

Engineering and Technology Precinct (ETP) – Stage 1

Construction Management Plan

Document and revision history

Document details	
Title	Construction Management Plan
Client	University of Sydney
Client reference no.	USYDCON/2016/184
Document Number	K33-LOR-PRM-PLN-00006
Laing O'Rourke contract no.	K33

Revisions

Revision	Date	Description	Prepared by	Approved by
1	21 November 2016	ECI Phase submission	Jody Hogg	Peter Gurd
2	28 February 2017	ECI Phase resubmission	Jody Hogg	Peter Gurd
3	16 November 2017	Routine update	James Last	Peter Gurd
4	22 November 2017	Changes in line with SJB comments (DA)	James Last	Peter Gurd
5	12 December 2017	Routine update	James Last	Peter Gurd
6	18 December 2017	Routine Update	Philip Barkman	James Last
7	18 October 2018	Updated for Construction	Keith Willis	Joe Thompson
8		Updated for REF 03	Mitchell Hill	
9	5 February 2019	Updated for SSDA Submission	Mitchell Hill	
10	16 April 2020	Updated for SSDA Modification for Out of Hours Works	Sarah Blagrove	Joe Thompson
11	28 May 2020	Updated for SSDA Modification for Out of Hours Works, in response to Community	Sarah Blagrove	Joe Thompson

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
SSDA	State significant 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

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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. This revision has been updated for the main build phase and submission with the 70% design documentation. Decant and demolition activities have already occurred and are therefore excluded from this document.

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 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 sensitive operating environments and we understand the potential impacts on staff, students and other stakeholders. We have developed our construction methodology and delivery model 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 operations of the retained building with minimal disruptions to the University and key stakeholders.
- **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 separated
- **Communication:** Ensuring key University stakeholders, faculty staff and students are updated of the project status and information with regular and effective communication

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
Services Manager and Project Technical Lead (Refer to org chart)	• Oversees the engineering team, providing technical coordination link between the construction and design. • Liaises with the Design Manager to resolve design issues. • Implements the Quality Management System with the Project • 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

Role	Responsibility
Construction Manager Structure, Façade, Landscaping (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, WHS and client liaison through the Project Leader. • Ensures management plan requirements are implemented. • Key focus on 'Next Gear' ethos on the project
Senior Project Engineer Fit Out	• Oversees the fit out subcontractors and ensure they execute the works in accordance with the design and contractual requirements. • Manages the design of the fitout to ensure coordination between various disciplines. • 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
WHS Manager	• Oversees all 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 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
- Design: Weekly design meetings to ensure construction input into design finalisation with respect to constructability, temporary works, logistics & materials handling, SiD and DfMA opportunities etc.
- CIUG: A weekly meeting with CIS and EIE faculty representatives and other affected stakeholders to communicate upcoming works and external impacts including access, shutdowns, detours etc.
- Subcontractors: A weekly meeting will be held with the subcontractors to coordinate the construction works, monitor the works against the construction programme and discuss any current issues.
- LOR: A weekly meeting will be convened with the Laing O'Rourke project team to run through current project status, programme, key issues and to 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 site generally slopes down to the East from Maze Cres towards Shepherd St. The campus is bounded by City Road, Cleveland Street, Shepherd Street and Maze Crescent.

The construction site's immediate neighbours are:

- The retained southern tower of J03

- 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 student accommodation buildings to the North of Maze Crescent along with 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 vehicular 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 marshalling area outside of the university campus, 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 controllers will be stationed to assist pedestrians and direct vehicles near the site access gates.

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



Figure 2: Vehicle access plan

3.2 Building J03

The retained part of the J03 building contains offices, teaching and research spaces (including an anechoic chamber) and to maintain normal operations of these areas it is vital that construction noise is minimised and kept below an acceptable level. Hoardings have been erected throughout the internal corridors on Levels 4-9 and to the external balconies on Levels 5-8 to prevent unauthorised access and provide acoustic barriers to the construction site.

3.3 Neighbours

As shown in Figure 1 above, the site is neighboured by the following:

- **The Seymour Centre** – The Seymour Centre is located to the North of the Site. As our project boundaries do not affect the access to the Seymour Centre, full access is made available for both vehicles and pedestrians via Blackwattle Creek Lane.
- **Mechanical Engineering (J07)** – The Mechanical Engineering building is located to the East of the Site. 'A Class' hoarding has been installed along the project boundary in a way that allows full pedestrian access off Blackwattle Creek Lane while maintaining existing bike rack facilities to minimise the impact on cyclist of the building occupants. The level 1 access to 'Jurassic Park' has been made redundant and mechanically fixed to ensure the J07 building occupants cannot gain access into the project footprint during the project duration.
- **The Link Building (J13)** – At the present, there is no access to the J13 Link building from J03 due to the BCA upgrade & fitout works being conducted by another Contractor.
- **Tyree Wing (adjoining J03)** – The Tyree wing will remain occupied throughout the duration of the Project. LORAC have constructed both an alternative storage space and a new access to ensure there is no disruption to the occupants of the building. Hoarding around the J03 carpark will be erected to maintain emergency egress of the existing fire escape (South-West of J03 building) while incorporating a swing gate to enable large deliveries to the building prior to the Southern Basin & landscaping construction.
- **Peter Nichol Russel (PNR) Building** – The PNR building is located to the South of the project footprint.
- **Cadigal Green** – Cadigal Green is located to the West of the project footprint.
- **International House** – The international house building is a student accommodation facility located to the North-West of the project footprint.

3.4 Existing Utilities

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

3.4.1 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. The submains for J03 enter the building via the Engineering Walk Tunnel and the retained 9 lid pit adjacent to the new proposed lift core. Considerable care needs to be taken during construction to protect the live services particularly during the piling/shoring works and installation of temporary retaining systems in that location.

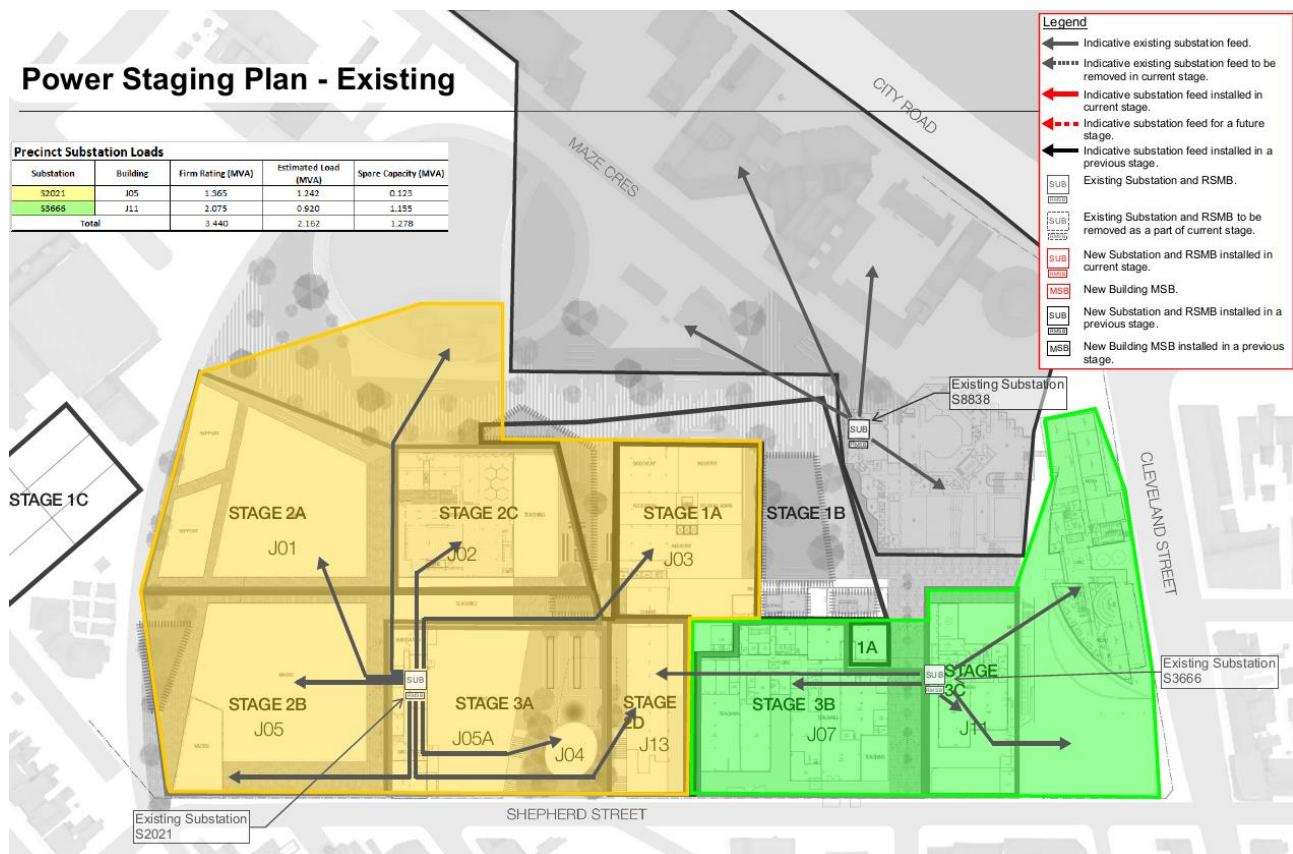


Figure 3: Ausgrid infrastructure

3.4.2 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 has recently been upgraded by the University; 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 a hydrant service to external hydrants and/or J07

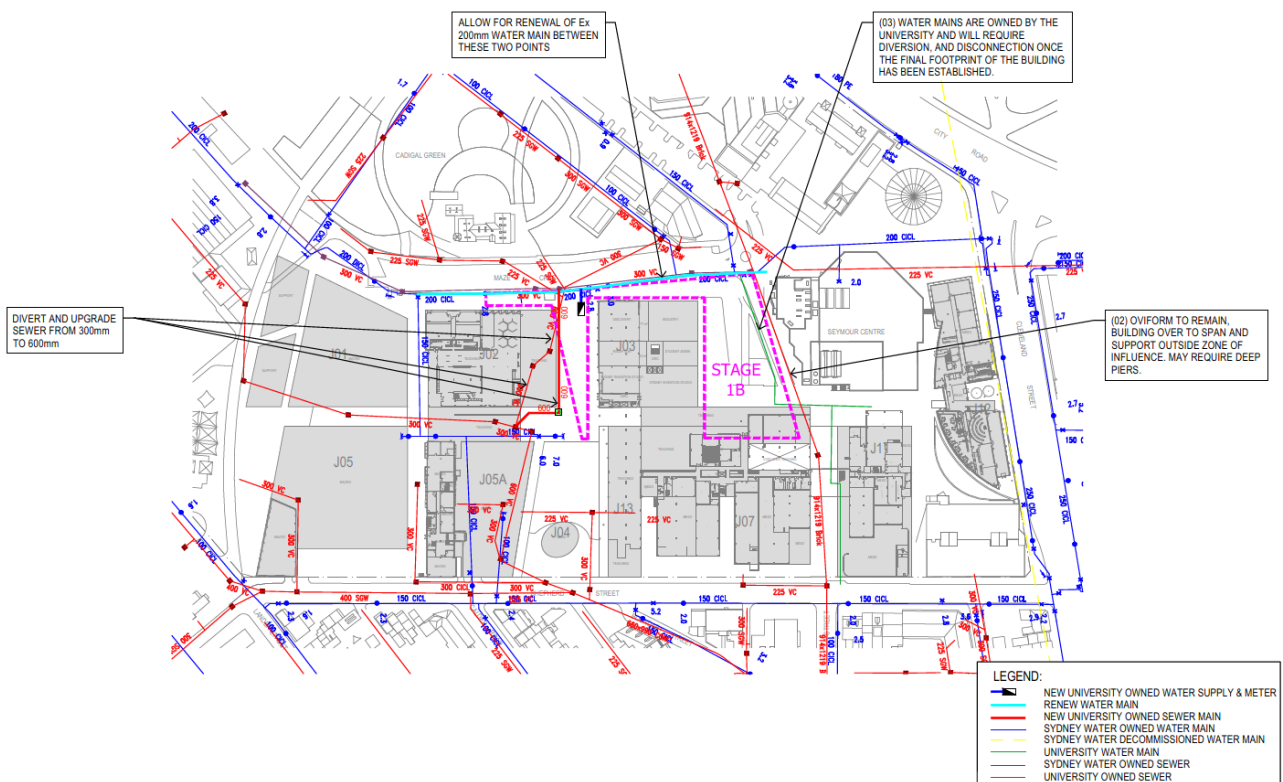
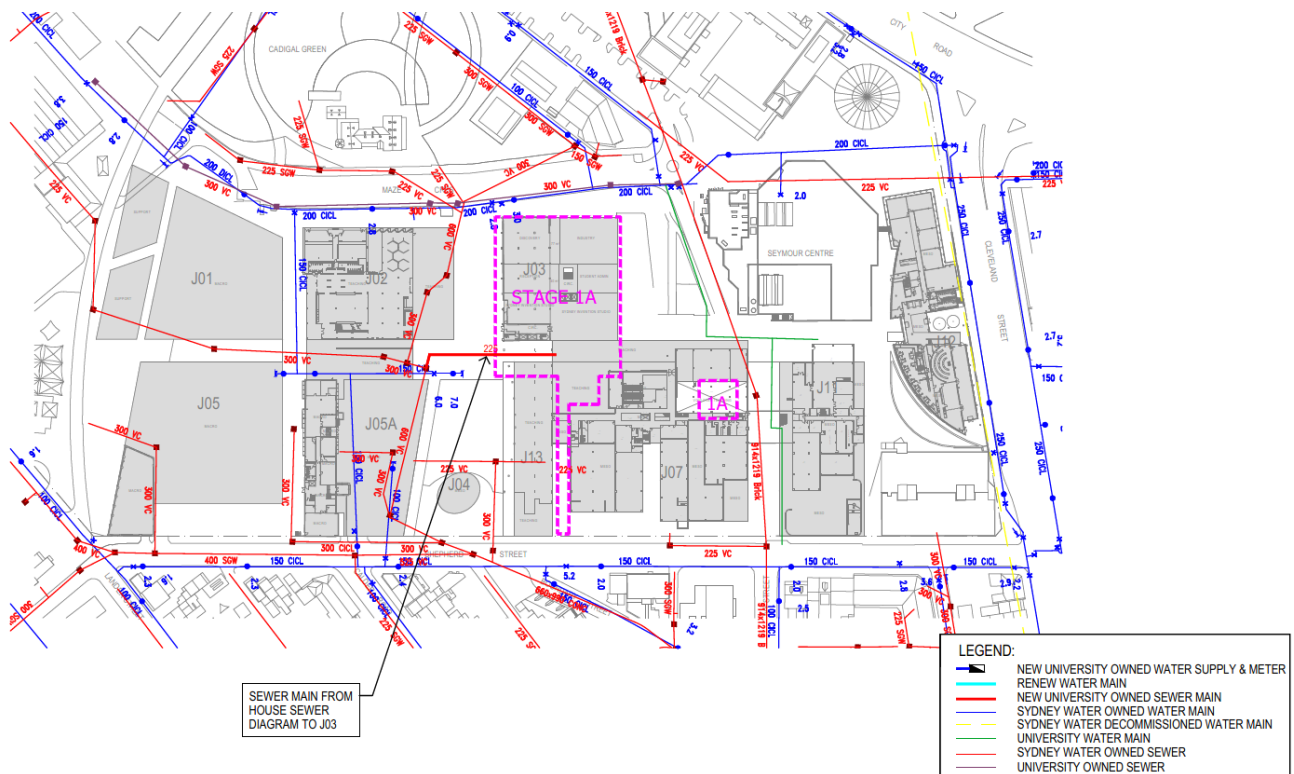


Figure 4: Existing water infrastructure

3.4.3 Sewer

There are a number of Sydney Water sewer mains within the engineering precinct (see Figure 5, below). Based on the survey drawings, no major 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. A new connection for J03 shall be made into an existing sewer main adjacent to Engineering Walk as shown in figure 5 below.



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. Note that the incoming main is in close proximity to the excavation (near western fire stair) and will be coordinated and carefully managed/protected during the construction.

3.4.6 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 temporary diversion has taken place (by the University's ICT team) and its pathway is via the crawl space slab on level 3 of the existing building. The temporary pathway drops down into the future substation's western wall and into an existing pit system that is retained and needs to be protected/managed during the construction phase.

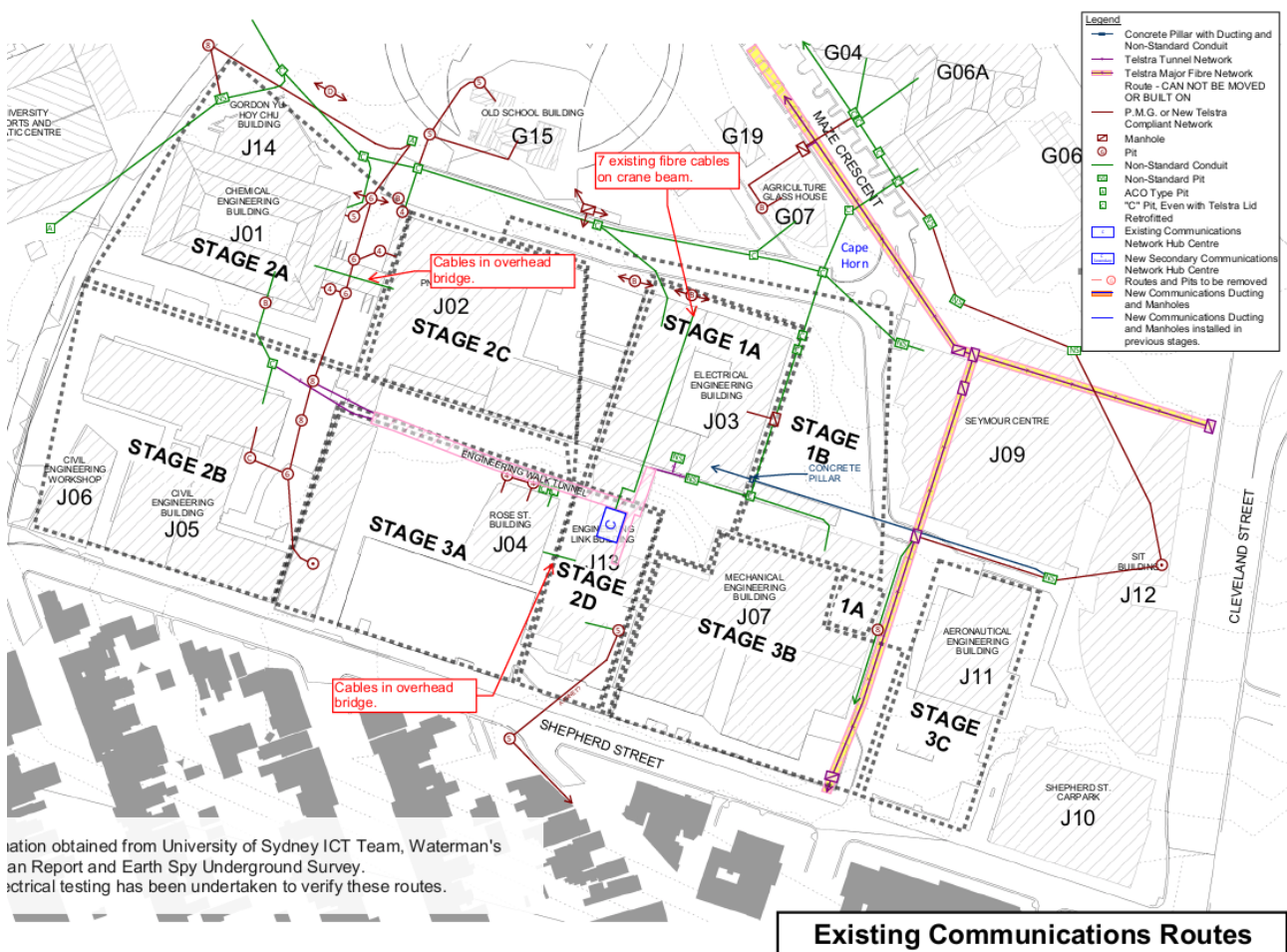


Figure 6: Existing communications infrastructure

3.5 Geotechnical conditions

Laing O'Rourke's construction methodology is based on the geotechnical information provided in the Douglas Partners October 2014 and November 2016 reports based on its investigation of the site.

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 may also be required for later 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 surface. Therefore, Laing O'Rourke will install working platforms for trafficability and stability of piling equipment and 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 however the boreholes nearer the site indicate no free groundwater encountered.

Figure 7 below shows the locations of the geotechnical boreholes. A summary of the material strata encountered and rock classifications in the closest two boreholes is summarised in Figure 8 and a typical borehole log is shown in Figure 9. Further geotechnical investigation will be carried out in the vicinity of the lift core to determine design parameters for the temporary excavation shoring.

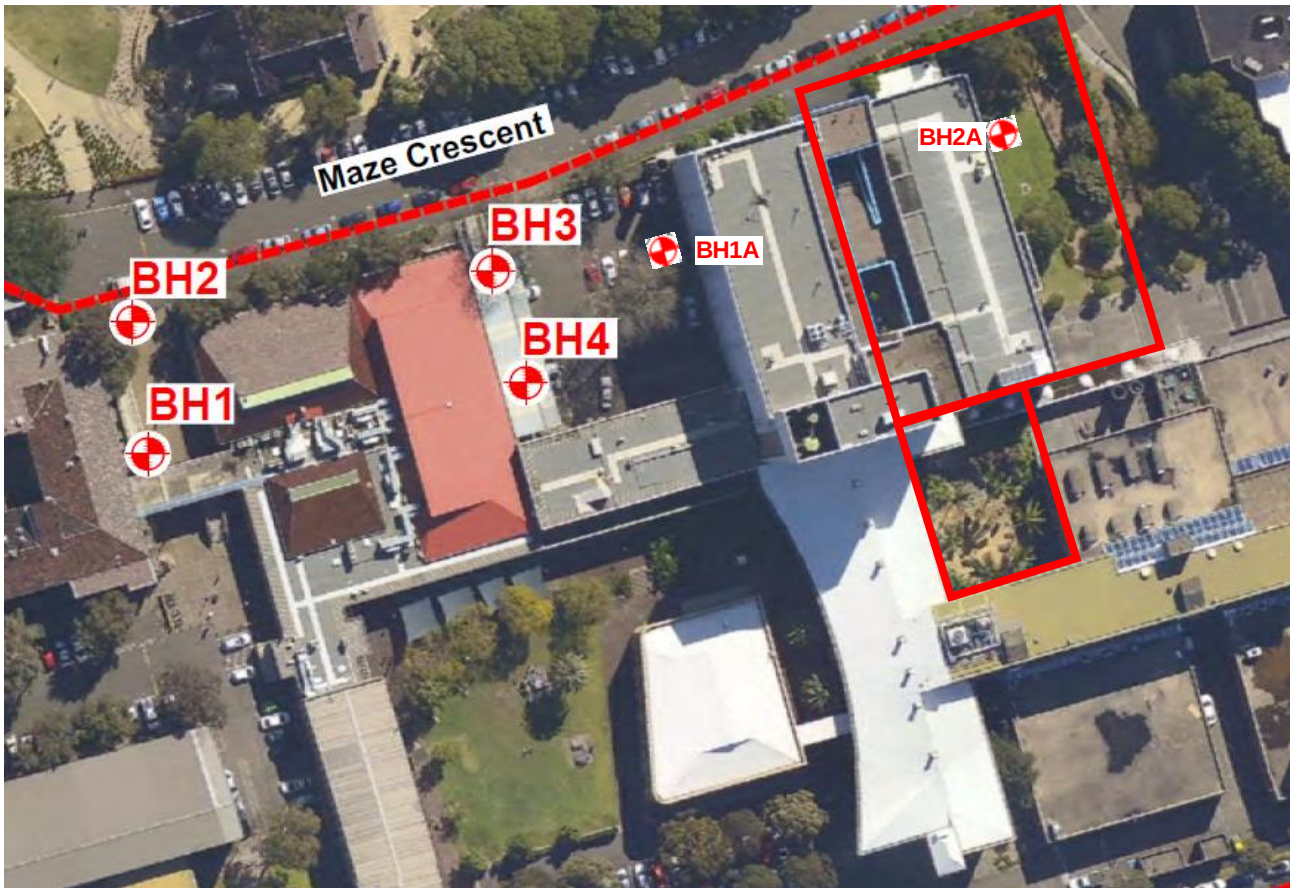


Figure 7: Location of boreholes drilled during geotechnical investigation near site and areas to be excavated (Oct '14 and Nov'16)

Bore	Level of Top of Stratum (m, AHD) in Bores				
	Ground Level	Stiff Clay	EL rock	MS Shale	Base of Bore
1 A	19.6	19.0	17.1	12.2	9.6
2 A	19.7	18.6	18.4	14.7	8.7

EL = extremely low strength, MS = medium strength

Figure 8: Summary of Material Strata Levels and Rock Classifications – Nov 2016

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.

3.6 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 (Partial Demolition and refurbishment)
- Mechanical Engineering Building (J07), built 1971 (Partial Demolition for future loading dock)

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

3.6.1 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.

Hazardous materials will only be removed by LOR from areas for demolition or refurbishment.

3.6.2 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

Contamination will be removed only from areas for demolition.

3.6.3 Ground Contamination

Based on the findings of the Preliminary Site Assessment carried out by Douglas Partners and dated December 2017, the potential for contamination to be present on the site is considered to be low. However, further investigation is recommended and will be carried out now that demolition is complete and prior to piling and bulk excavation activities commencing. This is to assess any potentially impacted filling material and impacts from any dangerous goods storage.

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	Joe Thompson	Laing O'Rourke	0437 476 581
Site Foreman	Jody Hogg	Laing O'Rourke	0477 732 276
Site Manager (24 hour contact):	Scott Sartori	Laing O'Rourke	0419 034 459
Services Manager	Luke Hoy	Laing O'Rourke	0477 723 024

Table 3: Contact details

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

4.2 Site establishment and staging

Laing O'Rourke will establish site amenities and accommodation along with the various access, security and materials handling equipment in four distinct phases as outlined in the following table:

Phase	Timeframe
1: Site Enabling and Demolition Works	May '18 – Sep '18 (Completed)
2: Civil and Substructure Works	Nov '18 – Mar '19
3: Main Construction Works	Mar '19 – Jul '20
4: Commissioning, Handover and Demobilisation	Jul '20 – late '20

Table 4: Phases of the ETP Stage 1 project site establishment

4.2.1 Phase 1 - Site Enabling and Demolition works (Completed)

During delivery of the early enabling and demolition works, the following site establishment activities have been carried out:

- Perimeter "A" class hoarding installed around the site perimeter to the North of J03 incorporating truck access gates to Blackwattle Creek Lane.
- Truck wheel wash down facility and stabilised entry ramp
- Temporary wayfinding and site signage installed as required.

- Trees and vegetation removed to make way for the site establishment and demolition activities (or protected in accordance with the arborist report). Refer Item 4.3
- A site compound comprising an office, meal room, change room and ablutions along with space for storage of materials and skip bins will be established in the existing J03 south car park.
- During this phase, the estimated on-site resources will comprise approximately 30 workforce personnel and six staff.

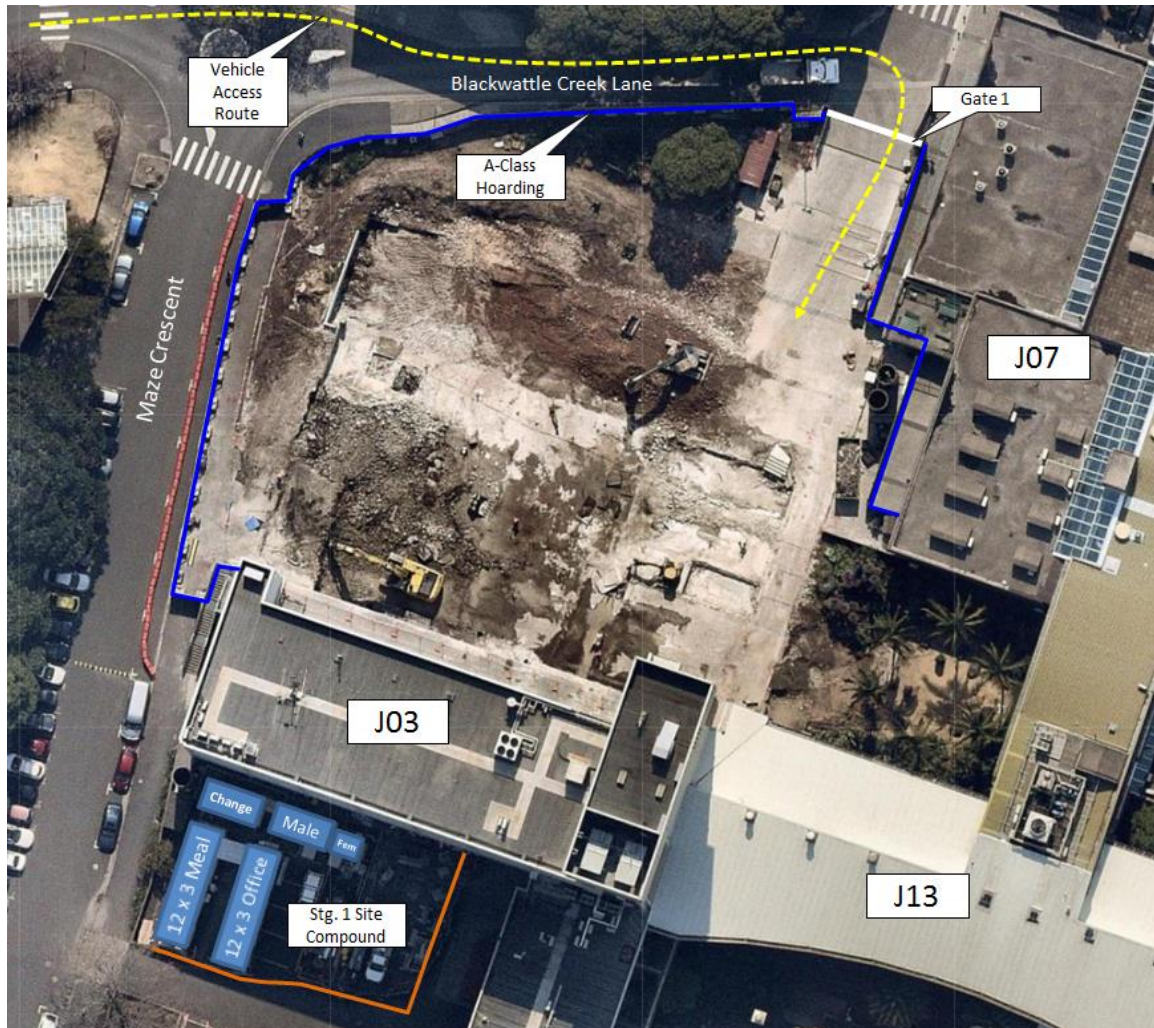


Figure 11: Phase 1 Site Establishment Plan

4.2.2 Shoring, Excavation, Piling and Substructure Works

The civil and substructure works will be carried out following demolition and issuing of the SSDA. During this phase the site establishment activities will include:

- Establishment of a LOR project office within the decanted Level 2 ACFR space and subcontractor offices on Level 3.

- Installation of a second vehicular access gate from Blackwattle Creek Lane at the north western corner of the site. This gate will become an entry gate to allow one-way vehicular movements through the site.
- Installation of the tower crane
- Repurposing of the current site office as a second meal room.
- Installation of a third meal room and covered walkways

During this phase, the estimated on-site resources will comprise approximately 80 workforce personnel and 16 staff.

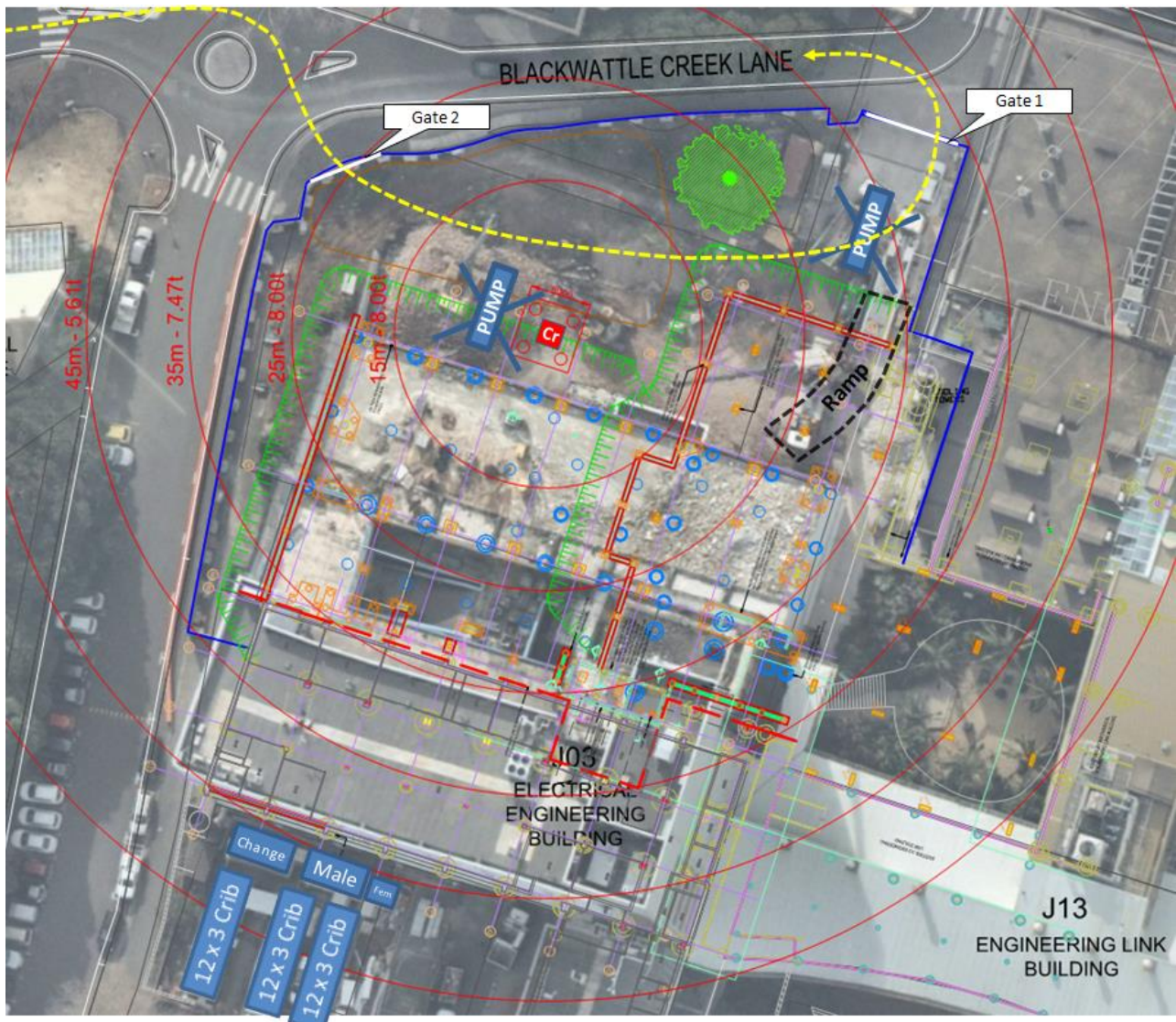


Figure 12: Phase 2 Site Establishment Plan

4.2.3 Main construction works

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

- Relocation and enlargement of the main welfare facilities on the Level 2 podium slab in the eastern landscape area. This will cater for the growing workforce numbers
- Installation of scaffold stairs, builder's hoist and loading bays as the structure progresses
- Installation of security access control
- Installation of on-site ablutions.

During this time, the estimated resources will comprise up to 160 workforce personnel and 24 staff. Refer to Item 4.4 for further details.

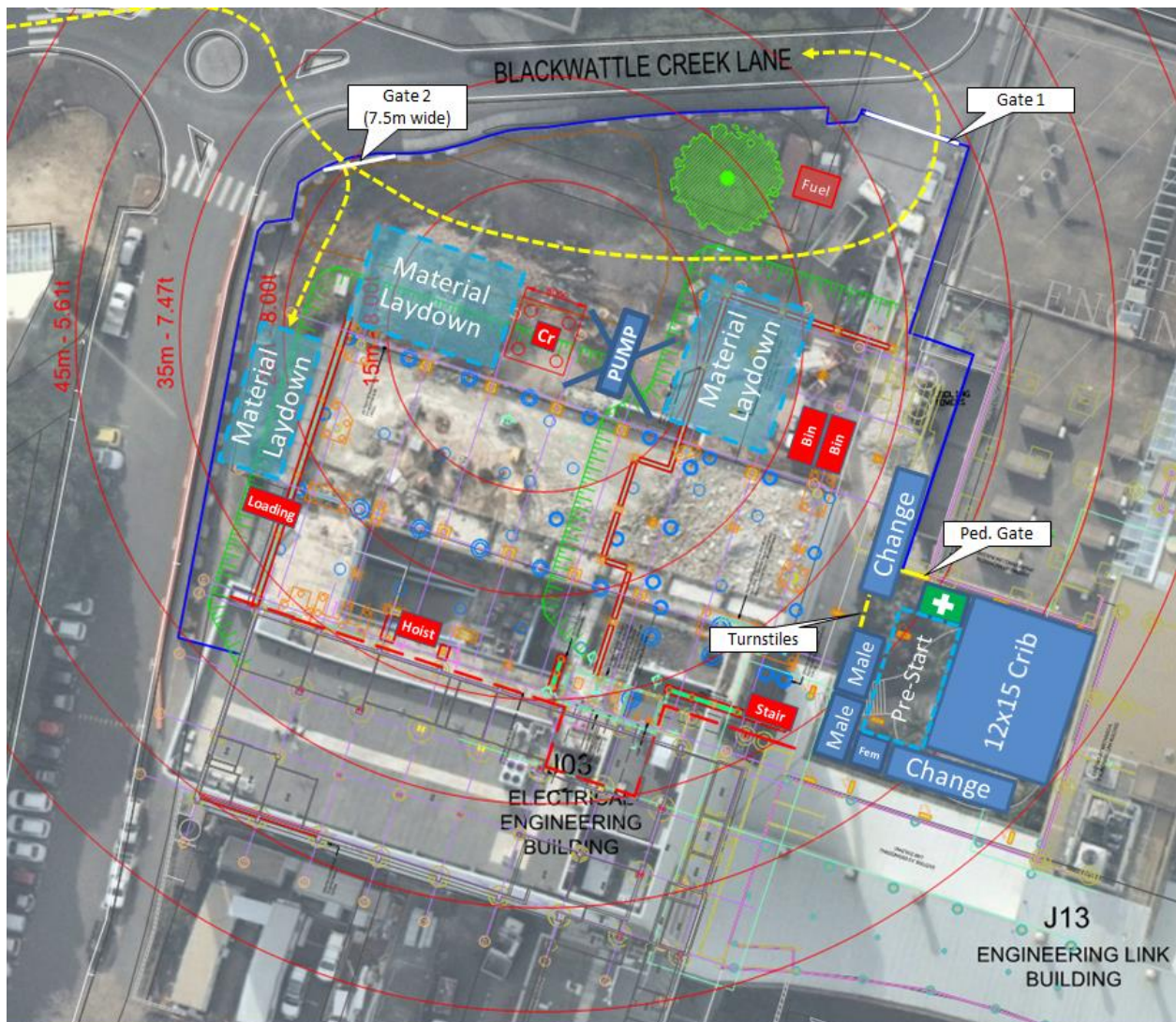


Figure 13: Phase 3 Site Establishment Plan

4.2.4 Commissioning, Handover and Demobilisation

As the workforce decreases, the welfare and office facilities will be downsized and relocated to within suitable spaces of the new building or completed external areas.

During this time, the estimated resources will comprise 20 workforce personnel and 12 staff including commissioning personnel and Laing O'Rourke's independent commissioning agent.

4.3 Removal and protection of trees



Figure 14 Example of a tree protection zone

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.

4.4 Main Build Phase - Site amenities

As previously mentioned the Laing O'Rourke project office, meeting rooms and subcontractors' offices will be located within the decanted areas on Level 2 and 3 of the existing J03 building with direct access to the southern, northern and eastern sections of the site.

Following construction of the Level 2 podium slab in the eastern landscape area the main site welfare facilities will be established in the area and will include the following portable buildings

- One 15m x 12m meal room
- Two 12m x 3 m change rooms
- Two 6m x 3m male ablutions buildings with toilets and showers
- One 3m x 3m female ablutions building with toilets and shower
- One 4.5m x 3m First Aid office

A spacious undercover area will also be provided for daily pre-start and regular toolbox meetings. Access to the site compound will be from the north via Blackwattle Creek Lane and Engineering Walk past the entrance to Building J07.

4.5 Hoardings

Hoardings have been installed around the ETP Stage 1 project site, and within the retained part of Building J03 as described below.

4.5.1 External hoardings

- **Building J03 car park:** The J03 car park compound has a temporary mesh fence installed around the perimeter, approximately 70m long. This fence incorporates a vehicle access gate and two pedestrian gates. Access from Maze Crescent into the PNR building via the walkway adjacent to the car park and the rear of Building J03 will be maintained throughout the construction period
- **Maze Crescent:** “A” class timber hoardings have been installed along the kerb line of Maze Crescent from the western end of the retained J03 building to the corner of Blackwattle Creek Lane. The hoarding incorporates a personnel access gate at the southern end. Emergency egress from the western fire stairs of the existing J03 building will be maintained throughout the construction phase. The existing building’s fire hydrant booster valve set and gas meter have been relocated to the western side of the existing building to maintain unimpeded access and general lighting along the hoarding and pedestrian crossing has been upgraded.
- **Blackwattle Creek Lane:** Blackwattle Creek Lane also has a similar “A” class hoarding installed, which will incorporate two vehicle access gates.
- **Engineering Walk:** An “A” class hoarding has been installed along the northern part of Engineering Walk. This will maintain the existing pedestrian access into the Mechanical Engineering Building (J07) from Blackwattle Creek Lane.

Pedestrian access around the work site has been maintained along Maze Crescent via a dedicated walkway delineated from the roadway with water filled pedestrian barricades. The existing footpaths along Blackwattle Creek Lane have also been retained.

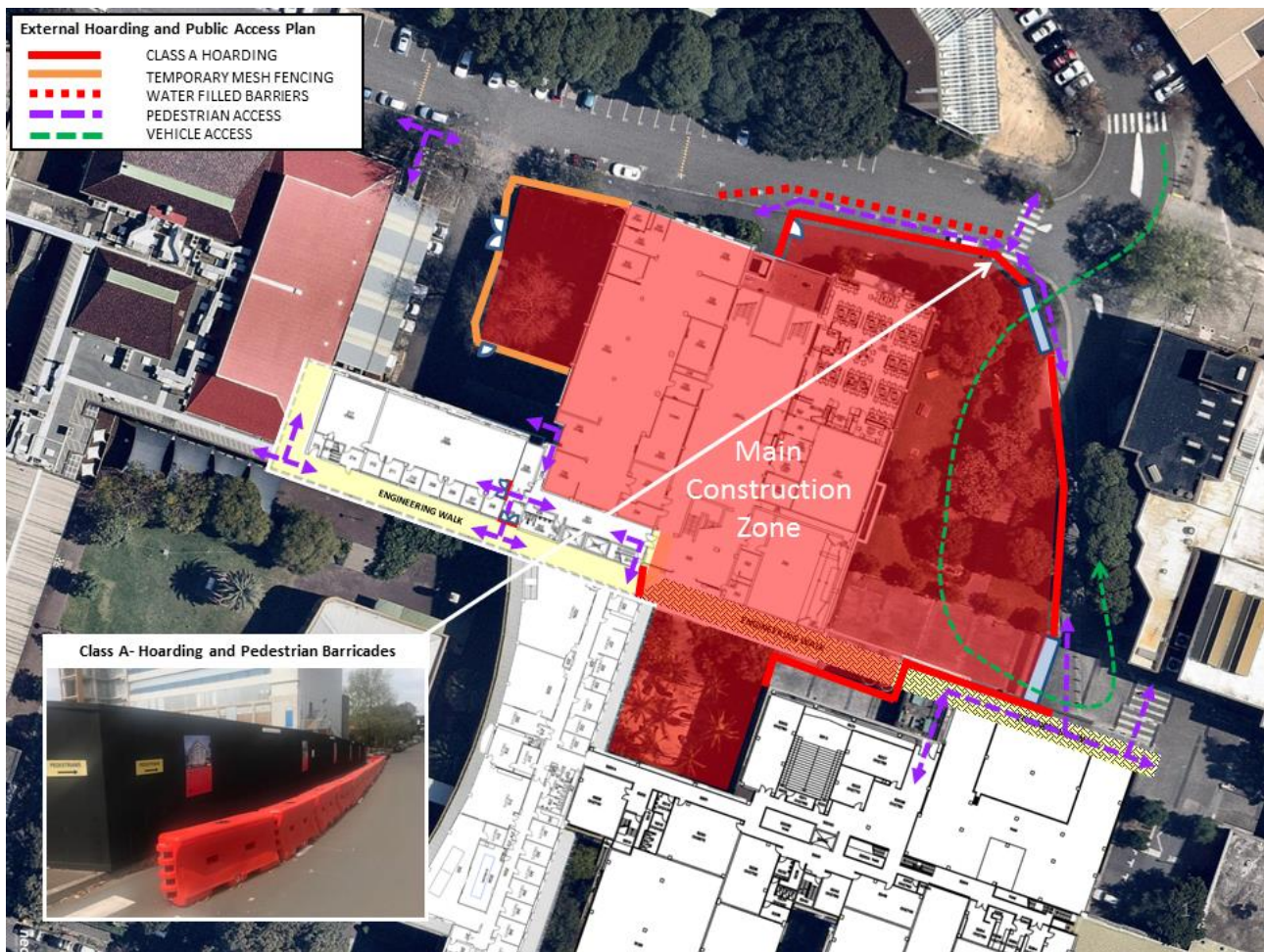


Figure 15: External Site hoardings

4.5.2 Internal hoardings

Hoardings will also be installed within the existing Building J03 as follows:

- Level 2: Existing doors and windows and doors to the lobby will be boarded up, with access to the Engineering Walk blocked
- Levels 3 and 4: Existing doors windows and the glass doors to the lobby will be boarded up, with access to Building J13 blocked
- Levels 5-8: Weatherproof acoustic & fire-rated hoardings will be installed on the external balconies and the internal lobbies at the demarcation line where the northern tower offices are demolished
- Level 9 – Hoardings will be installed on the demolition line inside the lobby and during later stages of the build, access will be restricted to the rooftop of the south building to authorised personnel for maintenance of HVAC plant only
- Level 10 – Hoarding will be installed across existing external doors to close off access to demolition areas.

General access to offices and teaching or research laboratories in the retained J03 south building will remain unchanged.

A typical internal hoarding arrangement is shown below.

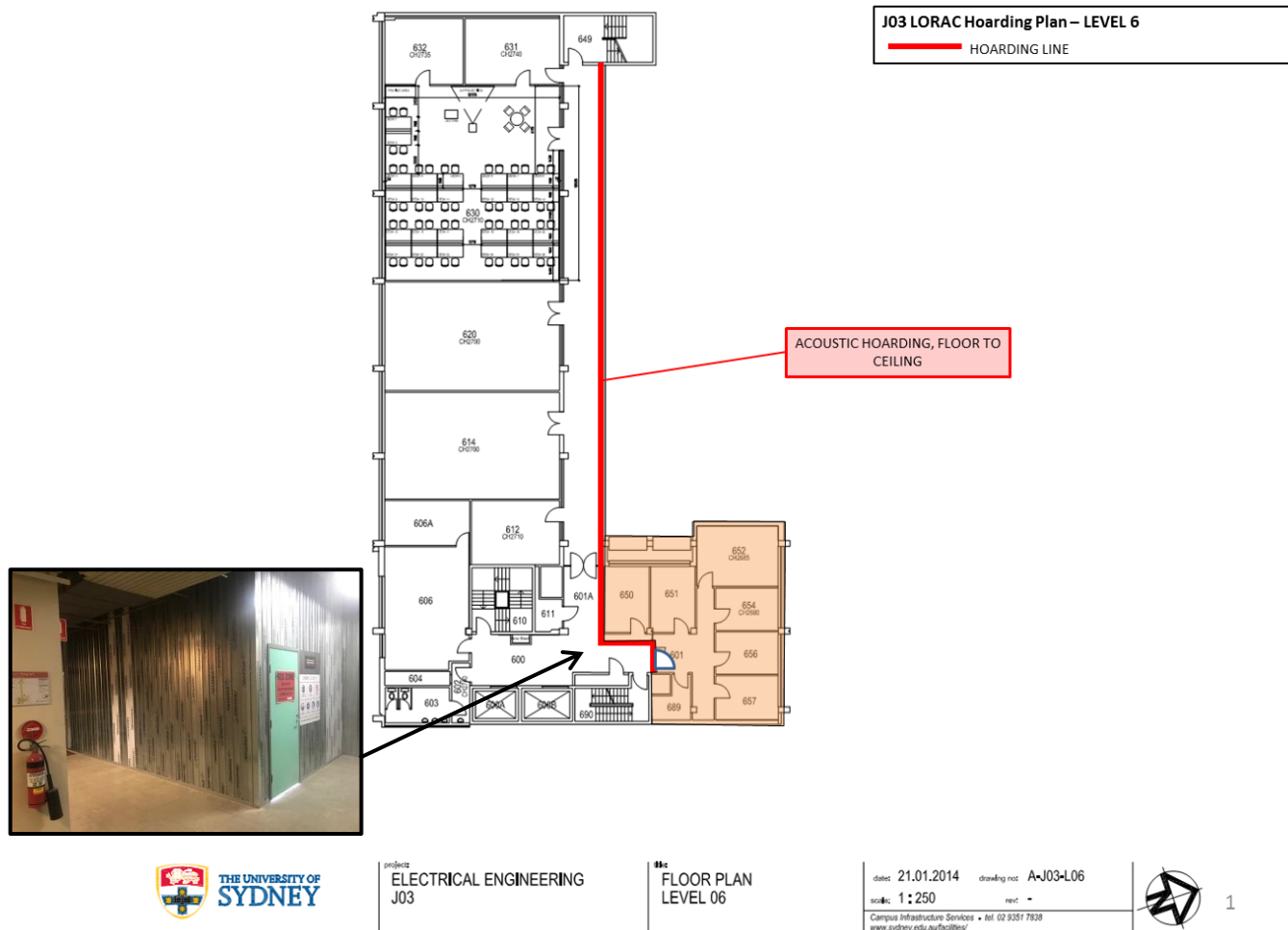


Figure 16: Typical Internal Hoarding

4.6 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 the ground floor of J03 south with an entrance from the J03 south carpark.

Construction areas will be secured with "A" class hoarding, with personnel and vehicle access gates included as required. Personnel will access the active construction site via an EiFy turnstile and gate system at the main site compound. This access control system will provide unmanned 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.

4.7 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, fire protection and air conditioning.

4.7.1 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

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

- Electric tower crane
- Builder's hoist
- Low voltage lighting
- General power
- Pedestrian and site 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 on every level 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.

4.7.2 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.

4.7.3 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.

4.7.4 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.

4.7.5 Hydraulic services

As well as water to the main compound, 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 2, 4, 6 and 8
- Water bubblers on all levels
- Ablution blocks at Levels 3, 5 7 and 9
- A hose reel at truck entry and exit gates

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.

4.7.6 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.

4.7.7 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.

4.7.8 Air conditioning

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

4.8 **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.
- Management of disruptive works to be coordinated with USYD.

4.8.1 Out of Hours Modification in response to COVID19

The project has put forward a modification to the approved SSDA construction hours to facilitate safe working distances for construction personnel and University students and staff in response to the unforeseen event of COVID19. There will be a peak in resource working on the project between May and September 2020 during the final stages of internal fit out, and the proposed construction hours will ensure all construction personnel can achieve social distancing requirements (noting these are expected to continue whilst other measures are relaxed) through the implementation of split working shifts throughout the day and night. The extended hours will ensure safety of the University students and staff where student laboratory and ongoing VC sessions are in place and enable works to proceed with distancing measures in place.

The modification of SSDA construction hours relates to two different components of the project; the refurbishment works located in the existing building, and the new build external to the existing building. Note that all new build internal works will only proceed out of hours on levels where façade installation is complete on that respective level.

The initial proposal for the modification of the SSDA construction hours has been altered following feedback from the community in May 2020.

The scope of works for both the existing building and new building are outlined below.

Scope of Works – New Build

	6:00am – 7:00am*	7:00am – 6:00pm* [Current Approved Working Hours]	6:00pm – 10:00pm*
Monday – Friday	Internal Service installation: - Wet and dry fire services - Hydraulics services - Electrical services - Duct services Internal Fit out Works - Ceilings & partitions (inc doors) - Painting, tiling, floor finishes - Balustrades & handrails - Service fit off - Signage & wayfinding - Flooring	Façade Installation - Install façade panels Service installation: - Wet and dry fire services - Hydraulics services - Electrical services - Duct services Internal Fit out Works - Ceilings & partitions (inc doors) - Painting, tiling, floor finishes - Balustrades & handrails - Service fit off - Signage & wayfinding - Flooring Civil & Landscaping Works - Landscaping, paving, placing of irrigation, planting and associated works - Civil works Site Logistics - Deliveries and unloading of delivery - Traffic Controller to manage above	Façade Installation - Install façade panels Internal services installation: - Wet and dry fire services - Hydraulics services - Electrical services - Duct services Internal Fit out Works - Ceilings & partitions (inc doors) - Painting, tiling, floor finishes - Balustrades & handrails - Service fit off - Signage & wayfinding - Flooring
		7:30am – 3:30pm [Current Approved Working Hours]	
Saturday		Façade Installation - Install façade panels Service installation: - Wet and dry fire services - Hydraulics services - Electrical services - Duct services Internal Fit out Works - Ceilings & partitions (inc doors) - Painting, tiling, floor finishes - Balustrades & handrails - Service fit off - Signage & wayfinding - Flooring Civil & Landscaping Works - Landscaping, paving, placing of irrigation, planting and associated works - Civil works Site Logistics - Deliveries and unloading of delivery - Traffic Controller to manage above	
Sunday	No works proposed		

*Note, there will be staggered shifts between subcontractors to enable social distancing

Scope of Works – Existing Build

	6:00am – 7:00am*	7:00am – 6:00pm* [Current Approved Working Hours]	6:00pm – 10:00pm*
Monday – Friday	Internal Fit out Works - Ceilings & partitions (inc doors) - Painting, tiling, floor finishes - Balustrades & handrails - Service fit off - Signage & wayfinding - Flooring	Service installation: - Wet and dry mechanical installation - Hydraulics installation - Electrical services - Duct installation Internal Fit out Works - Ceilings & partitions (inc doors) - Painting, tiling, floor finishes - Balustrades & handrails - Service fit off - Signage & wayfinding - Flooring	Internal Fit out Works - Ceilings & partitions (inc doors), plastering - Painting, tiling, floor finishes - Balustrades & handrails - Service fit off - Wayfinding installation - Flooring
		7:30am – 3:30pm [Current Approved Working Hours]	
Saturday		Service installation: - Wet and dry mechanical installation - Hydraulics installation - Electrical services - Duct installation Internal Fit out Works - Ceilings & partitions (inc doors) - Painting, tiling, floor finishes - Balustrades & handrails - Service fit off - Signage & wayfinding - Flooring	
Sunday	No works proposed		

*Note, there will be staggered shifts between subcontractors and laboratories in use by the University to enable social distancing and safe working distances from construction works.

Mitigation Measures:

Mitigation measures will be in place throughout the proposed out of hours works, in line with the Acoustic Assessment prepared by Resonate for the proposed scope of works. Such measures include, but not limited to:

- No deliveries out of the current approved working hours;
- No external landscaping works proposed out of the current approved working hours;
- All internal fit out and service installation works will be undertaken with building façade panels in place, or in the existing building's case, building walls in place, therefore resulting with works generally being inaudible;
- Equipment that is used intermittently should be shut down or throttled down to a minimum during periods where it is not in use;
- Two way radios not to be in use out of the current approved working hours;
- Noise associated with packing up plant and equipment at the end of works should be minimised.

- Façade installation out of hours only noted from Monday to Friday. All façade panels will be delivered and lifted onto the applicable floor plate prior to undertaking the works out of hours, to reduce the amount of plant required to install and fix into place.

4.9 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.

4.9.1 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
- Craning of demolition plant onto the existing buildings
- Erection and disassembly of the tower crane.

4.9.2 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.

4.9.3 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.

4.9.4 Work zones

A work zone will be established on Maze Crescent, occupying the existing footpath. Approximately eleven car parking spaces will be relinquished for this work zone as it will be necessary to provide a dedicated pedestrian access along. Consideration is to be given to deliveries to J01 during the works.

4.10 Traffic and pedestrian management

Laing O'Rourke has prepared Traffic and Pedestrian Management Plan (TPMP) for the ETP Stage 1 works. 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.

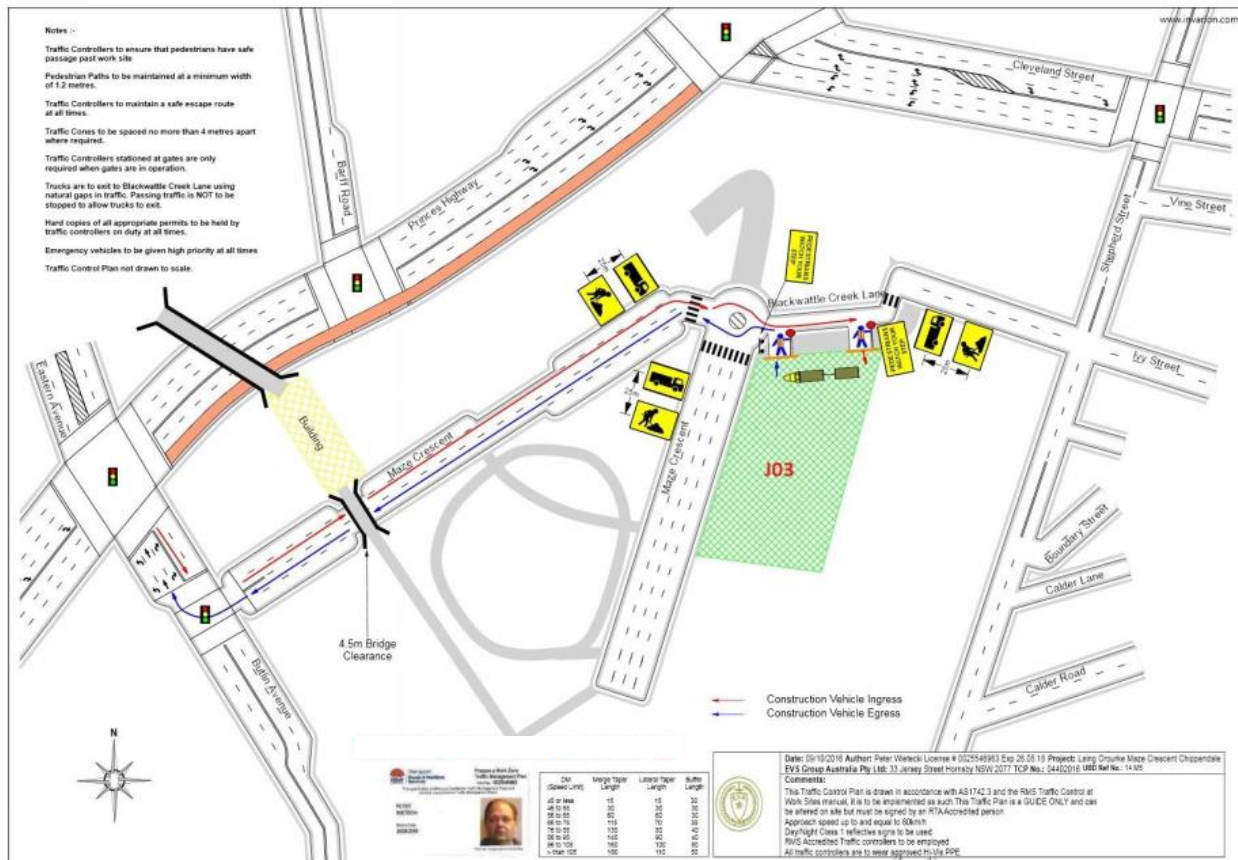
Key considerations that have influenced our approach to traffic and pedestrian management include:

- Avoiding access for heavy vehicles on Shepherd St
- Establishment of a work zone on the Maze Crescent footpath area
- 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 (i.e. from City Rd via Butlin Ave and Maze Cres)
- Access to neighbouring buildings 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 the workforce. Space will be provided for the storage of tools and materials required by trades, and workers 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 haulage route has been constructed through the egress and exit gate on site to allow Heavy Vehicles to park (if required) on site throughout the construction phase. Heavy vehicles are to further coordinate deliveries & site access requirements with the Voyager vehicle coordination software to ensure trucks are provided when needed and mitigate the likelihood of a build-up of on-site heavy vehicles.

A draft Traffic Control Plan (TCP) has been developed for the project and is included in the TPMP (see Figure 18, below).



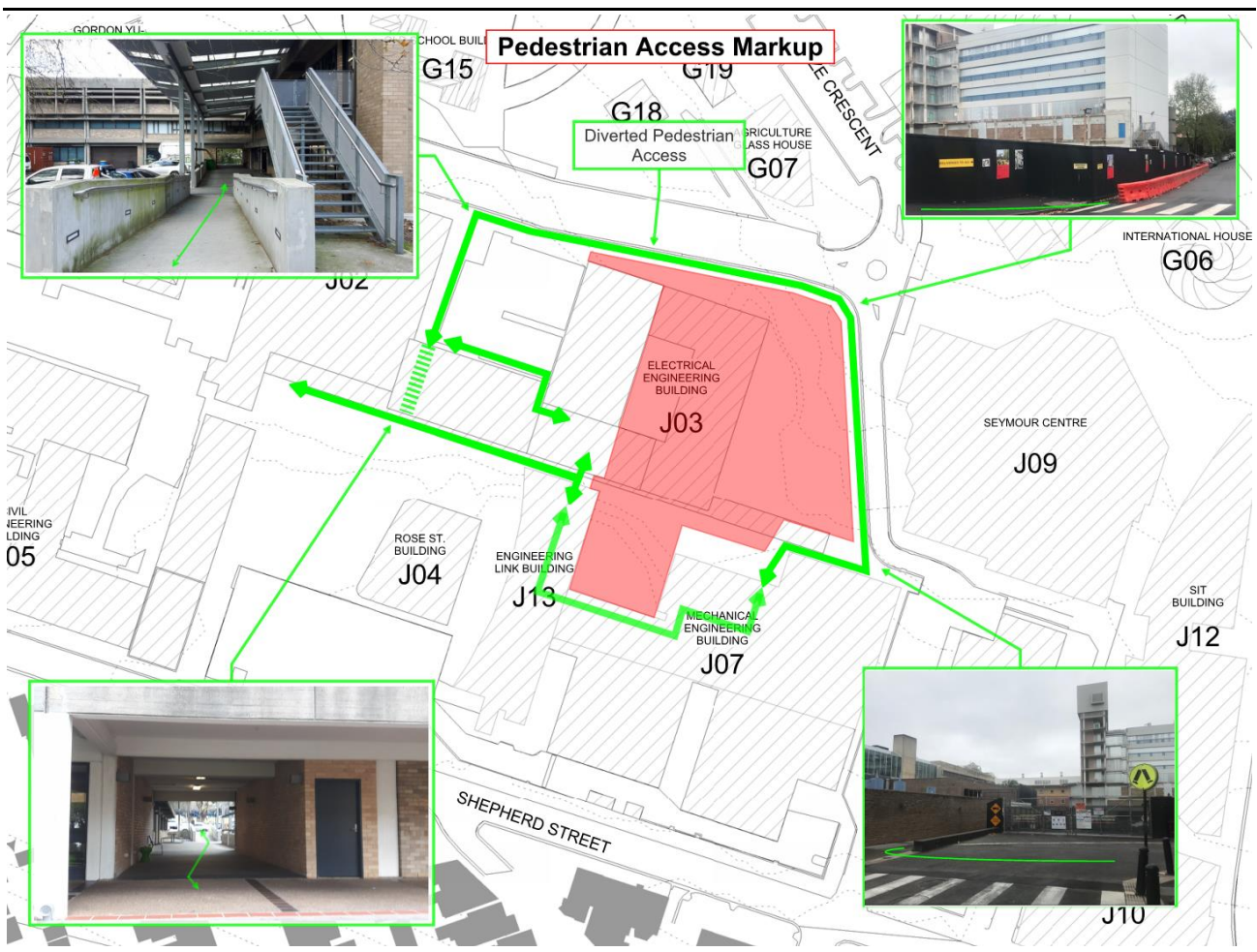


Figure 19: Pedestrian management plan

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.

4.11 Disruption notices & Stakeholder Communications

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 or access constraints), Laing O'Rourke will provide the University with a disruption notice prior to the construction activity commencing and communicate the plans through the Construction Interface User Group (CIUG) meetings. This will provide a forum to discuss the planned activities, expected impacts, durations and dates. This interface can also be used to 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 endeavour to co-ordinate works with USYD activities including events management as required.

4.12 Complaint and response process

LORAC will work with USYD / CIS to organise a single point of contact for local residents, USYD staff members, students and visitors. 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 (e.g. tower crane erection / dismantling) and also general information about the project.

4.13 HSE Requirements

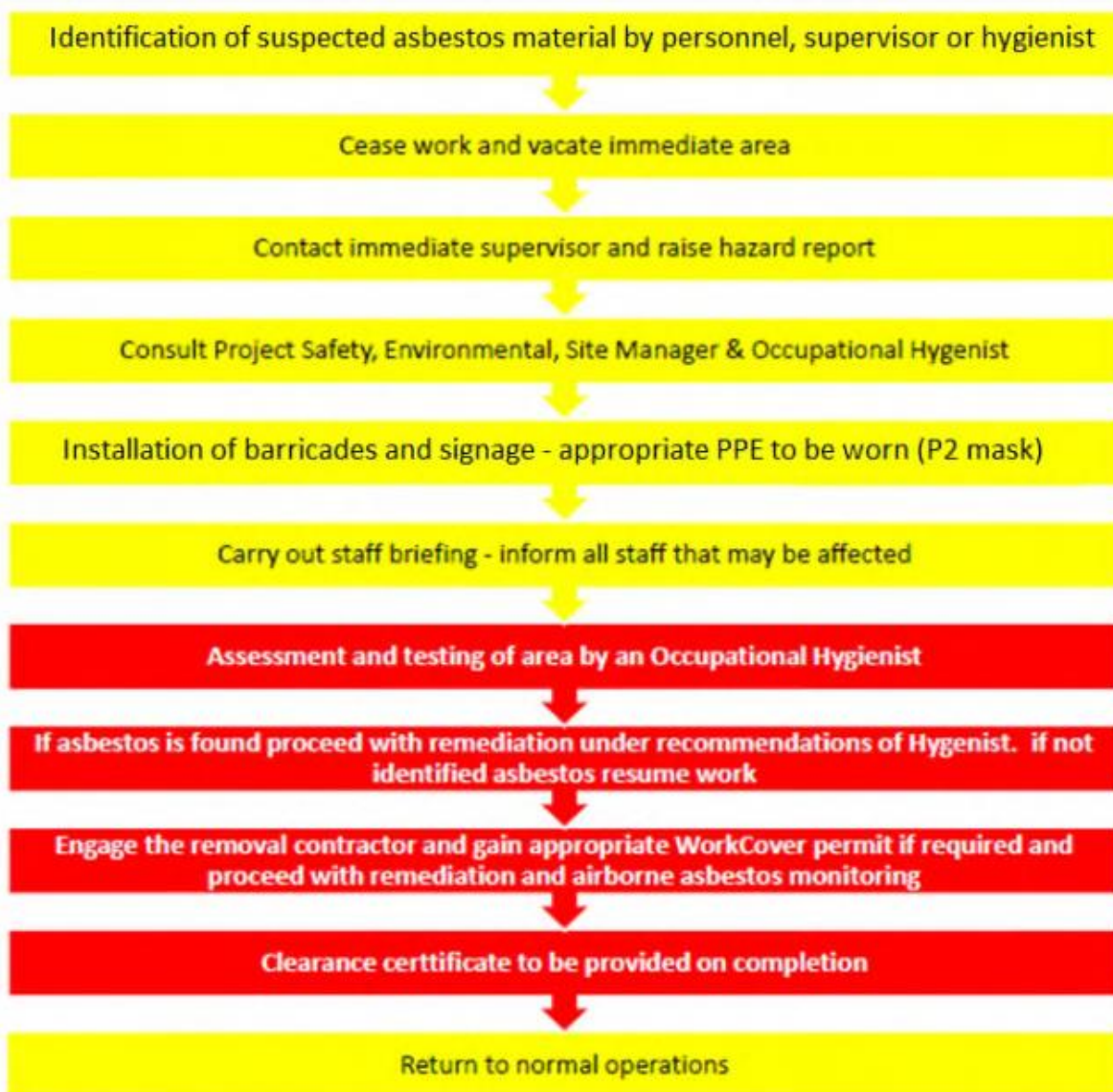
Refer to project safety management plan and environmental plan for information on inductions, site requirements, certification and evacuation procedure and muster point location.

4.14 CIS Handbook

All subcontractors will be directed to the USYD contractors handbook for guidance and information about working within and around the University campus.

4.15 Unexpected Finds & Heritage

In the event that there is an Unexpected Find (Heritage, Indigenous, Asbestos, UXD) the following process shall be followed. In the event that the unexpected find is Heritage in nature a Heritage Consultant shall be contacted in lieu of a Hygienist.

RESPONSE FLOW CHART

Yellow sections to be undertaken by Laing O'Rourke Australia

Red sections to be undertaken by a professional hygienist

5. Construction methodology

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

5.1 J07 Loading Dock Enabling works

As part of the loading dock construction works and to precede the associated demolition and enabling works it will be necessary for part of the existing J07 workshop tea room and amenities to be decanted and relocated. This work involves refurbishment of another space within J07 and currently sits outside of Laing O'Rourke's scope of work so will be carried out by another contractor.

5.1.1 Relocation

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

5.1.2 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 (by others)
- Existing tea room and amenities area to be demolished to create a new loading dock entry area into J03. Subject to CIS consultation, this area may also serve as an alternate future construction access for basement deliveries to the new build area
- Installation of hoarding and a temporary driveway.

5.1.3 Other enabling works

Additional enabling works required will involve:

- Removal and /or diversion of external building services within the new building footprint
- Removal of existing trees and vegetation

5.2 Demolition and Excavation works

5.2.1 Demolition

The ETP Stage 1 works involved 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 20). Demolition of these elements has been completed.

To supplement the pre-existing hazardous material surveys provided by the University, Laing O'Rourke carried out an extensive hazmat survey in the areas to be demolished and ensured that all identified contamination was removed and clearance certificates received prior to demolition.

Property condition surveys of nearby properties, assets and the like have also been conducted and any vibration sensitive receptors identified.

A qualified Structural Engineer reviewed and approved the use of the demolition plant and equipment on suspended slab along with the demolition sequence.

Where existing facilities within the old J03 building are to be upgraded, demolition will need to be further undertaken (prior level decanting) of common floor areas and restroom facilities throughout the buildings entirety.

Figure 21 below shows the location of the demolition area relative to the retained parts of the building.

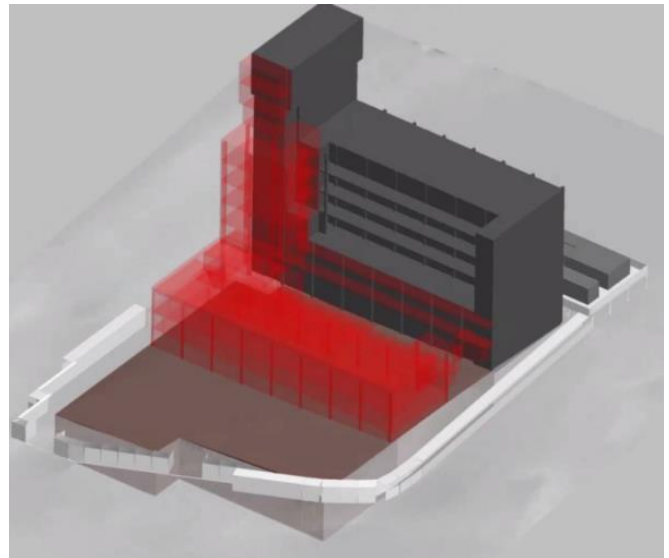


Figure 20: Digital model snapshot of the areas to be demolished (shown in red)



Figure 21: Demolition location plan

5.2.2 Excavation and Piling

Following demolition of the existing structures, bulk excavation will be carried out to enable 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	4,950m ³
Detailed excavation – lift pits and footings	380m ³
Total	5,330m³

Table 5: Approximate quantities of materials to be excavated

Figure 22 below indicates the areas to be excavated.

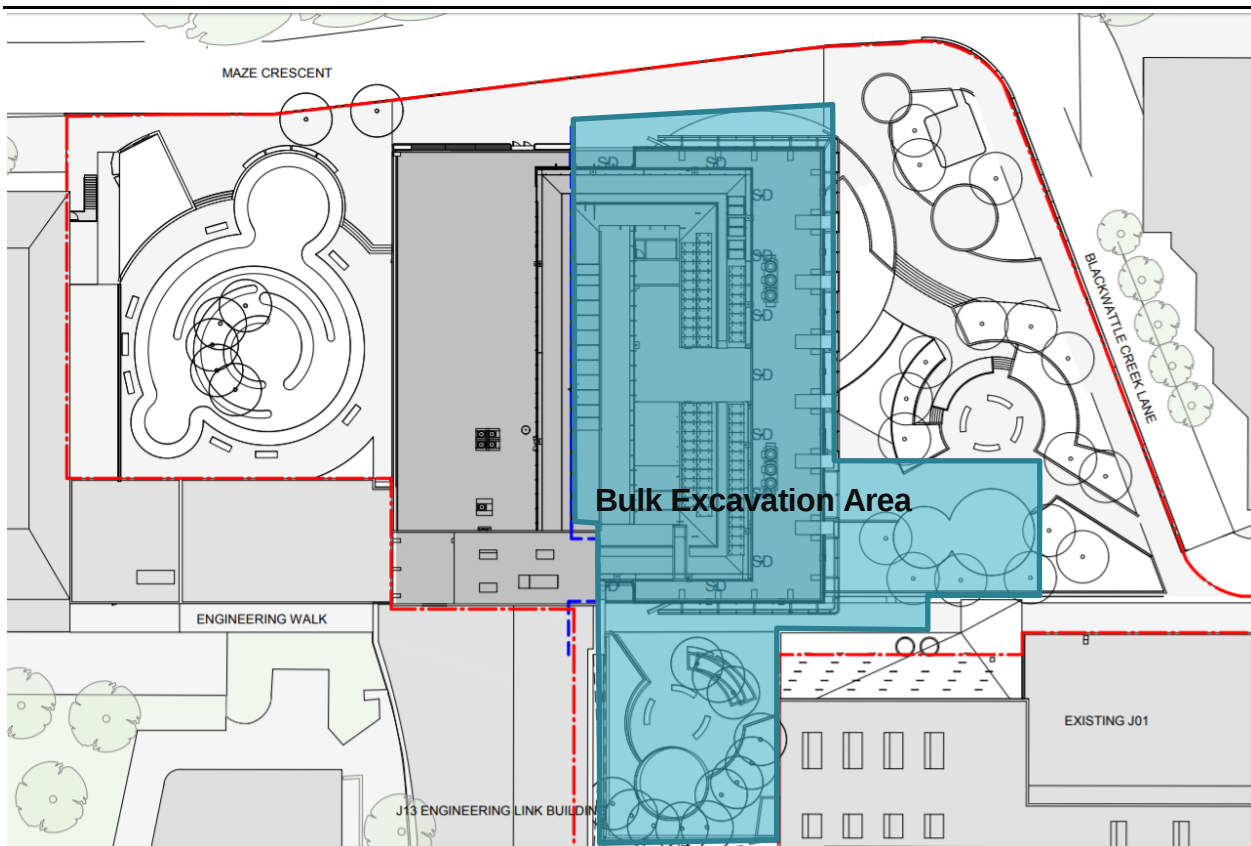


Figure 22: Bulk excavation plan (only Level 1 basement required)

Prior to the 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 3.5m deep to Bulk Excavation Level and about 5.5m in the Lift core.

The perimeter of the excavation will be mostly stabilised by forming batters with a section of piled retaining wall along the existing building. The wall will comprise a series of bored piles with shotcrete panels installed between them as excavation progresses.

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

During excavation surface falls will be directed to a temporary sediment basin that will collect rainwater run-off in the event of inclement weather. The water 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.

5.2.2.1 Temporary shoring wall to southern side

The first stage of civil works will involve construction of a temporary retaining wall along the face of the existing J03 South building.

Bored reinforced concrete piles, typically 450-600mm diameter, will be installed along the face of the building where the deepest excavation is required. The piles will be spaced at approximately 2.1m centres and socketed into the ground to a depth of approximately 3.0m 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 via a trammie and finished to the required cut-off level.

As excavation progress, a shotcrete in-fill panel approximately 200mm thick will be applied to the piles, and anchors will also be installed to the shoring piles.



Figure 23: Examples of piling (left) and shotcreting (right) activities

5.2.2.2 Bulk excavation

Excavation will commence from the south-west corner of J03 and progress east and north towards Blackwattle Creek lane and the temporary entry and exit gates. A ramp into the excavation will be situated at the northern end of the excavation leading out to Gate 1 on Blackwattle Creek Lane. It is expected that most of the excavation will be able to be carried out conventionally with some hammer work required in the deeper lift core area. Equipment to be used at various stages of excavation includes:

- 5t – 30t excavators with bucket, ripper and hydraulic hammer (if required)
- Skidsteer or Positrak loader
- Truck & Dog or Truck only tippers

When bulk excavation levels are reached, the civil contractor will place a layer of crushed rock over the building area to support the piling equipment for the foundation piling



Figure 24: Example of excavation works

5.2.2.3 Foundation Piling

Due to the low strength soils and rock that will be encountered at bulk excavation level the majority of the new structure will be supported on piled foundations to carry the building loads through to the higher strength rock. It is expected that the piles will generally be self-supporting and able to be dry bored conventionally. Upon drilling and cleaning out, the pile base will be verified before placement of the prefabricated steel reinforcing cage. Ready-mixed concrete, supplied from a batch plant, will be discharged into the pile excavation via a trammie and generally over poured to allow break back to the required cut-off level.

The piling sequence will generally follow that of the excavation from south-west to north-east.

5.2.2.4 Detailed excavation

The majority of the detail excavation will also be carried out with conventional equipment although typically smaller sized machines for better accessibility. Detailing of the lift pit and pile caps, pad footings and strip footings will be excavated to enable construction of the remaining sub-structure. In soils that are prone to softening in wet weather, a blinding layer of concrete will be placed to support the footing reinforcement.

5.2.2.5 Substructure

Along with the foundation piles, the substructure consists of the remaining building footings and ground slab. After detail excavation has commenced pile caps will be progressively be constructed by firstly trimming piles to required cut-off levels, placing reinforcement and column starters and pouring concrete to top of pile cap level. Strip footings and pad footings will be constructed in a similar manner.

When the footings are complete, in-ground services and pits will be progressively constructed, followed by the 120mm thick reinforced concrete slab on ground.

5.3 Main construction works

The main works phase comprises construction of a 10 storey building with typically 4.2m floor to floor heights on a similar footprint to the demolished building. The new structure includes three new lifts, loading dock, hazardous goods storage areas, laboratories and support areas, work spaces, offices, plant rooms and external landscaping. A full height atrium is situated in the centre of the new building and existing southern J03 tower.

The new and proposed buildings will be considered as structurally separate and independent structures with a permanent building joint between the two. It is proposed to maintain a suitable gap between the buildings such that they do act independently and to avoid potential “pounding” of the two buildings during an earthquake event, should it occur.

5.3.1 Superstructure

The superstructure of the new portion of the building will comprise concrete columns, walls and floor slabs. The slabs will be post tensioned. Lateral resistance to the building is to be provided by:

- 1) the main lift core at the east end of the building;
- 2) shear walls on the east and west ends; and
- 3) portal frame action in the north and south directions from end bay portal frames

The diagram below shows a 3-D view of the building structure

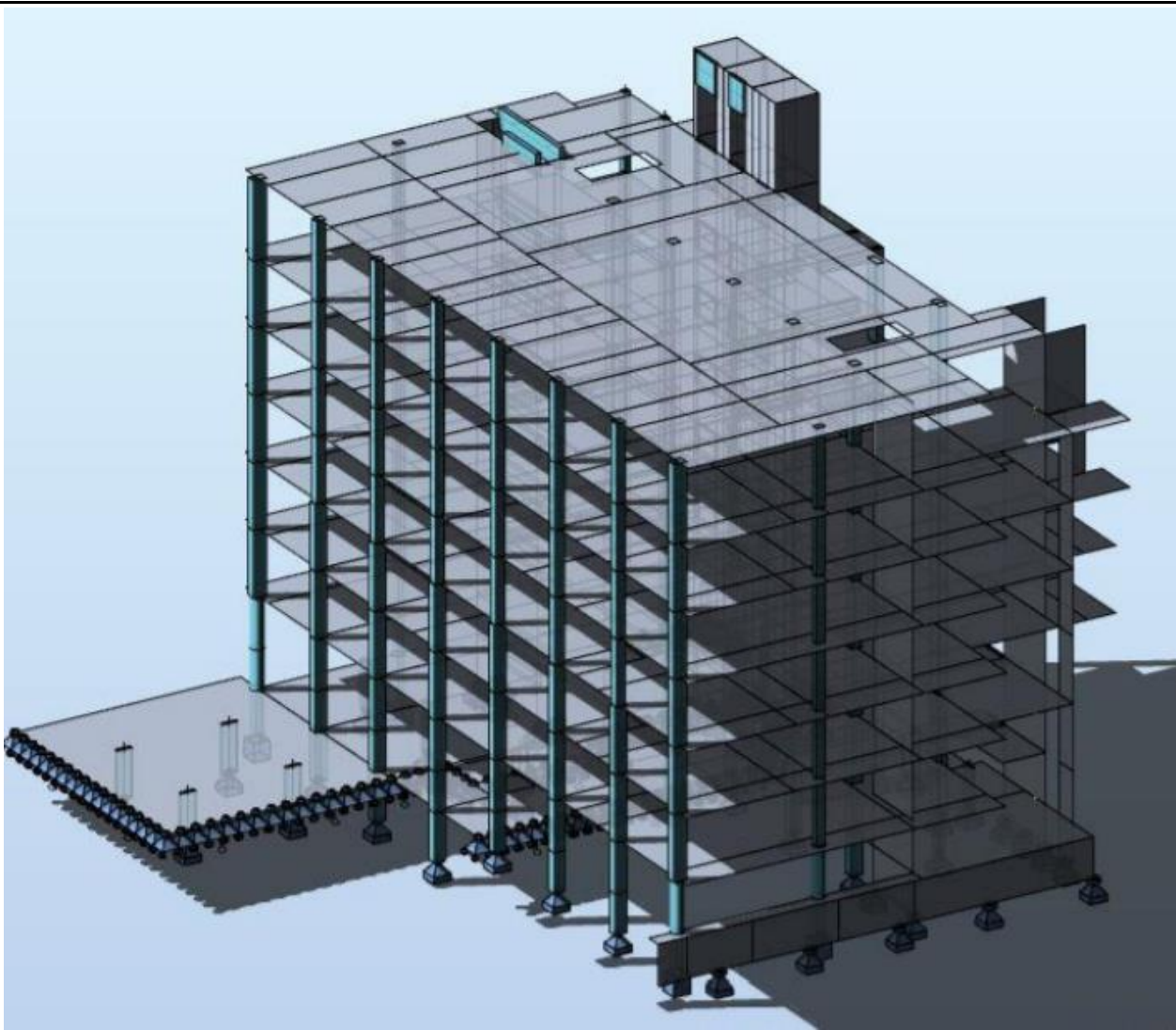


Figure 25: Isometric View of the Building Structure

The floor slabs will typically consist of a 350mm deep two-way spanning post-tensioned flat slab. This solution maximises head height and simplifies formwork. Band beams are provided on the east and west end bays.

5.3.1.1 Lift core construction

The new building will feature three lifts located on the southern side in the vicinity of the previously demolished tower. One passenger lift will start from the ground floor (Level 2) with one goods lift and another passenger lift starting from Level 1. The passenger lifts will service up to Level 9 and the goods lift will service up to the Level 10 plant room.

The lift base and walls to Level 2 will be conventional cast in situ, with the upper levels constructed of a prefabricated concrete double wall system. This system is a hybrid solution aimed at increased speed of construction and less construction materials.

The prefabricated sections will be lifted by crane to their final positions and braced before the cavity is filled with premixed concrete to form a solid wall. Bracing is fixed to cast-in ferrules

from an EWP (see typical installation example in



Figure 26).



Figure 26: example of a double wall precast concrete panel

5.3.1.2 Tower construction

The Level 1 basement walls will also be constructed from the same prefabricated double wall system as the lift core. On all levels above the slab-on-ground, suspended slabs will be cast on modular formwork tables and post tensioned. Columns will generally be poured down with the upper slabs. Upon pouring of the Level 2 external podium slab the basement walls will be waterproofed and backfilled with free draining aggregate.

The northern Level 2 podium slab will be used as a logistics / materials handling area to take deliveries of formwork materials, reinforcement and later on stillages for the facade. Due to the size constraints of the site only small dedicated areas will be allocated for storage and handling of materials. Therefore, efficient construction will rely on just-in-time deliveries.

For the majority of the internal footprint, Level 2 is a double height space and so the Level 4 formwork deck will be supported with a different arrangement of the formwork system to the remaining floors.

Construction of Levels 5-10 will involve installation of modular formwork tables (e.g. Peri systems) incorporating end portal beams, followed by post-tensioned reinforced concrete band beams.

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.

The roof on Level 10 will be constructed on a lightweight structural steel frame to house the plant rooms.

The diagrams below indicate typical formwork systems to be utilised during construction. For Levels 5 -10, an edge protection screen will form part of the perimeter table system.

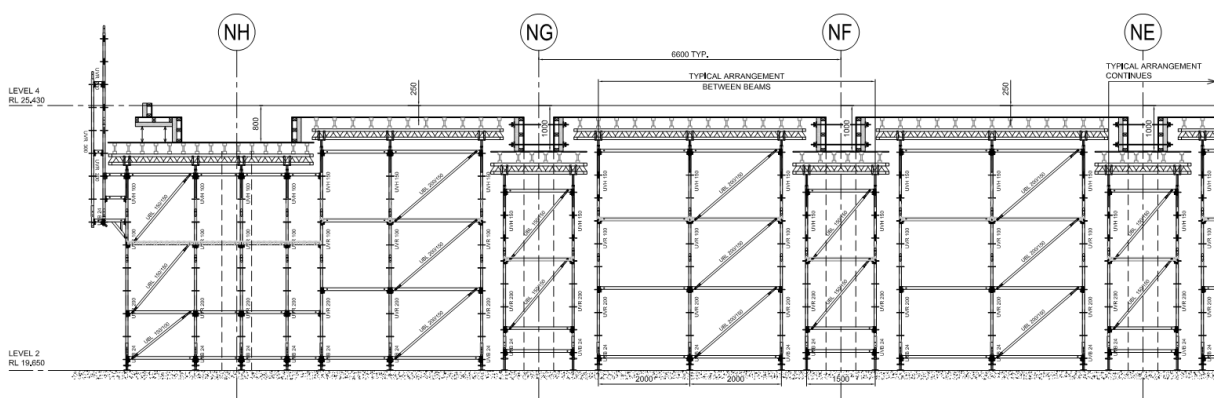


Figure 27: Level 4 formwork

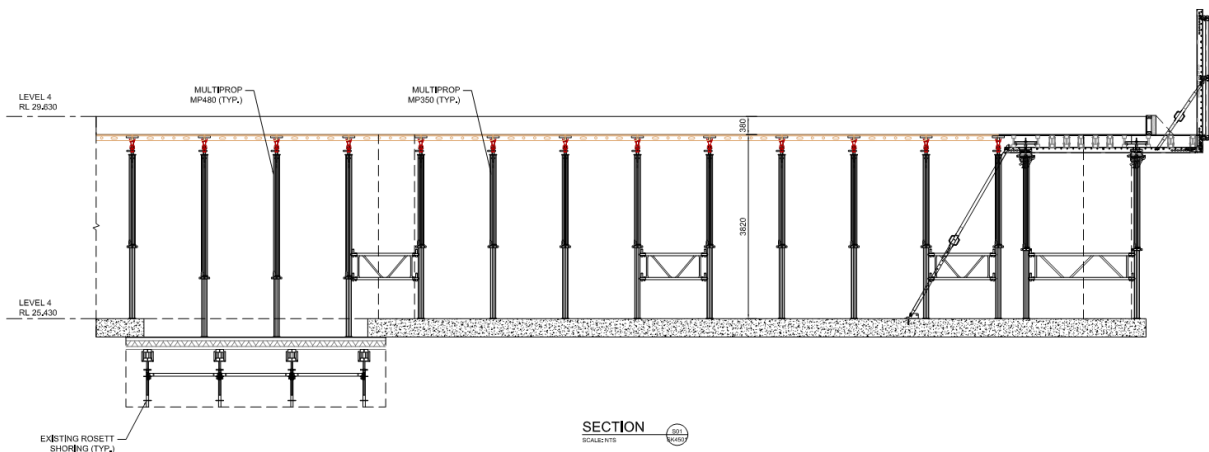


Figure 28: Level 5 - 10 formwork showing integral edge protection screens

5.3.2 Scaffolding and Edge Protection

Laing O'Rourke's construction methodology minimises the requirement for perimeter scaffolding to be erected. As mentioned above, containment screens will provide edge protection to the formwork decks as integral elements of the propping system during formwork erection and reinforcement installation and during concrete pours and post-tensioning works.

After curing of the slabs and removal of the formwork tables, handrails will be installed around the perimeter for ongoing edge protection. This will be a proprietary handrail system purpose built to allow for installation of the external façade from behind the handrail and without the need for fall restraint equipment to be worn. Handrails will remain in place until the external façade is installed.

Depending on the size, all slab penetrations are protected by handrails, cast-in mesh or penetration covers.

Scaffolding stretcher stairs will be used for access to each level of the structure during construction until the builders hoist is installed.

Other works to the external façade including installation of the outer veil will be performed from an EWP to avoid the need for external scaffolding.

5.3.3 Façade

Laing O'Rourke understands the risks of working at height and 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 which will reduce manual handling, and 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.

The envelope of the new electrical engineering building consists of:

- Double skin façade to the North, West and East elevations with:
 - Unitised glazed curtain wall inner skin (with floor to ceiling vision zone)
 - Horizontal louvre clad outer veil (aluminium blades suspended on tension rods from a structural steel "eyebrow");
- Double height shopfront glazing to lower level lobby and break out spaces on North, South, East and West elevations;
- Atrium curtain wall glazing (translucent and transparent); and
- Plant room metal cladding

As part of an upgrade to the thermal performance of the existing building, old windows will also be replaced with new.

5.3.3.1 *Delivery and Handling*

The curtain wall units will be prefabricated and delivered to site packed in cling-wrapped steel stillages on flatbed trucks for ease of handling and storage. Deliveries will be planned to suit the staging of the installation.



Figure 29: Typical pack of panels ready for installation

The stillages will be lifted one at a time by the tower crane and placed onto the required floors loading deck where they will be moved using pallet trolleys or electric walk behind forklifts to the installation location.

5.3.3.2 Surveying

Before any units on the new building are installed, a detailed survey will be carried out on the primary structure to mark out grid lines and RL's.

5.3.3.3 Fixing brackets (First Fix)

Once four floors, starting from Level 4, have been fully stripped and stressed, the dead load bracket installation team will set out the first level of brackets. Set-out will be done using offsets from grid lines to centre lines of joints with RLs transferred to each fixing location to estimate the packing required under each bracket and sub sills

The pre-drilled aluminium dead load brackets are loosely bolted to a cast-in unistrut system in runs of about 10. The end brackets will be set accurately to line and level, string lines will be set up and infill brackets completed. After tightening T-bolts, all positions and heights will be double checked before installing the sub sills. These will be completed prior to panel installation to ensure continuity of work for the panel crews.

5.3.3.4 Panel installation (Second Fix)

Stillages are opened and panels are removed one at a time before being placed on timber gluts and cleaned ready for installation. Panels will be then placed on launch tables, with the top of the panel parallel to the edge of the structure. Special lifting brackets are slid in and locked to the head extrusion and shackles fitted for lifting.

A mini crawler crane such as a Maeda MC-305 or a Unic URW-295 will be located above the installation floor. Two launch tables will be used to prepare the panels for launching. The panel will then be lifted and lowered into position before fixing off 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. Refer to images below for a typical launch and lift sequence.

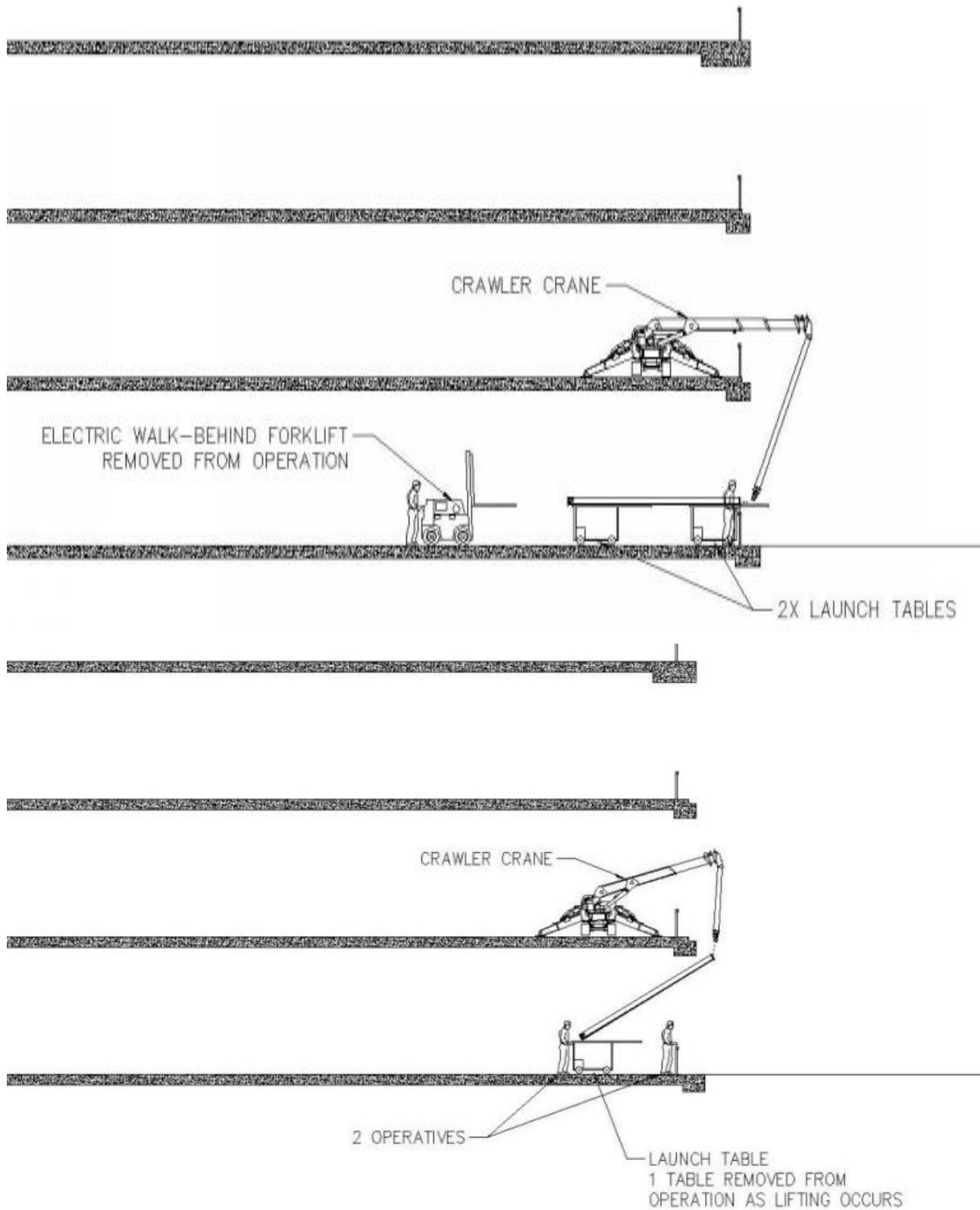


Figure 30: Launching curtain wall panels



Figure 31: Typical curtain wall panel installation

5.3.3.5 Sealing and Finishing (Third Fix)

The third fix consists of the internal smoke and fire seal installation and the fitment of the blind pelmet. The fire safe insulation is placed between the slab edge and the curtain wall and sits on a galvanized iron sheet safin clip installed after the dead load pockets are filled. The smoke seal is a 1.5 mm thick galvanized iron sheet fixed to the concrete slab and to the inside of the curtain wall and sealed with a polyurethane based sealant.

5.3.4 Lift installation

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

- One passenger lift servicing nine levels (Levels 1–9),
- One passenger lift servicing eight levels (Levels 2-9) and
- One goods lift – servicing 10 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.

5.3.5 Building services

The installation of building services works will begin once the floor propping has been cleared from the floor plate. 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 1-4
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.

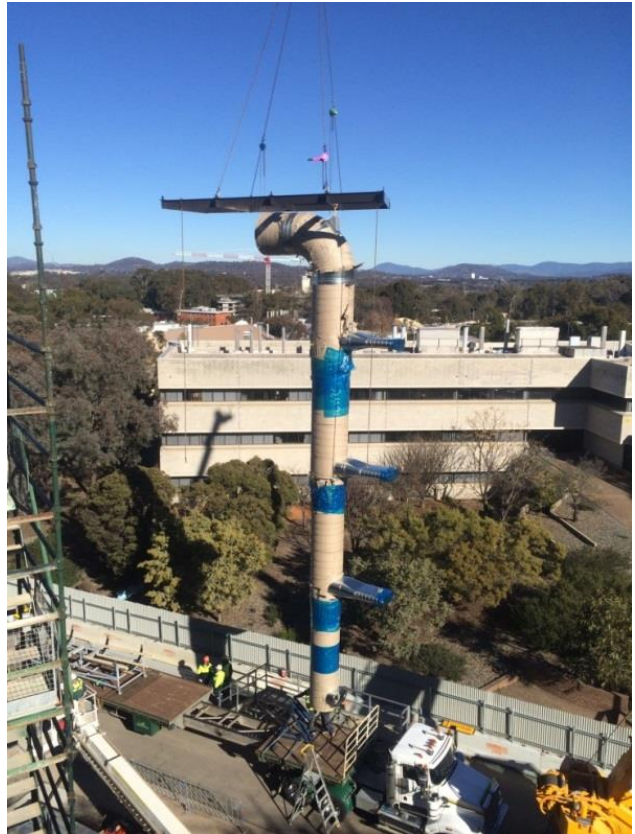


Figure 32: Examples of prefabricated services modules

5.3.6 Commissioning

A separate comprehensive project Commissioning and Validation Management Plan 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 33.

The crane is located between gridline NC-ND and 07-08. This will be clear of the permanent structure.

The tower crane will be erected to full height, with the cabin sitting above the existing Building J03 southern tower (see Figure 34, 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 external ground level slab, so that the crane base becomes sacrificial.



Figure 33: Terex CTT 331-16 HD23 Flat Top tower crane

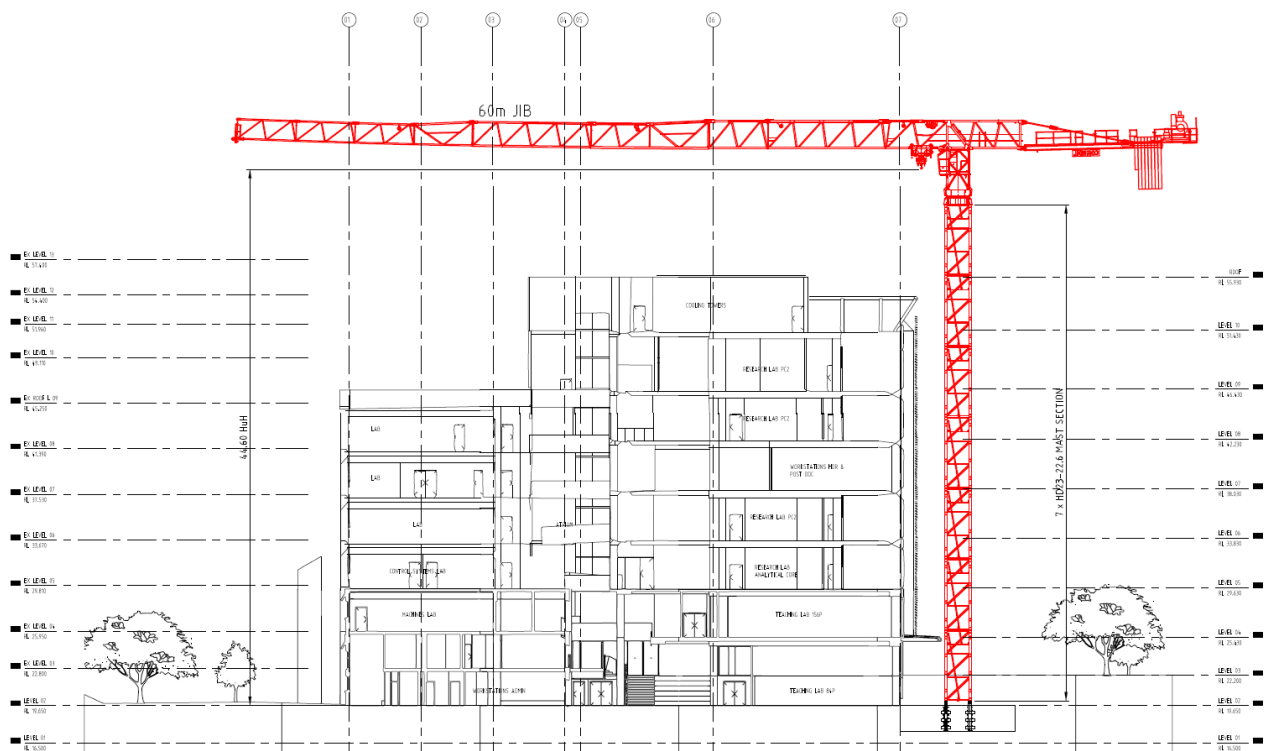


Figure 34: Crane elevation shown with new Building J03 structure

The radius for TC1 will be 60m (see Figure 35, below) and the crane loading and unloading area will be within the proposed laydown areas contained within the site hoardings.

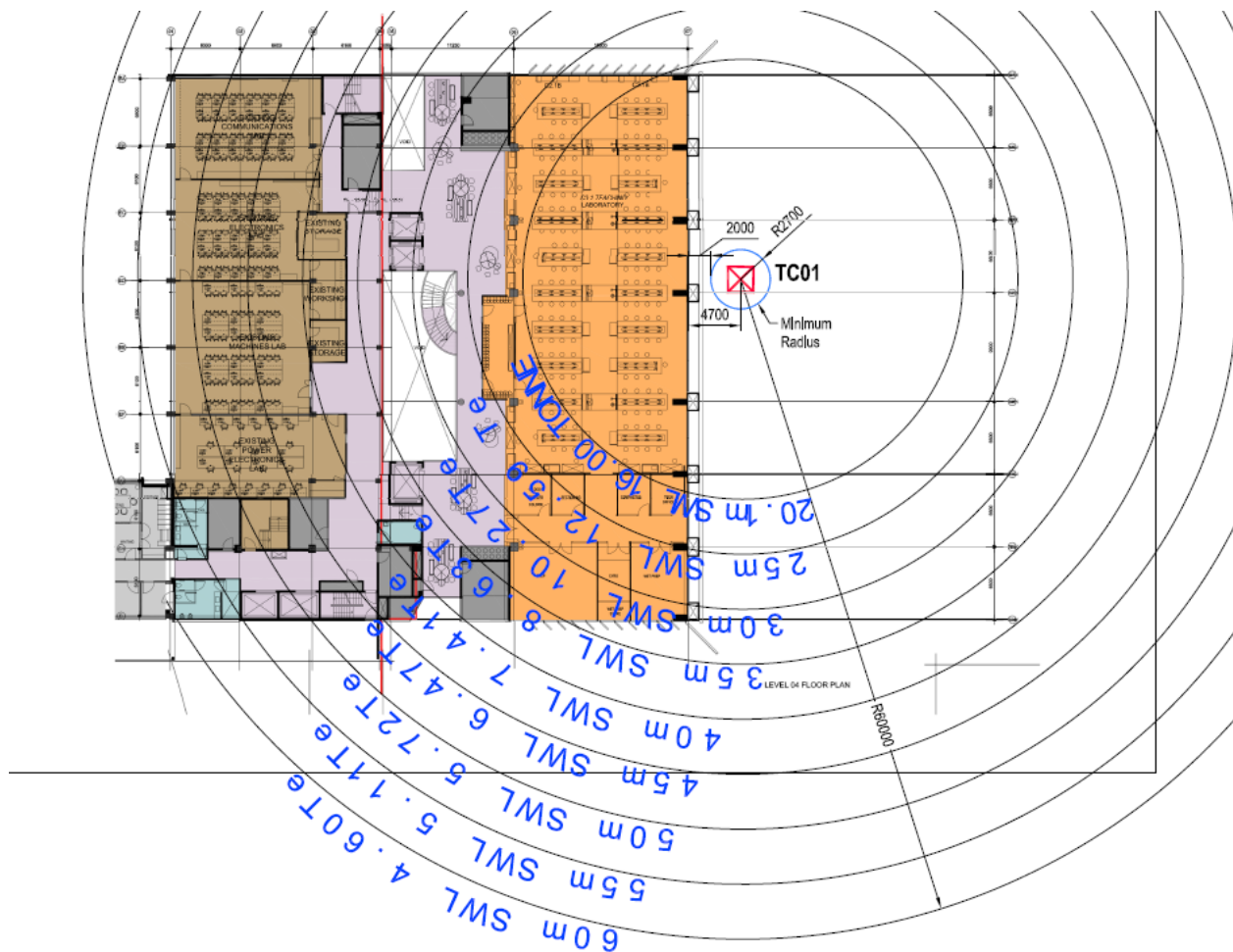


Figure 35: Crane radius diagram

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

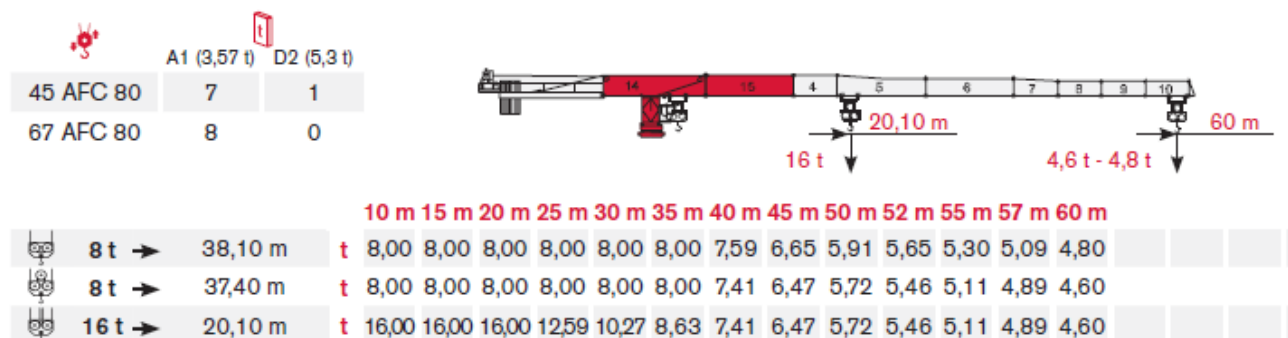


Figure 36: Load capacities of the Terex CTT 331-16 HD23 Flat Top tower crane

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:

- Northern External landscape area

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 37: 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	10,700kg	10
Hot water boiler	2,000kg	10
Heat exchanger	500kg	10
Cooling towers	2,000kg	10
Diesel generator	10,000kg	10
Main switchboard	2,000kg	2
Diesel generator switchboard	2,000kg	10

Table 6: Schedule of anticipated crane loads

6.1.2 Mobile cranes

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

- Installation of site accommodation
- Installation of selected precast concrete elements
- 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 inside the atrium of the new structure (see Figure 384, below). This allows the hoist to operate entirely within the building envelope.

The hoist will be powered from the temporary electrical builder's supply and will always run to the live deck.



Figure 38: Examples of builder's hoists

6.3 Builder's Lift – New Goods Lift

Following the installation of the new passenger and goods lifts, and while the remaining services and finishes works are being undertaken, the new goods lift will be utilised as a builders lift to facilitate vertical access in the new building. During this time the goods lift will be protected internally. Once a majority of the internal fit out is completed the builders lift will be decommissioned, the protection removed and the permanent goods lift commissioned.

To facilitate access for the fit-out of Level 3 and the extension of the existing stair core on the western side of the building of the southern building, it will be necessary for one of the existing passenger lifts in Building J03 to be converted to a builder's lift. A temporary lining will be installed in the lift to protect the finishes and maximum permissible loads will be strictly adhered to.

The floor plan of the J03 Building shows various rooms including Informal Learning, Building Main Switchroom, Mechanical Plantroom, Dry Lab, Wet Lab, School Hub, and a New Precinct Plant/Storage Room. A callout box labeled 'J03 Building - Existing Lift - Proposed Builders Lift' points to a green-shaded area at the bottom left, near the 'End of Trip Facilities'.

A photograph showing three yellow Preston mobile scaffolding units stacked vertically on a construction site. Each unit is a large, rectangular platform with a black metal grid floor and yellow side panels. The word 'PRESTON' is printed in large black letters on the side of each unit. The units are positioned on a concrete structure, and a tall metal scaffolding tower is visible on the left side of the image.

Laing O'Rourke are proposing to utilise loading platforms that will be mounted on floors 5-9 on the western façade of the building as indicated in Diagram 41.

The platforms are retractable and positioned vertically so that materials can be craned in and waste bins craned out directly from each floor. Each platform has a weight capacity of 5000kg.

The platforms will be situated away from the curtain wall façade to allow that section of the building envelope to be completed in one establishment w

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6.6 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 7:30am and 3:30pm.

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 work zone inside the hoarding on 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.

6.7 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 or craneable kibble.

6.8 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 program

Laing O'Rourke's maintain a regularly updated construction program for design, procurement, construction, testing & commissioning, and handover for the ETP Stage 1 works.

A summary of the overall project program is shown below, and a complete detailed program is available on site.

Excavation & Piling	November 2019 – March 2019
Substructure	February 2019 – June 2019
Superstructure	June 2019 – February 2020
Fit Out & Services	October 2019 – September 2020
Façade	April 2020 – September 2020
T&C and Handover	September 2020 – December 2020

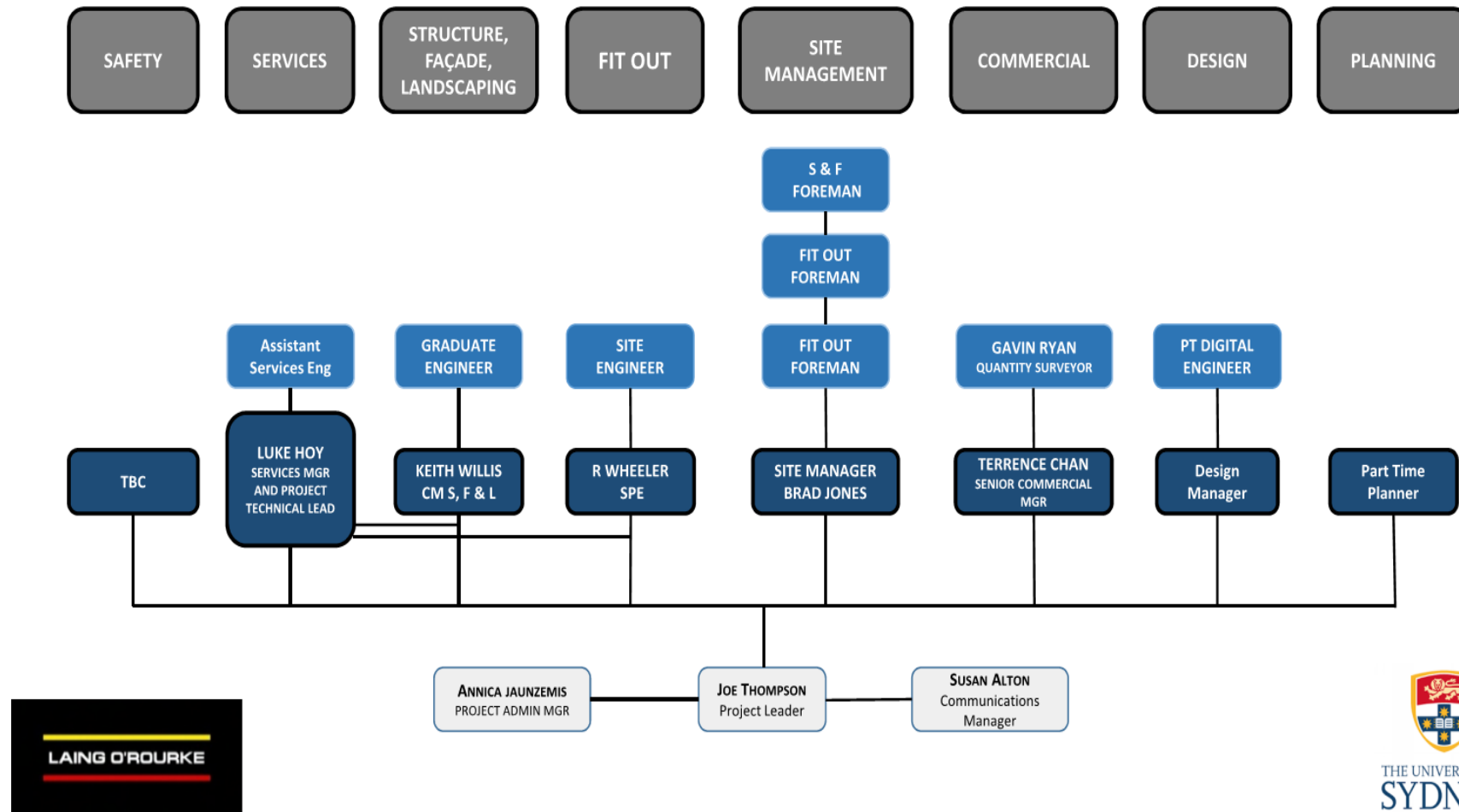
Appendix 1: Organisational chart

Figure 41: Laing O'Rourke's organisational chart for the ETP Stage 1 work