed within Buildings J07 and J13 to facilitate the refurbishment works. Hoardings will also be installed within the existing Building J03 as follows:

- Level 1 (loading bay): Existing windows to be boarded up and area to be hoarded.

- Level 2: Existing windows and the lobby will be boarded up, with access to the Engineering Walk blocked
- Levels 3 and 4: Existing windows and the lobby will be boarded up, with access to Building J13 blocked
- Levels 5-8: Acoustic “A” class hoardings will be installed on the terrace and walkways. Weatherproof hoardings will be installed to the lobbies at the demarcation line where the northern tower offices are demolished
- Level 9 – Hoarding will be installed to restrict access to the rooftop plant in the south tower
- Level 10 – Hoarding will be installed to close off access to demolition areas.

Appendix 2 includes further detailed plans of these internal hoardings.

4.4 Site security

The project site will be clearly signposted and all personnel, including visitors, will be required to report to the site office prior to entering the site. The site office will be located within a compound adjacent to the existing Building J03.

Construction areas will be secured with "A" class hoarding, with personnel and vehicle access gates included as required. Personnel will access the construction site via an eify turn-stile and gate system at Maze Crescent (see Figure 17, below). This access control system will provide un-manned access control in and out of site and will include video monitoring, vocalised messages upon entry/exit and the ability to show important messages via a video display.

Figure 17: "eify" access control system

Outside of normal working hours, site amenities will be secured and access gates to the compound locked. The construction site entry gates will be locked to prevent unauthorised access to the site when it is closed. Any access outside of normal working hours will be arranged with the Construction Manager or Project Manager whose contact details signposted at the main site entry gates.

4.5 Temporary services

Laing O’Rourke will establish temporary services to the ETP Stage 1 project site for power, nurse call, emergency lighting, site communications, hydraulic services, ablutions blocks and waste removal, and fire protection and air conditioning.

4.5.1 Power (non metered)

Laing O'Rourke has analysed the plant and equipment required to construct the ETP Stage 1 project. We anticipate the maximum demand power loads to be:

- New build to J03: 360amps
- Southern tower of Building J03: 120amps
- Building J07 area: 10amps.

In conducting this analysis, we have allowed for the following site resources and plant:

- Electric tower crane
- Builder's hoist
- Extra-low voltage lighting
- General power
- Pedestrian and site egress access lighting, where required
- Site accommodation.

Temporary power will be provided to site from the existing switchboard located in the Building J03 main switchboard (MSB) room.

Site power will be reticulated via temporary distribution boards powered from the Building J03 MSB. Temporary power boards will also be located around the site to ensure that no point within the construction site is more than 30m from a power board.

In addition to temporary distribution boards and lighting, temporary plant (e.g. tower crane and builder's hoist serving the site) will be powered directly from the Building J03 MSB where possible.

4.5.2 Nurse call

Nurse call points will be established at the builder's hoist and designated points around the site. These nurse call buttons will be part of a wireless radio system, linked to annunciator panels located in the site reception area.

4.5.3 Emergency lighting

Temporary emergency lighting will be installed in the stretcher stairs, as well as within the building footprint, to illuminate the emergency egress path for a worker located at any point within the building under construction.

Emergency lighting will also be placed throughout the floors, in front of the builder's hoist and builder's lift.

4.5.4 Site communications

During the enabling works, communications will be carried out via a wireless internet connection with Wi-Fi capability.

However, a high-speed fibre-optic network connection will be required during the main works, as approximately 24 staff requiring phones and computers will be on site at the peak of construction. Video conferencing will also be required for a meeting room.

As these connections typically require a 12-week lead time, Laing O'Rourke will place an order with a service provider in sufficient time to ensure the service is available when required.

Dedicated phone lines will be arranged for the two passenger lifts and the goods lift for early use during the construction phase. In addition, a two-way radio network will be used for communication between staff and the workforce. This network will include dedicated crane and emergency channels.

4.5.5 Hydraulic services

Temporary water will be required on site in the following areas:

- A hose point on each floor and at perimeter gates
- A washout drum at Levels 0, 4 and 8
- The hydrant rising main
- Hose reels on each floor
- Water bubblers at Levels 0, 4 and 8
- Ablution blocks at Levels 0, 4 and 8
- A hose reel at truck entry and exit gates
- The site welfare facilities compound.

The site will be serviced by a temporary water supply from Level 2 in the southern tower. Laing O'Rourke will install a temporary water meter to keep records of usage. This water supply will be utilised during the demolition, excavation and construction works.

Temporary water risers will be positioned within the core of the building and will be reticulated throughout the site with polyethylene piping.

If required, a temporary cold water booster pump will be used to pump water to the upper floor levels of the building as construction progresses.

4.5.6 Ablution blocks and waste removal

Ablution blocks will be located adjacent to the core on Levels 0, 4 and 8.

Liquid construction waste from washout drums will be removed from the site. The washout drums will be interlinked with waste traps leading down to a filtration system that is Environment Protection Authority (EPA) compliant.

During construction, temporary pumps will be used to remove this waste to the street for disposal off site. These pumps will be located in the permanent pit wells within the basement and will be replaced with permanent pumps by the hydraulic services subcontractor prior to commissioning and handover.

4.5.7 Fire protection services

Laing O'Rourke will ensure the site is protected by temporary fire hose reels, hydrants and extinguishers in accordance with the Building Code of Australia (BCA).

Combined fire hose reels and hydrants will be used for temporary fire protection.

The hydrants and hose reels will be located on every floor of the site covered by a roof or slab (excluding the two uppermost floors) once the building reaches an effective height of 12m.

Portable extinguishers will be provided by the fire services contractor and will be located at designated points (e.g. stairs and builder's hoist) in accordance with BCA Clause E1.9, which requires a minimum of two per floor.

4.5.8 Air conditioning

Temporary air conditioning will be provided for site offices and accommodation.

4.6 Hours of work

On-site work hours will be confirmed upon approval of the development application (DA) for the project.

Laing O'Rourke anticipates demolition, excavation and building construction work hours will be restricted to between 7:00am and 6:00pm Monday to Friday and between 7:00am and 3:30pm on Saturdays. No work will be conducted on Sundays or public holidays without approval.

Building, demolition and excavation works are defined as follows:

- "Demolition works" means any physical activity to tear down or break up a structure (or part thereof) or surface, or the like, and includes the loading of demolition waste and the unloading of plant or machinery
- "Excavation work" means the use of any excavation machinery and the use of jackhammers, rock breakers, excavators, loaders or the like, regardless of whether the activities disturb or alter the natural state of the existing ground stratum or are breaking up or removing materials from the site and includes the unloading of plant or machinery associated with excavation work
- "Building construction" means any physical activity on the site involved in the erection of a structure, cladding, external finish, formwork, fixture, fitting of service installation and the unloading of plant, machinery, materials or the like.

4.7 Permits

Unless otherwise approved in writing by the City of Sydney Council, all works, processes, storage of materials, loading and unloading associated with the development must occur entirely on the site.

Permits for out-of-hours work, using mobile plant or establishing work zones on the street, or storing materials on council or University property must be obtained.

4.7.1 Out-of-hours work

Where it is necessary for works to occur outside the hours allowed by the DA conditions, an Out of Hours Permit must be obtained from the council on each occasion.

Major activities where this will be required on the project will include:

- Termination and connection of services
- Floating of heavy plant
- Cranage of demolition plant onto the existing buildings
- Erection and disassembly of the tower crane.

4.7.2 On-street mobile plant

Restrictions apply to the hours and areas in which mobile plant (e.g. cranes, concrete pumps and cherry pickers) can be used. Separate permits are required for each occasion and each piece of equipment. Laing O'Rourke will set up equipment on site wherever possible and ensure that the use of any piece of equipment does not violate adjoining property owners' rights.

4.7.3 Storage of materials and building waste containers

Laing O'Rourke will apply to Campus Infrastructure Services (CIS) for work zones as part of the project and all material and skip storage will be constrained to these approved areas.

4.7.4 Work zones

A work zone will be established on Maze Crescent, occupying the existing footpath and kerb-side lane. Approximately seven car parking spaces will be relinquished for this work zone. Consideration is to be given to deliveries to J01 during the works.

Figure 18: Proposed work zone on Maze Crescent

4.8 Traffic and pedestrian management

Laing O'Rourke has prepared Traffic and Pedestrian Management Plan (TPMP) for the ETP Stage 1 works (included within this folder). The plan will be updated on a regular basis in conjunction with Campus Infrastructure Services.

The TPMP details the site access routes, construction zones, truck movements and other particulars of the traffic management for the project.

Key considerations that have influenced our approach to traffic and pedestrian management include:

- Establishment of a work zone on Maze Crescent
- Main access into the site via the entry/exit gates on Blackwattle Creek Lane
- Any road used by construction traffic must not be used as a waiting area for vehicles delivering to or awaiting collection of any persons, materials or plant
- Truck movements will be restricted to designated truck routes through the area
- Access to neighbouring properties will be maintained at all times
- Traffic controllers will be in place to direct construction traffic to and from the site
- All signage fencing, overhead protection, safety barriers and line marking details will be in accordance with relevant Australian Standards and the Roads and Maritime Services (RMS) Manual for Traffic Control at Work Sites.

Due to the close proximity of various public transport modes, as well as the constrained nature of the work space, no parking will be provided on site for staff at any time. Space will be provided for the

storage of tools and materials required by trades, and staff will be encouraged to deliver tools to site initially and then travel to site via bus and or train. Site staff and subcontractors will not be permitted to park in the immediate vicinity of the site to reduce impact on the local community.

A draft Traffic Control Plan (TCP) has been developed for the project and is included in the TPMP (see Figure 19, below).

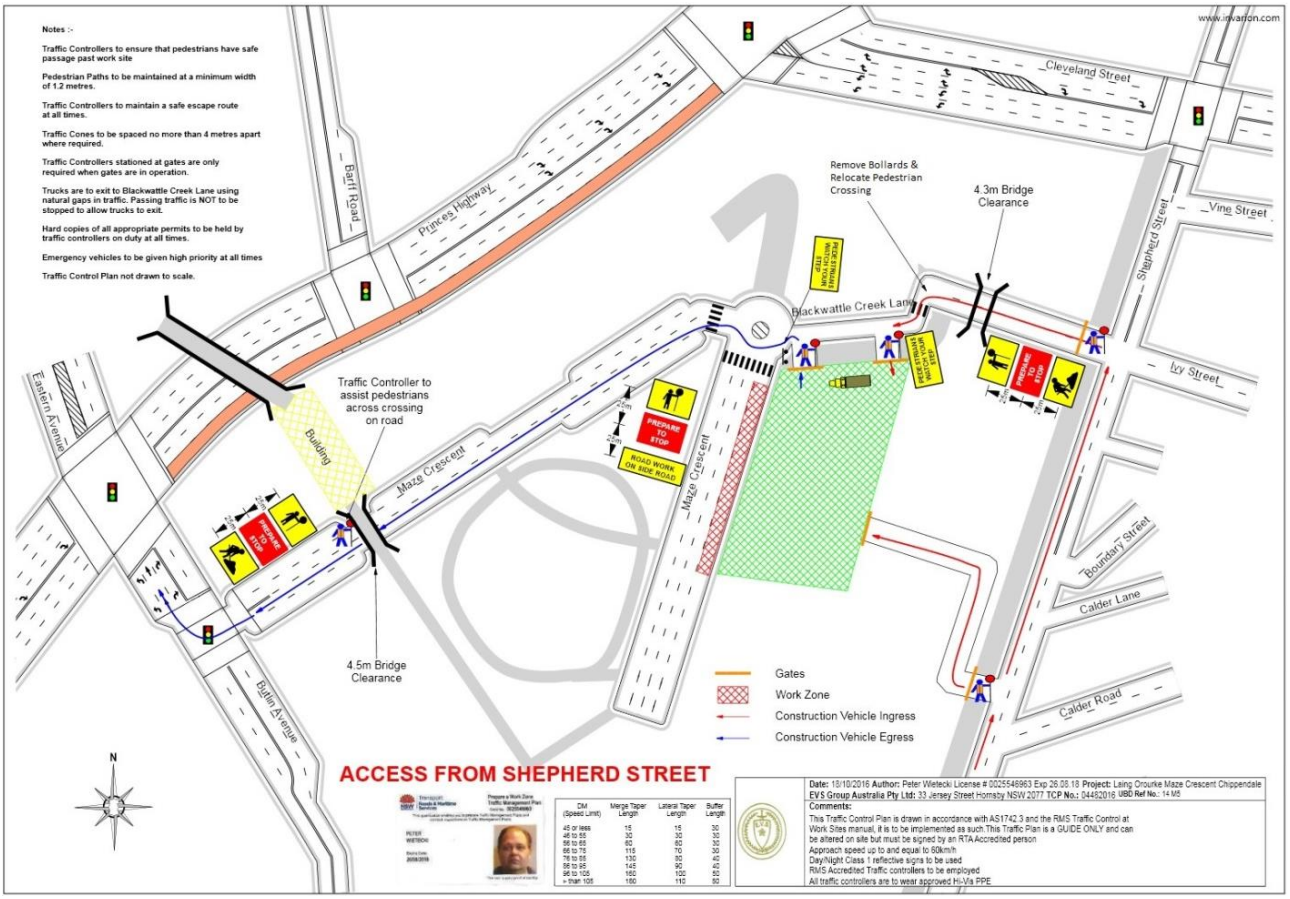


Figure 19: Draft traffic control plan for the ETP Stage 1 works

Additional TCPs will be developed throughout the project by suitable qualified personnel. For example, the demolition and excavation subcontractor will develop and implement suitable TCPs to ensure safe and effective management of traffic and pedestrians throughout the demolition phase. In addition, Laing O'Rourke's traffic management subcontractor will develop and implement suitable TCPs to ensure safe and effective management of traffic and pedestrians throughout the construction phase.

4.8.1 Pedestrian management

Laing O'Rourke's management of pedestrians, as discussed in the TPMP, will be driven by the following considerations:

- No construction vehicles or materials will obstruct pedestrian walkways adjacent to the site
- Access from Maze Crescent to the PNR Building will be maintained throughout the construction phase
- Temporary wayfinding signage will be established and maintained throughout the construction phase where pedestrian routes are adjusted.

The following figure indicates the proposed pedestrian routes for staff and students during the construction phase.

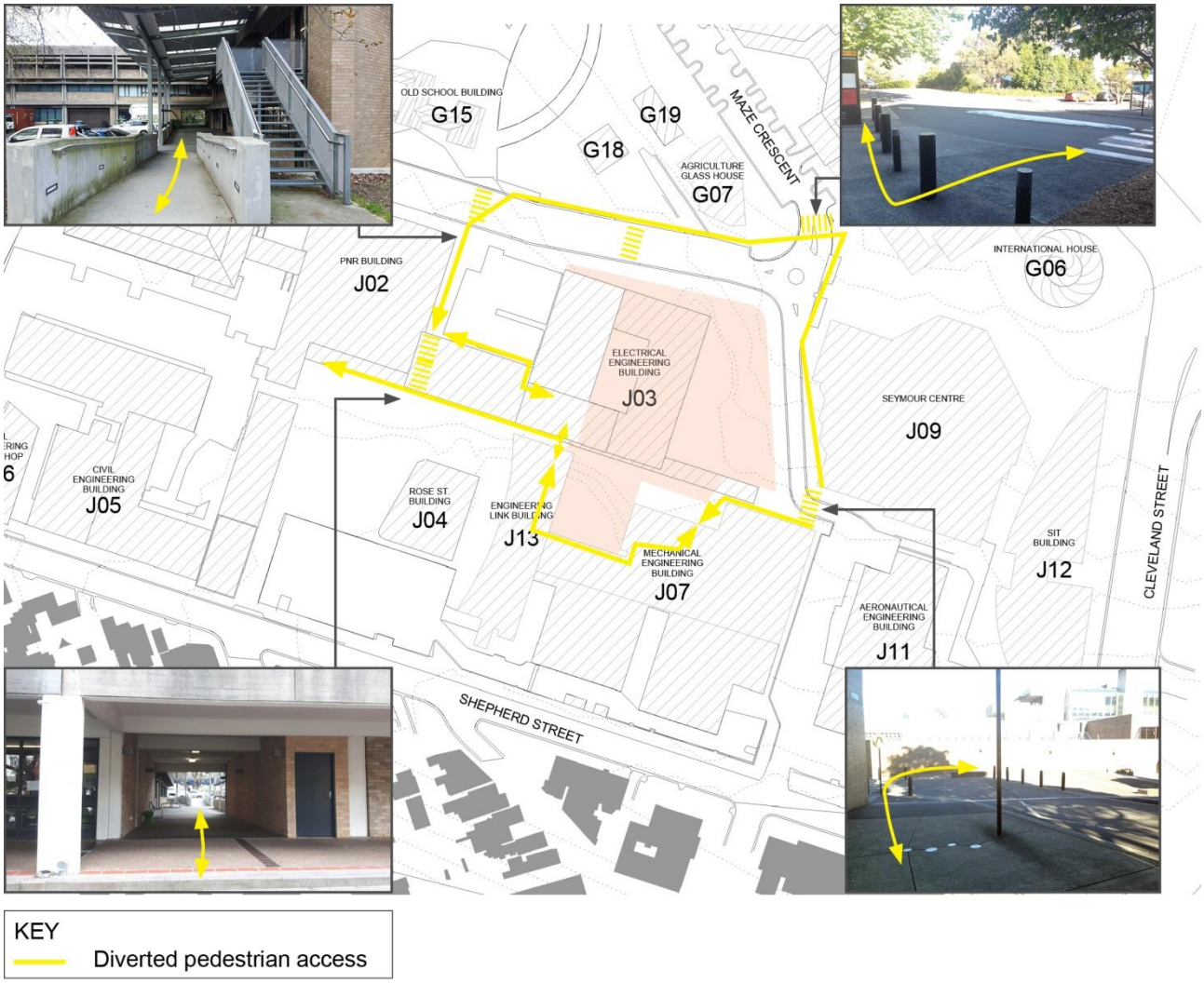


Figure 20: Pedestrian management plan

Laing O'Rourke's dedicated project app will be deployed to provide concise, up-to-date information on changes to pedestrian routes. Users will be able to download the app, select a "drop-pin" location on a map and view a high-resolution 360-degree photograph of the location and the pedestrian access route. These images will be updated throughout the construction phase to align with changes to pedestrian routes.

4.9 Disruption notices

Laing O'Rourke is mindful of the importance of clear communication throughout the project and minimising disruptions to the University and all stakeholders. Where there is a possible interface between University operations and construction activities (e.g. service outages), Laing O'Rourke will provide the University with a disruption notice prior to construction activity commencing. Exact communication requirements / notice periods to be agreed (LOR / CIS / USYD). A construction user interface process will be developed. This will cover points of contact and time periods for planned activities, this interface can also manage any concurrent works in and around the campus (by other contractors) and allow an understanding of any specific events being held by the USYD during the construction period.

LOR will also co-ordinate it works with USYD activities including events management as required.

4.10 Compliant and response process

LORAC will work with USYD / CIS to organise a single point of contact for local residnece and USYD staff members. This contact information will be promoted via letter drop and information notice boards adjacent to the project.

Information promoted via these methods may include any work outside normal working hours i.e. tower crane erection / dismantling and also general informative information on the project.

5. Construction methodology

This section details Laing O'Rourke's construction activities for the ETP Stage 1 project during the enabling, demolition and excavation and main construction works phases.

5.1 Enabling works

The scope of works consists of preparing areas within Buildings J13 and J07 to relocate existing areas from within J03 and J07.

5.1.1 Decanting existing spaces

Shown below is the relocation of the amenities and tea room. Exact requirements and exact location to be agreed. Note these works will need to be completed before demolition works commence.

Figure 21: Decanting plan for the offices on Levels 5–9 in Building J03

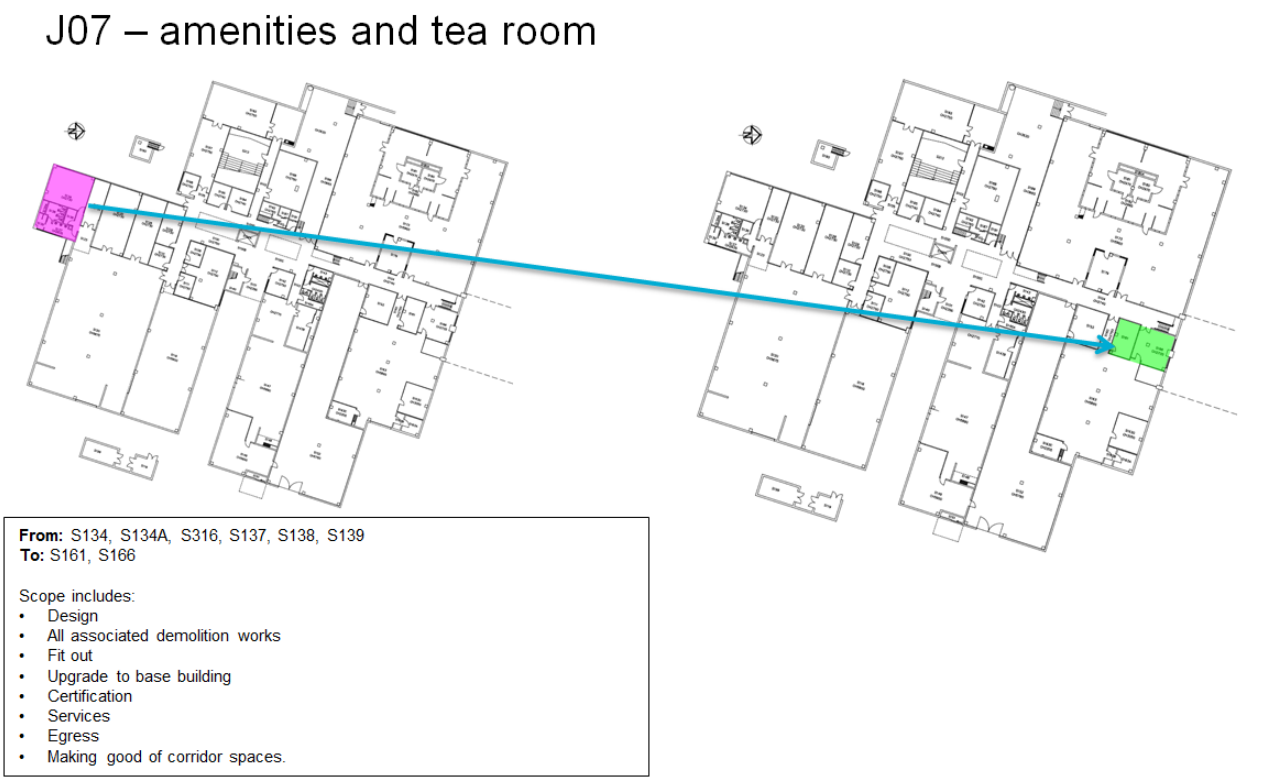


Figure 22: Decanting plan for the amenities and tea room in Building J07

5.1.2 Making safe existing services

This work will involve:

- Investigating existing services and assessing potential impacts of construction works
- Carrying out terminations and diversions, including refurbishment provisions
- Issuing disruption notices for service outages.
- Create simple documentation to be understood by all, to reduce the risk of unexpected service interruptions.

5.1.3 Demolition for refurbishment works

Demolition activities will involve:

- Temporary protection of existing surfaces as required
- Hazardous materials surveys
- Removal, monitoring and clearance of hazardous materials
- Soft strip of remaining materials and partitions.
- USYD pre-demo process's to be followed - HOLD POINT

Small bins will be transported through the existing corridors then to the existing loading dock via the lift.

5.1.4 Refurbishment works

All construction materials for the refurbishment works will enter the site via the Shepherd Street loading dock. Works will involve construction to accommodate the following:

- Labs
- Offices
- Tea room and amenities.

5.1.5 Relocation

When refurbishment is complete, Laing O'Rourke and the University will relocate the current room contents and fittings, furniture and equipment (FFE) to the new spaces provided.

5.1.6 Loading dock construction

The construction of a new loading dock for Building J03 will involve the following activities:

- Relocation of the tea room and amenities to Level 1 of Building J07
- Existing tea room and amenities area to be demolished and refurbished to create a new loading dock entry area into J03. This area will also serve as a temporary construction access for basement deliveries to the new build area
- Installation of hoarding and a temporary driveway.

5.1.7 Other enabling works

Additional enabling works required will involve:

- Relocation and diversion of external building services within the new building footprint
- Relocation and removal of existing trees
- Relocation of Oxometrical Society Sentimental Stonehenge

- Demolition of the Engineering Walk overhead structure from Building J07 to Building J03
- Relocation of mechanical plant in the southern tower of Building J03 from Level 9 to Level 13 (rooftop) to allow construction of the new levels tower above Level 9.

5.2 Demolition and excavation works

5.2.1 Demolition

The ETP Stage 1 works will involve demolition of office areas on the north-western edge of Building J03's southern tower, as well as demolition of the building's whole northern structure (see Figure 23). Demolition of these elements will be carried out concurrently.

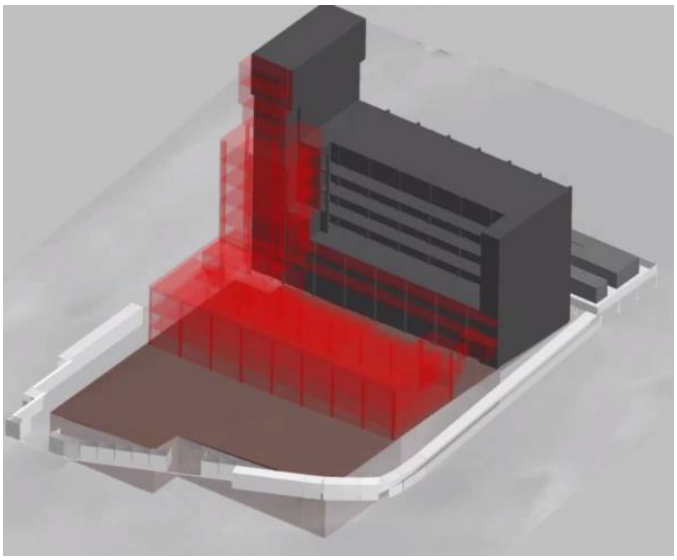


Figure 23: Digital model snapshot of the areas to be demolished (shown in red)

Prior to these works, Laing O'Rourke's demolition subcontractor will prepare a comprehensive demolition plan, which will be included in this CMP (Appendix 3) and submitted to council for approval with the relevant construction certificate application.

Prior to demolition commencing, Laing O'Rourke will ensure that:

- Contamination assessment and hazardous material survey are fully understood by all parties
- Removal works have been carried out
- A clearance certificate has been issued by a suitably qualified hygienist
- Property condition surveys of nearby properties, assets and the like have been conducted and any vibration sensitive operations or receptors identified.

A qualified Structural Engineer will approve the use of the demolition plant and equipment on suspended slabs. Loading of trucks and semi-trailers for the cartage of demolition debris will be conducted in accordance to RMS requirements.

Scaffolding will be erected in accordance with AS1579 and AS4576 and the Workcover Code of Practices for Scaffold Erection. Scaffold will be erected on the hoarding and buildings to ensure containment of debris and public protection.

Figure 24 below shows the location of the demolition area, together with pedestrian routes, truck access routes and hoardings.

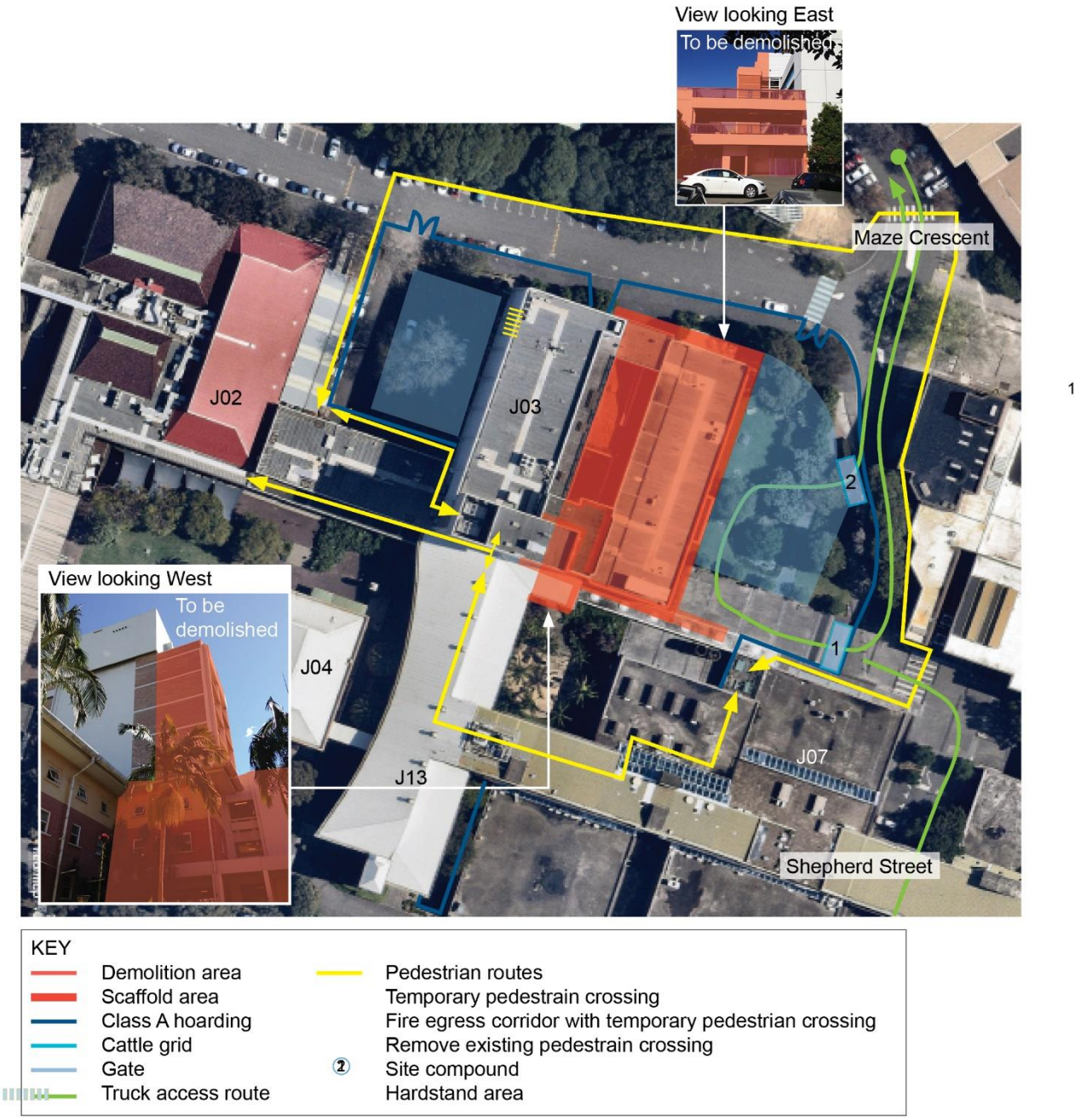


Figure 24: Demolition staging plan

5.2.2 Demolition of northern tower offices

A section within the northern tower floor plate will be demolished and then used as a demolition drop zone with a chute. On each floor, this location will be closed off with plywood to ensure the doors to the chute do not open during operation.

At the base of the building, modifications will be made to create an opening between the support columns to allow demolition debris to be removed.

A qualified structural engineer will determine if any temporary works are required in the existing building to support demolition plant loadings. Once any necessary works have been carried out, a 5t excavator will be craned onto the existing Level 4 roof slab, using a 130t crane. Excavators will begin the

demolition procedure using hydraulic hammer and pulveriser attachments. The excavator will begin demolition from one corner of the slab, working away from the demolished area.

5.2.3 Demolition of the northern structure

Like the southern tower, a grid will be demolished within the floor plate of the northern structure and used as a demolition drop zone. On each floor, this location will be closed off with plywood to ensure the doors do not open during the operation of the chute.

At the base of the building, modifications to the building between the support columns will occur to create an opening to drag out demolition debris.

This structure will be demolished using two 47t excavators with hydraulic pulveriser attachments. These excavators will work their way into the building from the northern side.

Temporary works will be required to support existing structures in various locations to support demolition plant loadings.

5.2.4 Excavation of the substructure

Following demolition of the existing structures, a full bulk excavation will be carried out, based upon a traditional bottom-up construction method.

Table 5 below outlines the estimated quantities of materials to be excavated for the ETP Stage 1 works.

Materials	Quantity
Bulk excavation – low strength shale and medium-to high-strength bedrock	4,215m³
Excavation – slab on ground	350m³
Detailed excavation – lift pits and pad footings	170m³
Total	4,735m³

Table 5: Approximate quantities of materials to be excavated

The following Figure 25 demonstrates the areas to be excavated.

Figure 25: Revised Bulk excavation plan (only Level 1 basement required)

Prior to the demolition and excavation works, the site environmental control system will be implemented along with an instrumentation and monitoring plan.

From the current existing ground level (Level 2), the excavation is approximately 4m deep.

The perimeter of the excavation will be retained by bored reinforced concrete piles spaced at approximately 2.4m centres. These piles will have anchors and shotcrete installed to the piles as excavation progresses. The excavation will bench in 2.5m intervals until it reaches the designed level of the Level 0 of the new build.

The southern tower will be underpinned as required to enable excavation to progress.

The excavated material will be loaded out by trucks via the construction site entry off Blackwattle Creek Lane.

Three lifts pits, two stairs, and pad footings will be detail excavated in medium density shale.

In the event of inclement weather, rainwater will be flocculated then tested for compliance with Laing O'Rourke's and the NSW Environment Protection Authority's requirements for pH, suspended solids, electrical conductivity and turbidity prior to discharge from the site.

Figure 26: Example of excavation works

5.2.4.1 Shoring piles to perimeter of excavation

The first stage of civil works will involve piling to the perimeter of the excavation area.

Bored reinforced concrete piles – typically 600mm diameter – will be installed along the perimeter of the proposed below-ground Level 1 of the new building. A piling rig sized to suit the expected ground conditions, as well as the required pile diameter and depth of piles will be used.

The piles will be spaced at approximately 2.4m centres and socketed into the ground to a depth of approximately 1.5m below excavation level. The pile base will be verified and cleaned before placement of the prefabricated steel reinforcing cage. Ready-mixed concrete, supplied from a batch plant, will be discharged directly into the pile excavation and finished to the required cut-off level.

A reinforced concrete capping beam will be constructed to the perimeter shoring piles. As excavation progress, a shotcrete in-fill approximately 200mm thick will be applied to the piles, and anchors will also be installed to the shoring piles.

Figure 27: Examples of piling (left) and shotcreting (right) activities

5.2.4.2 Bulk excavation

Excavation will commence from the south-east corner of J03 and progress north towards Black Wattle lane and the temporary entry and exit gates. Equipment to be used at various stages of excavation includes:

- 12t excavator with bucket
- 25t excavator with bucket and rock saw
- 30t excavator with hammer and rock saw
- 45t excavator with ripper
- 30t long reach, telescopic or chameleon excavator with bucket
- Bobcat.

5.2.4.3 Backhoe – Detailed excavation

A rock saw will be used to excavate in-ground services lift pits and pad footings. This will minimise over sizing the items. Smaller hydraulic excavators will then be used for detailed excavation.

A sequencing drawing will be developed to show the methodology for detailed excavation. We will leave a ramp inside the basement to allow vehicles to be fully loaded during bulk excavation.

5.3 Main construction works

The main construction works will include the delivery of three new lifts, two stair cores, loading dock, hazardous goods storage areas, laboratories and support areas, work spaces and offices and plant rooms. A new atrium will sit in the centre of the new building and existing southern J03 tower.

5.3.1 Superstructure (pre-cast install shown, in-situ to be further considered)

5.3.1.1 Lift core construction

The new building will feature a single goods lift in the south-east and two passenger lifts in the south-west. The lift pits for these three lifts will be cast in situ.

Figure 28: example of a precast concrete panel (right)

The lift cores will start at Level 1 with the passenger lifts servicing Level 9 and the goods lift servicing the plant room on Level 10. The lift core walls will be constructed using precast concrete panels that have been fabricated off site (see

Figure 28). Panels will be lifted by crane to their final positions.

When the footings are complete, in-ground services and pits will be progressively constructed, followed by the 120mm thick reinforced concrete slab on ground. The area to the labs will receive a 300mm thick reinforced concrete slab to meet EMI shielding requirements.

On all levels above Level 1, precast structural columns (fabricated off-site) will be installed by crane, to maximise on-site efficiency. Temporary propping will be implemented to these structural members in accordance with engineer's requirements. Post-tensioned reinforced concrete band beams of varying width and depth will be constructed spanning the columns.

Figure 29: Examples of precast concrete columns

Once the beams reach the required concrete strength, a crane will be used to install Hollowcore planks perpendicular to the beams, spanning beam-to-beam. The use of Hollowcore planks (shown in Figure 30, below) offer numerous benefits, including: efficiency of installation; long spans that do not require intermediate supports; provision of a safe work platform; reduced number of construction personnel required on site and therefore reduced safety risks; value for money; and sustainability (through a reduction in the use of raw material and wastage).

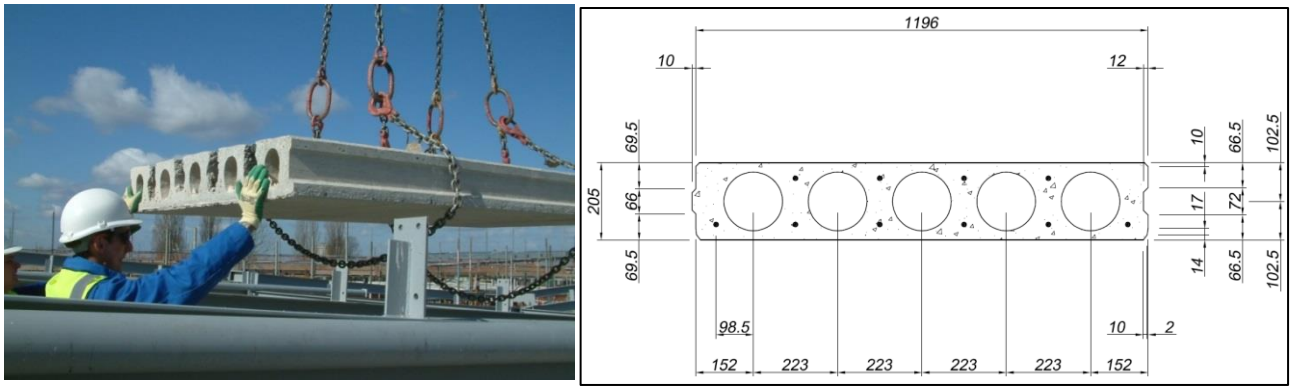


Figure 30: Example of Hollowcore plank (left) and typical section through Hollowcore (right)

Following the placement of the Hollowcore planks, a 80mm thick topping slab will be placed.

The slab for the hazardous goods storage areas east of the new tower will consist of precast concrete columns and beams and an in situ 200mm thick post-tensioned slab.

5.3.1.2 Tower construction

The Level 3 external slab will be used as a logistics podium to take deliveries of Hollowcore planks and later on stillages for the cladding. Due to the size constraints of the site, only small dedicated areas will be allocated for storage of materials.

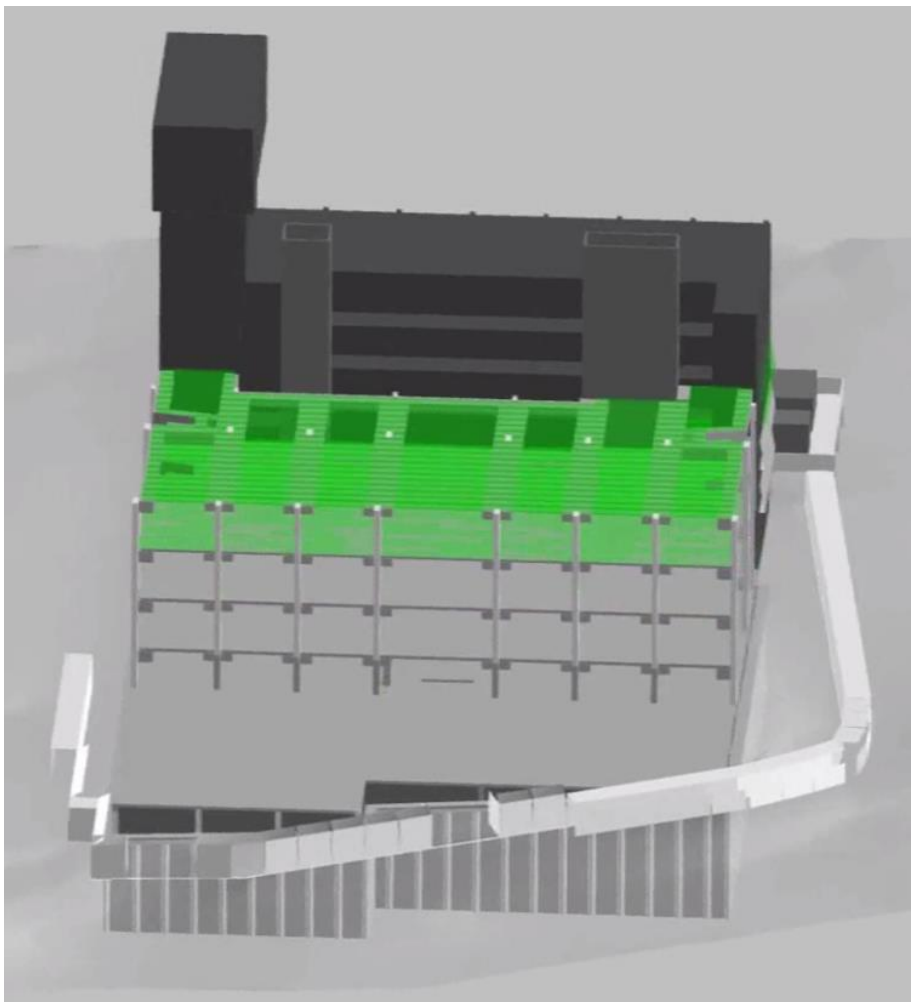


Figure 31: Level 6 external slab complete and main tower construction progressing

Construction of Levels 2-9 will involve installation of precast columns, followed by post-tensioned reinforced concrete band beams, Hollowcore planks and the topping slab. Level 10 will be constructed using a lightweight structural steel frame to house the plant room.

Pre-stressed reinforced concrete edge beams will be constructed using precast concrete constructed off site.

Reinforced concrete band beams will be spaced to support the Hollowcore planks and topping slab.

This construction sequence, comprising installation of columns, beams and slab, will be repeated every eight days for each level.

Lift-cores walls will continue to be constructed on the upper levels using precast panels constructed off site. These panels will be lifted into position by crane.

5.3.2 Scaffolding

Exact requirements to be provided.

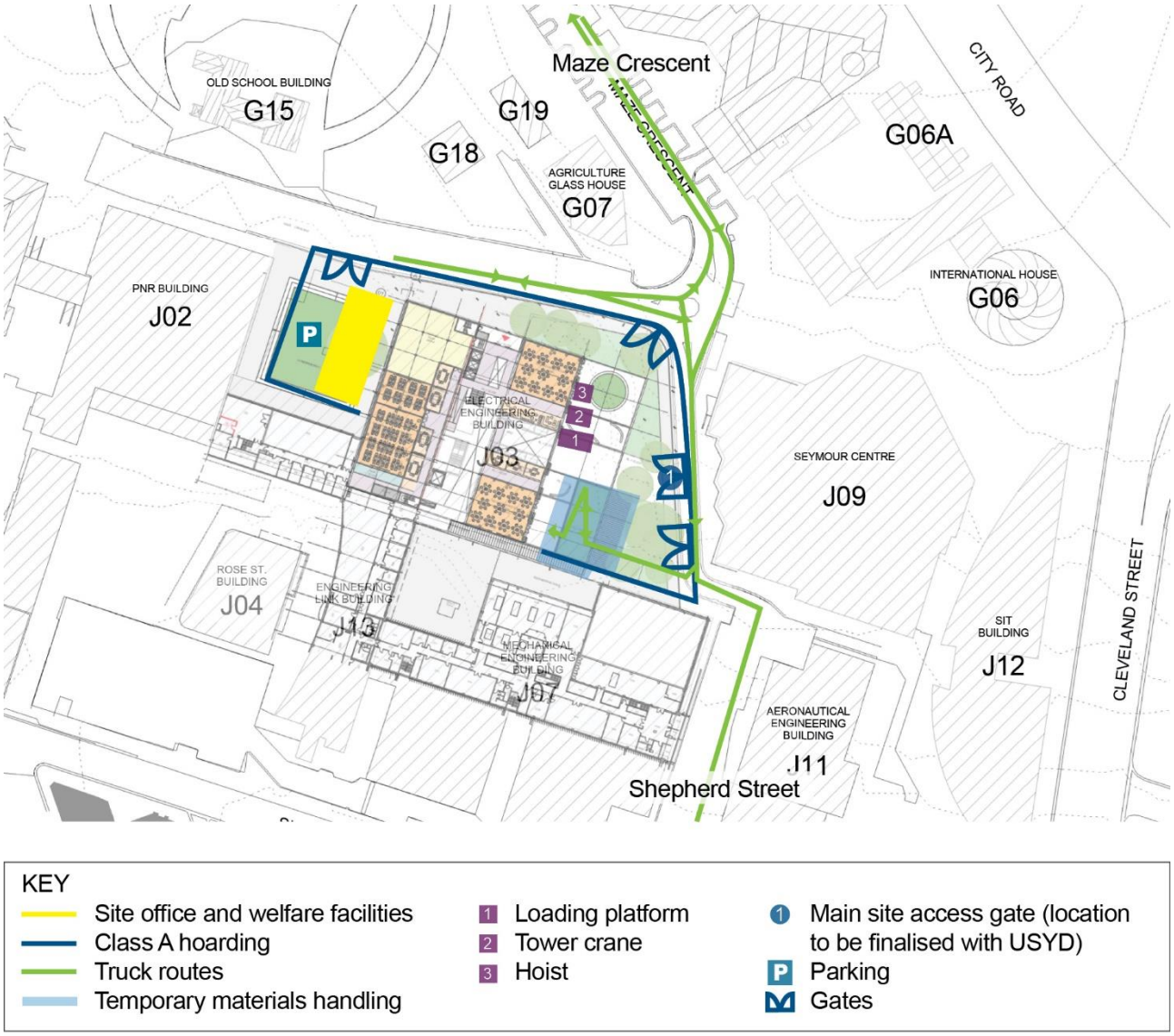


Figure 32: Scaffolding plan

Handrails will be installed to perimeter edge beams before they are lifted and placed in position. This will negate the need to install scaffolding around the new northern tower. Perimeter containment screening and/or shade cloth will be provided as required. This edge protection system will remain in place until the cladding is installed.

Internal scaffolding will be erected around the lift shafts and stair cores to facilitate installation of the precast lift core walls.

5.3.3 Falling objects

During the erection of the superstructure, proprietary safety net fans will also be erected as a proactive measure to stop objects that may otherwise fall to ground level. The fans will be designed and installed to suit wind conditions and to restrain falling objects in tight-knit debris netting. Fans will be installed at every third level, starting from the ground level.

Figure 33: Example of a safety net fan

5.3.4 Façade

Laing O'Rourke understands that delivering a high-quality building façade, with superior appearance and long-term performance, will require attention to detail – particularly during assembly. We also understand the risks of working at height. Therefore, we have worked closely with our supply chain to develop a rigorous methodology for installation of the building envelope.

Our strategy involves:

- Maximising the use of equipment for moving and installing panels to reduce manual handling
- Maximising the use of access equipment to ensure operatives installing the cladding have full access around the panels and feel safe carrying out the installation
- Sequencing the works so the potential for revisits and corresponding damage are minimal.

The scope is split into new and existing façade works. The new façade will consist of a combination of glazed curtain wall and aluminium sun shades. The façade on the existing southern tower will be over-clad with composite panels to improve the thermal resistance R-Values. The quality of the architecture used in envelope of the new building demonstrates our commitment and attention to detail as well showcasing engineering on display.

The northern façade will consist of glazed elements constructed off site and carefully packed to accommodate the installation sequence and avoid double handling. The panels will be packed in steel pallets, designed to be easily lifted and moved by a fork lift and/or crane. The pallets will be shrink-wrapped in a nylon film to protect the panels against weather ingress prior to installation.

The panels will be delivered to site on curtain-sided flatbed trucks, with deliveries planned to suit the staging of the installation. Each truck will take two to three hours to offload, which will be coordinated with other deliveries.

5.3.4.1 Surveying

Before any units on the new building are installed, a detailed survey will be carried out on the primary structure and grid positions.

5.3.4.2 Fixing brackets

Once four floors, starting from Level 4, have been fully stripped and stressed and grid lines and levels marked out, the bracket installation team will set out the first level of brackets.

Brackets for the curtain wall system will comprise of aluminium pre-drilled angles bolted to a cast-in unistrut system. Key brackets will be installed at height and perimeter locations. Once key bracket installation is complete, string lines will be set up and infill brackets completed. These will be completed prior to panel installation to ensure continuity of work for the panel crews.

5.3.4.3 Panel installation

Panels will be removed from the pallets using a stacker. The panels will be placed on manual trolleys for distribution around a floor or transported via the stacker to the workface. Once the panel has been transported to the work face, it will be placed in the launching position, with the top of the panel parallel to the edge of the structure. Lifting clamps will be fitted to either end of the panel through the weep slots of the gutter.

Figure 34: Example of curtain wall panel installation

A mini crawler crane (MC-305C-2) or panel lifting crane, such as a walkie reach stacker, will be located above the floor with the launch table. Two launch tables will be used to prepare the panels for launching. The panel will then be lowered into position and repeated around each floor slab. Once each floor is complete, the installation equipment will be raised one floor and the process repeated until we have reached one floor below the mini crane.

5.3.5 Lift installation

Three lifts will be installed and commissioned for the ETP Stage 1 project:

- Two passenger lifts – serving seven levels (Levels 1–9)
- One goods lift – serving eight levels (Levels 1–10)

The goods lift will be employed as the builder's lift to allow the builder's hoist to be dismantled. The shaft for the builder's lift will be handed over allowing seven weeks for the installation of the builder's lift. Lift installation will begin in January 2019 and be completed by the end of May 2019.

5.3.6 Building services

The installation of building services works will begin in January 2019, once the temporary supports have been cleared from the floor plate, allowing for services to commence. Water tightness, penetrations and as-built tolerances will all be assessed prior to handover of these areas for services installation.

Building services will be installed at four distinct work fronts:

1. Lower floors Levels 0-3
2. Typical floor plates
3. Risers
4. Plant rooms.

Each work front will follow a logical sequence of work: one discipline will take the lead (typically wet fire, as the range pipework will sit above the mechanical works), followed by mechanical, electrical and dry fire.

Laing O'Rourke will apply its Design for Manufacture and Assembly (DfMA) strategy to the project, considering prefabricated riser pipework and horizontal services modules. This will deliver advantages such as:

- Greater quality control

- Reduced labour required on site
- Reduced waste
- Fewer deliveries
- Greater safety benefits, due to less working at heights and less welding and drilling on site.

The services modules will be tested prior to installation, sealed and installed within metal frames.

Figure 35: Examples of prefabricated services modules

5.3.7 Commissioning

The project Commissioning and Validation Management Plan (contained in Schedule 18) outlines the commissioning activities to be carried out for the ETP Stage 1 construction works.

6. Materials handling

Materials will be handled on the ETP Stage 1 site using cranes; primarily a tower crane which will be supplemented by mobile cranes where required.

6.1 Cranage

6.1.1 Tower crane

Laing O'Rourke will use a tower crane for the ETP Stage 1 works – a Terex CTT 331-16 HD23 Flat Top (hammerhead) tower crane as shown in Figure 3639.

The crane, established via a set-up on Maze Crescent, will be located on gridline 3N and 4. This will be internal to the Level 0 laboratory and Level 1 lecture theatre, but external from Level 3 and above.

The tower crane will be erected to full height, with the cabin siting above the existing Building J03 southern tower (see Figure 370, below).

No ties to the building will be required as this crane has the capacity to free-stand 52.6m.

The crane base will be constructed below the lower ground level slab, so that the crane base is sacrificial.

Figure 36: Terex CTT 331-16 HD23 Flat Top tower crane

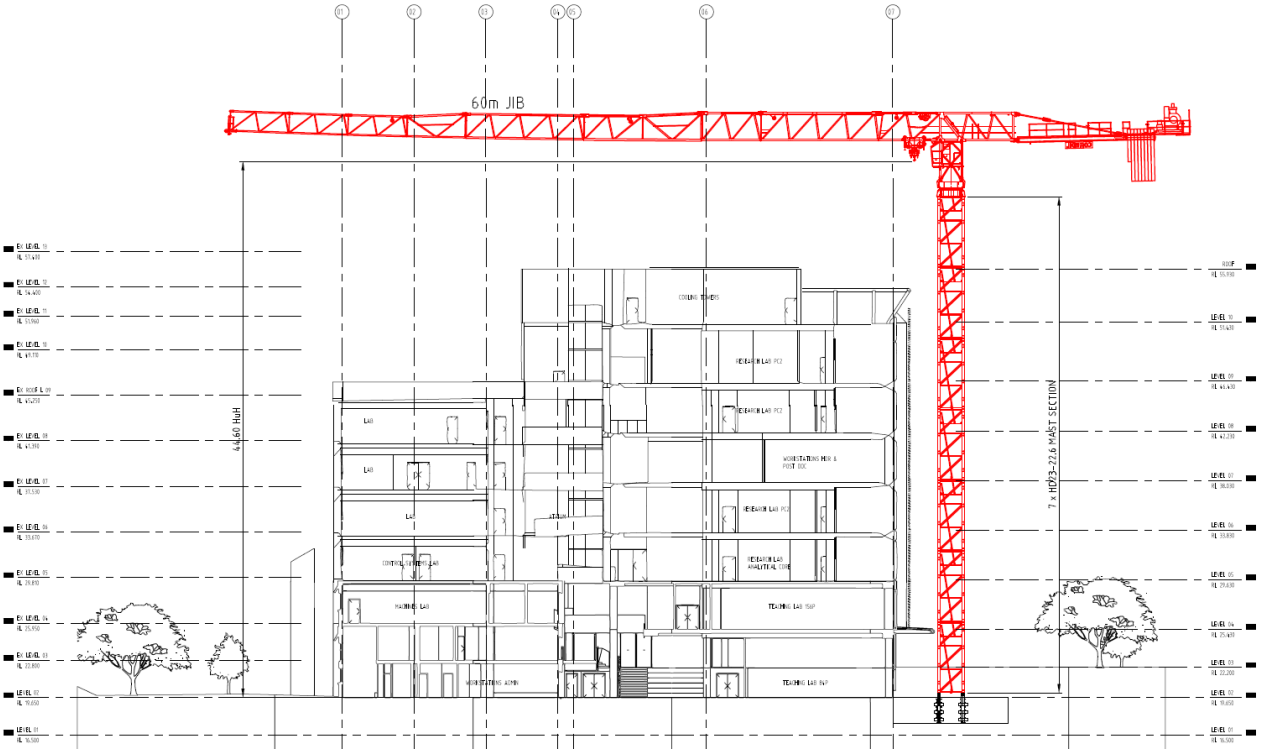


Figure 37: Crane elevation shown with new Building J03 structure

The radius for TC1 will be 60m (see Figure 381, below) and the crane loading and unloading area will be within the proposed work zone along Maze Crescent or theatre suspended slab off Blackwattle Avenue.

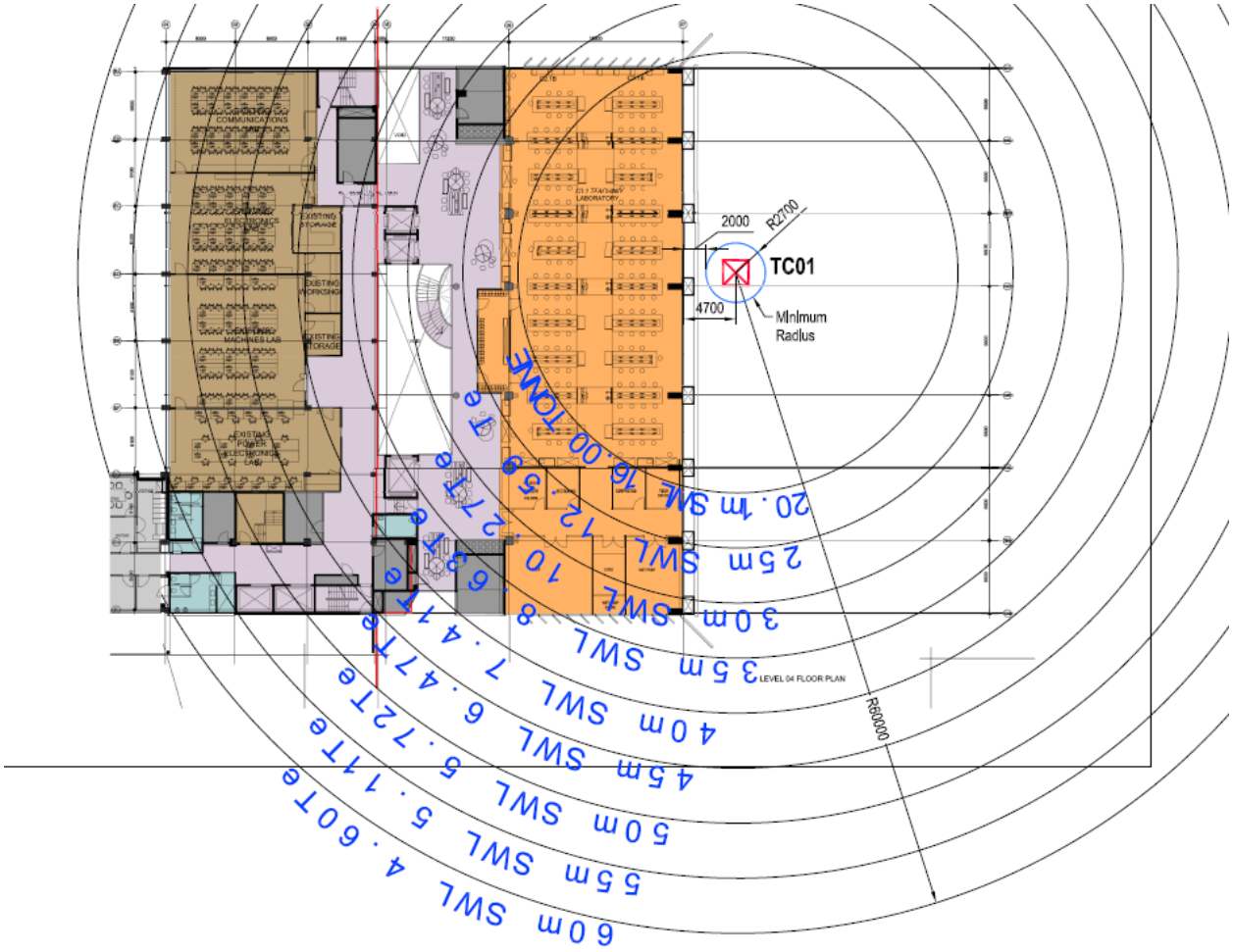
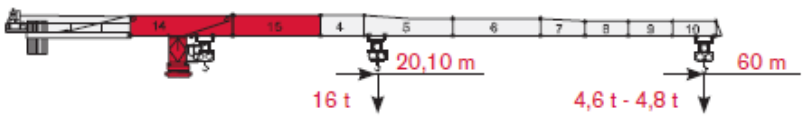


Figure 38: Crane radius diagram

The following diagram specifies the load capacity of the selected Terex tower crane.

	A1 (3,57 t)	D2 (5,3 t)
45 AFC 80	7	1
67 AFC 80	8	0



			10 m	15 m	20 m	25 m	30 m	35 m	40 m	45 m	50 m	52 m	55 m	57 m	60 m
8 t →	38,10 m	t	8,00	8,00	8,00	8,00	8,00	8,00	7,59	6,65	5,91	5,65	5,30	5,09	4,80
8 t →	37,40 m	t	8,00	8,00	8,00	8,00	8,00	8,00	7,41	6,47	5,72	5,46	5,11	4,89	4,60
16 t →	20,10 m	t	16,00	16,00	16,00	12,59	10,27	8,63	7,41	6,47	5,72	5,46	5,11	4,89	4,60

Figure 39: Load capacities of the Terex CTT 331-16 HD23 Flat Top tower crane

Recovery of the tower crane will be conducted via mobile crane. The removal of the crane will be programmed to coincide with the completion of the external façade, roof structure, installation of major plant and equipment on the floors.

6.1.1.1 Works affected by crane location

The following areas will be impacted by the crane location:

- Ground works / landscaping

6.1.1.2 Exhaust emissions

The tower crane will be powered by electricity and therefore will not emit any exhaust.

6.1.1.3 Overhead hazards

There are no overhead electrical or other cable hazards for operation of the crane on this site.

When the crane is not in service, the jib will be allowed to free slew to avoid high loadings being placed on the crane structure and foundations in wind conditions. The trolley of the crane will be stowed towards the tower of the crane when not in service. During service, no loads will be slewed over occupied buildings or public areas.

6.1.1.4 Power requirement

The Terex CTT 331-16 HD23 requires 160 amps.

	45 AFC 80	114 kVA*	400V - 50Hz / 460V - 60Hz	2000/14/CE modificata
	67 AFC 80	138 kVA*	400V - 50Hz / 460V - 60Hz	2000/14/CE modificata

Figure 40: Tower crane power requirements

The following Table 6 details the anticipated crane loads on the project.

Equipment and materials	Weight	Level
Air handling unit module	700kg per Unit	Each floor level
Chillers	10,000kg	10
Hot water boiler	2,000kg	10
Heat exchanger	500kg	10
Cooling towers	2,000kg	10
1000kVa kiosk transformers	7,000kg	3
Diesel generator	10,000kg	Roof
Main switchboard	2,000kg	2
Diesel generator switchboard	2,000kg	10
Diesel sprinkler and hydrant pump	1,500kg	00
Hollowcore plank (HC220) based on 10m length	4,000kg	Various

Table 6: Schedule of anticipated crane loads

6.1.2 Mobile cranes

The use of mobile cranes on the ETP Stage 1 works will generally be limited to specialised lifts for:

- Installation of site accommodation
- Demolition
- Installation of heavy services equipment
- Removal of heavy excavation plant
- The erection, assembly and dismantling of the tower crane.

6.2 Builder's hoist

A builder's hoist will be installed on the northern elevation of the new northern tower to provide access to each floor level as the structure commences (see Figure 414, below). Ties will be installed to support the hoist mast from the new building structure. The hoist will be powered from the temporary electrical builder's supply and will always run to the live deck.

Figure 41: Examples of builder's hoists

6.3 Builders lift in existing J03

One of the existing passenger lifts in Building J03 will be converted to a builder's lift to facilitate access for the construction of additional stair cores on the western side of the building of the southern tower. Exact logistics to be agreed with USYD / CIS.

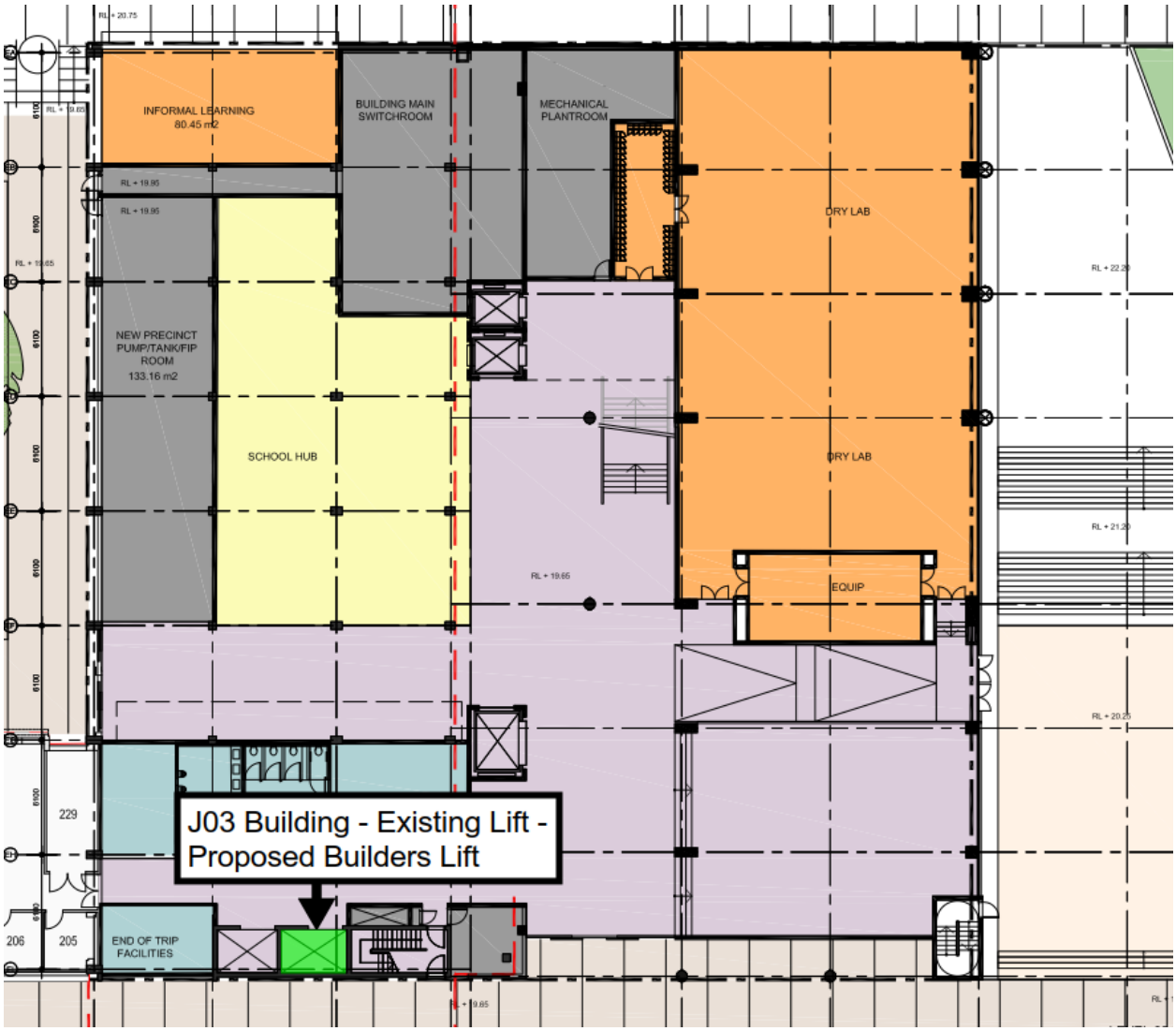


Figure 42: Existing Building J03 lift to be converted to a builder's lift

6.4 Deliveries

Laing O'Rourke's construction methodology is based on unrestricted truck movements and deliveries between 7:00am and 6:00pm Monday to Friday and on Saturdays between 7:00am and 3:30pm. These will be confirmed following approval of the DA.

The main vehicular access to the site will be on Maze Crescent, from Blackwattle Creek Lane and Shepherd Street. At the site entry, there will be manned gates to control access, monitor who enters the site and ensure that deliveries proceed to the correct location. The proposed vehicle access route allows for a one-way-in and one-way-out route, thereby reducing the construction traffic volumes on Maze Crescent. Subject to approval, Laing O'Rourke will establish a workzone in Maze Crescent to allow vehicles to be unloaded.

Deliveries will be either unloaded by the tower crane and lifted to their intended floors or taken into site and distributed using the builder's hoist.

The tower crane will primarily be loaded from the materials handling area in the north, but it will also be loaded as required from the work zone on Maze Crescent. Once unloaded, vehicles will exit the site from the materials handling area via the north-western gate.

6.5 Concrete pumping

Concrete will be pumped on site using either a static or trailer concrete pump or a mobile concrete pump.

During the excavation and construction of the basement structure and part of the tower structure, concrete will be placed using a two-truck feed mobile concrete pump located within the northern entry off Blackwattle Creek Lane. This approach will be implemented until the basement structure is complete, with a static pump installed at lower ground after the area is stripped and cleared of formwork. A cleaning facility will also be provided for the cleaning of concrete lines.

Placement of the concrete in floor plates will typically be split into two pours. The concrete will be pumped vertically using a mobile boom pump or, for higher floors, a trailer pump located in the floor plate. The line will run from the northern materials handling area to the slabs via a protected pipe, either at surface or underslung from the Level 3 slab. The concrete line will rise up the building as the works progress.

Vertical elements will be poured using a concrete placing boom.

6.6 Forklift

Laing O'Rourke will use a 2.5t gas dual fuel forklift to unload vehicles within the site, with limited on-street use. The forklift will be road registered and managed by Laing O'Rourke staff that hold relevant qualifications and licenses to operate the plant.

The forklift will be required once the Level 3 slab is poured and complete to supplement the crane for unloading of materials.

7. Construction programme

Laing O'Rourke's robust programme for the ETP Stage 1 works incorporates all design, procurement and construction activities.

Following contract award, the construction programme will be refined with further input from the Senior Project Engineer, Construction Manager with support from the Project Planner. This will ensure the successful on-time completion of the project.

An up-to-date construction programme will be available on site throughout delivery.

7.1 Staged construction certificates

It is proposed that the construction certificate for this project is split over four stages as follows:

1. CC1: Shoring & bulk excavations
2. CC2: Slab on ground, structure and facade
3. CC3: Fit Out
4. CC4: Landscape and public domain

Appendix 1: Organisational chart

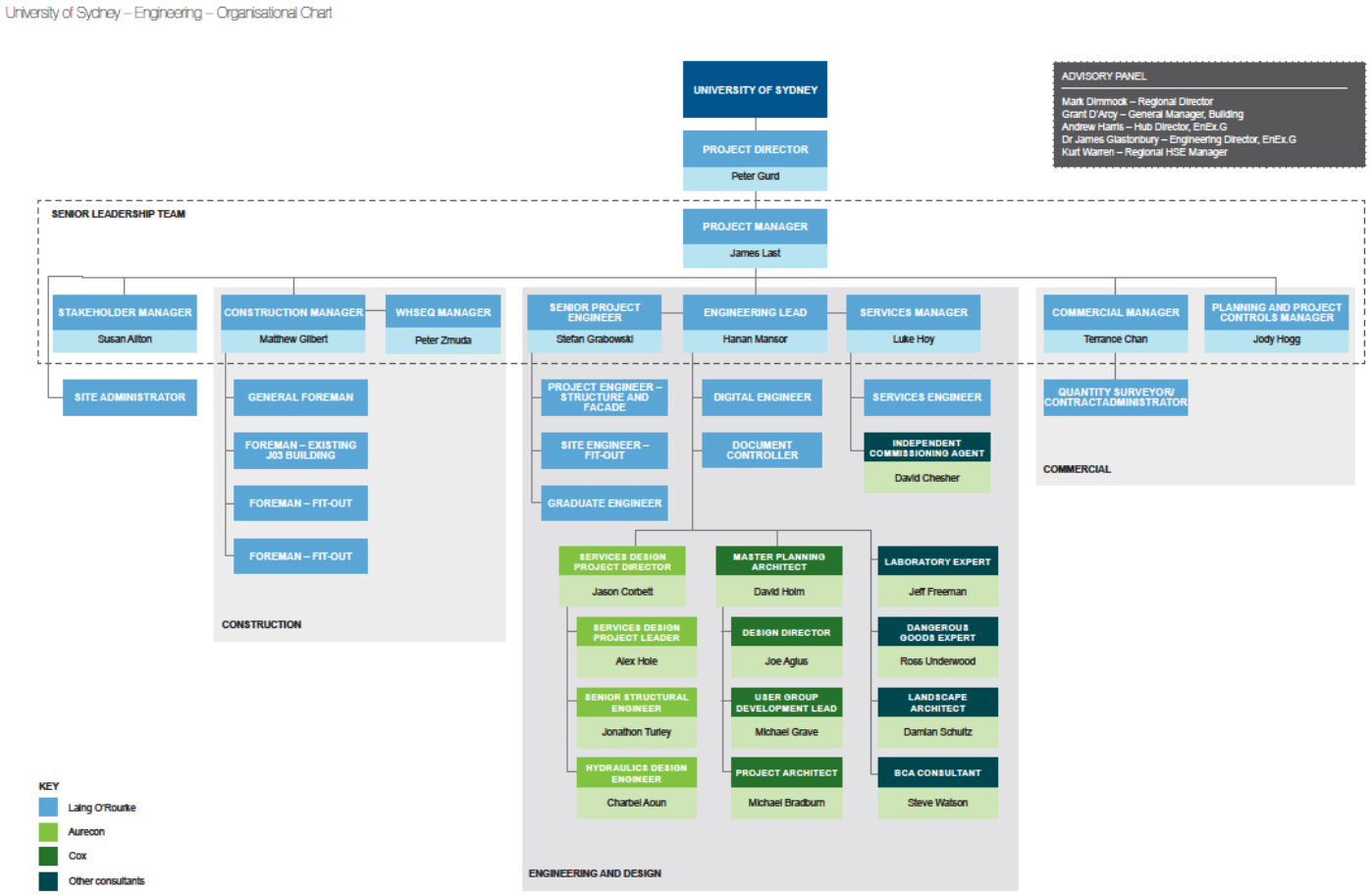


Figure 43: Laing O'Rourke's organisational chart for the ETP Stage 1 works

Appendix 2: Hoarding diagrams

Figure 447-Figure 525 on the following pages detail the internal hoarding to be erected within the existing Building J03.

J03 Level 1 to be added

J03 – L2

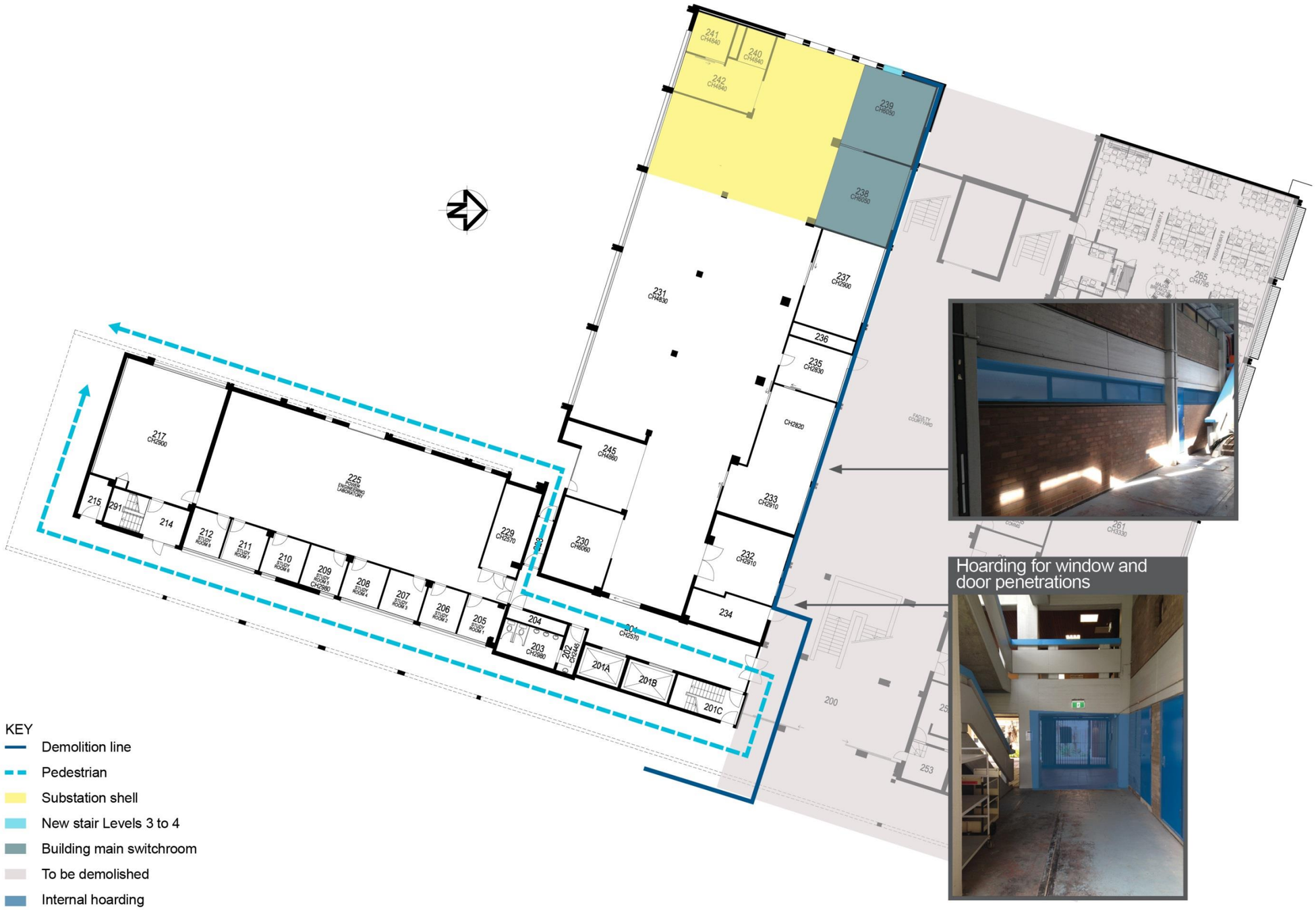


Figure 44: Level 2 internal hoardings

J03 – L3

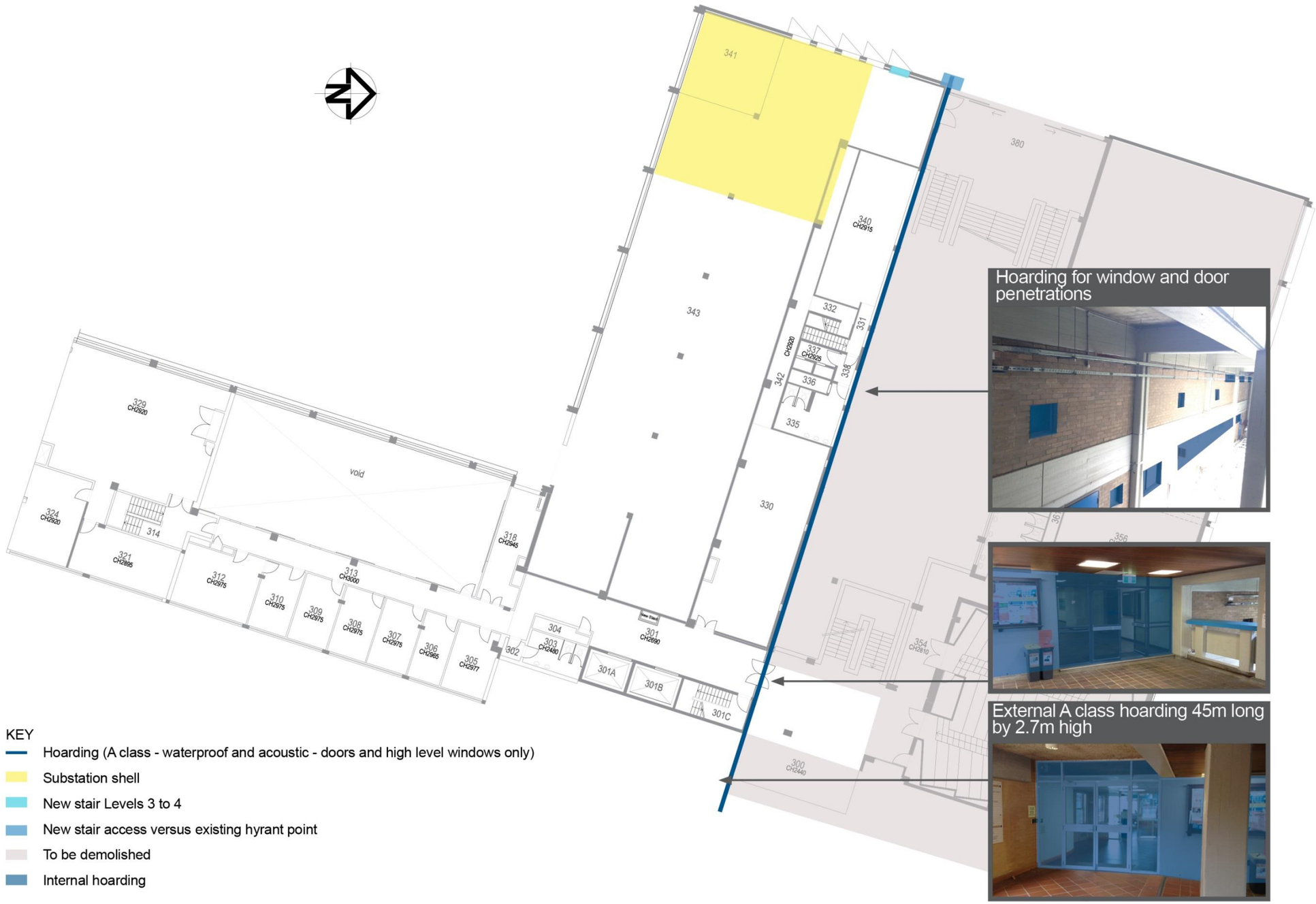


Figure 45: Level 3 internal hoardings

J03 – L4

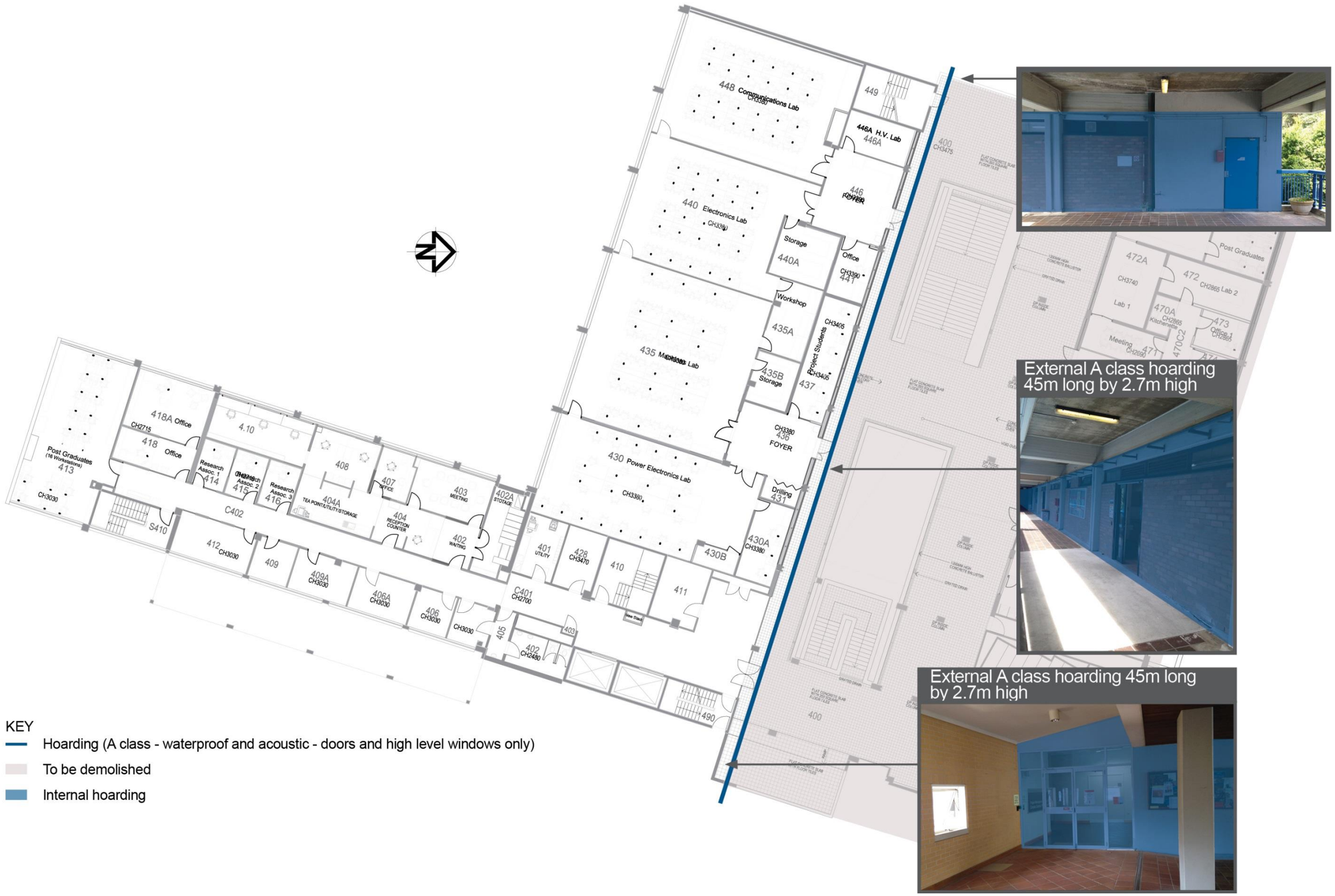


Figure 46: Level 4 internal hoardings

J03 – L5

Figure 47: Level 5 internal hoardings

J03 – L6

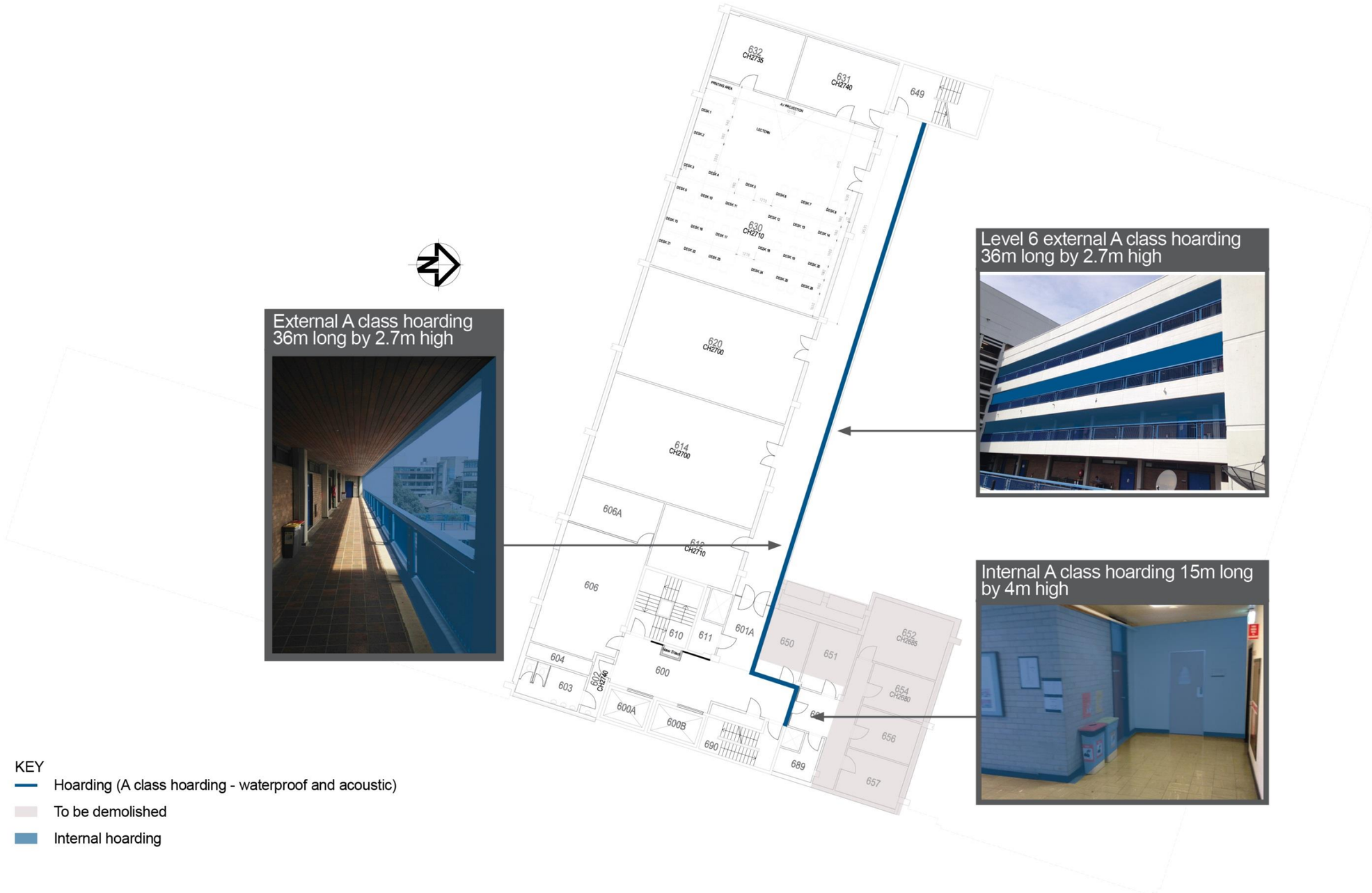


Figure 48: Level 6 internal hoardings

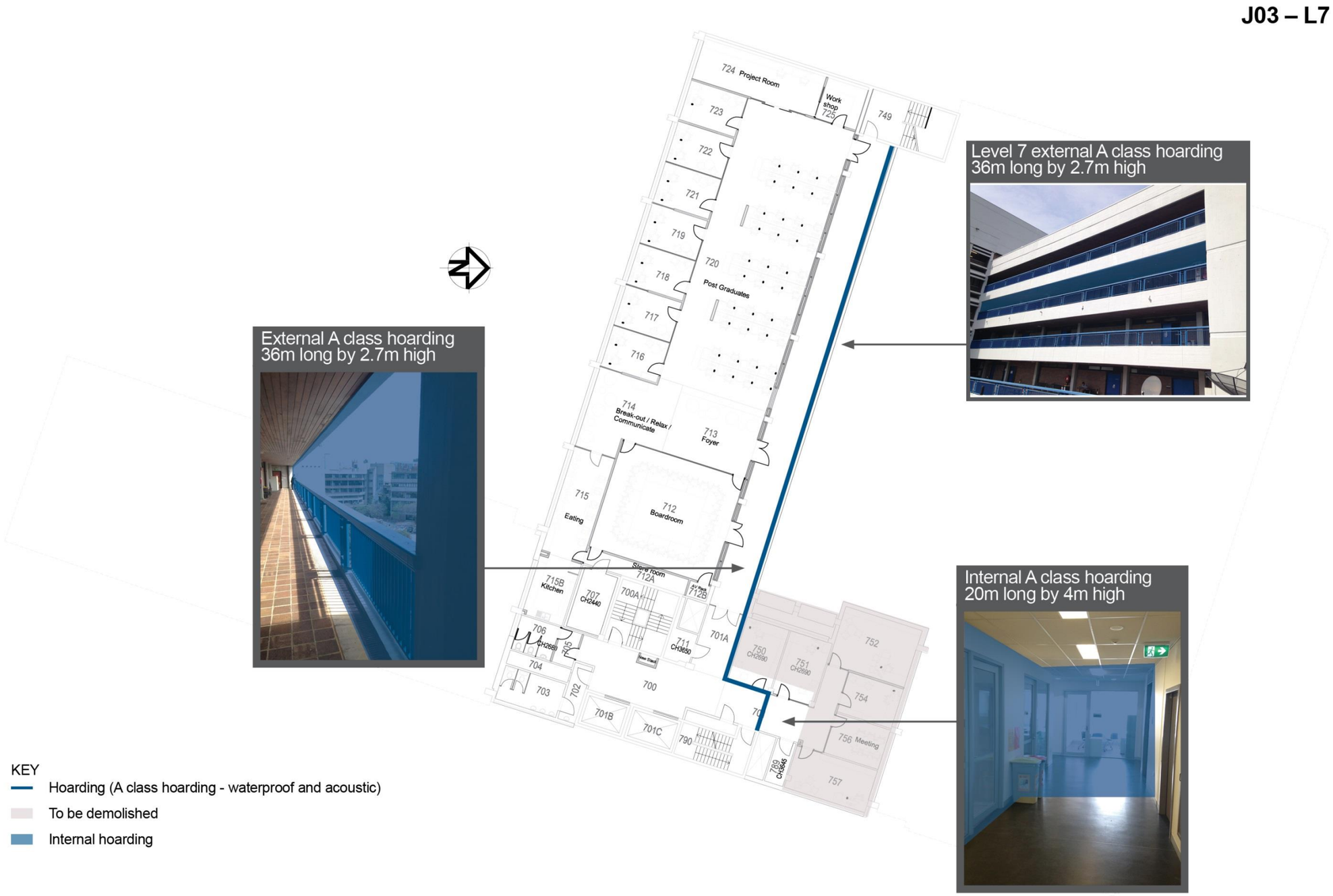


Figure 49: Level 7 internal hoardings

J03 – L8

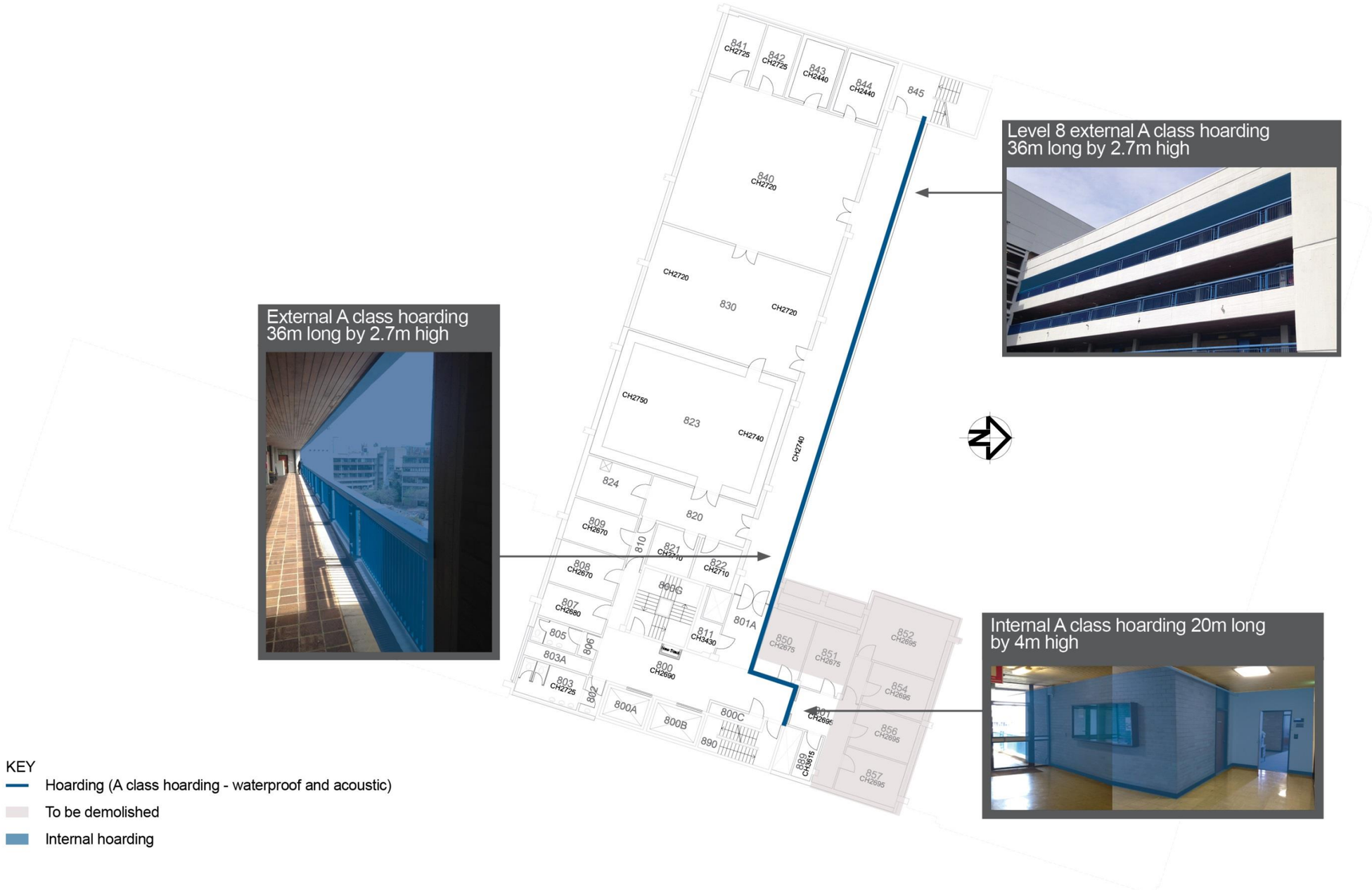
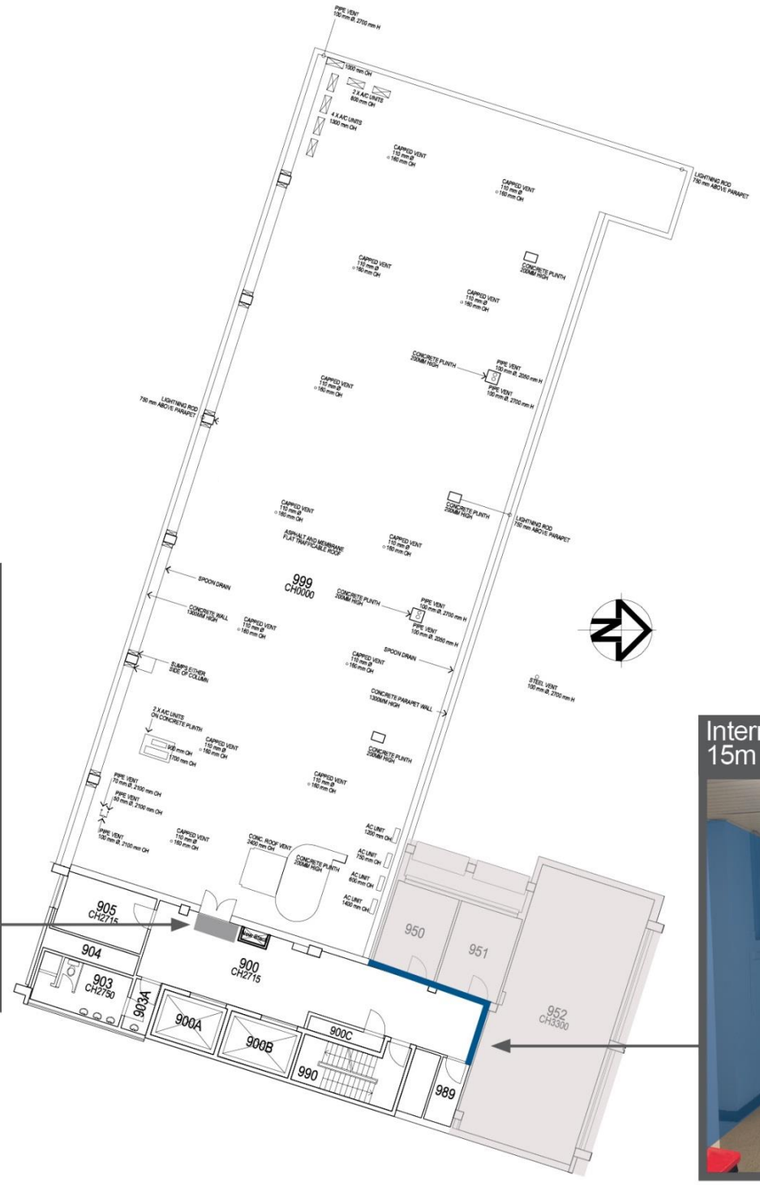
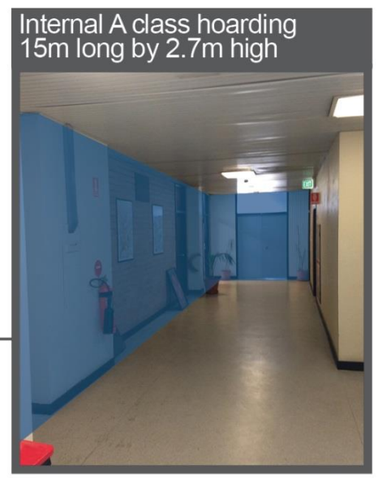


Figure 50: Level 8 internal hoardings

J03 – L9

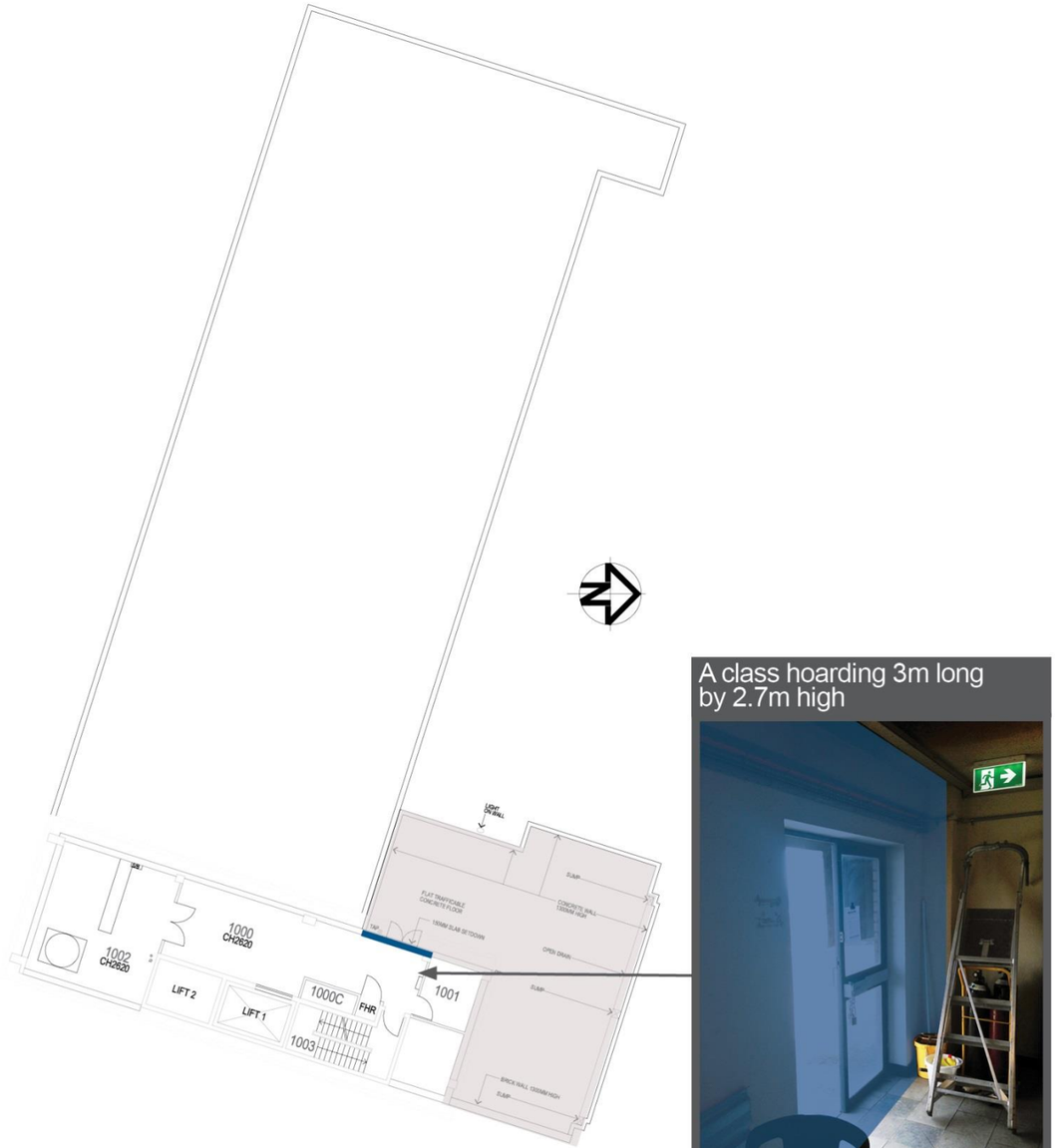




KEY
- Hoarding (A class hoarding - waterproof and acoustic)
- Restricted access
- To be demolished
- Internal hoarding

Figure 51: Level 9 internal hoardings

J03 – L10



KEY

- Hoarding (A class hoarding - waterproof and acoustic)
- To be demolished
- Internal hoarding

Figure 52: Level 10 internal hoardings

Appendix 3: Demolition plan

To be developed following contract award.