University of Sydney Susan Wakil Health Building (Stage 1)

Construction Management Plan

Construction Period: January 2020 to Completion

Document

Title	University of Sydney Health Precinct Stage 1 Construction
Laing O'Rourke Contract	K34
Document Number	K34-LOR-CMP-PLN-100002
Issue Date	28/02/20
Revision	I
Custodian	Senior Project Engineer
Approver	Project Leader

Approval	Role	Date	Signed
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Document Status

Revision	Change from previous	Date	Comment
A	Draft	01/06/17	-
B	For Internal Review	14/06/17	-
C	SSDA Issue	12/07/17	Construction planning – additional detail
D	Main Works Offer	10/11/17	-
E	For Contract	15/03/18	-
F	Updated Site Plans	27/07/18	Updated swept paths and establishment
G	Prior to Piling	10/09/18	Updated to include CIS comments
H	Completion of Piling	24/10/18	Updated to include CIS comments
I	SSDA Changes	28/02/20	Changes to working hours (Sect 4.2.3)
J	SSDA Changes	19/03/20	Changes to working hours (Sect 4.2.3), addressing initial community engagement

Version Control

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Contents

Abbreviations

Abbreviation	Meaning
CMP	Construction Management Plan
CTMP	Construction Traffic Management Plan
D&C	Design and Construct
ECI	Early Contractor Involvement
ESCP	Erosion and Sediment Control Plan
FDP	Final Distribution Points
Laing O'Rourke	Laing O'Rourke Australia Construction Pty. Ltd.
MDF	Main Distribution Frame
NOHSC	National Occupational Health and Safety Commission
PCA	Principal Certifying Authority
RPAH	Royal Prince Alfred Hospital
SSC	Sydney City Council
SSDA	State Significant Development Application
SWHB	Susan Wakil Health Building
TCP	Traffic Control Plan
USYD	University of Sydney
WMP	Waste Management Plan

1. Introduction

The development of the Health Precinct on the Camperdown campus is a key initiative of the University of Sydney to support the needs of the health disciplines through the creation of an attractive and world class multi-disciplinary research and education precinct. Due to its function and location, the Health Precinct will have a strong physical connection to the Camperdown campus.

The USYD's Susan Wakil Health Building has been identified as a major transformational project for the precinct since 2013. The project scope includes the development of a site master plan that enables the Stage 1 construction of a 9-storey health education facility and that will create a contemporary, collaborative and flexible teaching & learning environment for students and staff alike.

The local government with jurisdiction in this area is Sydney City Council. This document serves as the Construction Management Plan for Stage 1 of the overall Health Precinct. The objectives of this CMP are to:

1. Carefully plan all activities involved in the construction of SWHB to minimise the impact on the campus, nearby colleges, the Royal Prince Alfred Hospital, precinct neighbours, Newtown North Public School, pedestrians, road users, the environment and USYD property;
2. Be a vehicle for communicating the intent and focus of the procedures developed for site works throughout the life of the project; and
3. Be an instrument through which the project will meet a number of its State Significant Development Application requirements.

In keeping with these objectives, this CMP will be a live document that will grow in detail throughout the life of the project as the design progresses, methodologies are refined, subcontractors and consultants engaged and legislative requirements are met. It will be a reference point for project stakeholders and participants, the latest version of which will always be available for viewing onsite.

The CMP progresses by first describing the project, then the development site. Site establishment, site management issues and the construction methodology are discussed as well as the strategy for material handling onsite.

2. Design Objectives

SWHB will provide accommodation for a number of USYD disciplines and organisations including:

- Faculty of Health Sciences, currently located at Cumberland campus;
- Faculty of Nursing and Midwifery, currently located at Mallett Street campus;
- Medical Library, currently located on Level 3 of the Bosch 1B building; and
- Sydney Medical School Central Clinical School (CCS) teaching and learning components, currently partially located within buildings belonging to the RPAH and the Blackburn Building.

The key Design objectives for SWHB are to:

- Create a vibrant and attractive workplace that:
    - Supports the creation of multi-disciplinary academic and professional staff teams, while at the same time maintaining strength and identity at the faculty and discipline levels;
    - Creates an open, interconnected and functional working environment;
    - Provides welcoming places for part-time and off-campus staff, with easy access to support services when they visit;
    - Supports increased interaction between Higher Degree Research candidates and academic staff;
    - Increases access to core equipment and clinical research facilities;
    - Provides a variety of flexible working environments for different working functions and make them accessible to all;
    - Enhances business sustainability through efficient use of facilities and infrastructure;
    - Supports the USYD in its efforts to attract and retain outstanding researchers, clinicians and administrative leaders;
    - Creates space that can accommodate both current requirements as well as potential, technology driven, changes to workplace practices;

- Create teaching and learning spaces that creates a 'home for students of the health disciplines, provides centralised information, support and access to student services, and provides inter- professional learning opportunities;

- Enhance the campus experience:
    - Prioritises pedestrians and cyclists over vehicles;
    - Maximises views of and access to campus green spaces and heritage architecture;
    - Respect and enhance the amenity of adjoining residential colleges;
    - Make provision for a diverse student and staff population, including those with disabilities, those from different cultural backgrounds and those combining work or study with caring for children;
    - Create places that allow the USYD to engage with the community;
    - Consolidate back of house and support services, with a view to future expansion around redevelopment zones; and
    - Establishes strong connections with neighbouring facilities, within the USYD campus as well as RPAH campus.

- Create flexible spaces that:
    - Enable flexibility through design using modularity, generic, vertically repeated layouts;
    - Structural grid and performance that enables repurposing; and
    - Services infrastructure that enables maximises ease of repurposing systems that cater for future stages of the Health Precinct development and enable the integration of systems that will facilitate energy efficiency improvements.

3. The Site

3.1 Site Location

The Health Precinct site is located on the western end of the University's Camperdown campus and is directly adjacent to the RPAH. The Site is neighboured by Bosch 1A, Bosch1B, and the Glasshouse. The footprint of the new structure occupies what was previously the Blackburn Building & Dangerous Goods Store; these were demolished in the first half of 2018.

Boarded to the East by Western Avenue, to the West by RPAH and John Hopkins Drive, and to the South by Cadigal Lane, the site slopes steeply down to the North where it is bordered by the University Oval Number 01.

The site is almost the lowest point on the campus and is significantly affected by the requirement to manage overland flow of stormwater. Figure 1 below illustrates the greater Health Precinct Site.

Site Overview

Figure 1: USYD Health Precinct Location

3.2 Existing Buildings

The footprint of the new Susan Wakil Health Building is bounded by 5 buildings. To the North of the site footprint is the RPAH Chapel & the Oval #1 Grandstand. To the West of the Site Footprint is the RPAH and to the South of the footprint is Bosch 1A & Bosch 1B. Under a separate contract the Blackburn Building that occupied the footprint of the new SWHB was demolished. The existing building configuration can be seen in Figure 1.

3.2.1 Dilapidation Report

Prior to the construction of the SWHB a site Dilapidation Report will be undertaken. This will be completed in 2 sections

Part 1 – Post Demolition Dilapidation Report – a review of the condition of adjoining infrastructure in comparison to prior to demolition works

Part 2 – In ground CCTV Report of existing storm water & sewer services.

3.3 Access & Egress

Maintaining access and egress to local key locations will be as follows:

a. **Access to the Construction Site –** Large Vehicles - Ross Street onto Western Avenue & then into the Main Site Compound via the main gate (rumble grid). Vehicles will then be turned around within the footprint of the site and will leave via the same gate. Where vehicles cannot exit facing forwards they will be reversed out of the site under traffic management until such time as they can drive in a forward motion.

b. **Access to the Construction Site –** Small Vehicles - Ross Street onto Western Avenue & then into the Main Site Compound via the main gate (rumble grid). Alternatively, via Carillion Road, onto Western Avenue, and into the main gate. Vehicles will then be turned around within the footprint of the site and will leave via the same gate. Where vehicles cannot exit facing forwards they will be reversed out of the site under traffic management until such time as they can drive in a forward motion.

c. **RPAH** – Access will remain unchanged

d. **RPAH Chapel** – Access will remain unchanged

e. **Grandstand** – Access will remain unchanged via the shared footpath. An additional Pedestrian Crossing will be installed to assist pedestrians crossing Western Avenue.

f. **Bosch 1A –** Pedestrian access will be limited the main entrance on Western Avenue. A partitioned walkway shall be installed providing emergency exits from Bosch 1A in the event of a fire. Partitions shall be installed to prevent thoroughfare travelling through Bosch 1A and onto Bosch 1B. The thoroughfare shall also serve as access to the Bosch 1A substation.

g. **Bosch 1B** – Pedestrian access shall be limited to a newly installed walkway running South to North between the LORAC Site Sheds and Bosch 1B. The walkway shall provide access to Bosch 1B level 2 via a DDA compliant Ramp. Partitions shall also be installed to split the existing Bosch 1A/1B patio stairs to provide access to the Bosch 1B level 1 lift.

h. **Other**: Access to the Cadigal Lane Carpark & Bulk Gas Storage shall remain unchanged.

3.4 Neighbours

As shown above in Figure 2, the site is neighboured by the following:

- **Bosch 1A** (Pedestrian Access) will be maintained via the main entrance on Western Avenue. The Site hoarding shall be installed so that in the event of a fire the building can be egressed using either the main entrance on Western Avenue, the 2no. fire doors exiting the northern elevation of the lecture theatres, or the most western set of double doors. The western door and fire doors shall be channelled onto a footpath that leads back to the western avenue. The aforementioned footpath shall provide unrestricted access to the existing substation & plantrooms within Bosch 1A. Bosch 1A (Vehicular Access) to the loading dock will be provided via the LORAC construction site. Access is to be co-ordinated via the LORAC Site Manager.

Bosch 1B (Pedestrian Access) will be via Cadigal Lane using the newly installed access ramps. The access ramps will then provide onward access to LAS & the library via either the stairs or the lifts. The site hoarding shall be installed so that pedestrian access to the LAS loading bays are maintained. Bosch 1B (Vehicular Access) shall be solely provided via Cadigal lane.

- **Sydney Uni Cricket Ground and Grandstand** – The sporting ground located to the North of the site will be accessible via the newly created shared pathway recently opened by CIS.
- **RPAH** – The RPAH is located to the west of the site and has been identified as a sensitive receiver for the project.
- **St Andrew's College and Wesley College** – The colleges located to the east and south of the site have been identified as a sensitive receiver for the project.

3.5 Existing Utilities

3.5.1 Ausgrid

An existing Ausgrid substation asset (S2497) is located at ground level in the North-West corner of the Bosch 1A building (D04). Access by foot will be provided by the Fire Escape alleyway on the North side of Bosch 1A. Access to the loading bay underneath Bosch 1A will need to be co-ordinated with LORAC as per item 3.4 above. At present, the substation supplies the following:

- Bosch 1A Building (D04)

In addition, there is a neighbouring kiosk sub to the south up the hill which serves the Bosch 1B Building (D05), and the St Andrew's oval car park.

3.5.2 Sydney Water

3.5.2.1 Water

Domestic cold water is available from the 250 mm Sydney Water main at the Oval, north of the site. There are no Sydney Water mains assets within the footprint of the proposed development. There is a Sydney Water mains asset that runs along Western Avenue to the East of the development.

3.5.2.2 Sewer

There are two existing sewer mains that run north and south of the proposed Stage 1 building and must remain. Care will be taken to protect these during construction as they are live. No allowance has been made to carry out any works, diversions, modifications, maintenance and the like in any way to the existing sewer mains apart from connecting into the existing pit to the north of the site.

3.5.2.3 Stormwater

The following storm water assets are in the vicinity of the development's building footprint:

1. An existing 1200mm reinforced concrete (RC) stormwater main owned by SSC is located to the West, adjacent to the proposed building developing, running north to south.
2. A disused 300mm diameter RC stormwater drain running through the North-West corner of the site.
3. An existing 900mm diameter RC stormwater drain running north to south through the centre of the previous Blackburn Building footprint.

3.5.3 Sydney City Council

An existing 1200mm RC stormwater main owned by SSC is located to the West, adjacent to the proposed building developing, running north to south outside the original Blackburn building footprint.

There is a disused 300mm diameter RC stormwater drain running through the North-West corner of the site and a 900mm diameter RC stormwater drain running north to south through the middle of the existing Blackburn building at approximately IL18.34m.

3.5.4 Jemena

An existing secondary main natural gas supply runs around the USYD Camperdown Campus with a 1050kPa pressure supply. There are a series of gas mains that run around the perimeter of the existing site within the campus that form part of the 100kPa pressure USYD gas main supply.

The natural gas supply to the proposed building development is available within the north elevation of the original Blackburn Building where the gas meter is situated.

3.5.5 Communications

Consistent with the results of a Dial Before You Dig (DBYD) inquiry, there are a number of existing telecommunication cables installed adjacent to the proposed work site. The USYD host a comprehensive ICT network across the campus.

The location of the communications pits has been indicated within the USYD's 'Apricot Danish' drawings.

4. Construction Methodology

4.1 Introduction

Laing O'Rourke's construction methodology for the Susan Wakil Health Building (SWHB) works will provide the University of Sydney with high-quality facilities and certainty of delivery. We will work with the University and the precinct's neighbours to ensure the Camperdown campus operates as usual and that disruptions to the University and community stakeholders – such as Royal Prince Alfred Hospital (RPAH) and Newton North Public School – are minimised.

This methodology will be supported by our comprehensive approach to stakeholder engagement, as well as Laing O'Rourke's industry-leading Digital Engineering capabilities, which allow us to build projects twice – once virtually (see Schedule 4 for more detail).Throughout the Preliminary Contractor Involvement Request for Tender (RFT) period, we have engineered a 4D digital model to interrogate our construction methodology and ensure the project's buildability. The model can also be used during delivery to effectively communicate with stakeholders, presenting information in a way more readily understood by non-technical stakeholders.

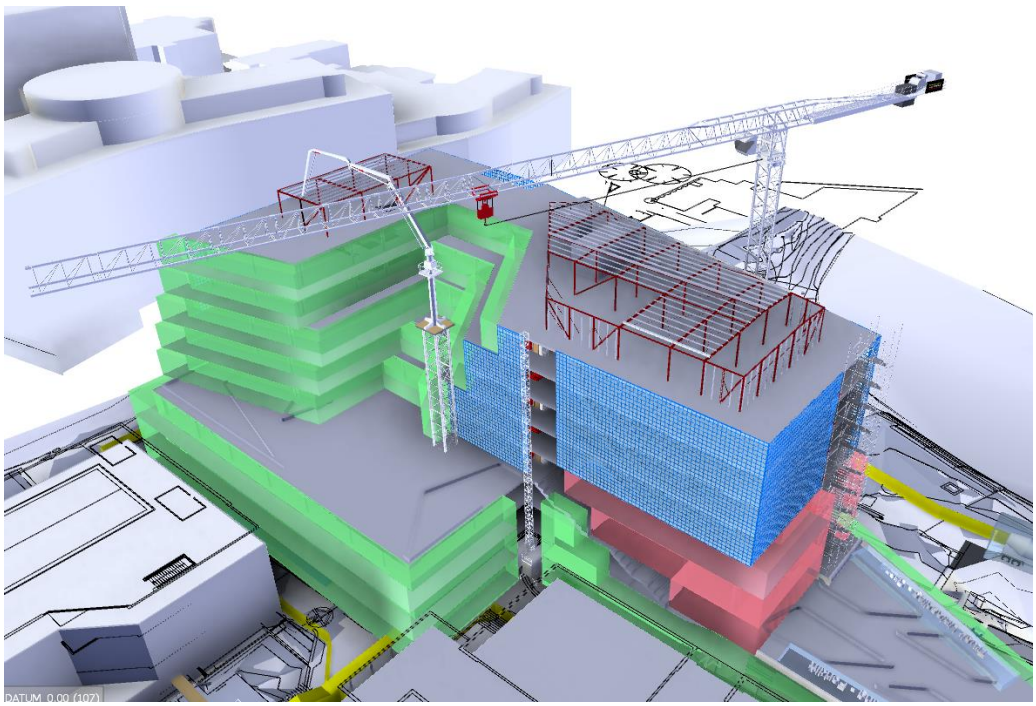

Figure 2: Snapshot of Laing O'Rourke's Digital Model

The following pages describe Laing O'Rourke's approach to site establishment and operation, civil and ground works, the superstructure, the façade, fit-out and building services, landscaping and commissioning.

4.2 Site establishment and operation

4.2.1 Current Hours of work

The on-site work hours for the project are as per Conditions C2 & C3 of SSD 7974 Development Consent

Condition C2

a) Construction, including the delivery of materials to and from the site, may only be carried out between the following hours
    a. Between 7am and 6pm, Mondays to Friday inclusive; and
    b. Between 7.30am and 3.30pm, Saturdays.
b) No work may be carried out on Sundays or Public Holidays
c) Activities may be undertaken outside of these hours:
    a. If required by the police or a public authority for the delivery of vehicles, plant, or materials; or
    b. If required in an emergency to avoid the loss of life, damage to property, or to prevent environmental harm; or
    c. Works are inaudible at the nearest sensitive receivers, or
    d. If a variation is approved in advance in writing by the planning secretary or her nominee,

d) Notification of any activities undertaken pursuant to condition C29c) must be given to affected residents before undertaking activities or as soon as is practical afterwards.

Condition C3

a) Rock breaking, rock hammering, sheet piling, pile driving, and similar activities may only be carried out between the following hours:

a. 9am to 12pm, Monday to Friday; and

b. 2pm to 5pm, Monday to Friday; and

c. 9am to 12pm, Saturday

4.2.2 Out-of-hours work

If it is necessary for works to occur outside the hours allowed by the SSDA conditions, an out-of-hours permit will be obtained from the council on each occasion. Approval will be limited where possible and will only be approved to avoid damage to property or if public safety or convenience is at risk or if it is in the best interest of the project.

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

- Termination and connection of services
- Delivery and unloading of plant – particularly wide loads where RMS approvals are required (ROLs). Examples may include the Piling Rig, Tower Crane, Large Mobile Cranes
- Delivery and unloading of permanent equipment – particularly wide loads where RMS approvals are required (ROLs). Examples may include the Climate Chamber, Substation & Components

4.2.3 Proposed changes to the hours of work

The following working hours and activities are being presented as a change to the currently approved SSDA Conditions of Consent. The proposed working hours and activities will enable the timely completion of the Project and secure its operational readiness ahead of the following teaching semester.

Construction Hours:

	Current Hours	Proposed Work Hours	Proposed delivery Hours
Mon – Fri	0700-1800	0700-2200	0700-2000
Sat	0730-1530	0700-2200	0700-1530
Sun	-	0800-2000	-

Scope to be completed:

	0700-1800	1800-2000	2000-2200
Mon – Sat	**Soft Landscaping Works*** o Soft Landscaping, placing paving, placing irrigation, planting & associated minor works **Internal Fit out Works** o Ceilings & Partitions (inc doors) o Painting, Tiling, & Floor finishes o Balustrades, Blinds, Fire Curtains, Operable Walls o Service Fit Off o Wayfinding installation **Site Logistics** o Deliveries to support above activities* o Forklift to unload materials o TC to manage above	**Internal Fit out Works** o Ceilings & Partitions (inc doors) o Painting, Tiling, & Floor finishes o Balustrades, Blinds, Fire Curtains, Operable Walls o Service Fit Off o Wayfinding installation **Site Logistics** o Deliveries to support above activities o Forklift to unload materials o TC to manage above	**Internal Fit out Works** o Ceilings & Partitions (inc doors) o Painting, Tiling, & Floor finishes o Balustrades, Blinds, Fire Curtains, Operable Walls o Service Fit Off o Wayfinding installation
	0800-1800	**1800-2000**	**2000-2200**
Sun	**Internal Fit out Works** o Ceilings & Partitions (inc doors) o Painting, Tiling, & Floor finishes o Balustrades, Blinds, Fire Curtains, Operable Walls o Service Fit Off o Wayfinding installation	**Internal Fit out Works** o Ceilings & Partitions (inc doors) o Painting, Tiling, & Floor finishes o Balustrades, Blinds, Fire Curtains, Operable Walls o Service Fit Off o Wayfinding installation	

**Soft landscaping works and deliveries to cease at 3:30pm on Saturdays, in response to Community Consultation*

A non-exhaustive list of plant, equipment, & hand tools is listed below:

Typical Plant Sound Power Levels (Taken from AS2659.1)			
Mobile Plant	**SWL (dBA)**	**Mobile Plant**	**SWL (dBA)**
13t Excavator	100	Front end Loader	113
4t Dumpy with water cart	106	General hand tools	100
7t Excavator	95	Generator	88
8t Excavator	98	Impact wrenches	105
Air drill	116	Jackhammer	121
Angle grinder	95	Lighting towers	85
Blowtorch	105	Light vehicle	102
Bobcat	104	Mechanical broom	100
Bogey (10-12T Truck)	103	Mobile Lighting tower	85
Chainsaw	111	Power tool (Electric)	102
Cherry picker	105	Rock Breaker	118
Compactor	113	Street Sweeper	107
Compressor	101	Sucker truck	107
Concrete mixer	109	Tip Truck	117
Concrete pump	108	Trench roller	108
Concrete saw/corer	117	Vehicle (light commercial)	106

Concrete truck	108	Vibratory roller	108
Concrete vibrator	103	Wacker Packer	102
Construction truck (20t)	107	Water cart	107
Delivery Truck	108	Welder	105
Drilling machine	116	Wood chipper truck	124
Dump Truck	117	Workforce vehicles	106

Mitigation Measures:

There are no additional construction impacts from the proposed out of hours works. An Acoustic Assessment has been undertaken by Resonate for the proposed scope of works, which supports the noted mitigation measures outlined below.

- There will be mitigation measures in place for external soft landscaping works, with the current site hoarding, or equivalent shielding such as noise blankets, in place to provide a level of reduction for work in relatively close to Wesley College.
- Given the location of the loading bay is in a protected area on Level 1 of the building, noise levels from any unloading are predicted to be below existing background noise levels at Wesley College, and inaudible at Royal Prince Alfred Hospital and the other residential colleges. The deliveries are limited and will cease at 20:00, Monday to Saturday.
- All internal fit out works will be undertaken with building façade panels in place, therefore resulting with works generally being inaudible.
- There will be no additional workers onsite.
- The entry and egress for deliveries will avoid the main construction gate in from of Wesley College.

4.3 Site establishment

Laing O'Rourke will set up a temporary site compound (as shown in **Figure 3)** for use during Stage 1 construction. The compound will be located between Bosch Building 1B and Bosch Building 1A on the grass area. The compound will use available services located in the area for power, waste and water. The Site Compound arrangement shall support up to 220 workers. This will be sufficient to service all onsite trades during the peak phase of constructions.

The Compound configuration shall include, Crib Rooms & kitchen facilities, changing & drying rooms, male & female toilets, showers, sheltered seating areas, water coolers, vending machines, site notice boards, and a sheltered walkway to the new structure.

The Laing O'Rourke delivery team will utilise the Bosch Building 1B as agreed with CIS for staff office accommodation for approximately 30 people.

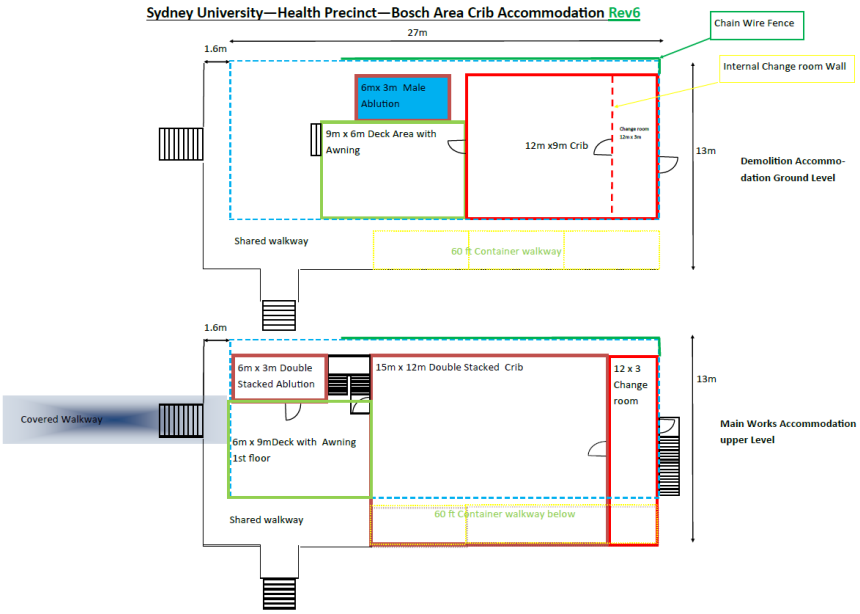

Figure 3: Site Compound

4.3.1 Project Staff: Emergency Muster Routes & Muster Points

For Project Staff & Workers the Site Emergency Muster points shall be as per the LORAC WH&S Management Plan – Appendix 8. **Refer to Figure 4: Emergency Evacuation Muster Points**

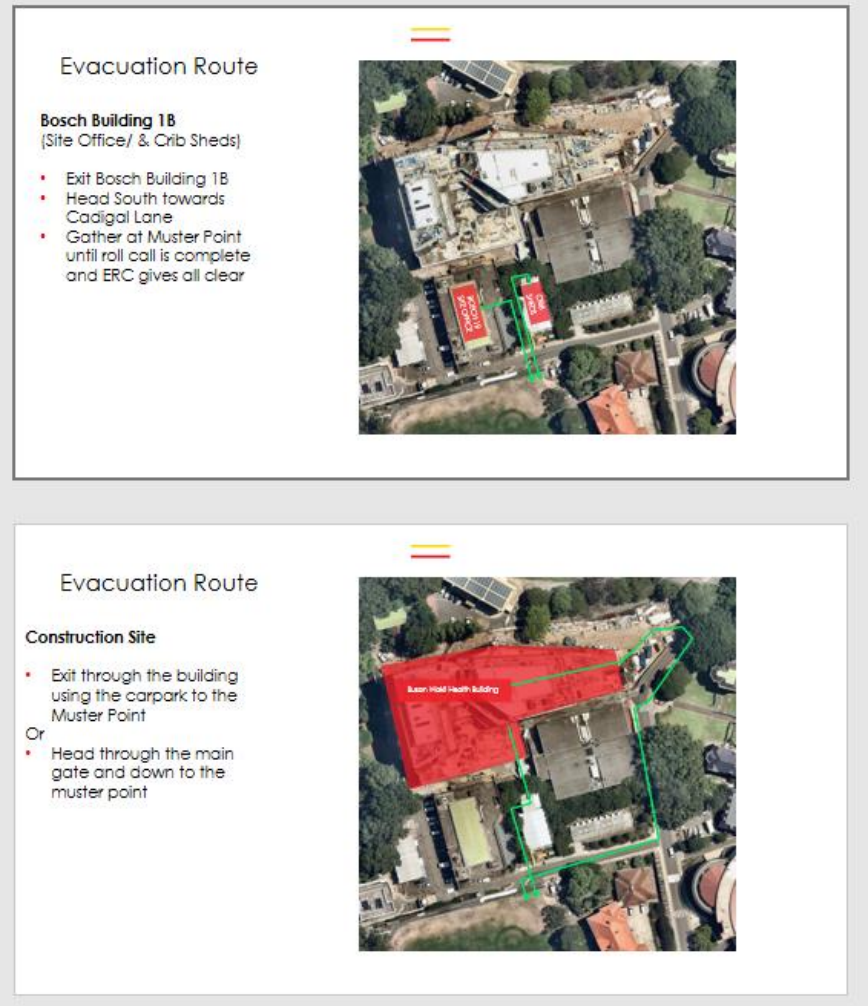

Figure 4: Emergency Evacuation Muster Points

4.3.2 Stakeholder: Emergency Muster Routes & Muster Points

For Stakeholders, the Site Emergency Muster points shall be as per **Figure 5**

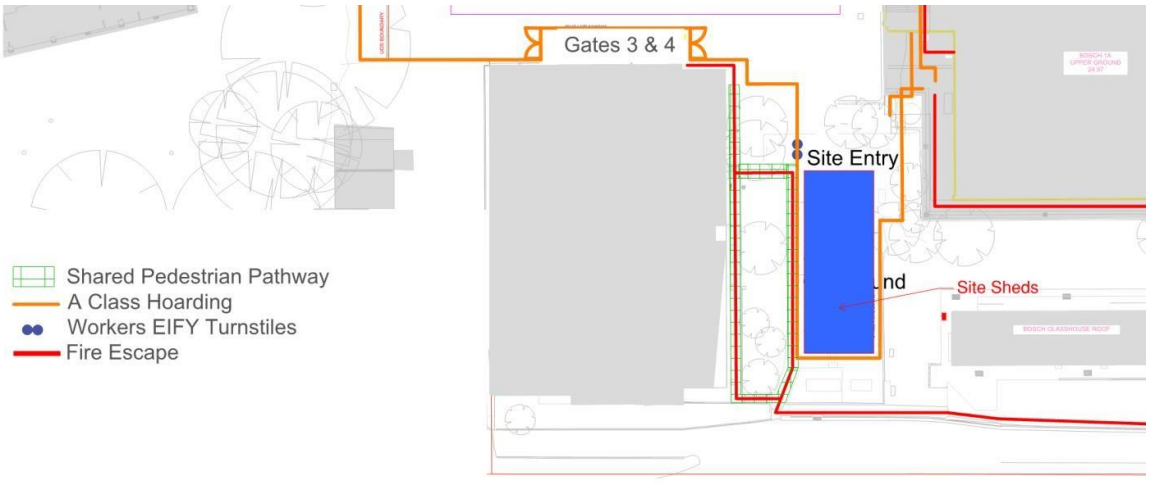

Figure 5: Bosch 1B Evacuation Route

For Bosch 1A the Site Hoarding shall be positioned so that there is no thoroughfare between Bosch 1A and 1B. The Hoarding that Handrails the Norther Elevation of Bosch 1A building shall be positioned so that in the event of a fire or another emergency occupants can exit the lecture theatres via the normal fire doors and be channelled back up to Western Avenue.

4.4 Hoardings and Gates

We will use perimeter "A" class hoarding for the site's external perimeter shown in **Figure 6** below. This will ensure the site remains secure during non-working hours and prevent unauthorised entry.

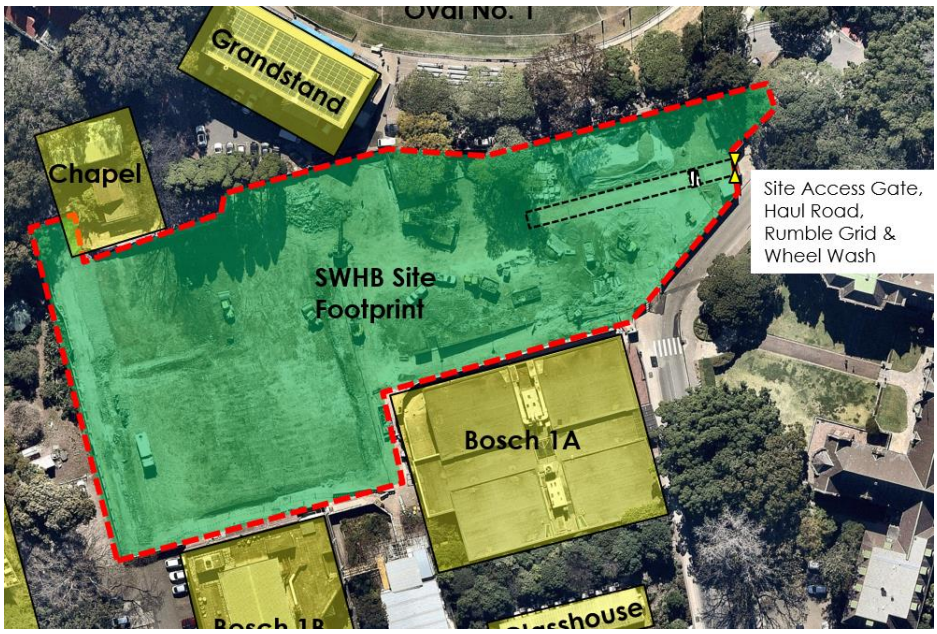

Figure 6: Site Hoarding and Vehicle Access Routes

All access to site will be via the main gate with the guard house, rumble grid, and wheel wash for vehicles only. This will serve as the main entrance / exit with all vehicles being turned around within the site footprint.

The project site will be clearly signposted, and all personnel, including visitors, will be required to enter via Cadigal Lane, and walk on a dedicated pathway between Bosch Buildings 1A and 1B. For Pedestrians access to site shall be via the Elfy Turn styles and Site Compound / Crib Sheds. Once the hoarding has been installed there shall be no thorough fare through Bosch 1A to Bosch 1B. **(Figure 7)**

Figure 7: The Eify access control system

The existing gate on the North West Corner of the Site (RPA) will remain locked at all times and has a different padlock on. This gate may be used in the future for the fit out of the Substation – but will only be used after co-ordination from neighbouring stakeholders.

4.5 Vehicle and pedestrian management

Laing O'Rourke has created a Construction Traffic Management Plan (CTMP) to define how we intend to manage project traffic that seeks to minimise impact on pedestrians, bicycles, public transport and vehicular traffic (including emergency vehicles) and to ensure the safety of all project staff, subcontractors, members of the University community and the public.

The plan has been based on the following principles:

- No construction vehicles or materials will obstruct walkways on Western Avenue, noting that the pedestrian walkway immediately along the eastern hoarding of the site boundary will need to be closed due to vehicles entering and exiting via the gates. The pedestrians will be directed across the existing pedestrian crossing to the other side of Western Avenue
- Western Avenue (which links Carillon to Parramatta Road will be kept open throughout the construction phase.
- Access will be maintained along Cadigal Lane for bulk gas storage tanks and entrance to the car park.
- Construction vehicles will enter the site from the north (via Parramatta Road) and exit the campus via the same route, minimising the impact of construction to the sensitive receivers located along Carillon Avenue.

4.6 Materials handling

We have selected one tower crane and a twin hoist to ensure efficient delivery and location of materials.

A twin builder's hoist will be installed on the southern elevation to provide access to each upper level floor as the structure commences. 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.

Different materials handling strategies will be applied to different levels of the new building:

- Level 1 will be accessed via a temporary construction ramp
- Level 1 is the main staging/delivery area so level 1 materials do not require the hoist to be loaded in
- Level 2 will be serviced with a Manitou tele handler through the front entrance of the building using the overhanging slabs
- Level 2 will be the first level serviced by the hoist and will continue up to level 8

The twin hoist will be dedicated to moving the workers during the shift start and finish times. Level 1 structure on the eastern side of the building has been designed to support 15KPa loading for the lift and construction traffic to support the staging/delivery area.

4.6.1 Twin hoist

The hoist will be a 65.32 twin car, which can be used for materials and labour. **(Figure 8)**

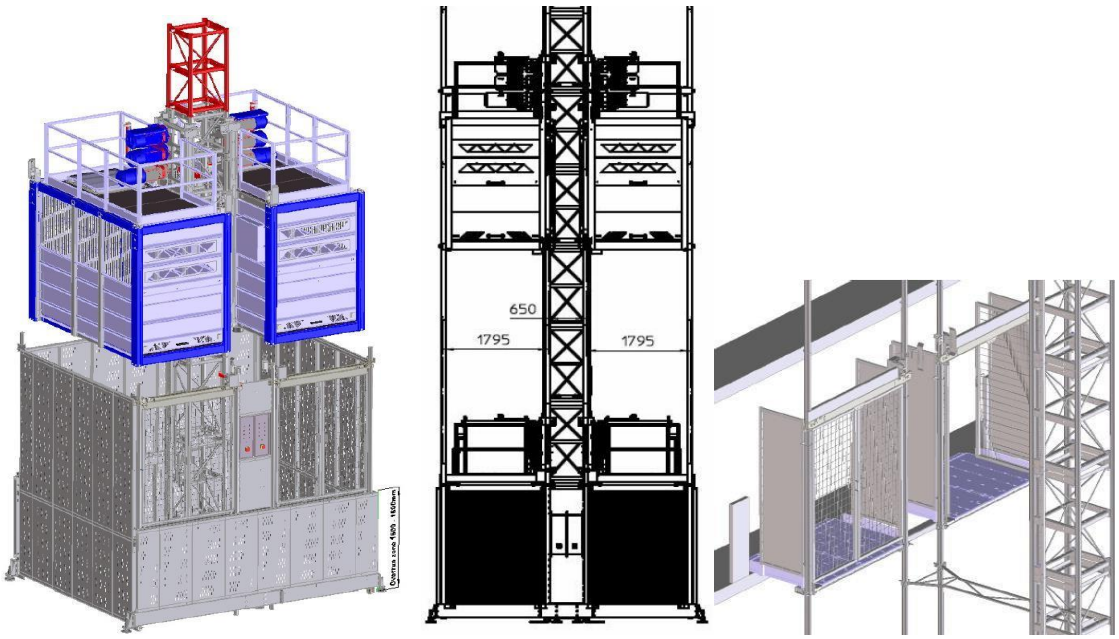

Figure 8: Alimak 65.32Lift twin goods hoist

The hoist will be a 65.32 twin car, which can be used for materials and labour.

4.6.2 Tower crane

Laing O'Rourke will use a Terex CTT 332-16 hammerhead tower crane for the SWHB works (**Figure 9**). We have selected this type of crane to ensure the hook can be used across the site. Another factor influencing our choice of crane was the adjacent helipad; a luffing jib crane would penetrate the RPAH helipad airspace. We will also supplement tower crane 01 (TC01) with mobile cranes for the larger floor plates on Levels 1, 2, 3 & 4.

Cranes will be mobilised, operated, and demobilised using task specific SWMS. The SWMS will cover the detailed methodology for erection and commissioning but shall adhere to the following sequence:

1. Construction of Tower Crane Piles & Pad
2. Delivery of Tower Crane to Site
    1. Assembling the parts of the Tower Crane
    2. Assembling the 1.6 x 1.6 x 3m mast section
    3. Assembling the upper and lower slewing
    4. Assembling the cat head (Tower Head)
    5. Assembling the counter jib
3. Erection of the Tower Crane
    1. Base Mast

2. Mast Sections
3. Installation of mono blocks (for internal climbing)
4. Slewing assembly
5. Tower Head Assembly
6. Counter Jib
7. Counter weight ballast
8. Fitting the jib
9. Tie Bars through counter jib
10. Fitting remaining counter weight ballast

4. Commissioning
   1. Prepare power supply
   2. Installation of riser cable
   3. Testing controls & motors
   4. Calibration of limit switches
   5. 3rd party load testing
   6. Handover unit

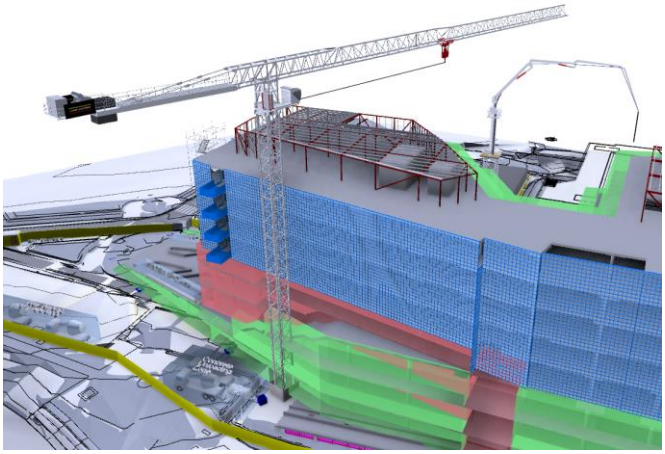

Figure 9: Temporary Works BIM Snapshot

All necessary Sydney Airport approvals have been granted for the tower crane to be erected to a height of 73AHD. **(Figure 10)**

Sydney Airport

Monday, 14 May 2018
Reg. No: 18/0349

TO: AVIPRO

Notice to Proponent Crane Operation

Dear Sir/Madam

Application for approval pursuant to *s.183 Airports Act* - Notification of decision under Reg 15A(2) of the *Airports (Protection of Airspace) Reg's 1996*

Proposed Activity: TOWER CRANE

Location: UNIVERSITY OF SYDNEY, CAMPERDOWN

Proponent: AVIPRO

Date: 01/05/2018

Sydney Airport received the above application from you.

This location lies within an area defined in schedules of the Civil Aviation (Buildings Control) Regulations which limit the height of structures to 45.72 metres above existing ground height (AEGH) without prior approval of the Civil Aviation Safety Authority.

The application sought approval for the TOWER CRANE to a height of 73.0 metres Australian Height Datum (AHD).

In my capacity as Airfield Design Manager and an authorised person of the Civil Aviation Safety Authority (CASA) under Instrument Number: CASA 229/11, in this instance, I have no objection to the operation to a maximum height of 73.0 metres AHD. Should you wish to exceed this height a new application must be submitted.

The application is approved, subject to the following conditions:

Maximum Operating Height: 73 metres AHD or 51 metres above existing ground height (AEGH)

Figure 10: Sydney Airport approval to erect tower crane

4.6.3 RPAH medical helipad

Laing O'Rourke is conscious of the proximity of the SWHB site to the medical helipad at RPAH, and we have reviewed our cranage strategy in relation to transitional surface penetration in accordance with the requirements of 14.4 of the NSW Ministry of Health Hospital Helicopter Landing Sites - HLS) Policy guidelines - Rev07d (The Guidelines).

To minimise interference of the crane with flights to and from the helipad, we have placed the crane as far to the east as possible. We have consulted with AviPro, aviation management, safety advisors, the RPAH and Sydney Airport and as such we have received approval to erect the tower crane to a height of 73 AHD.

The tower crane will be lit with Low intensity Steady Red Lights operating 24hrs / day in accordance with Part 139 of the MOS issued by CASA. In such an event that the crane needs to cease operating then then the shift Airfield Operations Supervisor shall contact them LORAC designated contact (Luke Allman) and notify him that the crane needs to cease works within 15 minutes until such time as otherwise notified.

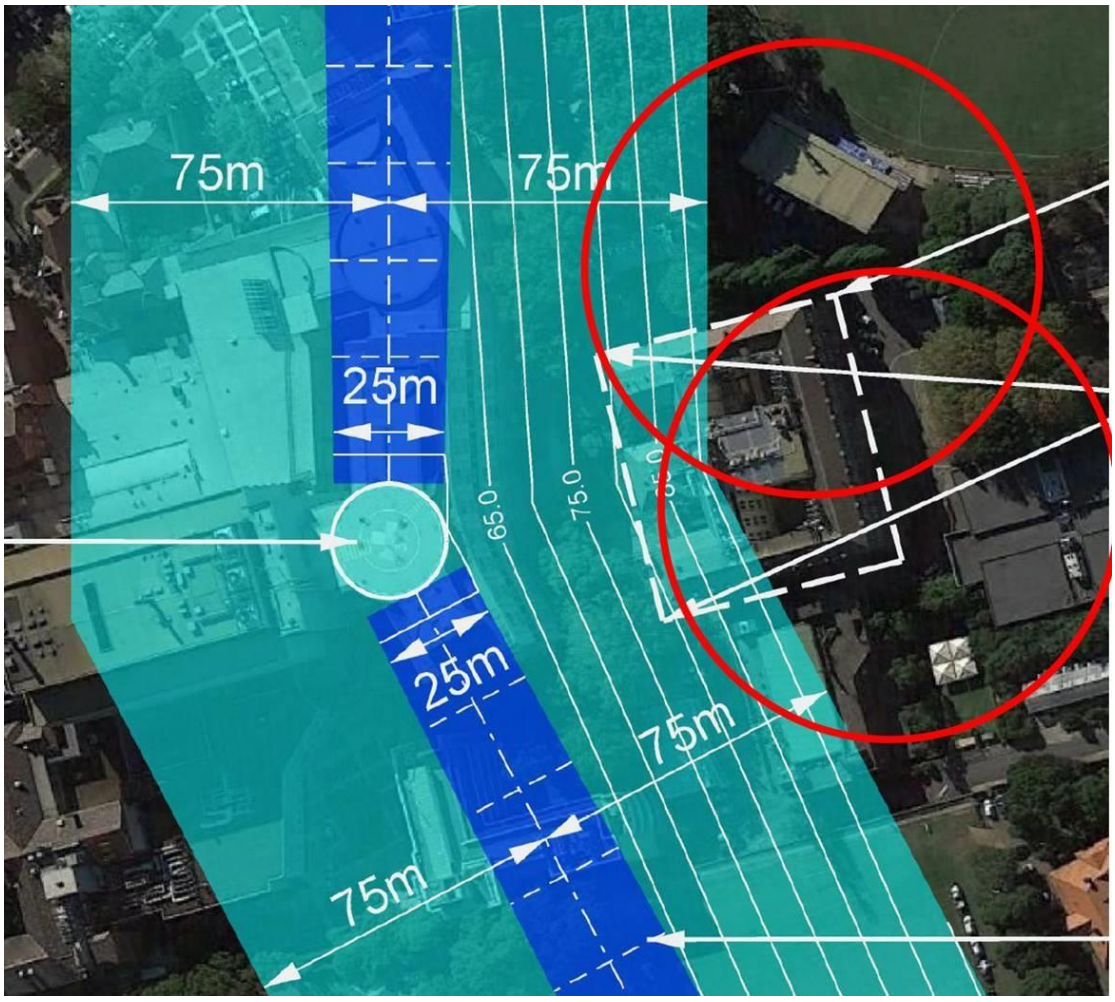

Figure 11: Minimisation of carnage impacts of the RPAH Helipad.

4.7 Unexpected Finds & Heritage

Prior to the Main Works being undertaken the site footprint was unencumbered of services and for the most part reduced to VENM site wide prior to the construction of the Piling Mat. In the event that there is an Unexpected Find (Heritage Items, Asbestos, UXD) the following process shall be followed. In the event that the UXF is Heritage in nature a Heritage Consultant shall be contacted in lieu of a Hygienist.

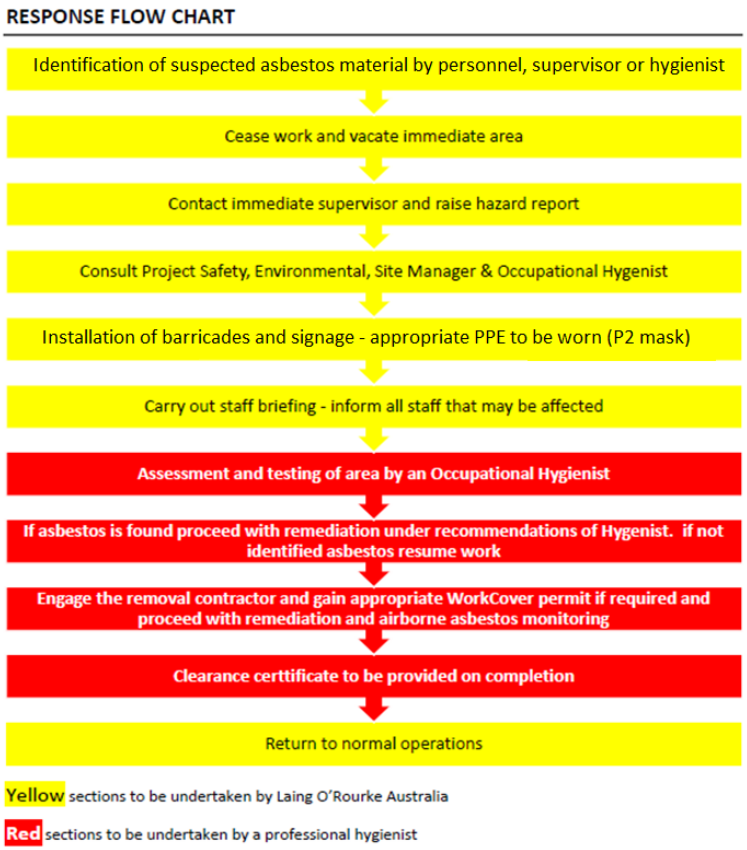

Figure 12: Unexpected Find Flow chart

5. Civil and Ground Works

This section will describe key elements of the construction using selected images from the 4D model.

5.1 Diversions and Sewers

5.1.1 High-voltage

As part of the REF works the HV feed that supplies Bosch 1A (Substation S2497) was refed along Western Avenue to unencumber the site. The Bosch 1A Substation shall be used to provide construction power to the Site Sheds.

The new HV design is currently not yet approved

5.1.2 Sewer and stormwater

There are two existing sewers that run north and south of the proposed Stage 1 building and must remain. Stage 1 will utilise the Northern Sewer, connecting to an existing pit. Care will be taken to protect these during construction as they are live.

We have allowed for the storm water diversions as noted in the PPR and Tender Addendum 7 and will generally follow the routes designated on the Tender Addendum 7 drawings as "525 Stormwater Deviation Stage 1" and "450 Stormwater Deviation Option 1". However, these will require some modification to suit the final building footprint. We note that the "450 Stormwater Deviation Option 1" appears to result in some new pipework and pits under the proposed PPR new building footprint. There is also a 900mm diameter existing storm water line and 300mm diameter stormwater running under the centre and North West corner of the existing of the Blackburn Building respectively, which are not identified for diversion or relocation.

5.2 In ground Structure

The in ground structure will comprise of a mixture of 750dia & 900dia Piles. Piles will be installed using a Continuous Flight Auger and will be unsheathed. Combinations of 50mpa & 65mpa concrete will be used depending on the expected design loads within the piles. Once complete detailed excavation will reduce the piles down the appropriate RLs prior to the construction of Pile Caps, Columns, Shear Walls, and Slabs.

The Piling Rig (Enteco E25 SD-CFA 300) will be mobilised using RMS roads under approved TCPs and ROLs. Due to the height of the Cab when on the low loader the Piling Rig will require unloading at the entrance of Western Avenue / Parramatta Road and then tracked through campus. This will be to prevent it clashing with underside of the tree canopies. Once on site the Piling Rig will then be mobilised (assembled) using a City Crane (100t). Once Operational, the Piling Rig will work independently with a 15m exclusion zone. The exception to this will be PDA / Integrity Testing onsite of Poured Piles at 7 day strengths - which will also require City Crane assistance.

5.3 Superstructure

Following completion of the ground slabs, a climbing jumpform system will be installed to safely erect the central core. Columns will typically be poured down with the deck, and the pour sequence generally runs from east to west. Please refer pour sequence drawings in Appendix 7

5.4 Formwork

We will use Kingflor steel formwork (or similar) for typical slab decking areas, as shown in **Figure 13**. This product is ideal for concrete slabs and has several advantages:

- A permanent composite formwork system, Kingflor KF57 becomes part of the slab once it has been laid – eliminating the programme time required for stripping formwork
- Wide spans enable clear access for in-floor services
- The closed rib profile is embedded into the concrete slab and results in a major reduction in fire reinforcement
- Profiles can be cut to length off site, reducing wastage and installation time, therefore reducing the overall programme.

As the health and safety of everyone involved in or impacted by our operations is our first priority, we will establish dedicated tie down areas to ensure metal sheets do not blow off the building. Screens and scaffold will also be used to prevent materials falling from heights

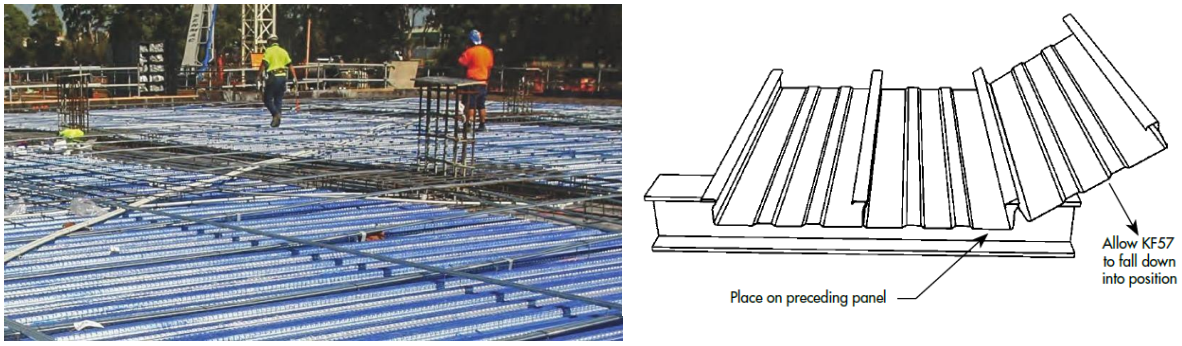

Figure 13: Kingflor-KF57 in use & Typical laying sequence of Kingflor-KF57

5.5 Pour Sequences

A detailed pour sequence can be found in Appendix 5 – Pour Sequences. Incidcatively the pour sequences / construction joints can be seen in **Figure 14**. The above images shows the approximate pour sequence. The concrete pour cycle will progress from east to west (grey, green, yellow) for each floor.

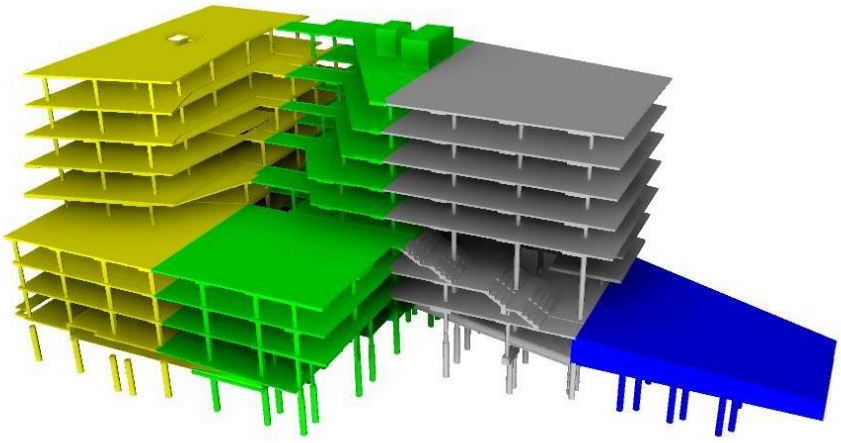

Figure 14: Indicative Construction Joints and Pour Sequence

5.5.1 Temporary Waterproofing

Until such time that the curtain wall has been installed to each elevation, 3no. Temporary de-watering points will be installed to each level. This will allow de-watering from each floor.

5.6 Concreting

5.6.1 Concrete Pours

Concrete pours for the superstructure will be 800–1,200m² in size. Three to four pours will be carried out for each of Levels 1–4. However, as the floor plate reduces in size as the building becomes taller, three pours will be required for each of Levels 5–8. During the pours, we expect a concrete truck delivery every 10 minutes.

To accommodate the pour sizes of 800–1,200m², concrete trucks will deliver on average 250m³ of concrete, with a double-fed pump to enable continuous pouring. Vehicles will access the site via Parramatta Road, as described in Section 2.6. We will minimise the distance the trucks travel by using local concrete batching plants, such as those in Alexandria operated by Holcim. This will reduce the impact carbon footprint and ensure continuity of concrete for each pour

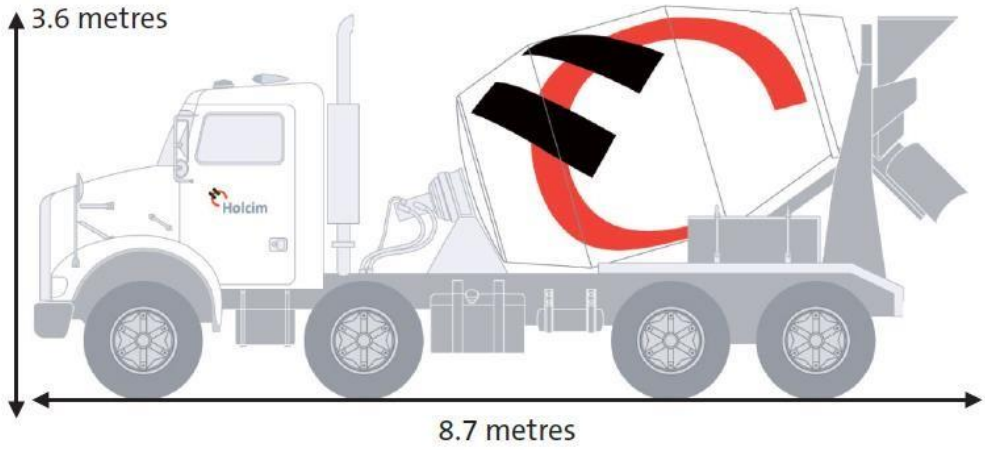

Figure 15: Typical 8 wheeler concrete agitator showing dimensions delivering up to 7.6m³ of concrete per movement

5.7 Reinforcement and Post Tensioning

The band beams will be formed using a pan system and the perimeter edge protection would be a conventional screen and scaffold gap protection.

Columns will be poured down with the deck using an Ezytube or conventional system.

We will complete the core and stairs elements progressively with the main structure, which will allow safe access and egress during construction. The lift and stair cores walls will be cast in situ given the structural properties required for the core. We have considered using structural walling similar to a Dincel Wall as a solution to build the basement walls efficiently and safely, this will be confirmed during the procurement and planning stages. The cores will be incorporated into the fire strategy for the overall site and will form the main escape route. The early installation of the

permanent risers will allow them to be used as temporary risers in the event of a fire during the construction phase.

During the superstructure phase, screens will be used for typical slab edges (non-step back areas) as edge protection. These will be set up once the first suspended slab is completed and will cover approximately four floors (18m).

For high-strutting areas, we will use a Rosset shoring system and a full captive scaffold (shoring) system (or similar).

Figure 16: Peri-Rosset shoring and formworks systems

5.8 Structural Steel

There is a small amount of Structural Steel within the project – Main Stairs, Roof Structure, & Primary Façade Steel.

This will be fabricated and finished off site then transported to site for assembly. Steel will be installed using a combination of cast ins (ferrules, dowels, and threaded bars) and post fix anchors.

6. Façade

We will use a unitised curtain walling systems for the upper floor Levels 4 to 8. Our approach has been to design manage the cladding so that it is primarily unitised system and offsite assembly in order to deliver a high-quality envelope in the most efficient and safe manner. Our unique solar shading system will also be also be standardised in design and manufacture to ensure these arrive to site as preassembled units ready for installation.

Laing O'Rourke understands the importance and significance of the external appearance of the new Health Precinct to the University of Sydney, and as such a dedicated project engineer has been allocated to the façade package and will have the following responsibilities:

- managing the design development, ensuring compliance with the Australian standards, guaranteeing the latest technologies and products are implemented to deliver the required façade quality level to achieve Building Control Regulations and Statutory Requirements

- checking and monitoring the facade design in accordance with the agreed design, procurement, manufacture and installation programme
- guarantee the necessary health and safety issues are addressed, and confirmation of the access strategy in collaboration with the subcontractor
- review and comment documents submitted by the cladding contractor such as drawings, calculations, method statements and quality control procedures
- supervise, monitor and expedite the subcontractor's manufacturing and installation process
- oversee the installation on site, including witnessing of key quality hold points and testing.

6.1 Levels 1–4

The cladding for Levels 1–4 will be designed and manufactured as stick systems. The brackets and stick systems will be installed using a free-standing mast climber or elevated work platform. Following this, the systems will be prepared for glass installation. The glass will be installed using a using a Maeda floor crane and vacuum sucker units, as shown below. When all the glass is in place, the pressure plates and cover caps will then be installed.

Figure 17: Glazed cladding being installed using a mobile crane and vacuum sucker units

6.2 Levels 5–9

Laing O'Rourke will deploy a unitised curtain wall system for the façade of Levels 4–9. Unitised curtain wall systems carry numerous benefits, including the following:

- Installation can be carried out entirely from the inside of the building, with no need for external access or reliance on tower cranes
- A large proportion of the assembly is carried out by specialised, skilled labour in factory-controlled conditions, thereby guaranteeing greater quality control
- Site installation, working at height and manual handling are reduced to the absolute minimum, optimising safety for site operatives
- Better thermal, structural and acoustic performances are achieved due to the presence of soft joints in the system
- Weather tightness can be achieved early, allowing subsequent traders (such as mechanical, electrical and plumbing and fit-out) to progress rapidly.

6.3 Installation

The panels will be fully manufactured and glazed off site before being carefully packed in accordance with the installation sequence, avoiding double handling on site. The panels will be packed in wooden shipping crates that have been standardised as much as possible to enable easy handling by a Manitou and/or crane - reducing complications in site operations. The pallets will also be shrink-wrapped in a nylon film to protect the panels against weather ingression.

The panels will be delivered to site on medium rigid flat-bed trucks. Deliveries will be planned to suit the installation programme and scheduled to minimise impacts on the overall site logistics. Typically the deliveries will take place towards the end of normal working hours, to allow the panels to be preloaded onto the decks, ready for the next day. Brackets, pressings and associated components will also be delivered, unloaded and distributed in the same manner.

Upon arrival on site, delivery vehicles will be directed into the off-loading position to the east of the site. There are 3 loading/unloading areas on site. Loading bay 1 is specifically dedicated to forklift unloading, loading bay 2 is specifically dedicated to the tower crane and loading bay 3 is designated as a staging area for concrete agitators waiting to be backed onto the concrete pump hoist located off Western Avenue.

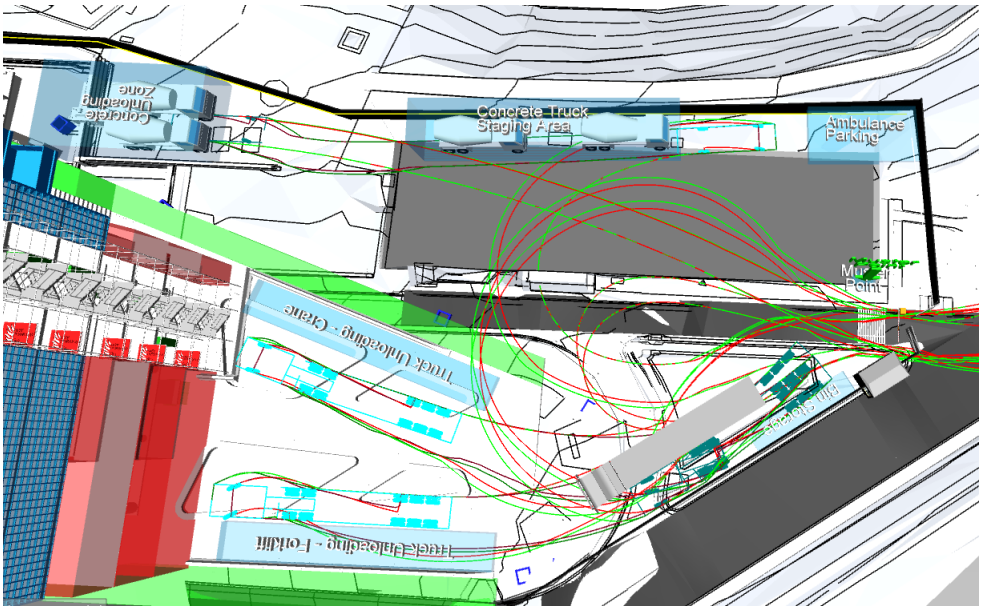

Figure 18: Manitou used for unloading cladding units

Loading decks will be used on the northern elevation, adjacent to the staging area and hoist, and rolled out as required to minimise the impacts of cladding leave down areas on the worksite. The slabs will be back-propped in these areas and the maximum loading of these decks on the superstructure will be checked by a qualified temporary works engineer.

Figure 19: Example of loading decks

The units will be distributed around the floor slab at each level evenly so as not to overload the floor slab. Once the brackets have been installed and checked, the panels will be installed using a mini crane and electric scissor lift, as shown in Figure . The units will be lifted externally, using the winch and a launch table for manoeuvrability, before being lowered into position. This process will be repeated around the perimeter of each floor slab. Once each floor is complete, the installation equipment will be raised to the next floor and the process repeated until we reach one floor below the mini-crane on Level 7.

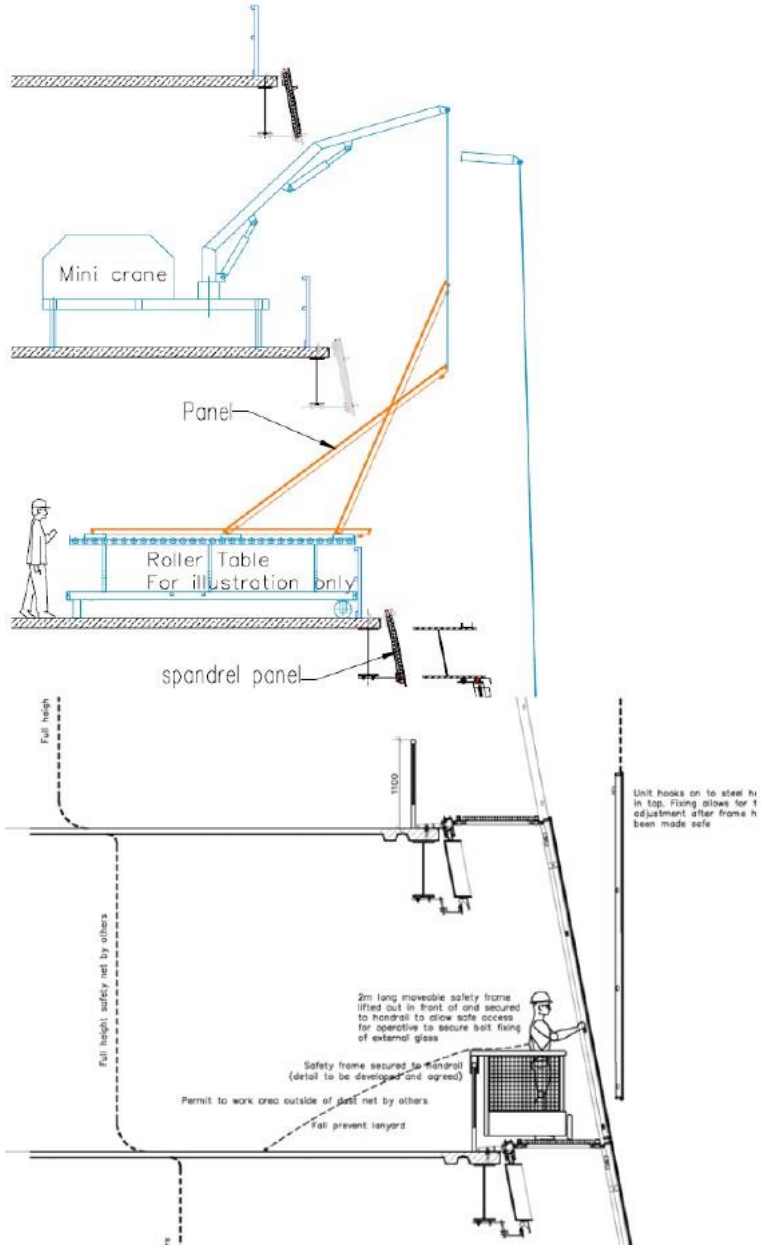

Figure 20: Installation of panels on Levels 5-9

6.4 Installation methodology

The feature solar shading will be based on the standard glazed units dimensions and installed on the table prior to launching the glass into position. The solar shading will be installed in the following sequence:

1. Set-out will be carried out using offsets to grid and datums provided by Laing O'Rourke
2. Deadload brackets, subsills and jambs will be installed by the façade subcontractor
3. Deadload brackets will be placed into the approximate location and then a string line is used using the offsets created in Step 1. The brackets will then be set to height using an automatic level. The positions and heights will then be rechecked.
4. The subsills will be installed from one side of the structure to the other, placed on estimated packing, set to location using offsets from the set-out phase. The positions and heights will then be checked. Jambs will be installed in the same manner, but vertically rather than horizontally.
5. Once the subsills and jambs have been installed, the stack joint gaskets will be laid on top of the subsills and glazing tape will be laid in the jambs for the curtain wall installation
6. Each glass unit is then installed using the floor crane
7. A polyurethane sealant bed will be applied to the slab and the curtain wall and sealed internally, ensuring the acoustic seal is checked and positioned correctly
8. Once all the glazing is complete, a trade clean will be carried out before handing over to Laing O'Rourke for a final builders clean.

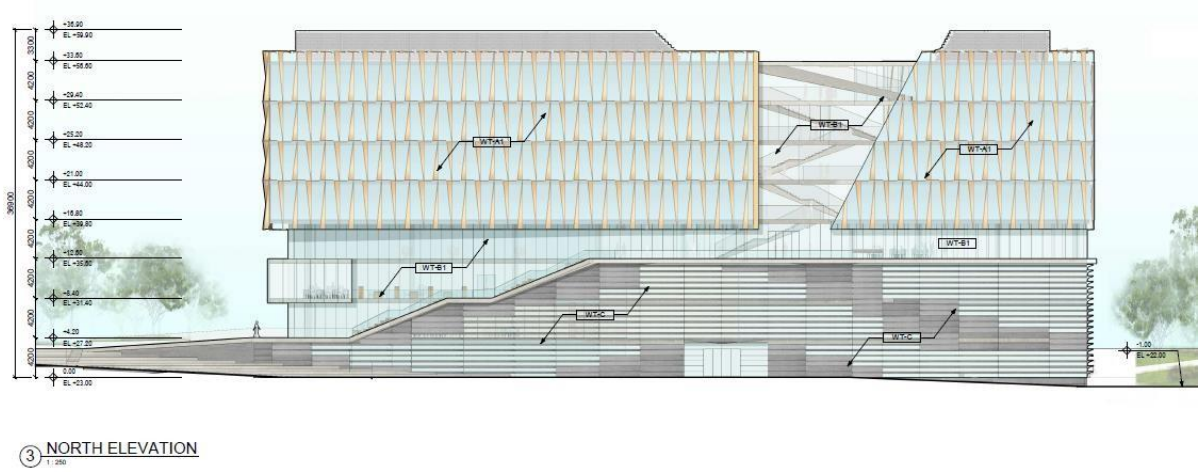

Figure 21: North Elevation Cladding

7. Fit-out and Building Services

Laing O'Rourke will apply its Design for Manufacture and Assembly (DfMA) strategy to the project where possible.

Installing packaged plant services modules where appropriate. 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 installation of building services will begin after levels are stripped and cleared. Fit off and pre commissioning will commence progressively once the façade has been completed. Areas will be checked for water tightness, penetrations and as-built tolerances will be assessed prior to handover of areas for services fit off and pre commissioning.

The building services will be installed in four distinct work fronts:

- Lower floors, Levels 1-4
- Typical floor plates, Levels 5-9
- Risers
- Substation, switch rooms and plant rooms.

A logical sequence of work will be followed in each work front following stripping: 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.

8. Landscaping

As practical completion approaches, the site delivery and staging will be reduced to make way for the new Lower Wakil Garden area and Turpentine Forest planting. The underground infrastructure will be installed and then the ground levels will be trimmed to the correct height for the surface treatment. Typically, all the hard landscaping will be installed first and then the soft landscaping joining up to the paving and hard landscaping.

This will ensure there is no machinery tracking over the soft landscaping.

Figure 22: Master plan external works

9. Site Specific Management Plans

9.1.1 WHS Management Plan

A detailed site specific Work Health and Safety Plan, which will include a health and safety risk assessment for the planned construction works shall be prepared by the Laing O'Rourke prior to the CC being issued.

The Plan shall include, but not be limited to:

- Name of key personnel responsible for site safety;
- Emergency contact details and procedures;
- Identification and description of the risks associated with each operation conducted;
- Description of actions to be taken to mitigate risks and hazards;
- Confirmation that on-site personnel are adequately trained to perform their join responsibilities; and
- Description of personal protective clothing (PPE) that will be worn by site personnel.

9.1.2 Environmental Management Plan

Prior to the commencement of works, a detailed site specific Environmental Management Plan will be prepared by the Contractor. The EMP will include a Waste Management Plan, Sediment and Erosion Plan as well as a Noise and Vibration Management Plan.

9.1.3 Waste Management Plan

Laing O'Rourke shall prepare the Waste Management Plan (WMP) prior to the commencement of the works.

9.1.4 Erosion and Sediment Control Plan

Laing O'Rourke shall prepare the Erosion and Sediment Control Plan (ESCP) prior to the commencement of the works.

9.1.5 Noise and Vibration Management Plan

Laing O'Rourke has had a preliminary SEARs Noise and Vibration Assessment report(NVAR) compiled for the ECI phase to set out the noise and vibration goals and limits for the SWHBS1 project. The NVAR forms part of the SSDA submission.

9.1.6 Previous Reports

During previous works (Demolition & REF works) several other Reports have been commissioned. These include but are not limited to

a. Preliminary Site Investigation (Geotechnical)
b. Detailed Site Investigation (Geotechnical)
c. Hazardous Materials Surveys

These reports can be found saved on the Project Network Drive – having become redundant upon completion of the REF works (September 2018).

10. Commissioning & Handover

Laing O'Rourke will prepare a Commissioning and Validation Management Plan (CVMP) that outlines the key management systems, procedures and controls that we will use to commission the Stage 1 works.

We will conduct pre-checks during installation of mechanical, electrical, fire, hydraulic, lifts, steam systems and lab gases where possible to ensure there are no defects on handover. For example, pressure testing, flushing and cleaning of pipework/ductwork and proportional balancing of air and water systems, electrical and communication installations testing before and after power and communications have been enabled, and cable/wiring, software testing to life safety, BMCS and lighting control systems must all be conducted.

It is vital that during these periods an accurate status of the progress is documented so that the "follow-on" subcontractors can proceed to finalise the ongoing installation prior to commissioning.

Laing O'Rourke and services subcontractors will follow an equipment pass/fail/readjust procedure: each item of equipment can only progress to the next stage of commissioning once a "pass" has been recorded. A

Site-commissionable systems/sign-off register will be maintained, providing a detailed description of each of the systems, quality documentation, commissioning and final sign-off procedures.

If a piece of equipment or a system/loop testing achieves the desired result, it can progress to the next stage of commissioning. However, if a piece of equipment or a system/loop fails to achieve the required result, the following process must be followed

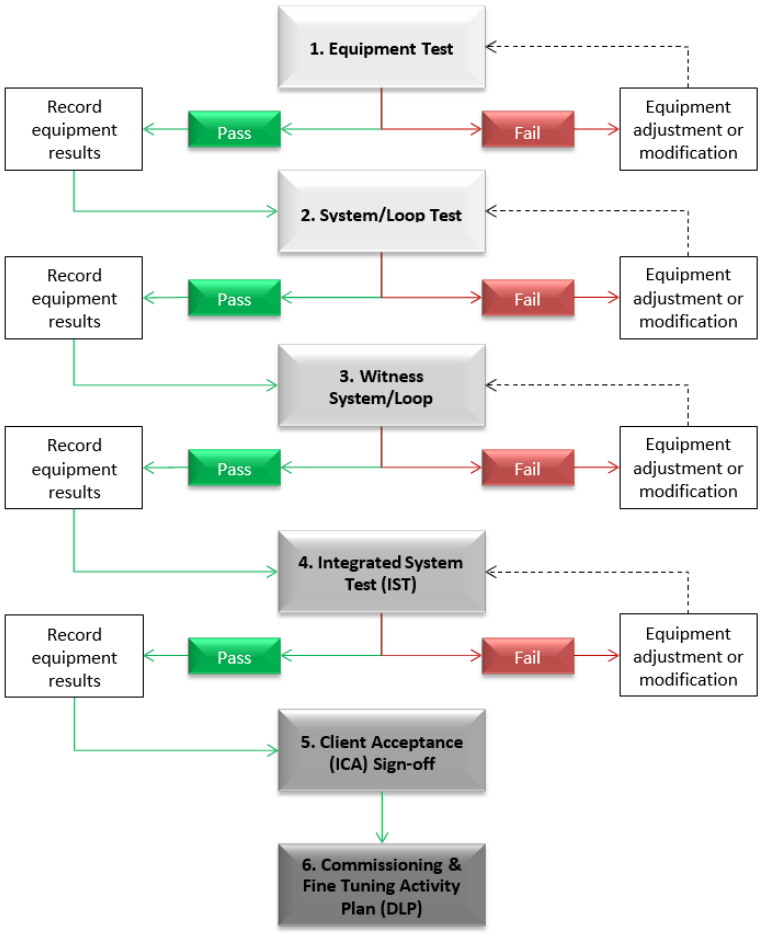

Figure 23: Pass/Fail/Readjust Process

Laing O'Rourke consultants and specialist subcontractors will hold primary responsibility for the correctness of the design and checking commissioning documentation prior to finalising the document, including:

- Verification of the correctness of subcontractor commissioning documentation, including appropriate cross referencing between documents
- Employment of appropriately qualified personnel to attend and witness testing and commissioning as required
- Upon completion of the commissioning of each section or part system, the designers will verify by witnessing, in accordance with the agreed codes, inspection and test plans or University project requirements and subcontractor figures for inclusion in the operating and maintenance manual.

The University will be invited to attend all testing and commissioning activities and decide which testing and/or commissioning they wish to attend. If the University chooses not to attend, Laing O'Rourke will continue to witness testing and commissioning to comply with the programme requirements.

Copies of all completed testing and commissioning records, signed by the respective parties will be provided to the University.

The final signed-off sheets will be included in the relevant commissioning section of the Operating and Maintenance Manual. In some cases, for nominated equipment, a Factory Acceptance Test (FAT) may also be required to be performed at the equipment vendor's premises.

The following flowchart summarises the commissioning stages of the project, illustrating how various trades are managed and documented at any given time over the course of the project. This includes the final integration of systems in the Integrated Systems Test (IST).

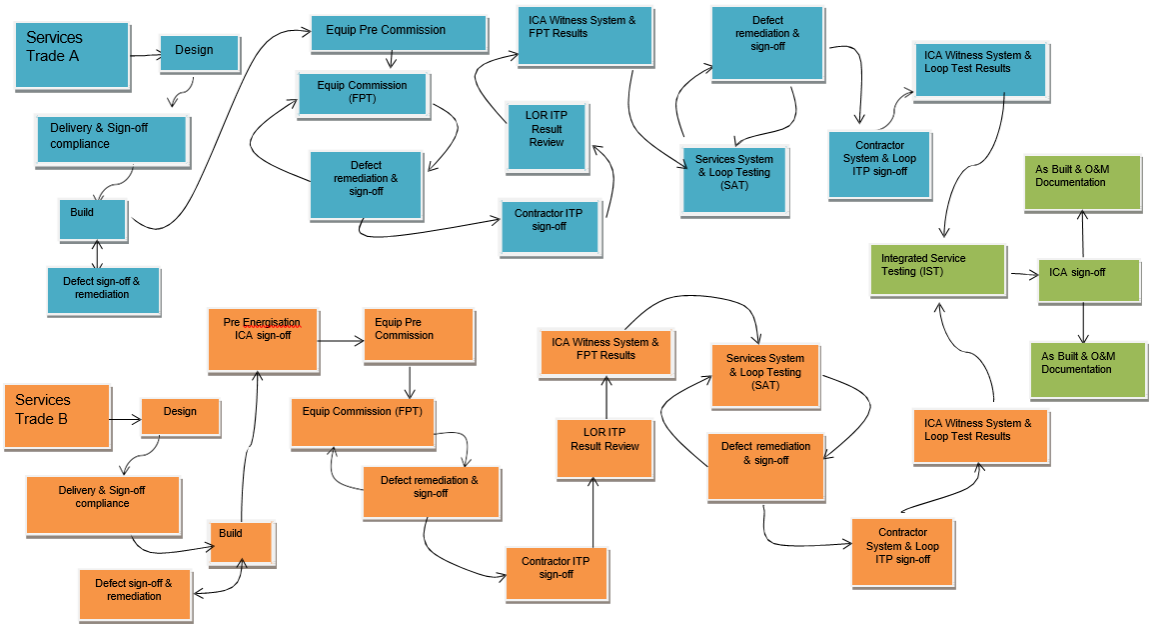

Figure 24: Commissioning stages

Appendices

Appendix 1: Project Organogram

The key management roles and responsibilities are outlined as follows