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APPENDIX AA

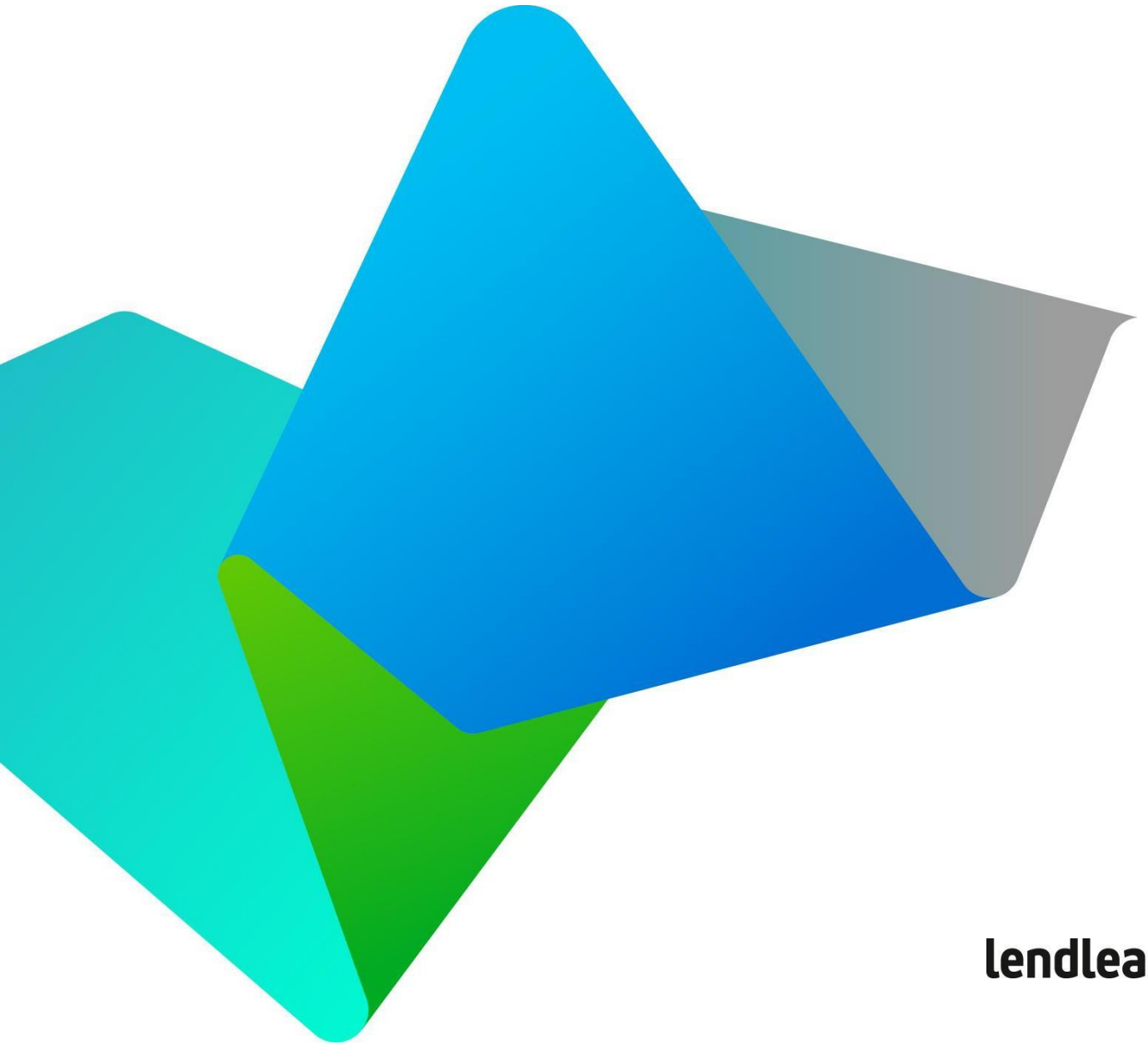
Construction Management Plan

Lendlease

SYDNEY FOOTBALL STADIUM REDEVELOPMENT

CONSTRUCTION MANAGEMENT PLAN

ISSUE:06 | DATE: 31/05/2019



lendlease

Project Name: *Sydney Football Stadium Redevelopment*

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REVISION STATUS

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Rev	Date	Details / Description	Intl	Sign	Intl	Sign	Intl	Sign
03	30/03/19	Stage 2 Works	DM		DM		DM	
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05	22/05/19	Stage 2 Works	DM		DM		DM	
06	31/05/19	Additional Changes Requested TK						

CONTENTS

1. PURPOSE

This Construction Management Plan is to demonstrate to project stakeholders that Lendlease has a detailed understanding of the construction processes and procedures required for the Sydney Football Stadium Redevelopment Project. The project plans that Lendlease operates under, which will be further developed for Stage 2 works.

2. PROJECT REQUIREMENTS

Conditions of Consent- SSD9249

Requirement	Reference
C41. The future development application must include a Construction Pedestrian and Traffic Management Plan detailing the management of construction traffic and the likely impacts on the surrounding road network during future construction works.	Refer Construction Pedestrian & Traffic Management Plan by Arup Appendix to EIS
C47. The future development application must address whether there is an impact on the timing or delivery of the Sydney Light Rail's Project's programme of works, including, but not limited to, footpaths, kerbs, gutters and road restoration works. The supporting documentation must include appropriate management and mitigation measures to avoid conflicts with the timing and delivery of the Sydney Light Rail's Project's programme of works.	Refer Construction Pedestrian & Traffic Management Plan by Arup Appendix to EIS

Mitigation Measures- SSD9249

Requirement	Reference
CP-WM1 The Construction Management Plan accompanying the Stage 2 Development Application should outline measures to avoid, minimise, reuse and recycle waste generated during the construction of the new stadium	Section 7
CP-CM1 A Construction Management Plan is to be prepared and submitted with the Stage 2 Development Application outlining the practices and strategies to be implemented during the construction phase in order to avoid, reduce and mitigate the environmental impacts of construction activities.	Section 7

SEARs

Requirement	Reference
SEAR 15- Heritage • Provide a draft Construction Heritage Management Plan that details measures to avoid impacts on surrounding heritage items. This should incorporate the recommendations of the Methodology Statement – Working Near Busby's Bore dated September 2018 submitted as part of SSD 9249.	Section 8.2
SEAR 20- Underground petroleum storage • Provide details of measures proposed to ensure the development would not compromise the integrity of the existing underground petroleum storage system, and to prevent adverse impacts on groundwater resources in the event that the integrity of the underground petroleum storage system is compromised during Stage 2 works.	Section 7.7
SEAR 28 Construction Management (including construction traffic) • Provide an assessment of potential impacts of the construction on surrounding buildings and the public domain, including noise and vibration, air quality and odour impacts, dust emissions, water quality, stormwater runoff, groundwater seepage, soil pollution and construction waste.	Noise measures are outlined at Section 5 and within the Noise and Vibration Assessment prepared by Arup and Appended to the

	EIS. Air quality is outlined at section 7.4 and within the Air Quality report at Appendix A of this CMP. Water quality, stormwater runoff is detailed in the Stormwater Management Plan appended to the EIS. Groundwater is outlined in the Groundwater Statement appended to the EIS. Waste is detailed at section 7. Soil pollution is addressed within the Detailed Site Investigation prepared by Douglas Partners and appended to the EIS.

• Identify proposed construction hours and provide details of the instances where it is expected that works will be required to be carried out outside the standard construction hours.
• Identify, quantify and classify the likely waste streams to be generated during construction and operation and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.
• Detail measures and procedures to minimise and manage the generation and off-site transmission of sediment, dust and fine particles.
• Assess construction traffic impacts in a draft Construction Traffic and Pedestrian Management Plan (CTPMP) which shall address, but not be limited to, the following:
  • an assessment of the cumulative impacts associated with other construction activities;
  • an assessment of road safety at key intersections and locations subject to heavy vehicle movements and high pedestrian activity;
  • details of the construction program detailing the anticipated construction duration and highlighting significant and milestone stages and events during the construction process; o details of anticipated peak hour and daily truck movements to and from the site;
  • details of car parking and access arrangements of construction vehicles, construction workers to and from the site, emergency vehicles and service vehicles, including measures to reduce construction worker private vehicle trips;
  • details of temporary cycling and pedestrian access arrangements during construction;
  • details of any crane locations and road closures;
  • details of construction vehicle access arrangements at all stages ofconstruction;
  • details of a consultation strategy for liaison with surrounding stakeholders;
  • details of the traffic and transport impacts during construction and how these impacts will be mitigated for any impacts to traffic, pedestrians, cyclists, parking, and public transport (including special event buses) within the Moore Park Precinct, including during adjacent events; and
  • details of vehicle size, truck routes, truck movements, hours of construction, access arrangements, parking arrangements and traffic control measures for all demolition/construction activities.
✓ Relevant Policies and Guidelines:
• Managing Urban Stormwater – Soils & Construction Volume 1 2004 (Landcom)
• Approved Methods for the Modelling and Assessment of Air Pollutants in NSW(EPA)
• Guidelines for development adjoining land and water managed by DECCW (OEH, 2013).
• Waste Classification Guidelines Parts 1 (General): (https://www.epa.nsw.gov.au/your-environment/waste/classifying-waste/waste-classificationguidelines)
• Underground Petroleum Storage Systems Best Practice Guide for Environmental Incident Prevention and Management:
• (https://www.epa.nsw.gov.au/your-environment/contaminated-land/preventing-contaminatedland/upss)
	Construction hours are included at section 6.2. Waste is addressed in section 7.
	
	Measures for dust are detailed in section 7.4 and the attached Air Quality Report appended to this CMP.
	
	Construction traffic impacts are detailed in the Construction Traffic and Pedestrian Management Plan prepared by Arup and included within the Transport Assessment appended to the EIS.
	
	Crane locations addressed in section 9.2.1
	
	Consultation is outlined at section 11.

SEAR 29 Staging • Outline the details of staging of construction works and the timing for each stage of the works (where relevant).	Section 10

3. INTRODUCTION

3.1 PURPOSE

The purpose of this Construction Management Plan (CMP) is to provide the Lendlease Site Management Team with the framework, procedures and controls to deliver the project works in a safe, efficient and environmentally responsible manner, in accordance with the project timeline and with minimal disruption to the surrounding community stakeholders.

Furthermore, the CMP will clearly define procedures that Lendlease will implement to manage the Contractor's activities for the Sydney Football Stadium Redevelopment Project in such a way as to:

- Complete the Contractor's activities in accordance with the contract.
- Clearly detail the management strategies to be implemented to address co-ordination and communication with iNSW and its stakeholders to ensure an operational facility is delivered in accordance with the contract.
- Define the processes and management protocols to be adopted by all Head Contractor personnel, subcontractors, suppliers and any other personnel required to execute part of the works and in doing so are required to access the site during performance of the Contractor's activities.

The CMP has been prepared in outline form, recognising that it will be further developed to reflect the finalised scope and delivery strategy.

3.2 APPLICATION

This outline CMP will form part of the overarching Project Management Plan (PMP) to be developed by Lendlease for the construction related activities of the Project.

Implementation of the CMP will be updated to address any conditions of consent for the project. The CMP will be further developed and progressively revised for re-issue where required to:

- Incorporate progressive work methodologies as developed and approved during the delivery.
- Incorporate any amendments required by and mutually agreed with iNSW.

4. ORGANISATION

4.1 OVERVIEW

The Lendlease team, including corporate and technical support, allocated to the Sydney Football Stadium Redevelopment Project are highly experienced and possess the suitable skills and competency levels necessary to manage the Project works.

4.2 SITE MANAGEMENT TEAM

The Site Management Team has been established progressively in a Project Office on-site to manage the delivery of the Project, namely the design, procurement, construction or remediation work and completion/handover phases. The objective of this team will be to promote collaboration, cohesiveness, enthusiasm, initiative and spirit of cooperation throughout the Project. The Site Management Team shall be directly supported by the NSW Senior Management Team.

The Site Management Team will provide the following Delivery Phase requirements:

- Project management.
- Procedural and process control.
- Tendering and procurement management.
- Construction control.
- Contract administration and cost control.
- Site management and construction supervision.
- Time control and programming.
- Quality control, monitoring and reporting.
- Environmental control, monitoring and reporting.
- Safety monitoring and reporting.
- Traffic and pedestrian management.
- Authority and approvals coordination.
- Commissioning and completion management.

5. NOISE MANAGEMENT

5.1 OVERVIEW

Lendlease will endeavour to minimise noise from construction activities. Lendlease will align its management practices to the Acoustic Assessment included as part of the submission. Lendlease's primary objective is to:

- Avoid or minimise adverse noise impacts from construction, through construction methodology and appropriate management measures;
- Minimise the generation of noise and vibration from construction activities which could affect the site personnel;
- Minimise the generation of noise and vibration from construction activities which could affect neighbouring residences, businesses and associated building structures and other community members; and
- Establish and maintain good relations with the community and neighbouring sites.

The following controls may be implemented to ensure that noise related issues are controlled, addressed and resolved in accordance with regulatory requirements:

- As the work environment changes, additional assessments may be conducted, the timing of which will be determined in consultation with the Site Management Team, Site Safety Committee and Site EHS Coordinator;
- Where personnel protection equipment is required, the work areas shall be identified by signage. The appropriate noise protection devices are to be issued to all exposed persons.

Noise management during construction activities will comply with the mitigation measures outlined in the Acoustic and Vibration Impact Assessment prepared by Arup and appended to the EIS.

5.2 TRAINING

Training will be undertaken to ensure employees are aware of:

- Any noise limits applying to works.
- Correct method of fitting ear protection muffs and plugs.
- Recognition of hearing protection areas.
- Care and maintenance of personnel protective equipment.

Ongoing training will be reviewed from time to time by the Site Safety Committee. Records of training and audiometric testing shall be retained by the Site Management Team.

Noise levels of operating plant and equipment shall be determined from Plant Induction Checklists prior to commencement of work on site.

5.3 HIERARCHY

The hierarchy of noise control to be applied is:

- Elimination - eliminate the source of the noise.
- Establishment of safety, environmental, traffic and emergency procedures.
- Substitution - substitute source of noise for quieter plant or processes.
- Design - process or equipment to be designed with appropriate control measure.
- Engineering controls - additional or modified equipment to suppress noise.
- Administrative controls - such as rotation of effected employees or out-of-hours work.
- Personnel protection - ear plugs, ear muffs, etc.
- Material selection

6. VIBRATION AND ACOUSTIC MANAGEMENT

6.1 VIBRATION AND ACOUSTIC MONITORING

Lendlease have engaged an acoustic and vibration consultant to carry out monitoring during construction activities.

Specific vibration monitoring has been installed in the shaft for Busby's Bore, Sydney Cricket Ground, Rugby League Central and Rugby AU. Monitors have been calibrated to generate real time alerts when the established vibration criteria are exceeded. Alerts will be sent to the site team and will trigger a review of works giving rise to the vibration exceedances, and require a review of the vibration criterion and demolition methodology to ensure that damage to surrounding structure does not occur.

The recommendations of the Noise and Vibration Impact Assessment in relation to noise and vibration management during construction will be adopted:

No.	Item	Detail
Construction noise and vibration		
1	Noise and vibration management plan	A Construction Noise and Vibration Management Plan shall be prepared prior to the issuing of a Construction Certificate. This will specify the actual plant to be used and will include updated estimates of the likely levels of noise and the scheduling of activities.
2	Staffing	Appointing a named member of the site staff who will act as the Responsible Person with respect to noise and vibration; Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise; Ensuring good work practices are adopted to avoid issues such as noise from dropped items, noise from communication radios is kept as low as is practicable; Avoid the use of radios or stereos outdoors; and Avoid shouting and minimise talking loudly and slamming vehicle doors.
3	Plant and equipment	Where possible stationary equipment should be located behind structures such as demountable buildings or stockpiles to maximise shielding to receivers; Consider using electric / hydraulic equipment where possible Using the smallest equipment as is practical All plant and equipment used on site must be: • maintained in a proper and efficient condition; and • operated in a proper and efficient manner. Turn off all vehicles, plant and equipment when not in use Ensuring that the Responsible Person checks the conditions of the powered equipment used on site daily to ensure plant is properly maintained and that noise is kept as low as practicable.
4	Scheduling	Ensure that the Responsible Person controls the working hours on site to ensure that work is only done during the acceptable periods (7am to 6pm on weekdays and 8am to 1pm on Saturdays. No work on Sundays or public holidays)
5	Work site training	'Toolbox talks' will be held at regular intervals with the contractor workers, including discussion of noise and vibration mitigation, monitoring and assessment. These topics will also be covered under induction processes. Operate two way radios at the minimum effective volume, and avoid shouting or whistling at the site. Identification of all reasonable and feasible noise mitigation methods will be conducted by the Responsible Person on a daily basis during noisy works. The Responsible Person will have the authority to modify work practices in response to complaints, where this is considered appropriate.

No.	Item	Detail
6	Scheduling	High noise activities will be programmed to occur during the daytime hours wherever possible and will be scheduled with due consideration to the nearest sensitive receivers. For approved out-of-hours work (refer Section 3.4.1), noisy activities should be scheduled early in the night to minimise the impact on adjacent residents. Limit number of consecutive nights receivers are impacted
7	Community liaison	Ensuring that the Responsible Person keeps the local community advised on expected activities and coordinates scheduling and locations of noisy works around any critical user events where practicable. This shall include face to face meetings with nearby receivers if requested and a letter box drop, and shall include close liaison with neighbours during construction, including Fox Studios, UTS, NRL and Rugby Australia; and Maintaining appropriate records of complaints to include timing, reported issues, actions taken and measures to be included for on-going works. The complaints log will need to be filed with the Responsible Person.
8	Reversing alarms	The use of audible movement alarms of a type that would minimise noise impacts on surrounding noise sensitive receivers must be implemented. Where practicable, broadband, non-tonal reversing alarms should be utilised on site equipment. Ensure that the difference in volume between the reversing warning devices and the base machine noise level (at maximum governed speed under no load at any given test location) is minimised (in accordance with International Standard ISO9533:1989), and ensure that warning devices are no more than 5 dB above the Australian Standard level;
9	Material handling	Avoid dropping equipment/materials from a height or into trucks. Where practicable, use sound dampening material to cover the surfaces on to which any materials must be dropped.
10	Equipment Location	Site noisy equipment away from noise-sensitive areas. Plant known to emit noise strongly in one direction is to be orientated so that the noise is directed away from noise-sensitive areas; Locate site access roads and site compounds as far away as possible from noise sensitive receptors; Plan truck movements to avoid residential streets where possible;
11	Construction vibration	Adherence to minimum working distances presented in Table 23, and Methodology Statement for Working Near Busby's Bore [9].

6.2 WORKING HOURS

Lendlease will ensure strict compliance with approved working hours during the Project works. Any requirement for works outside of the approved hours will be sought through the relevant authorities in conjunction with communication protocols for stakeholders and the community.

Proposed working hours are as follows:

Day	Proposed construction hours
Monday to Friday	7.00 am to 6:00 pm
Saturdays	8.00 am to 1:00 pm
Sundays or Public Holidays	No construction

7. WASTE MANAGEMENT

The majority of waste generated due to construction activities occurred during the Stage 1 demolition works. The main source of waste during the Stage 2 construction works is through bulk excavation of soil. Approximately 86,000m3 of soil is expected to be removed from site during the Stage 2 construction works. For further information regarding bulk excavated waste refer to the Detailed Site Investigation prepared by Douglas Partners and appended to the EIS.

7.1 WASTE TYPES AND CLASSIFICATIONS

The Project will generate wastes of varying categories. Certain wastes have the potential to present safety concerns to human health or harm to the environment. All wastes will be identified prior to disposal.

7.2 GUIDELINES FOR WASTE MANAGEMENT

The person responsible for each waste type will locate bins in a convenient place. All endeavours will be made so that recycling is made as easy as possible for workers to participate in and contribute to recycling targets.

Persons responsible for ordering materials will, where practical and appropriate:

- Order materials in the appropriate quantities;
- Give a high priority to using non-hazardous products where practical;
- Give a high priority to the use of products made with recycled materials; and
- Waste should be separated at its source by the employees and subcontractors where practical and safe to do so.

All works will be planned to minimise construction waste and contamination of the site and surroundings, encourage recycling and practise resource conservation. Lendlease will not discharge or dump any deleterious material into the drainage system, or onto any roads, hard standing or unmade area on or in the vicinity of the Site. Lendlease will separate waste into appropriate bins and arrange collections to maximise recycling of waste. No burning of waste or rubbish will be allowed.

7.3 MAINTENANCE, CLEANING AND WASTE REMOVAL

All construction personnel will be responsible for maintaining clean and tidy work sites. Subcontractors will be responsible for maintaining cleanliness of each specific work face.

Removal of waste from the work faces shall be via standard proprietary ‘wheelie’ bins. Receptacles will be located conveniently and near work faces. Subcontractors will collect and dispose of waste in bins on a daily basis. At the end of each day or other such regular frequency, bins will be collected and emptied into central industrial waste bins for removal and disposal off-site by the waste management contractor.

Site specific waste management controls, monitoring, reporting and performance measures have been identified and include but are not limited to:

- The establishment of designed waste handling areas;
- The correct storage and handling of waste materials including liquids;
- On and off-site separation of wastes for reuse and recycling;
- Identifying external opportunities for reuse to achieve mutually beneficial outcomes;
- Appropriate disposal and verification of all waste leaving site; and
- Monthly reporting of waste and recycling data.

7.4 DUST CONTROL

Dust shall be suppressed wherever possible to ensure air quality, and to avoid health and safety issues and nuisance to occupants. All waste to be removed from Site shall be adequately covered by suitable means to minimise air-borne dust.

Dust control measures are addressed in further detail in the Air Quality Plan appended to this CMP.

7.5 WORKS ON EXISTING SERVICES

The following shall be considered by the Site Management Team prior to carrying out works on engineering services:

- Carry out all work on services, including inactive services, in accordance with the requirements of the relevant authorities;
- Protect and maintain all existing active services on or adjacent to the site;
- Relocate services if required and provide temporary services during relocation as necessary; and
- Mitigate against disruption of continuous supply of services during construction

7.6 DAMAGE TO EXISTING SERVICES

In the event of damage or disruption to any services on or adjacent to the Site, the Site Management Team shall:

- Notify the Relevant Authorities;
- Cease works should the damage pose a threat to persons or property;
- Cease work in the vicinity and clear the area of people, including people in Adjacent Properties and public land as appropriate and notify the relevant emergency services;
- Not recommence works until approval has been obtained from the Relevant Authorities; and
- Provide assistance as required in connection with any such incident, involving repair, diversion, relocation, cutting, sealing or disconnection or make safe as required by the relevant authority and to maintain supply.

7.7 UNDERGROUND PETROLEUM STORAGE

The existing underground petroleum tanks have been considered in the design of the new works. As such excavation works will be limited and carefully monitored in the immediate area around the tanks to ensure the development will not compromise the integrity of the existing underground petroleum storage system. The area surrounding the underground storage tanks will be physically marked on site and all workers will be made aware of the existence of the tanks and specific working procedures within this area during site inductions and tool box talks. All workers working in the vicinity of the tanks will be made aware of the recommendations within *Underground Petroleum Storage Systems Best Practice Guide for Environmental Incident Prevention and Management* (EPA), The site Environmental Manager will be responsible for ensuring this is implemented.

Contamination testing has been carried out in localised areas, by the Douglas Partners, around the known location of the tanks to assess any extent of contamination. The results of this testing are contained within the Detailed Site Investigation (Contamination) prepared by Douglas Partners which is appended to the EIS.

8. SITE ESTABLISHMENT

Lendlease will continue to establish the site as the Project transitions through Stage 1 to Stage 2 works. Resources have been allocated to manage this process ensuring that construction activities can continue as scheduled the site establishment process will cover the following key activities:

- Compound fencing;
- Secure site access for deliveries;
- Statutory signage;
- Temporary site office and amenities
- Temporary access roads;
- Temporary services connections to existing infrastructure;

- Environmental controls;
- Waste management; and
- Appropriate drainage of the work areas and ensuring compliance to the Blue Book

8.1 POTENTIAL IMPACTS OF CONSTRUCTION

An assessment has been carried out on the potential impacts of the construction on the surrounding buildings and public domain. The following items have been identified and addressed:

- Impacts to the surrounding road network – A photographic dilapidation report has been conducted prior to construction on the surrounding roads and footpaths to capture the existing state of the roads prior to the impacts of construction traffic. Further to this specific haulage routes into and from site have been established and agreed to contain construction related traffic to the specific routes only.
- To ensure ongoing compliance and to ensure appropriate measures are in place Lendlease will engage independent consultants to review the mitigation measures and monitoring in place on site

8.2 HERITAGE

A final Construction Heritage Management Plan will be prepared that details measures to avoid impacts on surrounding heritage items. The following items have been identified and addressed:

- Busby's Bore – In consultation with the relevant authority a design solution will be finalised that satisfies the Authorities requirements for future access and prevents damage to the existing asset during the construction process

For further information please refer to the draft Heritage Management Plan prepared by Curio Projects.

8.3 PROJECT PERIMETER FENCING

A perimeter fence has been established for the Stage 1 demolition works. This fence will remain during the Stage 2 construction works.

The site will be established in the following stages for the Stage 2 construction works:

- Civil and Piling Works:
  - Limited site access and egress locations
- Stadium Structure, Facade & Roofing
  - To facilitate an efficient materials handling strategy multiple access and egress locations will be established.
- Stadium Finishes
  - Access and egress locations will be progressively shut down to allow external works and finishes to be completed

Figures 8.1.1 – 8.1.3 below provide an overview of the stages for Site Establishment.

Site Access During Civil and Piling Works

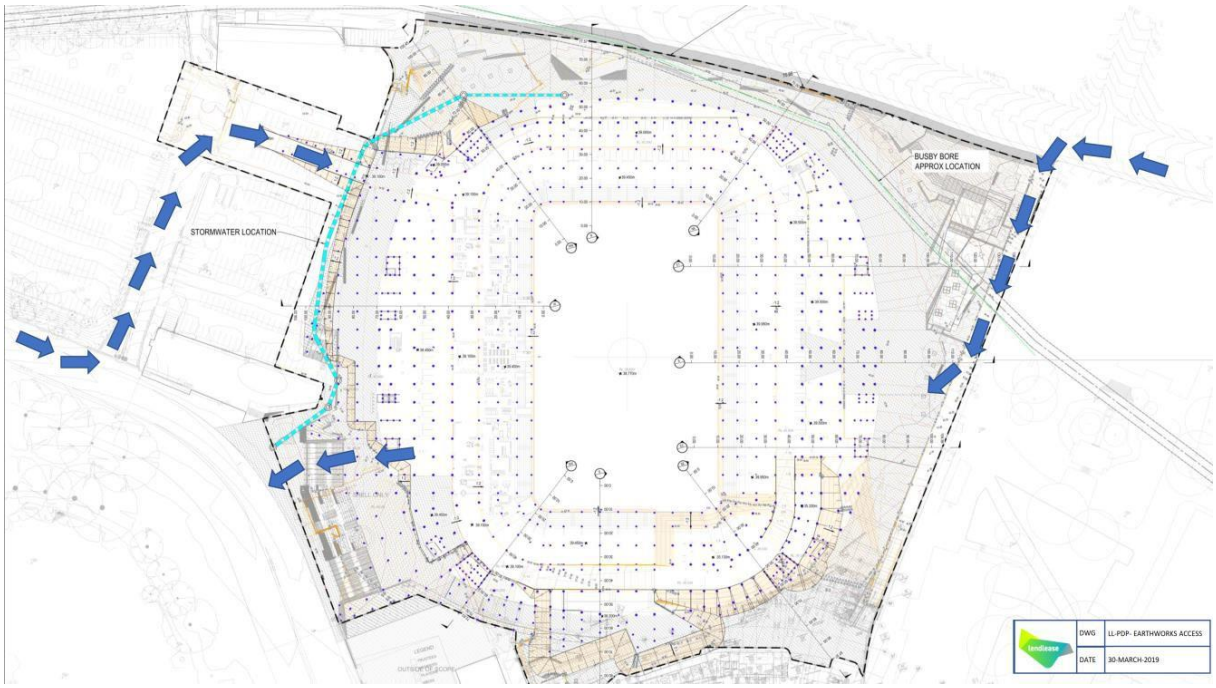


Figure 8.1.1 Stage Access for Civil and Piling Works

- The access and egress locations will be to access down the existing Paddington Lane from Moore Park road and from Driver Avenue on the West. At times Stormwater and Piling Works may require access to be diverted between the two locations nominated on Driver Avenue.

Site Establishment – Stadium Structure, Façade & Roofing

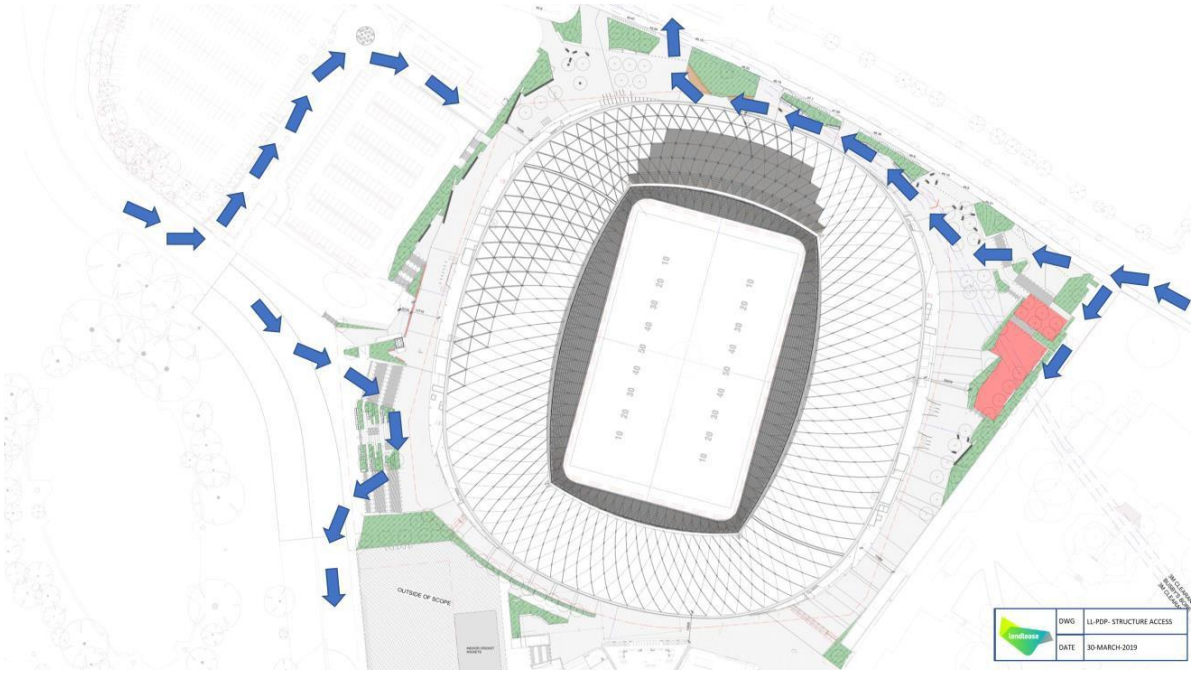


Figure 8.1.2 Stage 1b Stadium Structure, Façade and Roofing

- As the construction works progress access and egress points will increase to enable materials handling to service multiple work fronts. The project will use existing Gates and Council laybacks on Moore park Road.

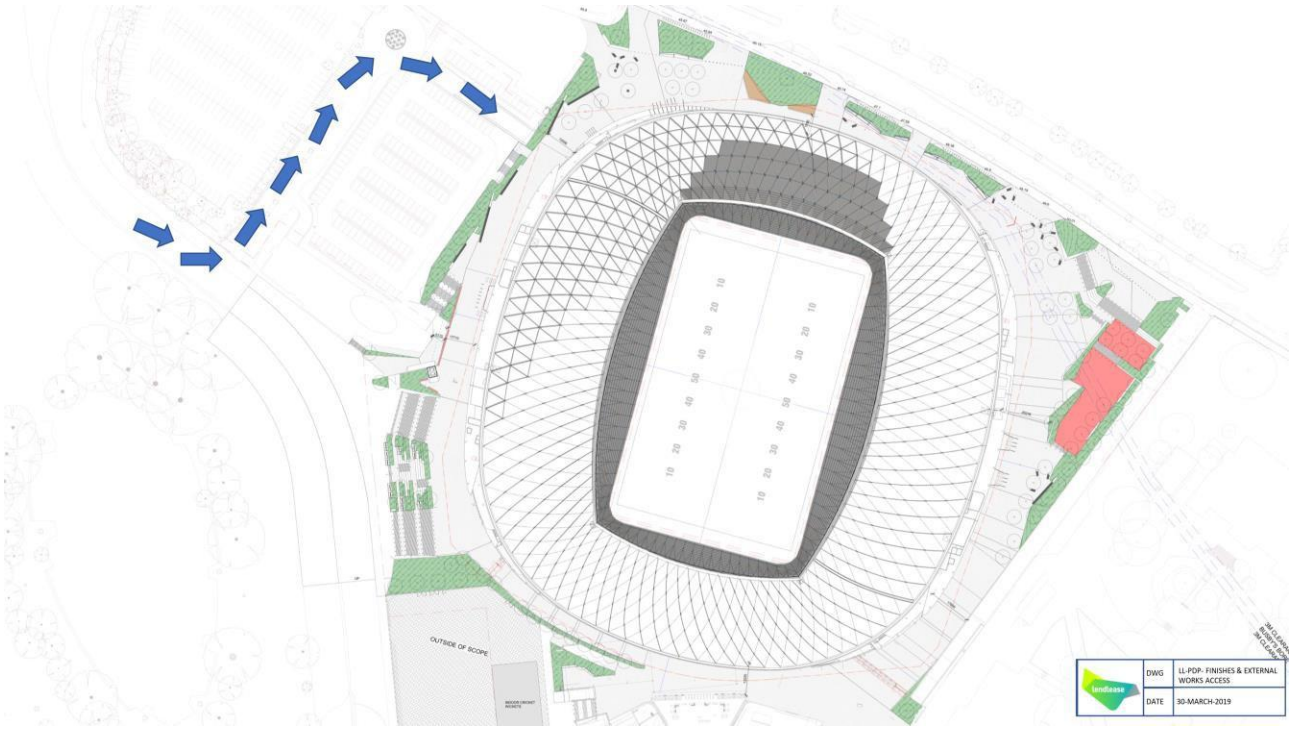


Figure 8.1.3 Stage 1c Finishes and External Works

- As external works commence access and egress will be limited to the permanent location.

8.4 CONSTRUCTION WORKER RESOURCE PROTECTION

During planning an estimate of the construction workforce over the duration of the construction programme has been developed. Peak resources on site will occur towards the end of the structure works where there will be numerous work fronts where structural trades, steel trades, finishes and façade trades will all be on site at once.

The forecast is for a peak of 600 workers on site in 2021.

8.5 PROJECT SITE OFFICE AND CONSTRUCTION WORKER AMENITIES

The project office and construction worker amenities will be contained within the Site Boundary for the duration of the project and will be established in a staged process to minimise relocations;

- The Project Office and Construction Worker Amenities will be located within MP1 West as outlined in figure 8.5.1.

Project Office and Worker Accommodation Establishment – Stage 2

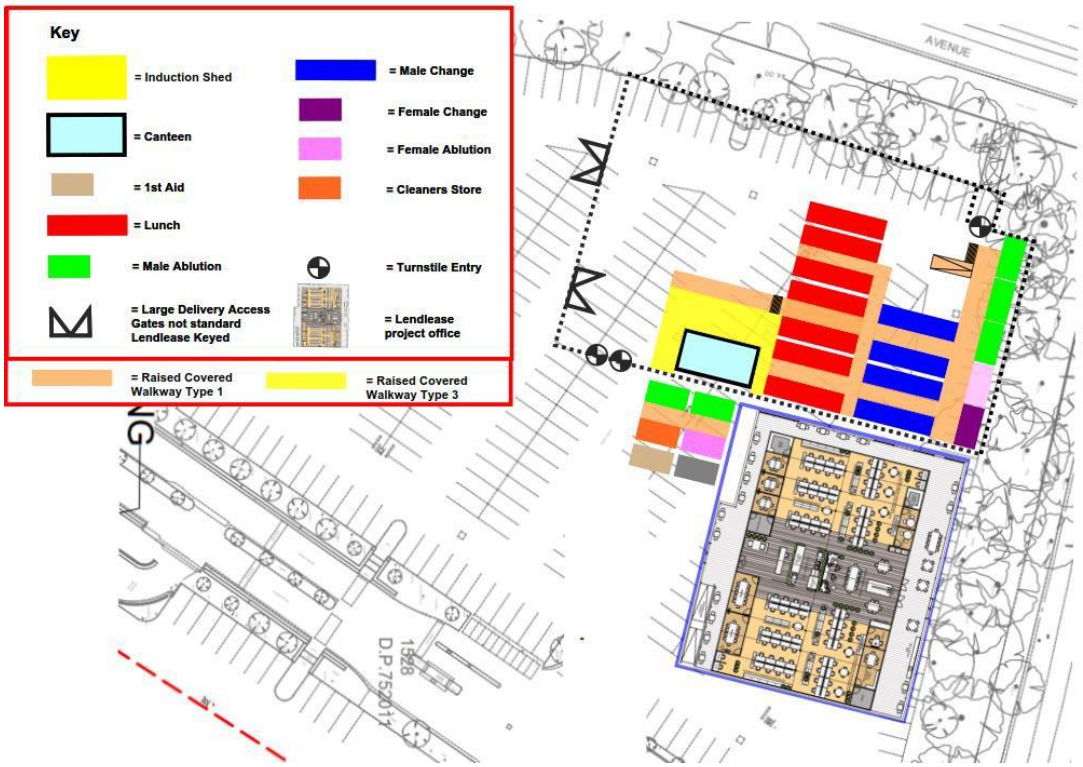


Figure 8.5.1 Stage 2 Office and Accommodation

Stage 2 Site Office and Worker Accommodation will be established and will become the permanent site office and accommodation compound for the remaining duration of the works.

The initial set up will have capacity for 150 workers and will gradually be added to as workforce increases to provide capacity for up to 600 workers (stages 2b & 2c in Figure 10.3.2 outline these additions).

8.6 SITE ACCESS – VEHICLES

An overview of the access and egress points for vehicles (being deliveries, plant & equipment, etc.) entering and exiting site are shown below in Figures 8.6.1. Vehicle swept paths for these entry / egress locations, demonstrating their suitability are included as 8.6.2 – 8.6.4. The nominated locations allow for continued operation of existing adjacent premises, existing road infrastructure and pedestrian movements.

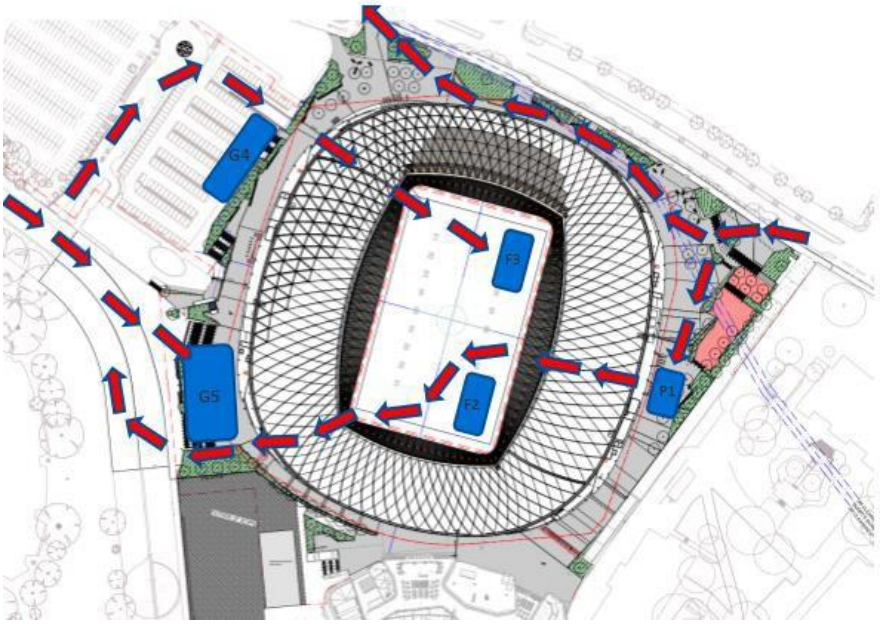


Figure 8.6.1 Haulage Routes Overview

As works progress access created will allow articulated vehicles to access and turn around on the existing playing field as shown in figure 8.6.1 above.

Trucks will be able to return to the MP1 carpark area as required or exit via a Gate located further south on Driver Avenue adjacent Rugby League Central building.

During stadium structure construction, a materials handling location will be established at the North-East, external to the new stadium but within the site boundary. The extent of this entry and loading zone are shown in Figure 8.6.2 below.

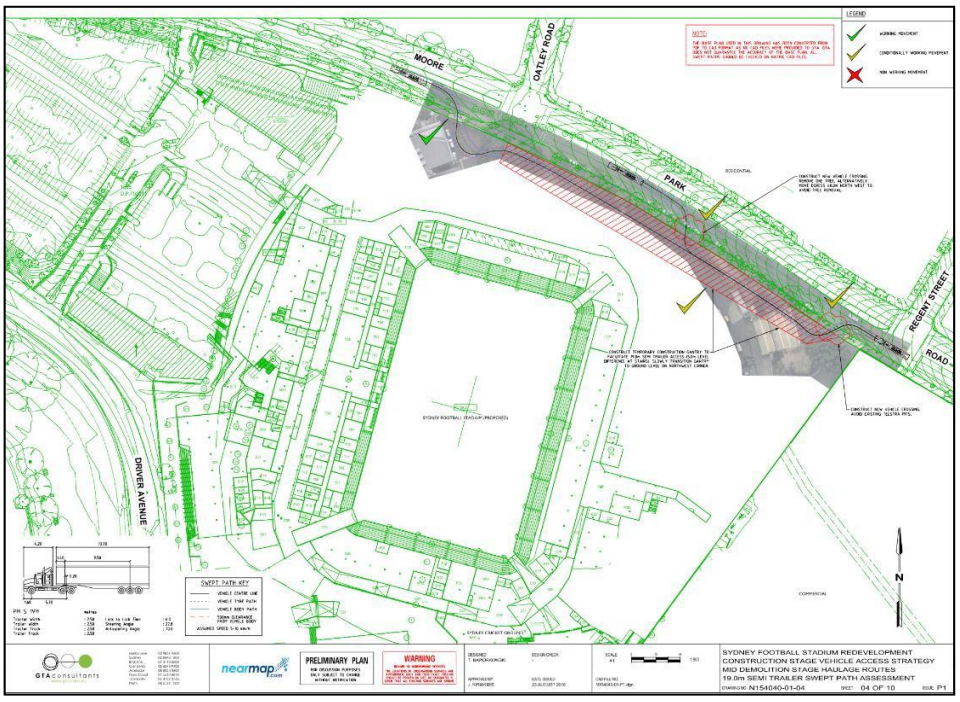
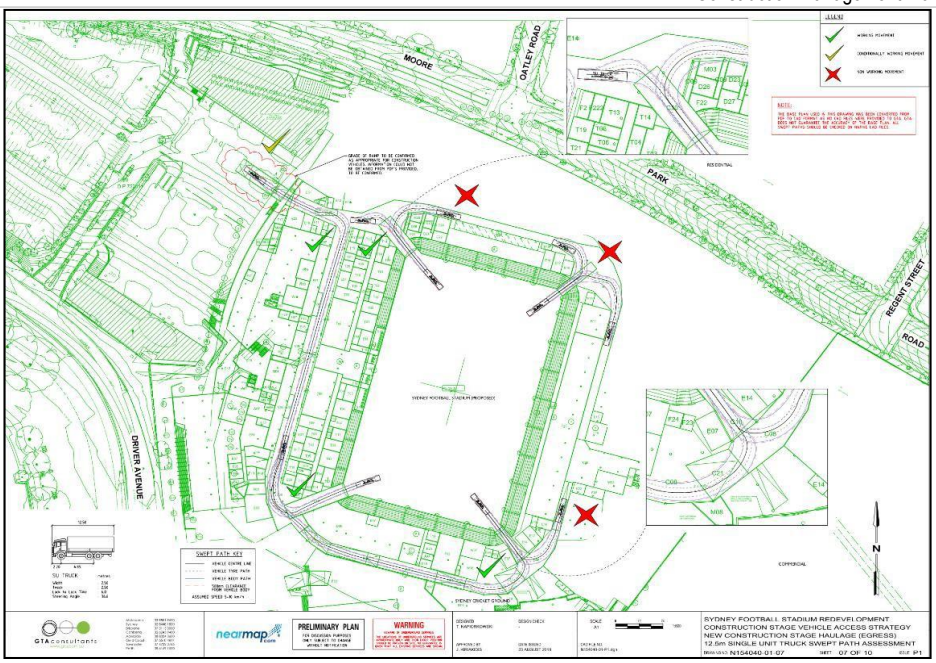


Figure 8.6.2 Stage 3 Structure Construction

During the stadium structure finalisation and roof construction, access into the pitch area will be via the permanent



tunnel at the North-West corner. Vehicles will enter and exit via Driver Avenue and continue through the Eastern MP1 Carpark compound area as shown in figure 8.6.3 below.

A turning circle will be established within the pitch to allow vehicles to turn around once unloaded before exiting through the same tunnel.

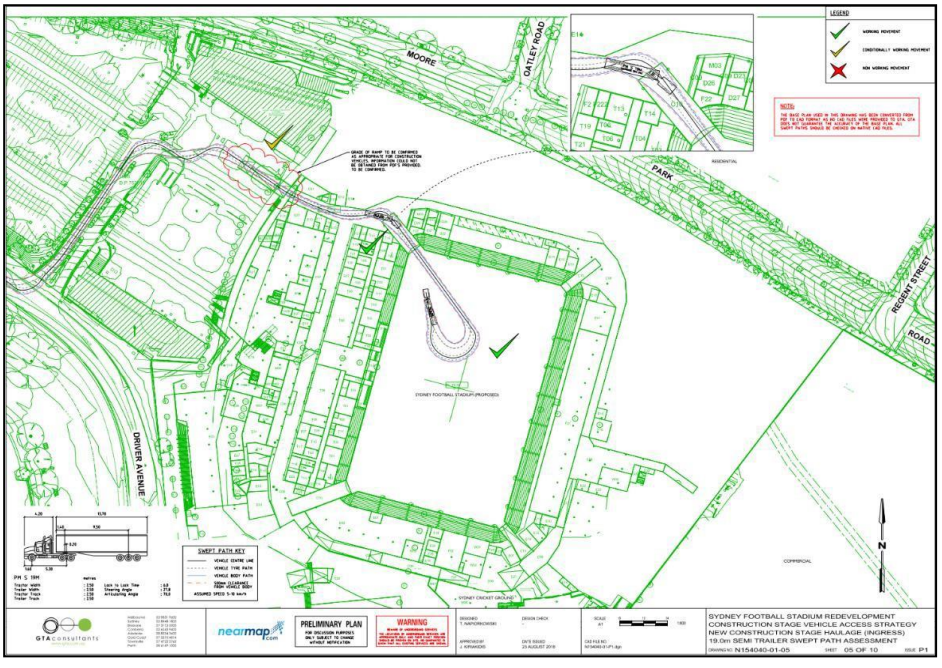


Figure 8.6.3 Stage 4 Stadium Roof Construction

At fit-out stage, builder's lifts will be operational and smaller delivery vehicles will be able to transport materials around the stadium footprint via the permanent basement driveway to desired builder's lift location.

Entry and exit to site will be via Driver Avenue Gates. Single unit trucks will be able to reach the pitch to unload materials via the north-west, south-west and south-east tunnels as shown in figure 8.6.4 below.

Figure 8.6.4 Stage 5 Fit-out

8.7 SITE ACCESS PATHS – CONSTRUCTION WORKFORCE AND PROJECT STAFF

Given the vast area of the project, the anticipated number of daily deliveries and the extent of plant and equipment required for demolition and construction, the segregation of the construction workforce and vehicles and plant is a significant focus area to ensure safe passage within site as well as access to and egress from site. The positioning of the site office and amenities has been coordinated to minimise the required crossover points between construction personnel and vehicles.

The site entries to MP1 carpark will provide the simple access from public transport options (Central Station, Future Light Rail at Anzac Parade as well as Bus Stops along Anzac Parade), adjacent to an operation traffic intersection with signal management for traffic and pedestrians.

Within the site compound, positioning the site access walkway along the North of the compound results in no direct crossover of construction workforce and plant / equipment as the vehicle gates are located to the South of the compound.

Within the site itself, key access paths will be provided to work areas, with the focus being on:

- Minimising the number of paths to the stadium structure itself to better control people movement.
- Clearly defined, physical segregation of pedestrian and vehicle pathways.
- Applying key controls to enable plant and equipment to circulate the site as planned.

- Having the ability to relocate / shift access paths as required without jeopardising the key controls established.

8.8 Construction Traffic

The recommendations of the Transport Assessment in relation to Construction Traffic and Pedestrian Management will be adopted for Stage 2 construction works.

8.9 TEMPORARY SERVICES

Temporary power to operate the Project will be fed from both new and existing kiosks located on the site. Analysis has been completed with regards to site power requirements, including cranage, hoists, site accommodation, temporary lighting to access ways and power required for build works. The required capacity to operate the site exists within the current infrastructure. The set-up of the site accommodation was done with access to service pick up location off Moore Park Road and Driver Avenue in mind.

Water will be provided through the existing supply which currently feeds the Sydney Football Stadium. These will feed the site accommodation precinct, satellite amenities and bubblers located throughout the site.

The layout of temporary services to each floor of the stadium during the construction phase has been carefully considered. Figure 8.8.1 below shows a typical floor plan, with all necessary services coverage provided to every zone of the stadium. In isolated areas, generators may be used.

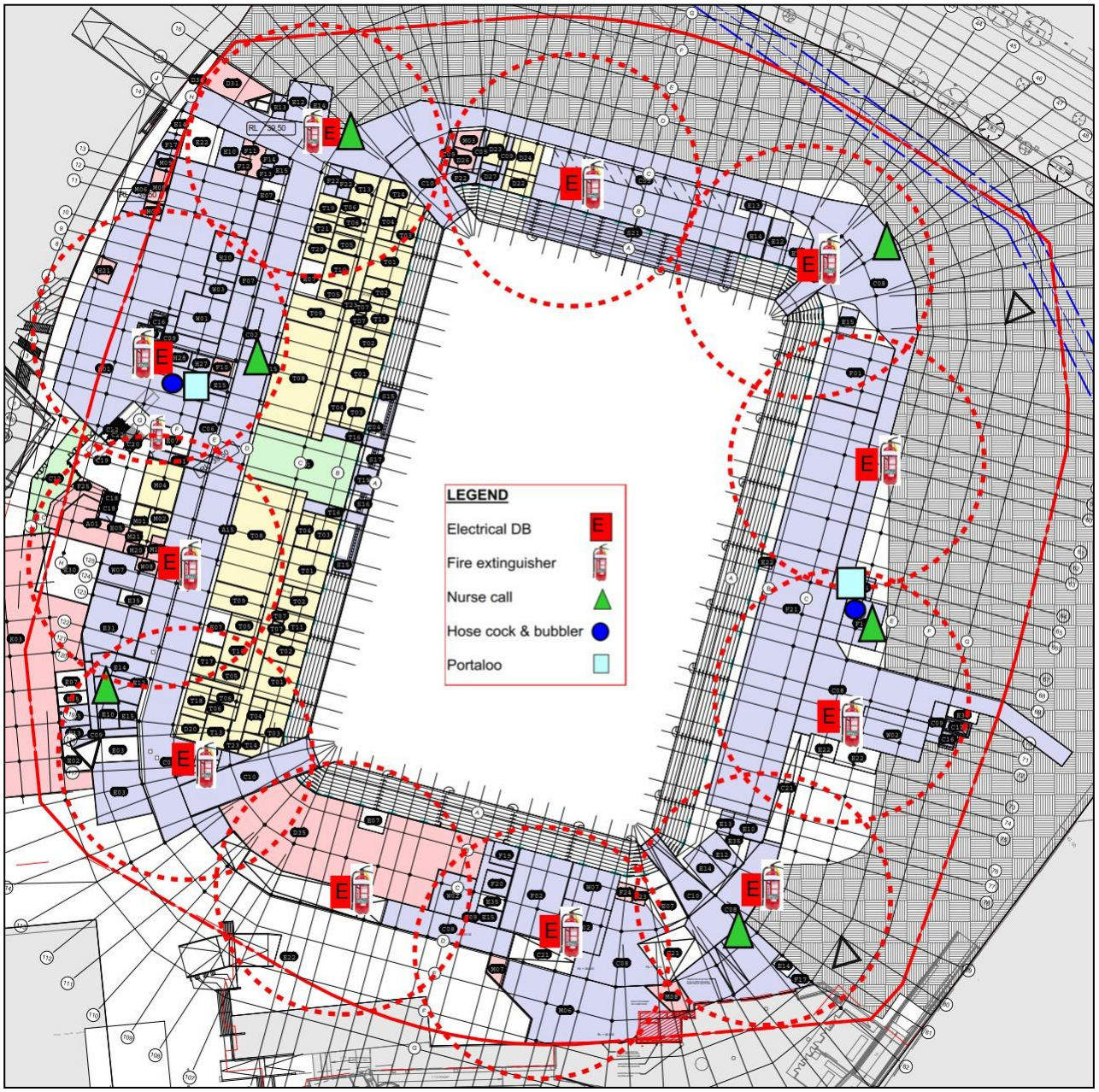


Figure 8.8.1 – Basement level temporary services plan

8.10 SITE SECURITY

Site Access will be secure, with the use of turnstiles located in the within the site accommodation set up and for access into site. Access to site will require security passes obtained post a site induction. This security system (Pegasus) is regularly used on Lendlease Projects and;

- Allows Lendlease to understand how many workers and who exactly is onsite at anyone point in time. This is typically used in circumstances of emergency to ensure all those present on site prior to an evacuation have registered as present at the muster point post evacuation.
- Allows contractor insurances to be linked to site access (Public Liability and Workers Compensation)
- Allows labour statistics to be monitored daily, plus reported on accurately.

Further to the above, Lendlease will implement night security patrols on the project from the commencement of build works until completion.

9. MATERIALS HANDLING

9.1 DELIVERIES AND LOADING ZONE MANAGEMENT

The Site will consist of several defined loading zones which will enable the project to operate on multiple work fronts whilst maintaining separation between plant, equipment, the site workforce and adjacent activities. Figure 9.1.1 below shows loading areas to service each of the cranes proposed for use.

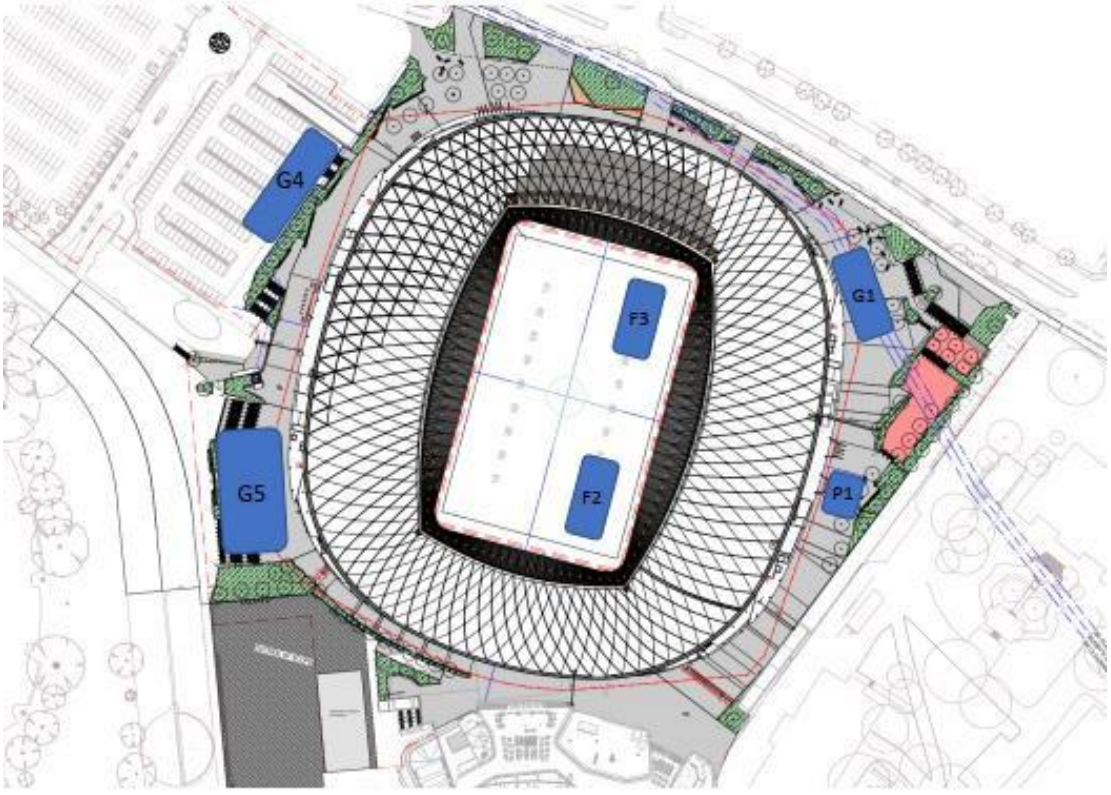
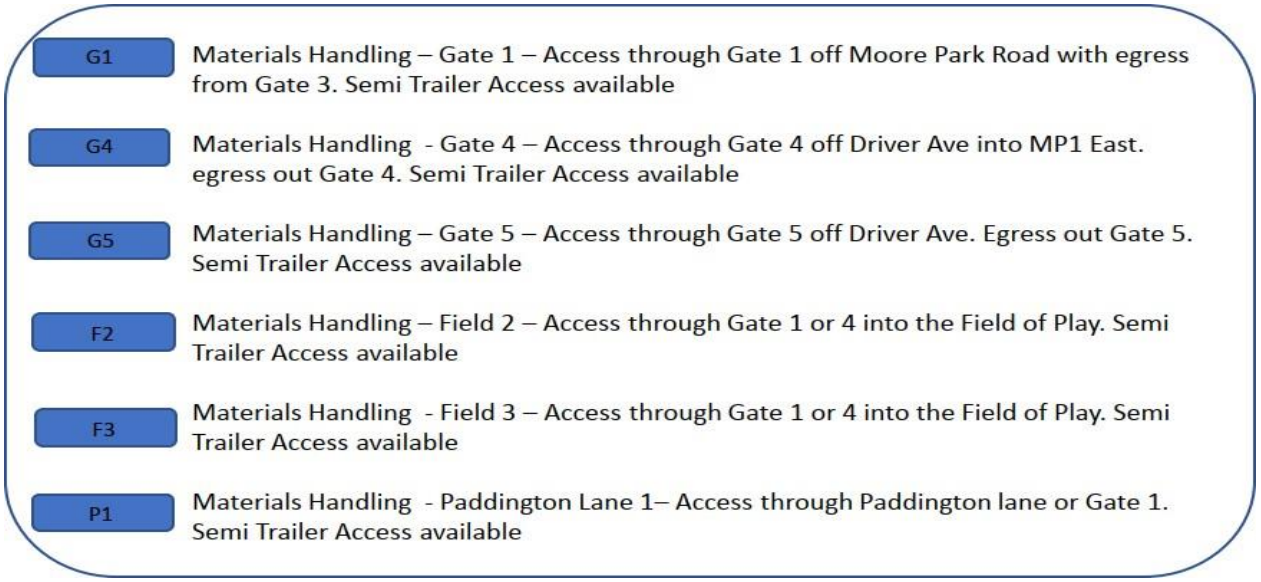


Figure 9.1.1 – Material handling zones

The defined construction / loading zones consist of:



9.2 VERTICAL TRANSPORTATION

9.2.1 CRANAGE

As outlined in the Materials Handling section above, the construction of the structure for the stadium will require tower cranes to be erected. The location of the cranes will provide greatest efficiency for the construction of the stadium structure while minimising the requirement for materials to be brought onto the field area; as once the roof structure commences, the field will be predominantly used for roof preassembly and installation.

The tower cranes selection takes into account the construction sequence and requirement to provide the greatest coverage for the installation of the precast seating plats during construction of the stadium seating bowl.

In addition to the fixed tower cranes, heavy lift crawler and mobile cranes will be required in coordination with the tower cranes

The cranage strategy will continue to be developed to ensure that the most efficient strategy is selected. Prior to erection submissions will be made to CASA and SACL. All cranage will be internal to site and not overhang Council land.

9.2.2 HOISTS

During construction of the stadium superstructure the construction workforce will adopt the route shown above in figure 9.5.1 to reach their work area from the site amenities.

As the concrete structure progresses and catch scaffold is introduced, stretcher stairs will be used to service higher levels. These stairs will remain in place until the permanent stairs are completed and scaffold is stripped.

In addition to the stretcher stairs, two hoists will be established as the structure approaches the Suite level at the North-East and North-West of the project. The hoists will initially provide a secondary means of access for the site workforce, but post formwork removal, will provide materials access from the western loading zone to the specific work level. The hoist will service from basement level to upper concourse, and remain in place until builders' lifts are brought online.

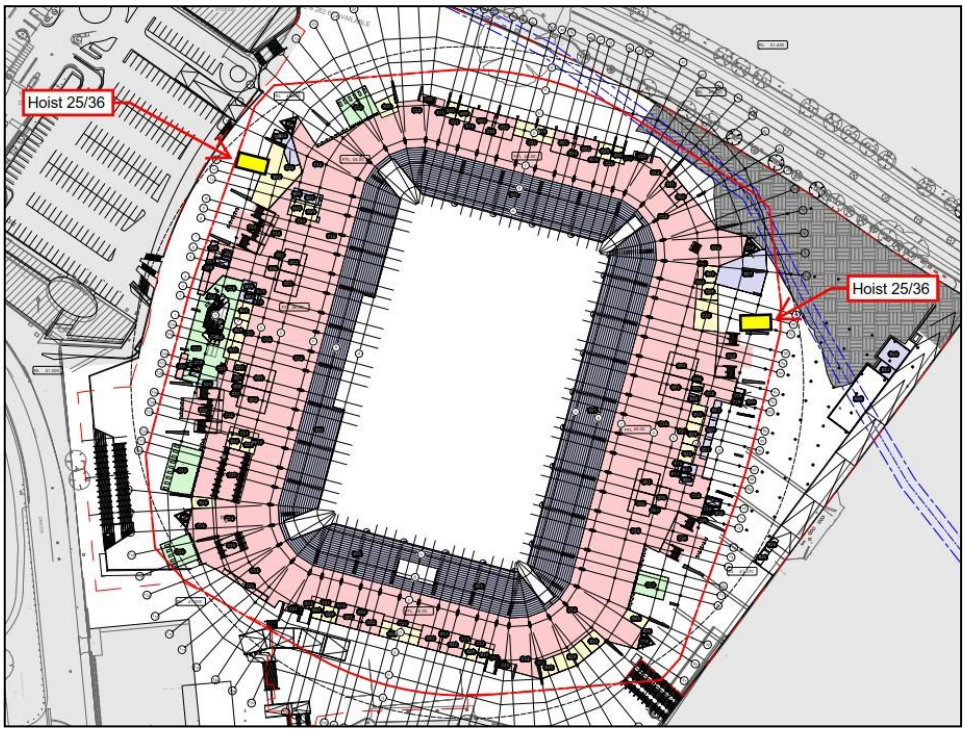


Figure 9.2.2 – Hoist Locations

10. CONSTRUCTION METHODOLOGY

10.1 TIMING and STAGING

The construction works are scheduled for approximately a 36 month period commencing on the respective planning approval.

The proposed staging of the works is as follows:

Phase	Approx. duration (note some stages will be undertaken concurrently)
1 – Stadium Bowl Construction	18 months
2 – Stadium Roof Construction	18 months

Phase	Approx. duration (note some stages will be undertaken concurrently)
3 – Infrastructure Works	12 months (indicative)
4 – Concourse Finishes	12 months (indicative)

10.2 BULK EXCAVATION

Commencing in several locations, as indicated above in the Figure, the bulk excavation works will establish and maintain a number of work fronts moving both clockwise and counter clockwise from the south east corner.

Excavation works to focus on establishment of two piling platforms at indicative heights of approximately RL39 & RL46 respectively to suit the piling methodology (refer below).

Backfill of retaining walls will occur progressively following wall construction with site won material, compacted to the requirements of the Geotechnical engineer, who will undertake periodical inspections to verify compliance.

It is anticipated that excess material will be disposed of progressively, with all excess material disposed off-site verified with movement records, tipping dockets and validation of disposal in accordance with the EPA requirements.

10.3 PILING

Piling works will commence concurrently with bulk excavation on site following the installation of a working platform.

A two-level piling platform will be established at the bulk earthwork phase, reflecting the heights required for Basement level and the concourse level. A portion of the higher area for concourse will be located within the existing stadium footprint and allows for existing piles to be demolished to 1500mm below future FFL and then piling platform built back up from this level.

The height differential between the two piling platform levels will require a stabilised batter which will be designed to facilitate piling at both levels with minimal alterations.

10.4 FOUNDATIONS

Upon completion of the piling works to the first zone, the detailed excavation and Form/Reo/Pour of pile caps and footing beams will commence. The general methodology for this activity is:

- Survey.
- Detailed Excavation.
  - The pile caps and footings will require a slight over-excavation to allow for access.
- Pile Trimming to required height.
  - Using pile crushing attachment on excavator and hand-trimming to tidy up to required heights.
  - The top section of pile reinforcement cages will be fitted with foam covers to facilitate simple removal of concrete.



- Reo, Formwork, backfill and Concrete place to Pile Caps and Footings.
  - Reo cages will be prefabricated to minimise work required within excavated areas, these cages will be lifted in by the excavators.
  - Lightweight lost formwork boxes will be installed and backfilled against (using backfill as restraint for the formwork)
  - Concrete trucks will have access to the area and pour directly into the pile cap.

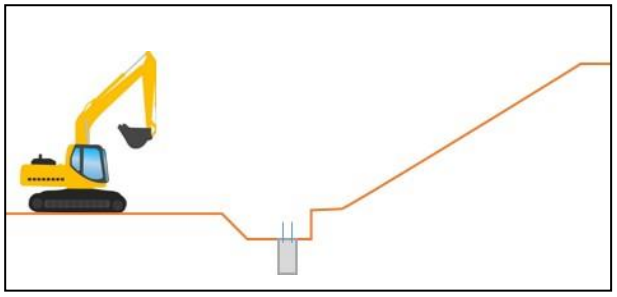
10.5 IN-GROUND SERVICES

In-ground services will be completed by crews of 5-6 consisting of a small excavator, plumbers and electricians. The in-ground services crews will use the grids previously provided by the surveyor for the pile caps and works will be completed and backfilled prior to the commencement of the slab-on-ground in the same zone.

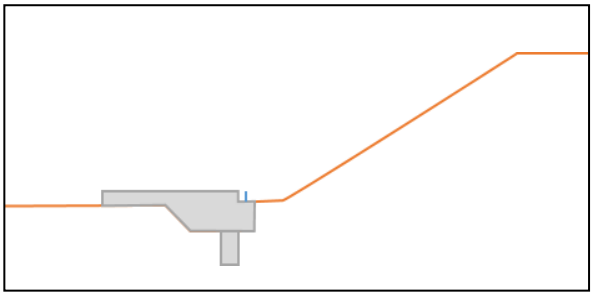
10.6 RETAINING WALL

At locations where earth needs to be retained and new levels are higher than existing levels a retaining wall structure will need to be constructed to allow bulk excavation works to progress. For locations where an insitu concrete retaining wall is required the general sequence for the construction of the basement retaining wall is as follows, and is outlined in figures 10.7.4 – 10.7.7.

- Retaining wall footing beam Form / Reo / Poured will be completed concurrently with in-ground services – noting that services design will locate services out of the footing beam and support slab area where possible to separate the two work fronts.



Figures 10.7.4 Stages 1 Detailed Ex. for footing beam



Figures 10.7.5 Footing beam install – for retaining wall

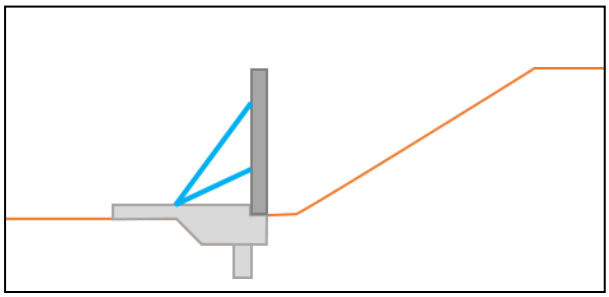


Figure 10.7.6 Stages 3 – precast retaining wall install

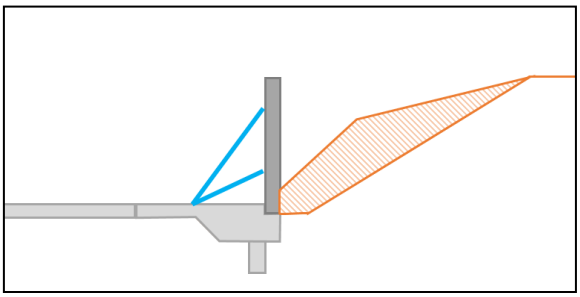


Figure 10.7.7 Stages 4 – backfill behind retaining wall

- Commence waterproofing to Eastern and Northern face of retaining wall once panels are installed, progressively backfilling to provide access higher up the wall. Bandaging of joints will be required.
- De-propping of panels commences once concourse level is poured over and strength achieved. Note propping of the retaining wall may not be sufficient and the concourse suspended slab may be required to be constructed to retain the head of the retaining wall prior to backfilling.

10.7 SUSPENDED STRUCTURE

The stadium suspended structure, with floor to soffit strutting heights ranging from 4m to 9m, will be constructed using a combination of structural systems including but not limited to prefabricated flooring options, steel and bondek or traditional formwork systems. The final selection of systems will be confirmed during the design phase to provide optimal efficiency and risk mitigation for the project.

The North and South stands are 3-4 levels in height, consisting of Basement, Basement Mezzanine, Concourse and Club Levels. The East and West stands are 5-6 levels in height, consisting of Basement, Concourse, Concourse Mezzanine (at the North of the Eastern Stand and the central zone to the West), Club Level and Suite Level. The concourse mezzanine level introduces a combination of high strutting areas from concourse to suite level.

The tower cranes have been positioned and sized primarily to support the construction of the stadium suspended structure, with a mobile crane required for supplementary lifting at the Northern structure.

It is anticipated that Scaffold edge protection will be used to the perimeter of the stadium structure, while internally, the tiered nature of the structure will allow for edge protection to be incorporated in the structure system.

10.8 STADIUM SEATING STRUCTURE

Once the stadium suspended structure has progressed sufficiently, the stadium seating bowl structure can commence. The seating bowl structure is a combination of structural steel columns and rakers and precast vomitories and seating platforms. At the North and South ends, the seating bowl consists of two tiers – Basement to Concourse and Concourse to Club Level – while the East and West have an additional tier that extends from the upper concourse, supported by larger structural steel columns and rakers based off the Upper Concourse level.

With the exception of the Northern stand and the final portion of seating to be installed at the South, the steel columns, rakers and precast vomitories and seating platforms will be installed using a combination of mobile and tower cranes – which have been sized to accommodate the anticipated weights associated with these lifts.

Given the timing of the install of most of the columns, rakers and platforms running concurrently with the stadium long span truss roof members, the majority of the prefabricated stadium bowl structure will be lifted from loading zones outside of the stadium to allow for greater materials handling space within the field of play zone.

10.9 STADIUM ROOF STRUCTURE

The stadium roof structure design is continuing to evolve. Current planning and staging has been based upon the Arup Engineering advice. This is a work in progress and yet to be finalised.

10.10 STADIUM ROOF FABRIC

The installation of the Roof Fabric will occur after the installation of the roof members. These works will be carried out using a combination of access strategy's.

The Roof Fabric will be installed from a prefabricated drum, temporarily mounted to the inner of the roof truss steelwork. This method was successfully used on the Adelaide Oval Project and more recently at the Western Sydney Stadium.

10.11 STADIUM FAÇADE

The stadium facade design is continuing to evolve. This is a work in progress and yet to be finalised.

10.12 CONCOURSE FINISHES

The progressive installation of the seating platforms over will allow for the commencement of the Concourse and Upper Concourse levels' food, beverage and amenities block, allowing for continuity of the trades associated with their construction. These works will require close coordination with roof steelwork and fabric as well as façade installation to ensure adequate exclusion zones are established and maintained.

10.13 INTERNAL FINISHES

After completion and strip out of the concrete structure, services rough-in and internal finished works will commence. These works will be facilitated through materials movement by hoist with longer length materials preloaded prior to removal of tower cranes.

10.14 PLAYING FIELD

The construction programme trigger for the commencement of the field of play sub-grade and in-ground drainage is the demobilisation of the temporary works required during roof construction within the stadium.

To enable stadium completion a section of the Main Carpark, MP1 West will be retained by the Contractor for final site amenities post Practical Completion and will be decanted in the period after.

11. COMMUNICATIONS

Lend Lease will appoint a Precinct Manager who will be responsible for all communications with the surrounding community and stakeholders. The Precinct manager will be responsible for:

- Managing and actioning complaints in relation to the works;
- Providing regular project updates to surrounding stakeholders; and
- Ensuring all workers on site are aware of their responsibilities in relation to project communications.

Appendix A draft Heritage Construction Management Plan

1. Introduction

This draft Construction Heritage Management Plan (CHMP) has been prepared by Curio Projects, on behalf of Infrastructure NSW (INSW) for the Sydney football Stadium Redevelopment project, relevant to the main construction works as per the Stage 2 SSDA.

This CHMP addresses and fulfils the SEARs requirement:

> *Provide a draft Construction Heritage Management Plan that details measures to avoid impacts on surrounding heritage items. This should incorporate the recommendations of the Methodology Statement – Working Near Busby's Bore dated September 2018.*

The purpose of this draft CHMP to provide a base framework to address and describe how heritage fabric and archaeology will be protected and managed during the construction of the project. This draft CHMP functions as an Appendix to the SFS Redevelopment Stage 2 SSDA *Heritage Impact Statement* (HIS), and should be read in conjunction with the HIS report.

No heritage items are located within the SFS Redevelopment site, and therefore physical mitigation measures are not required. Assessment of visual impact to surrounding heritage items and conservation areas have been described, addressed, and assessed in detail in Section 7 of the Stage 2 HIS.

This draft CHMP will be further developed and finalised in parallel with Stage 2 site construction works, to be included within an overall Construction Management Plan for the SFS Redevelopment works.

1.1. Busby's Bore

The Stage 2 HIS (Curio Projects 2019) states that:

> *As a State significant heritage item/relic, Busby's Bore and its shafts and associated deposits should remain in situ. While the 2019 investigations of the Bore were relatively inconclusive with regards to the overall alignment of the Bore within the subject site and potential location of additional shafts in the vicinity, the investigation removed over 10 tonnes of modern (i.e. 20th Century) building rubble from one shaft, without reaching the top of the Bore itself. Therefore, based on the results of the investigation it is considered likely that the top of the horizontal Bore is located at a depth of c.12m below the existing ground surface.*
>
> *The vibration monitor device as installed in Bore Shaft 10 during investigative works (Section 6.1) has been subject to ongoing monitoring by Arup (structural engineers) throughout the demolition of the former stadium (as approved by the Concept Plan/Early Works SSDA). The conservative criterion of 3mm/s (as established via the 'Methodology Statement Working Near Busby's Bore') has to date been sufficient, and therefore is considered appropriate to also be applied to the Stage 2 development works.* (HIS, p.117)

After reviewing the construction methodology for the Stage 2 works, no adjustments to the 'Methodology Statement Working Near Busby's Bore' is required. Therefore, measures to avoid impact to Busby's Bore are proposed to remain as per those presented and described within the document 'Methodology Statement Working Near Busby's Bore', which is attached below.

In addition to the application of the Methodology Statement for works near Busby's Bore, while bulk excavation works are not proposed in the assumed location of the Bore, it is still recommended that archaeological mitigation measures be put in place during Stage 2 construction works in the general vicinity of Busby's Bore (i.e. in the northeast of the subject site), to avoid unexpected adverse impact to the State significant heritage item. Archaeological mitigation measures are presented in detail in the Historical Archaeological Research Design, which functions as Appendix A to the Stage 2 HIS. Section 6.1.3 of the ARD states that:

> *The archaeological impact assessment presented in this ARD has identified that Stage 2 construction works will have no impact to the State significant Busby's Bore. However, it is still recommended that archaeological mitigation measures be put in place during construction works in the general vicinity of Busby's Bore (i.e. in the northeast of the subject site), both to ensure protection of the known shafts (Shafts 9 and 10), as well as in order to ensure that works will not unexpectedly impact the State significant heritage item or any associated archaeological deposit.*
>
> *Therefore, archaeological monitoring/supervision of bulk excavation works in the northeast of the site is proposed. The archaeological monitoring program will be undertaken by Dr Matthew Kelly as nominated Excavation Director (who meets the criteria for State Significant Excavation Director) with assistance from a suitably qualified historical archaeological field assistant, if required. Should any development impacts encounter deposits suspected to be associated with the Bore itself, or associated shafts, works would cease in the immediate vicinity until the nature of the find is verified by the Excavation Director, with the Supervision mitigation protocol (as outlined above) to be enacted if required.*

1.2. Archaeology

With reference to potential archaeological impacts (both Aboriginal and historical archaeology), the Stage 2 HIS states that (Section 7.5):

> *The archaeological impact assessment relevant to the Stage 2 impacts (presented in detail in the ARD- Appendix A to this report) has identified that the majority of the area of the site assessed to be of moderate historical archaeological potential, will be subject to filling (i.e. in the east of the site). Therefore, any potential archaeological deposit in these locations would be mostly conserved protected through construction works with limited impact. The locations across the site that will be impacted by bulk excavation works (i.e. mainly in the west and northwest of the site), generally consist of areas assessed to be of low historical archaeological potential. While the potential for an archaeological resource to remain in these areas has been assessed as low, mitigation of potential impact is proposed via the application of historical archaeological management strategies.*
>
> *Areas of historical archaeological potential across the SFS Redevelopment site have been zoned in order to identify areas of the site that may require more archaeological consideration that others. This archaeological management zoning reflects two different historical archaeological mitigation strategies that should apply across the SFS*

Redevelopment site during Stage 2 construction works: Supervision; and Unexpected Finds.

Demolition and construction activities associated with Stage 2 of the SFS Redevelopment have the potential to impact on potential Aboriginal archaeological remains in areas where development activities have the potential to encounter and impact natural soil profiles. As ground disturbance into the natural soil profiles will vary across the site, the redevelopment will have varying impacts on the potential Aboriginal archaeological resource across the SFS Redevelopment site.

The potential impact to Aboriginal cultural heritage values and Aboriginal archaeological potential of the study area are proposed to be managed and mitigated via two main strategies: Archaeological investigation tailored to specific below ground impacts of the development works; and Aboriginal Heritage Interpretation to facilitate a long term conservation outcome for Aboriginal cultural heritage values (tangible and intangible).

The proposed archaeological mitigation strategies developed through the ACHAR and ARD are to be applied throughout the process of the Stage 2 construction works for the SFS Redevelopment.

1.2.1. Unexpected Finds Protocol

In addition to the archaeological methodologies developed through the ARD (historical archaeology), and the ACHAR (Aboriginal archaeology), an unexpected finds policy should apply to all works within the site, ongoing throughout the development, should unexpected archaeology (i.e. archaeological deposits, relics or resource not addressed within the ARD or ACHAR) be encountered during site works.

Should any unexpected historical archaeological resource/relics of State significance be uncovered during the course of the development works (i.e. other than the potential deposits, resources and relics described in this report associated with the known historical activities and occupation of the subject site from 1788 to 1987), then development works should cease in the immediate area of the find, and the nominated Archaeological Excavation Director be contacted to confirm the nature of the find.

The discovery of potential human skeletal remains would be in accordance with the approved OEH protocol for the discovery of human remains which is stated as:

If any suspected human remains are discovered and/or harmed the proponent must:

a) Not further harm these remains;
b) Immediately cease all work at the particular location;
c) Secure the area so as to avoid further harm to the remains;
d) Notify the local police and OEH's Environment Line on 131 555 as soon as practicable and provide any available details of the remains and their location; and
e) Not recommence any work at the particular location unless authorised in writing by OEH.

2. Methodology Statement—Working Near Busby's Bore

Developed by INSW, Arup (acoustics and vibration), Curio Projects (heritage and archaeology), and Aver (construction and demolition management).

This methodology has been developed to support demolition and construction around Busby's Bore. It has been developed with the input of Arup (acoustics and vibration), Curio Project (heritage and archaeology) and Aver (construction and demolition management). In particular it has been developed to respond to the comment DPE12:

While the proposal is for a concept building envelope, it is considered that further assessment regarding the protection of Busby's Bore during demolition and construction works would be required. The report should include a methodology of how the bore would be identified, protected, assessed and monitored throughout the demolition and construction works. The method should be included in detail in an updated Construction Management Plan, supported by the HIA. This document should be submitted for further consideration.

This methodology also addresses comment COS34:
The site is affected by a State Heritage Listing and General Terms of Approval should be obtained from the Heritage Council. There is a potential that the demolition works through vibration could impact Busby's Bore.

It is noted that approval for construction works is not being sought as part of the Stage 1 SSDA, however it is considered the principles contained within this methodology will be applicable to those works. Adjustments may be made to this methodology to support the construction as part of the Stage 2 application when further detail regarding the construction methodology is known.

1. Identification and Assessment

Prior to the commencement of demolition, investigations will be undertaken in an effort to determine the condition of the bore through the site. This will entail access through the existing shafts on site with known locations (Shafts 9 and 10). The exact path as the Bore crosses beneath the site, and the precise locations of Shafts 11 and 'Intervening Shaft 4' remain unknown.

The steps to be followed will include:

- Land owners consent for access and support for the methodology for the investigative works to be obtained from Sydney Water prior to seeking approval from the NSW Heritage Division to undertake investigative works of the Bore.
- If land owners consent if provided, then a Section 57 (2) Heritage Exemption will be prepared by qualified historical archaeologist and submitted to the NSW Heritage Division in accordance with the requirements of the NSW Heritage Act (1977) to undertake investigation works.
- Safe Work Method Statement for access to be developed.

The results of the investigation works will be utilised to determine the current state of the Bore, where possible to further inform the design and management of impacts to known and potential sections of the Bore during Stage 1 demolition works and future Stage 2 construction works.

Figure 1, below, demonstrates the location of the known shafts and an indicative path of the tunnel beneath the site, with reference to the proposed indicative footprint of the new stadium envelope.

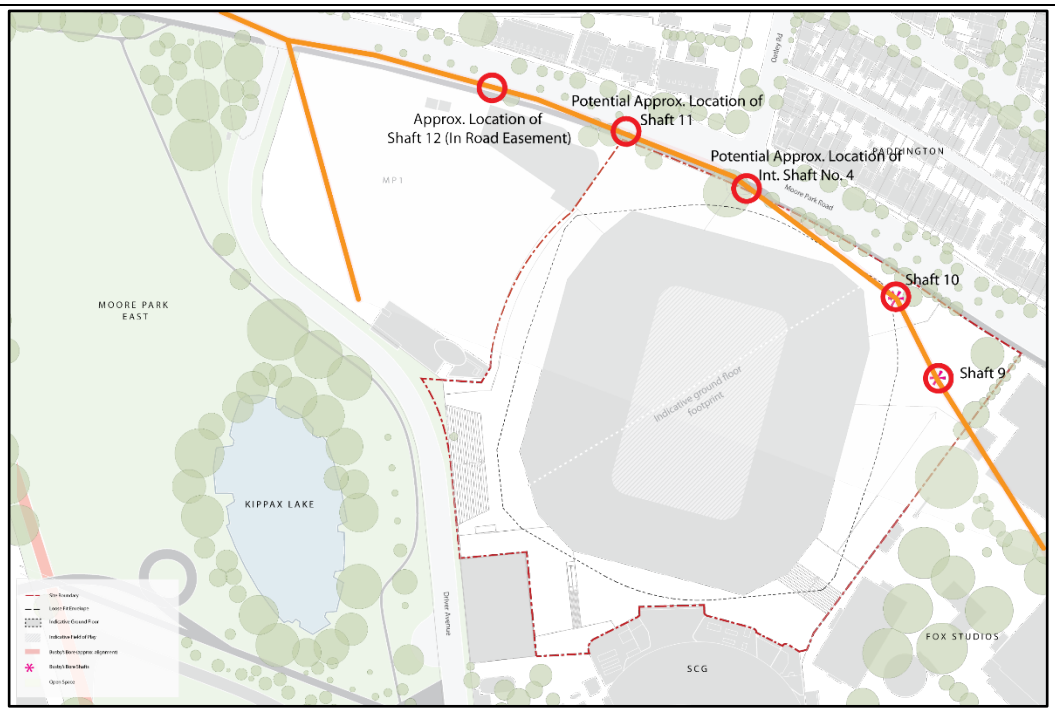


Figure 1: Locational Map of known and possible Busby's Bore shafts within SFS Redevelopment Site (Source: SJB Architects with Curio Additions 2018)

2. Protection

A physical exclusion zone will be maintained around the existing shafts and the Bore (if found during investigation works). The project archaeologist and the Site Manager will liaise regarding the best location for these barriers.

Vibration monitoring devices will be installed within the shafts of Busby's Bore in a location agreed by the project archaeologist, structural engineer and acoustic consultant. A conservative vibration criterion of 3mm/s, based on structural damage criterion for 'sensitive structures' in DIN 4150 – Part 3[1] will be applied. The vibration monitors will be calibrated to generate real-time alerts (SMS messages and/or flashing lights) when vibration criterion is exceeded.

3. Monitoring

In the event that the vibration criterion is exceeded by works on site an alert will be sent to the Site Manager. This alert will trigger a cessation of works and the project archaeologist and structural engineering advisor will be notified and requested to attend site. A visual inspect of the pits and/or Bore will be undertaken to determine whether any damage has been sustained.

An exceedance of the vibration criterion will necessitate a change in demolition and/or construction methodology. This could include:

- Re-evaluation of the vibration criterion based on results of the initial condition investigation and inspections of the structure following the commencement of works.
- Maintain vibration monitoring throughout Stage 1 and Stage 2 works.

[1] German Standard DIN 4150-Part 3 'Structural vibration in buildings – Effects on Structure'

- Reduce the size of demolition and construction equipment and develop alternative methodologies to minimise vibration.
- Use less vibration emitting demolition methods such as concrete pulverisers and smaller percussive hammers if necessary closer to Busby's Bore.
- Use rubber tracked excavators and machinery if necessary closer to Busby's Bore.
- Balance variable speed vibrating plant and operate at speeds that do not produce resonance.
- Ensure all fixed plant at the site are appropriately selected (on a risk assessment approach), and where necessary, fitted with vibration attenuation measures.
- Position vibrating plant and equipment as far apart as it practicable from each other and consider whether orientation and location of the plant can reduce vibration impacts at sensitive receivers such as Busby's Bore.
- Use non-percussive piling techniques for all piles where practicable.
- Ensure that vibratory compactors must not be used closer than 30 meters from sensitive receivers unless vibration monitoring confirms compliance with the vibration criteria specified.
- Maintain machinery and equipment.
- If necessary plan traffic flow, parking, loading/unloading areas to minimise movements within the area of Busby's Bore.

Appendix B Air Quality Report

ACOUSTICS AND AIR

SYDNEY FOOTBALL STADIUM REDEVELOPMENT - STAGE 2

AIR QUALITY IMPACT ASSESSMENT

REPORT NO. 18274-S2
VERSION A

MAY 2019

PREPARED FOR

INFRASTRUCTURE NEW SOUTH WALES
167 MACQUARIE STREET
SYDNEY NSW 2000

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Draft	3 May 2019	Nic Hall	John Wassermann
A	Final	29 May 2019	Nic Hall	John Wassermann

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GLOSSARY OF AIR QUALITY TERMS

Air Pollution – The presence of contaminants or pollutant substances in the air that interfere with human health or welfare, or produce other harmful environmental effects.

Air Quality Standards – The level of pollutants prescribed by regulations that are not to be exceeded during a given time in a defined area.

Air Toxics – Any air pollutant for which a national ambient air quality standard (NAAQS) does not exist (i.e. excluding ozone, carbon monoxide, PM-10, sulphur dioxide, nitrogen oxide) that may reasonably be anticipated to cause cancer; respiratory, cardiovascular, or developmental effects; reproductive dysfunctions, neurological disorders, heritable gene mutations, or other serious or irreversible chronic or acute health effects in humans.

Airborne Particulates – Total suspended particulate matter found in the atmosphere as solid particles or liquid droplets. Chemical composition of particulates varies widely, depending on location and time of year. Sources of airborne particulates include dust, emissions from industrial processes, combustion products from the burning of wood and coal, combustion products associated with motor vehicle or non-road engine exhausts, and reactions to gases in the atmosphere.

Area Source – Any source of air pollution that is released over a relatively small area, but which cannot be classified as a point source. Such sources may include vehicles and other small engines, small businesses and household activities, or biogenic sources, such as a forest that releases hydrocarbons, may be referred to as nonpoint source.

Concentration – The relative amount of a substance mixed with another substance. Examples are 5 ppm of carbon monoxide in air and 1 mg/l of iron in water.

Emission – Release of pollutants into the air from a source. We say sources emit pollutants.

Emission Factor – The relationship between the amount of pollution produced and the amount of raw material processed. For example, an emission factor for a blast furnace making iron would be the number of pounds of particulates per ton of raw materials.

Emission Inventory – A listing, by source, of the amount of air pollutants discharged into the atmosphere of a community; used to establish emission standards.

Flow Rate – The rate, expressed in gallons -or litres-per-hour, at which a fluid escapes from a hole or fissure in a tank. Such measurements are also made of liquid waste, effluent, and surface water movement.

Fugitive Emissions – Emissions not caught by a capture system.

Hydrocarbons (HC) – Chemical compounds that consist entirely of carbon and hydrogen.

Hydrogen Sulphide (H_2S) – Gas emitted during organic decomposition. Also, a by-product of oil refining and burning. Smells like rotten eggs and, in heavy concentration, can kill or cause illness.

Inhalable Particles – All dust capable of entering the human respiratory tract.

Nitric Oxide (NO) – A gas formed by combustion under high temperature and high pressure in an internal combustion engine. NO is converted by sunlight and photochemical processes in ambient air to nitrogen oxide. NO is a precursor of ground-level ozone pollution, or smog.

Nitrogen Dioxide (NO_2) – The result of nitric oxide combining with oxygen in the atmosphere; major component of photochemical smog.

Nitrogen Oxides (NO_x) – A criteria air polluant. Nitrogen oxides are produced from burning fuels, including gasoline and coal. Nitrogen oxides are smog formers, which react with volatile organic compounds to form smog. Nitrogen oxides are also major components of acid rain.

Mobile Sources – Moving objects that release pollution; mobile sources include cars, trucks, buses, planes, trains, motorcycles and gasoline-powered lawn mowers.

Particulates; Particulate Matter (PM-10) – A criteria air pollutant. Particulate matter includes dust, soot and other tiny bits of solid materials that are released into and move around in the air. Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, incineration of garbage, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining operations, agricultural burning (field and slash burning), and operation of fireplaces and woodstoves. Particulate pollution can cause eye, nose and throat irritation and other health problems.

Parts Per Billion (ppb)/Parts Per Million (ppm) – Units commonly used to express contamination ratios, as in establishing the maximum permissible amount of a contaminant in water, land, or air.

PM10/PM2.5 – PM10 is measure of particles in the atmosphere with a diameter of less than 10 or equal to a nominal 10 micrometers. PM2.5 is a measure of smaller particles in the air.

Point Source – A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g. a pipe, ditch, ship, ore pit, factory smokestack.

Scrubber – An air pollution device that uses a spray of water or reactant or a dry process to trap pollutants in emissions.

Source – Any place or object from which pollutants are released.

Stack – A chimney, smokestack, or vertical pipe that discharges used air.

Stationary Source – A place or object from which pollutants are released and which does not move around. Stationary sources include power plants, gas stations, incinerators, houses etc.

Temperature Inversion – One of the weather conditions that are often associated with serious smog episodes in some portions of the country. In a temperature inversion, air does not rise because it is trapped near the ground by a layer of warmer air above it. Pollutants, especially smog and smog-forming chemicals, including volatile organic compounds, are trapped close to the ground. As people continue driving and sources other than motor vehicles continue to release smog-forming pollutants into the air, the smog level keeps getting worse.

1 INTRODUCTION

A State Significant Development (SSD) application for the redevelopment of the Sydney Football Stadium has been submitted to the Minister for Planning, pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The redevelopment of the Sydney Football Stadium is proposed in a staged manner as follows:

- Stage 1 – Concept Proposal for the stadium envelope and supporting retail and functional uses as well as development consent for the carrying out of early works, including demolition of the existing facility and associated structures.
- Stage 2 – Detailed design, construction and operation of the stadium and supporting businesses, retail and functional uses.

Wilkinson Murray Pty Limited has been engaged by Infrastructure New South Wales to prepare an Air Quality Impact Assessment (AQIA) for the construction works proposed under Stage 2 of the Sydney Football Stadium redevelopment.

1.1 Purpose of this Report

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) for the project (ref. SSD 9835) relevant to air quality. The SEARs relevant to air quality are:

30. Construction Management (including construction traffic)

- *Provide an assessment of potential impacts of the construction on surrounding buildings and the public domain, including noise and vibration, air quality and odour impacts, dust emissions, water quality, stormwater runoff, groundwater seepage, soil pollution and construction waste.*
- *Detail measures and procedures to minimise and manage the generation and off-site transmission of sediment, dust and fine particles.*

To address the above requirements, this report presents a qualitative assessment of potential dust impacts in accordance with the *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014), prepared by the UK Institute of Air Quality Management (IAQM), and identifies appropriate mitigation and management measures to minimise these impacts.

2 PROJECT DESCRIPTION

2.1 Site Location

The site is located at 40-44 Driver Avenue, Moore Park. The site is located on the eastern edge of the city, approximately 3 kilometres from the Sydney CBD, and forms part of a large entertainment and recreation precinct shared with Centennial and Moore parks, Fox Studios and the Entertainment Quarter. It is located in the north corner of the precinct and is bounded by Moore Park Road to the north, Paddington Lane to the east, the existing Sydney Cricket Ground stadium to the south and Driver Avenue to the west. The site is located immediately to the south of the suburb of Paddington, with the suburbs of Centennial Park to the east and Surry Hills to the West.

The location of the site is show in Figure 2-1.

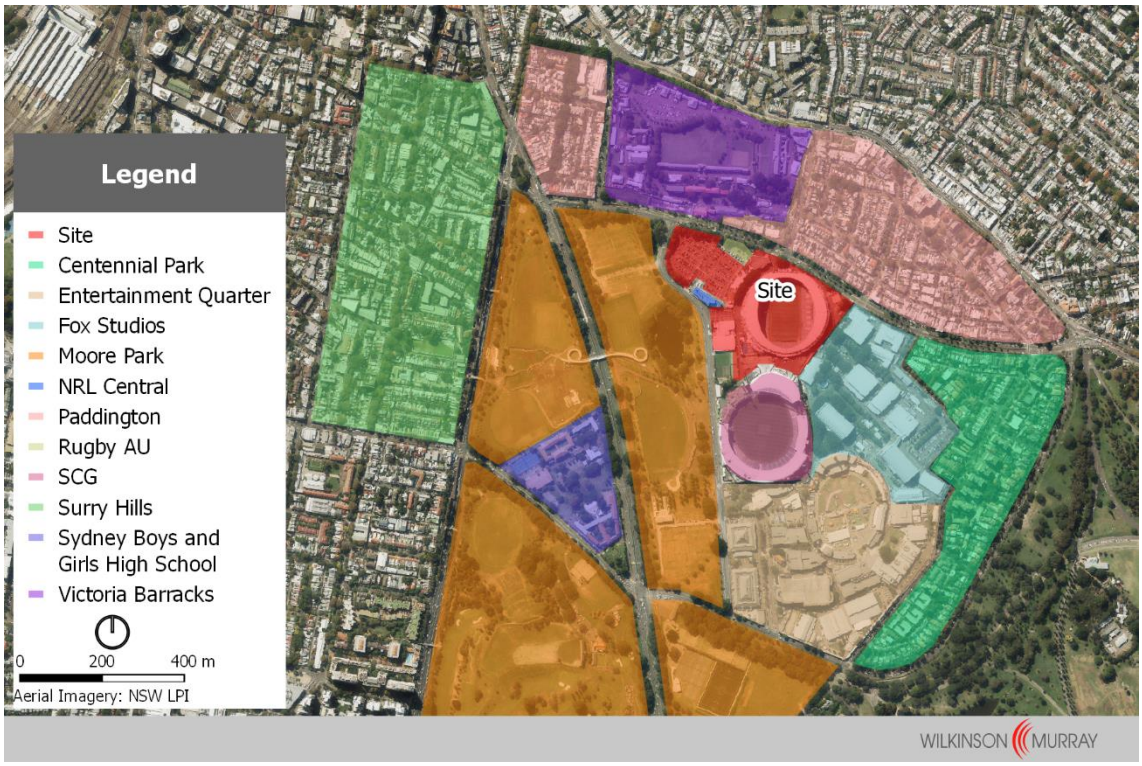
2.1.1 Sensitive Receptors

A number of sensitive receptors are located in proximity to the site, including:

- Residences in nearby Paddington, Centennial Park and Surry Hills;
- Places of work within:
    - Rugby AU/ UTS;
    - NRL Central;
    - The SCG;
    - Fox Studios; and,
    - The Entertainment Quarter;
- Moore Park
- Victoria Barracks;
- Kira Child Care Centre; and,
- Sydney Boys and Girls High School.

These sensitive receptors are shown in Figure 2-1.

Figure 2-1 Site Location and Sensitive Receptors



2.2 Overview of the Proposal

The proposed development, consistent with the Concept Proposal, will comprise:

- Construction and operation of a new stadium with up to 45,000 seats (55,000 capacity in concert-mode), including playing pitch, grandstands, administration areas, food an drink kiosks, corporate facilities and all other aspects of a modern stadium;
- Operation an use of the stadium and surrounding site area for a range of sporting and entertainment events;
- Vehicular and pedestrian access and circulation arrangements, including excavation to deliver a partial basement level for internal loading and servicing at the playing pitch level;
- Reinstatement of the MP1 car park following the completion of construction;
- Public domain improvements within the site boundary, including hard and soft landscaping, to deliver a range of publicly accessible, event and operational areas;
- Provision of new pedestrian and cycling facilities within the site; and,
- Signage, including building identification signage, business identification signage and a wayfinding signage strategy.

2.3 Construction

The anticipated construction methodology is outlined in Table 2-1

Table 2-1 Indicative Construction Staging

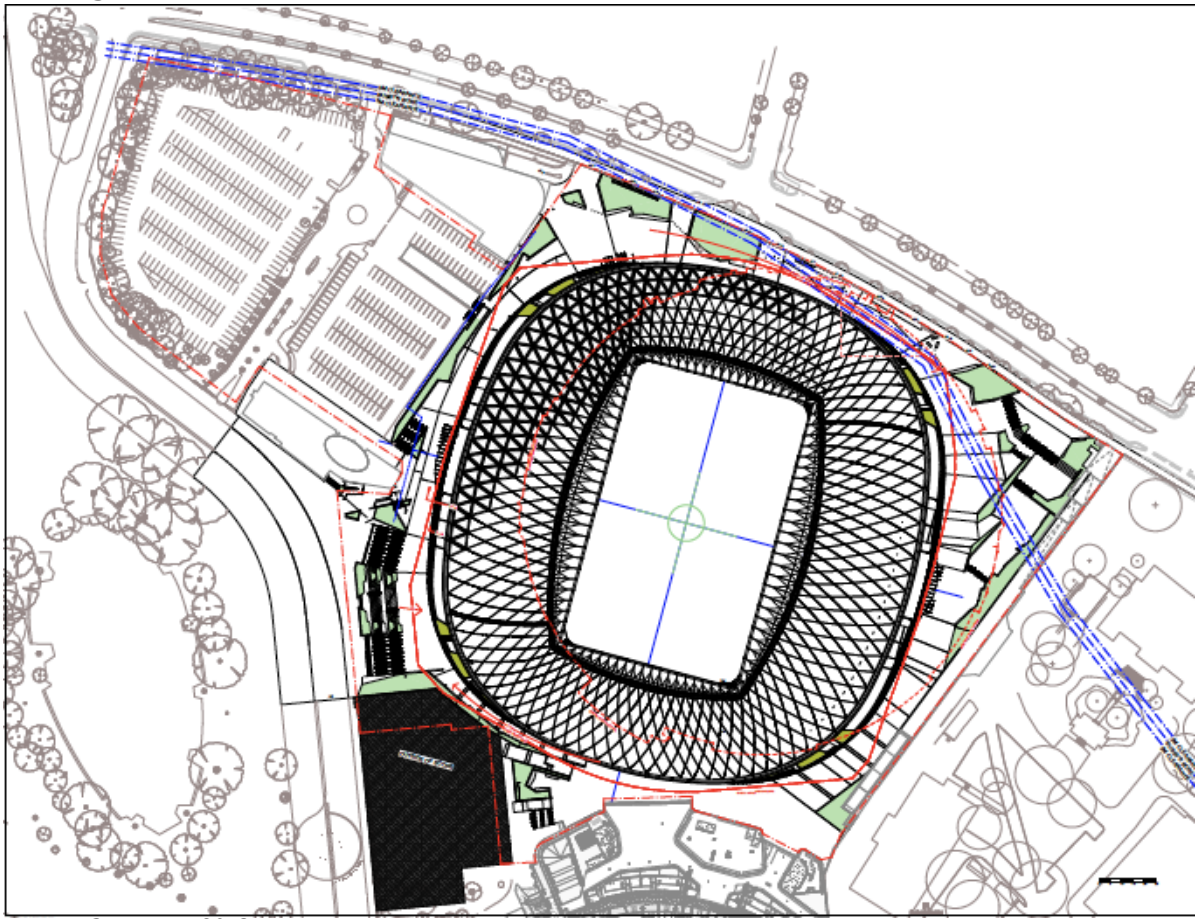
Stage	Duration (approx.)
1 – Stadium Bowl Construction	18 months
2 – Stadium Roof Construction	18 months
3 – Infrastructure Works	12 months
4 – Concourse Finishes	12 months
5 – Internal Finishes	18 months

2.3.1 Plant and Equipment

Plant and equipment required for the works would be determined by the contractor. However, the works are anticipated to require the following:

- 250 – 400 tonne cranes and boom lifts;
- 50 tonne mobile cranes;
- Excavators;
- Concrete pumps;
- Concrete trucks;
- Forklifts;
- Jackhammers;
- Dump trucks ;
- Water carts; and
- Hand tools and other small equipment.

Figure 2-2 Construction Site Plan



The works would largely be confined to the following standard construction hours:

- 7:00am to 6:00pm Monday to Friday;
- 8:00am to 1:00pm Saturday; and,
- No work on Sunday or public holidays.

2.3.3 Site Access

Access to the site throughout construction would be via:

- Paddington Lane, off Moore Park Road;
- Gate 4, off Moore Park Road opposite Oatley Road; and
- Through the existing MP1 car park entrance off Driver Avenue and Moore Park Road.

3 AIR QUALITY CRITERIA

3.1 Introduction

The NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (the Approved Methods) sets out applicable impact assessment criteria for a number of air pollutants.

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the pollutants of interest in this study and the applicable air quality criteria for each pollutant.

3.2 Pollutants of Interest

Potential air pollutants associated with the Project comprise dust and particulate matter. Specifically, the following pollutants are identified:

- Total Suspended Particulates (TSP);
- Particulate Matter (PM_{10} and $PM_{2.5}$); and,
- Deposited Dust.

3.3 Impact Assessment Criteria

The Approved Methods specifies air quality assessment criteria for assessing impacts from dust generating activities. These criteria are consistent with the National Environment Protection Measures for Ambient Air Quality (NEPC, 1998).

Table 3-1 summarises the air quality goals for dust and particulate matter that are relevant to this study. The air quality goals relate to the total concentrations of dust and particulate matter in the air and not just that from the project. Therefore, some consideration of background levels needs to be made when using these goals to assess impacts.

Table 3-1 Impact Assessment Criteria – Dust and Particulate Matter

Pollutant	Averaging period	Impact	Criteria
Total suspended particulates (TSP)	Annual	Total	90 µg/m³
Particulate matter ≤10 µm (PM_{10})	Annual	Total	25 µg/m³
	24-hour	Total	50 µg/m³
Particulate matter ≤2.5 µm ($PM_{2.5}$)	Annual	Total	8 µg/m³
	24-hour	Total	25 µg/m³
Deposited dust (DD)	Annual	Total	4 g/m²/month
	Annual	Incremental	2 g/m²/month

4 EXISTING ENVIRONMENT

4.1 Local Climate

Meteorological conditions strongly influence air quality. Most significantly, wind speed, wind direction, temperature, relative humidity, and rainfall affect the dispersion of air pollutants. The following sub-sections discuss the local meteorology near the Proposal site.

4.1.1 Wind

Observations of wind speed and direction from the Office of Environment and Heritage (OEH) air quality monitoring station (AQMS) at Randwick have been selected to represent typical wind patterns in the area surrounding the site. The Randwick AQMS is located approximately 5 kilometres south east of the site.

Figure 4-1presents annual and seasonal "wind rose" plots for the Randwick AQMS for the period 2013 to 2017, inclusive. The plots show that north-easterly winds are prevalent in summer and spring and westerly winds are prevalent in winter and autumn.

4.1.2 Temperature Humidity and Rainfall

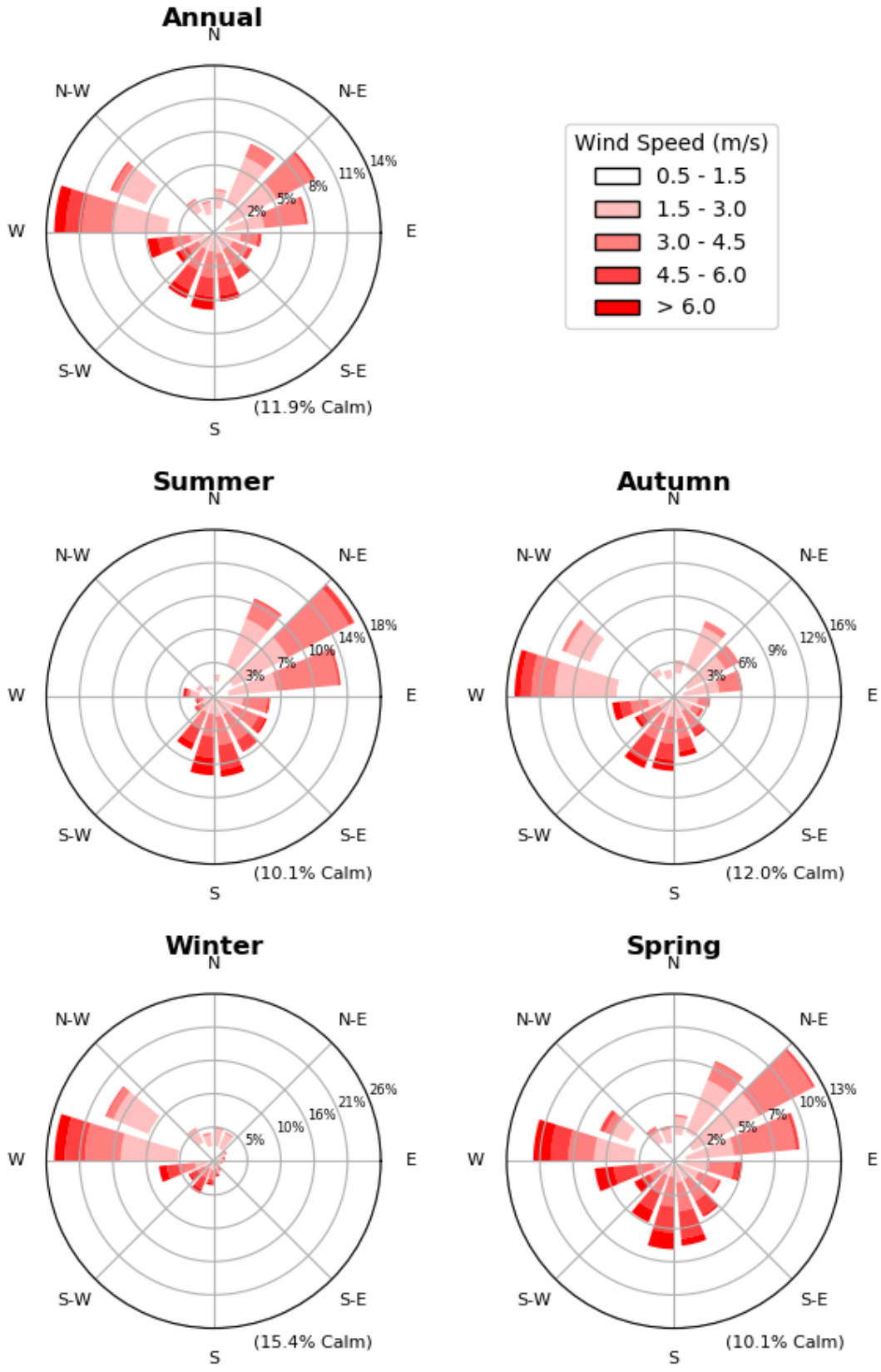
Long term meteorological data for the area surrounding the Site is available from the Bureau of Meteorology (BoM) operated weather station at Observatory Hill. The Observatory Hill BoM station is located approximately 3.7 km north west of the Proposal site and records observations of a number of meteorological parameters including temperature, humidity, and rainfall.

Long-term climate statistics are presented in Table 4-1. Temperature data recorded at the Observatory Hill BoM station indicates that January is the hottest month of the year, with a mean daily maximum temperature of 26.0°C. July is the coolest month with a mean daily minimum temperature of 8.1°C. June is the wettest month with an average rainfall of 133 mm falling over 9 days. There are, on average, 100 rain days per year, delivering 1,216 mm of rain.

Table 4-1 Climate Averages for Observatory Hill BoM Station

Obs.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9am Mean Observations													
Temp (°C)	22.5	22.3	21.1	18.2	14.6	11.9	10.9	12.5	15.7	18.5	19.9	21.6	17.5
Hum (%)	71	74	74	72	74	74	71	66	62	61	66	67	69
3pm Mean Observations													
Temp (°C)	24.8	24.9	24.0	22.0	19.4	16.9	16.4	17.5	19.2	20.7	22.1	23.8	21.0
Hum (%)	62	64	62	59	57	57	51	49	51	56	58	59	57
Daily Minimum and Maximum Temperatures													
Min (°C)	18.8	18.8	17.6	14.7	11.6	9.3	8.1	9.0	11.1	13.6	15.7	17.6	13.8
Max (°C)	26.0	25.8	24.8	22.5	19.5	17.0	16.4	17.9	20.1	22.2	23.7	25.2	21.8
Rainfall													
Rain (mm)	101.7	117.5	130.8	127.9	118.0	133.2	96.6	80.7	67.9	76.4	83.6	77.5	1216
Rain (days)	8.6	9.0	9.8	9.0	8.6	8.7	7.5	7.2	7.2	7.9	8.4	8.0	99.9

Figure 4-1 Windrose Plot – Randwick OEH AQMS, 2013-2017



4.2 Local Ambient Air Quality

Data from the Randwick AQMS has been used to establish typical ground level concentrations of particulate matter in the area surrounding the Proposal. A summary of the PM_{10} and $PM_{2.5}$ monitoring results collected at the Randwick AQMS over the period 2013 – 2018 is presented in Table 4-2. It is noted that observations of $PM_{2.5}$ at the Randwick AQMS began in 2017.

From time to time, the 24-hour average concentrations of PM_{10} and $PM_{2.5}$ exceed the goals of 50 µg/m^3 and 25 µg/m^3, respectively. These events are most often associated with extreme conditions such as bushfires, hazard reduction burning and dust storms. Where the maximum 24-hour average particulate matter concentrations in a particular year exceeded the goal, Table 4-2 presents the next highest value. In the majority of cases, the next highest values comply with the goals. During 2018, wide spread dust storms during February, March, August and November resulted in PM_{10} concentrations exceeding the goal of 50 µg/m^3 on 5 days of the year.

Table 4-2 Particulate Matter Monitoring Results – Randwick

Year	**PM_{10} (µg/m^3)**		**$PM_{2.5}$ (µg/m^3)**	
	24-hour average (100th percentile)	Annual average	24-hour average (100th percentile)	Annual average
2013	55.3 (45.3)	18.8	No data	
2014	46.1	18.1		
2015	77.4 (41.9)	18.6		
2016	44.1	17.9		
2017	56.0 (46.2)	19.2	45.3 (22.0)	6.9
2018	95.5 (67.1)	21.2	31.8 (24.7)	7.6

5 ASSESSMENT OF IMPACTS

5.1 Assessment Methodology

This section presents a qualitative assessment of potential air quality impacts associated with the proposed demolition works and has been conducted in general accordance with the methodology described in *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014) prepared by the UK Institute of Air Quality Management (IAQM). This approach presents the risk of dust soiling and human health impacts associated with construction and demolition works and involves the following steps:

- Step 1: Screen the need for a detailed assessment;
- Step 2: Assess the risk of dust impacts arising, based on:
    - The potential magnitude of dust emissions from the works; and,
    - The sensitivity of the surrounding area.
- Step 3: Identify site-specific mitigation; and,
- Step 4: Consider the significance of residual impacts, after the implementation of mitigation measures.

5.2 Risk Assessment of Dust Impacts from Construction Works

The following qualitative risk assessment of potential dust impacts has been conducted for the proposed construction works.

5.2.1 Step 1 – Screen the need for a detailed assessment

The IAQM guidance document recommends that a risk assessment of potential dust impacts from construction activities be undertaken when sensitive receptors are located within:

- 350 m of the boundary of the site; or,
- 50 m of the route(s) used by construction vehicles on public roads up to 500 m from the site entrance(s).

As shown in Figure 2-1, a number of sensitive receptors are located within 350 m of the site and within 50 m of routes used by construction traffic. Therefore, an assessment of dust impacts is considered necessary under the guideline.

5.2.2 Step 2A – Potential dust emission magnitude

The following section evaluates the potential dust emission magnitude for earthworks, construction and trackout (i.e. haulage) activities. These emission magnitudes have been classified based on the examples provided in the IAQM guidance document (Section 7, Step 2: Assess the Risk of Dust Impacts).

The dust emission magnitude associated with earthworks activities may be classified as:

- **Large:** total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes;

- **Medium:** total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes; and,
- **Small:** total site area <2,500 m^2, soil type with large grain (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.

The total site area is large than 10,000 m^2. Therefore, the dust emission magnitude for earthworks activities is classified as **large**.

The dust emission magnitude associated with general construction activities may be classified as:

- **Large:** total building volume >100,000 m^3, on site concrete batching, sandblasting;
- **Medium:** total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete) on site concrete batching; and,
- **Small:** total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The total building volume of new structures to be built exceeds 100,000 m^3 and on-site concrete batching has not been proposed. Therefore, the dust emission magnitude for the construction of the Proposal is classified as **large**.

The dust emission magnitude associated with trackout by heavy vehicles may be classified as:

- **Large:** >50 heavy vehicle (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;
- **Medium:** 10-50 heavy vehicle outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m; and,
- **Small:** < 10 heavy vehicle outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

During concrete pours, more than 60 heavy vehicle outward movements would be expected. However, the majority of haulage roads within the site are paved, resulting in lower potential for dust release. Therefore, the dust emission magnitude for trackout is classified as **medium**.

5.2.3 Step 2B – Sensitivity of surrounding area

The sensitivity of the surrounding area to dust impacts considers a number of factors, including:

- Specific receptor sensitivities;
- The number of receptors and their proximity to the works;
- Existing background dust concentrations; and,
- Site-specific factors that may reduce impacts, such as trees that may reduce wind-blown dust.

The most sensitive receptors near the proposed works are residents in nearby Paddington. In accordance with the IAQM guidance document, these receptors are considered to have a "high" sensitivity to dust soiling and health impacts.

Furthermore, in accordance with the IAQM guidance document, workers in nearby offices would have a "medium" sensitivity to dust soiling and health impacts and nearby parks and recreational areas would have a "medium" sensitivity to dust soiling impacts and a "low" sensitivity to health impacts.

It is considered unlikely that significant construction works would be conducted within 20 m of sensitive receptors. However, there is the potential for more than 100 high sensitivity receptors to be located within 50 m of the works.

Based on the above factors and following the decision matrix in Table 2 of the IAQM guidance document and presented in Figure 5-1, the area surrounding the works is determined to have a **high** sensitivity to dust soiling impacts.

Figure 5-1 Area Sensitivity Decision Matrix – Dust Soiling

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)[c]			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

In accordance with the decision matrix in Table 3 of the IAQM guidance document and presented in Figure 5-2, the area surrounding the works is determined to have a **low** sensitivity to human health impacts from construction dust.

Figure 5-2 Area Sensitivity Decision Matrix – Human Health

Receptor Sensitivity	Annual Mean PM_{10} concentration[c]	Number of Receptors[d]	Distance from the Source (m)[e]				
			<20	<50	<100	<200	<350
High	>32 µg/m³ (>18 µg/m³ in Scotland)	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m³ (16-18 µg/m³ in Scotland)	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m³ (14-16 µg/m³ in Scotland)	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m³ (<14 µg/m³ in Scotland)	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m³ (>18 µg/m³ in Scotland)	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m³ (16-18 µg/m³ in Scotland)	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m³ (14-16 µg/m³ in Scotland)	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m³ (<14 µg/m³ in Scotland)	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

The determinations of area sensitivities to dust soiling and human health impacts from the proposed works are summarised in Table 5-1.

Table 5-1 Sensitivity of the Surrounding Area

Impact	Key Factors	Sensitivity of the Area
Dust Soiling	Receptor sensitivity = high >100 receptors within 50 m of works	High (ref. IAQM Table 2)
Human Health	Receptor sensitivity = high >100 receptors within 50 m of works Annual average PM_{10} concentration < 24 µg/m^3	Low (ref. IAQM Table 3)

5.2.4 Step 2C – Define the risk of impacts

To define the risk of impacts, the dust emission magnitudes for earthworks (large), general construction (large) and trackout (medium) are combined with the sensitivity of the area, as per Table 5-3, Table 5-3 and Table 5-4, respectively.

Table 5-2 Risk of Dust Impacts from Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

In accordance with Table 5-2, earthworks activities associated with the Proposal are considered to have a "High Risk" of dust soiling effects and a "Medium Risk" of health impacts.

Table 5-3 Risk of Dust Impacts from Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

In accordance with Table 5-3, general construction activities associated with the Proposal are considered to have a "High Risk" of dust soiling effects and a "Medium Risk" of health impacts.

Table 5-4 Risk of Dust Impacts from Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Medium Risk	Low Risk	Negligible

In accordance with Table 5-4, vehicle trackout associated with the construction of the Proposal is considered to have a "Medium Risk" of dust soiling effects and a "Low Risk" of health impacts.

The identified dust risks associated with the construction of the Proposal are summarised in Table 5-5.

Table 5-5 Summary of Dust Risks

Potential Impact	Risk		
	Earthworks	Construction	Trackout
Dust Soiling	High Risk	High Risk	Medium Risk
Human Health	Medium Risk	Medium Risk	Low Risk

5.2.5 Step 3 – Site-specific mitigation

The IAQM guidance document identifies a range of appropriate dust mitigation measures that should be implemented as a function of the risk of impacts. These measures are presented in Section 6.

5.2.6 Step 4 – Significance of residual impacts

In accordance with the IAQM guidance document, the final step in the assessment is to determine the significance of any residual impacts, following the implementation of mitigation measures. To this end, the guidance states:

For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be "not significant".

Based on the proposed construction works, and the advice in the IAQM guidance document, it is considered unlikely that these works would result in unacceptable air quality impacts, subject to the implementation of the mitigation measures outlined in Section 6.

6 MITIGATION AND MANAGEMENT

6.1 Mitigation Measures

The preceding assessment of potential dust impacts from the proposed construction works indicates that, in the absence of specific mitigation measures, the works have a high risk of dust soiling impacts and a medium risk of health impacts.

Accordingly, the following mitigation measures are deemed "highly recommended" in accordance with the IAQM guidance document. A Dust Management Plan (DMP) should be developed prior to commencement of works and should consider the following measures where practicable:

- **Communications**
    - Develop and implement a stakeholder communications plan that includes community engagement before construction work commences on site, and:
        - Displays the name and contact details of the Responsible Person accountable for air quality and dust issues on the site boundary.
        - Displays the head or regional office contact information.
    - Develop and implement a Dust Management Plan (DMP) that considers, as a minimum, the measures identified herein.
- **Site management**
    - Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
    - Make the complaints log available to relevant authorities (Council, EPA, DP&E).
    - Record any exceptional incidents that cause dust and/or air emissions, either on or off site, and the action taken to resolve the situation in the log book.
    - Hold regular liaison meetings with any other high-risk construction sites within 500 m of the site boundary to ensure plans are coordinated.
- **Monitoring**
    - Undertake daily on-site and off-site inspection, where receptors are nearby, to monitor dust. Record inspection results and make available to relevant authorities. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary, with cleaning to be provided if necessary.
    - Carry out regular on site and off site inspections to monitor compliance with the DMP, record inspection results, and make inspection log available to relevant authorities.
    - Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during any periods of prolonged dry or windy conditions.
    - Agree any dust monitoring locations with the relevant authority. Where possible, commence baseline monitoring before work commences on site.
- **Preparing and maintaining the site**
    - Plan site layout so that machining and dust generating activities are located away from receptors, as far as possible.
    - Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on sit.

- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If being re-used, keep materials covered.
- Cover, seed or fence stockpiles to prevent wind erosion.

- **Construction vehicles and sustainable travel**
  - Ensure all vehicles switch off engines when stationary - no idling vehicles.
  - Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
  - Impose and signpost a maximum-speed-limit of 25 kph on surfaced and 15 kph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided).
  - Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
  - Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)
- **Operations**
  - Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
  - Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
  - Use enclosed chutes and conveyors and covered skips.
  - Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
  - Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
- **Measures specific to earthworks**
  - Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
  - Use hessian, mulches or trackifiers (soil stabiliser) where it is not possible to re-vegetate or cover with topsoil as soon as practicable.
  - Only remove the cover in small areas during work and not all at once.
- **Measures specific to construction**
  - Avoid scabbling (roughening of concrete surfaces) if possible.
  - Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
  - Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of

material and overfilling during delivery.

- For smaller supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust.

- **Measures specific to trackout (haulage)**
  - Use water-assisted dust sweeper(s) on the access and local roads, as necessary.
  - Avoid dry sweeping of large areas.
  - Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
  - Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
  - Record all inspections of haul routes and any subsequent action in a site log book.
  - Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
  - Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
  - Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
  - Access gates to be located at least 10 m from receptors where possible.

Prior to the commencement of construction / demolition works, the dust mitigation management measures recommended by the IAQM guidance document should be considered and, where practicable, included in the *Construction Environmental Management Plan* (CEMP) for the project.

6.2 Dust Monitoring

It is recommended that dust monitoring is conducted during the works at locations representative of the most potentially affected sensitive receptors. The monitoring locations should have regard for the location of dust generating equipment and activities and the prevailing weather conditions.

The monitoring equipment should be capable of measuring ambient PM_{10} concentrations and providing notifications when levels exceed certain threshold values. The notifications should be provided in a timely fashion, say within one hour, to facilitate the implementation of reactive management. It is recommended that optical type equipment, such as an Aeroqol Dust Sentry, is used for the monitoring. While it is noted that these units are not approved under the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (EPA, 2007), they are well suited to reactive management of construction dust as they can provide data in near real-time and have significantly lower capital costs compared to other equipment.

The trigger levels in Table 6-1 are proposed for reactive management. These values have been developed with a view to ensuring that ambient dust and particulate matter concentrations in the surrounding area comply with the criteria presented in Section 3.3, but are expressed in time scales short enough to support reactive management. Similar trigger levels have been used on other large dust generating activities in NSW.

Table 6-1 Reactive Management Trigger Levels – PM_{10}

Trigger Stage	Averaging Period	Trigger Value ($\mu g/m^3$)	Action Required
1 Investigate	1 hour	85	Site Manager to undertake review of possible dust sources operating during the average period. Identify possible measures for these activities; action if deemed necessary.
	3 hour	80	
2 Action	1 hour	470	Site Manager to attend site and ensure implementation of the control. Effectiveness of control actions to be reviewed and escalate where appropriate.
	3 hour	160	
3 Stop Work	1 hour	940	Targeted shut down of dust-generating activities until the measured pollutant levels are below the stated trigger value. Identify long-term solutions to dust issues.
	3 hour	320	

Prior to the commencement of construction / demolition works, a dust monitoring plan should be prepared and included in the CEMP for the project.

It is noted that a dust monitoring system has been implemented for the Stage 1 demolition works which is generally consistent with the details above.

7 CONCLUSION

A State Significant Development (SSD) application for the redevelopment of the Sydney Football Stadium has been submitted to the Minister for Planning, pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The redevelopment of the Sydney Football Stadium is proposed in a staged manner as follows:

- Stage 1 – Concept Proposal for the stadium envelope and supporting retail and functional uses as well as development consent for the carrying out of early works, including demolition of the existing facility and associated structures.
- Stage 2 – Detailed design, construction and operation of the stadium and supporting businesses, retail and functional uses.

Wilkinson Murray Pty Limited has been engaged by Infrastructure New South Wales to prepare an Air Quality Impact Assessment (AQIA) for the construction works proposed under Stage 2 of the Sydney Football Stadium redevelopment.

A qualitative assessment of potential air quality impacts associated with the proposed construction works has been conducted in general accordance with the methodology described in *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014) prepared by the UK Institute of Air Quality Management (IAQM).

In accordance with the IAQM assessment methodology, the construction of the Proposal is considered to have, at worst, a "High Risk" of dust soiling effects and a "Medium Risk" of health impacts. Accordingly, a range of management and mitigation measures have been identified to minimise these impacts.

Subject to the implementation of mitigation measures, the residual effects of dust from the project are expected to be not significant and to have a low risk of generating unacceptable air quality impacts.

Real time dust monitoring and reactive management, which have been employed for the Stage 1 demolition works, are recommended to confirm that dust impacts associated with the works are acceptable.