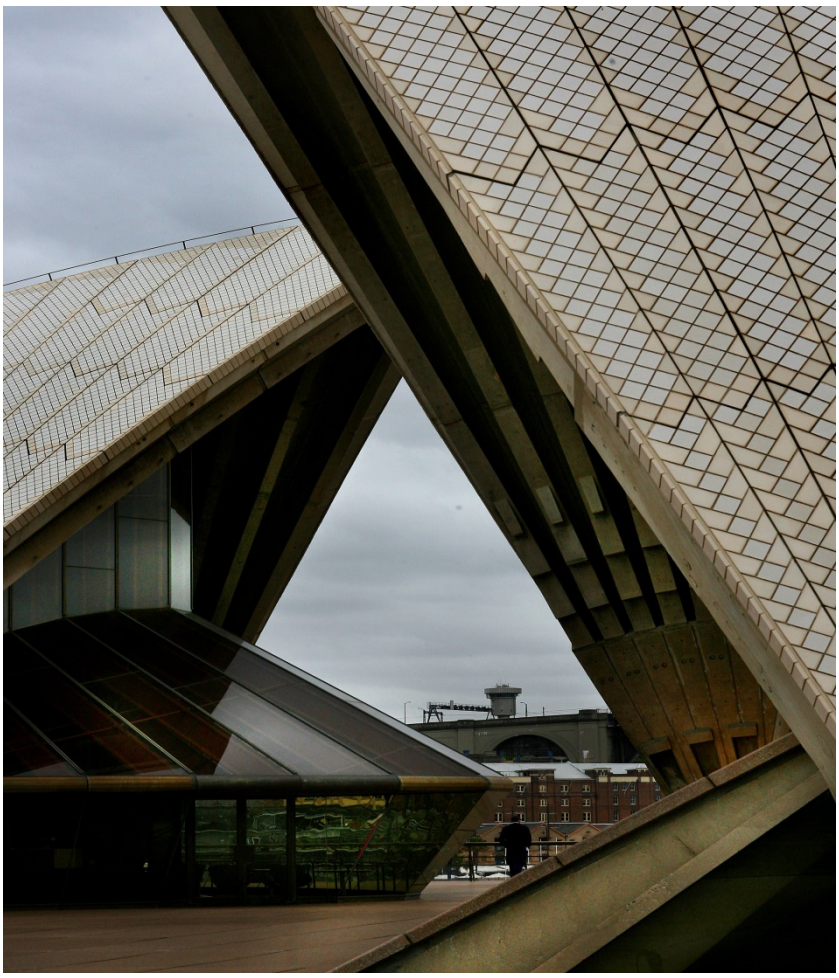
Sydney Opera House

Accessibility and Additional Works Joan Sutherland Theatre, Eastern Accommodation and Entry Foyer

DA2

Construction Management Plan



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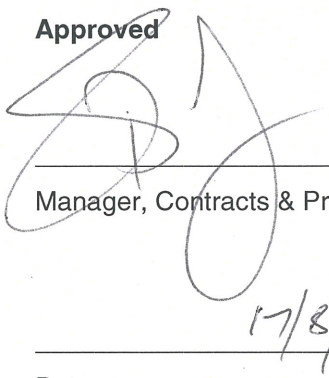

Manager, Contracts & Projects

17/8/16

Date

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1 INTRODUCTION

During the closure of the Joan Sutherland Theatre (JST) in 2017 to upgrade the Theatre Machinery the Sydney Opera House (SOH) proposes to take advantage of this rare opportunity to undertake a number of additional projects. These projects range from accessibility lifts, level passageways and additional sanitary facilities to upgrades of control rooms and the fire curtain system.

During the 7 month closure the remainder of the Opera House will remain operational. Business integration operational plans are in development to ensure the success of the projects while allowing day to day business as usual activities to continue throughout the remainder of the Opera House.

This report addresses the key construction activities, waste management and safety aspects of the projects. The identified methodology, procedures and details described in this report are indicative, and will be refined by the Contractor engaged to undertake the project prior to commencing construction. This methodology has been developed to provide a basis for assessment of the environmental impacts of the project.

2 PROJECT DESCRIPTION

There number of individual projects which are designed to address operational, accommodation and safety upgrade issues for staff as well as significantly enhanced function facilities and entry foyer spaces. The installation of lifts, level passageways and additional sanitary facilities are designed to benefit not only disabled patrons in wheelchairs but our numerous older patrons with limited mobility.

The individual projects include;

- Joan Sutherland Theatre (JST) Accessibility Projects
- Joan Sutherland Theatre (JST) Seat Refurbishment
- Joan Sutherland Theatre (JST) Alterations to the Fire Curtain
- Joan Sutherland Theatre (JST) Follow Spot Room
- Eastern Accommodation
- Entry Foyer

This package of works is collectively being assessed as DA2 as part of the Renewal Stage 1 works at the Sydney Opera House.

2.1 Joan Sutherland Theatre (JST) Accessibility projects

These works involve the following ‘packages’ of works;

i) Wheelchair Accessible Seating- This project provides wheelchair accessible seating in two key locations within the theatre where access is possible and sight lines are maintained. Accessible seating upgrades will be completed in rows A, B, C and M, N, P of the auditorium to comply with DDA legislation

ii) Vertical and Horizontal Connections- Provision of an equitable path of travel to the western side of the theatre, providing access to the wheelchair accessible seating spaces off Level 2 and 3 of the Foyer. This will be achieved through the creation of a level passageway through the West Foyer linking the Southern Foyer to the bottom level of the Northern Foyer. A new lift core (Lift 31) will also be created to service all levels of the North Foyer which will connect to a second passage on Level 3.

iii) Patron Amenities- New accessible toilet will be installed adjacent to the existing facilities on level 3 of the Northern Foyer.

iv) Performer Accessibility- In order to provide accessible facilities for the performers, upgrades will be proposed for the dressing room facilities, and accessible paths to the performance areas of the theatre. Whilst the Stage is currently accessible, the Orchestra Pit below is not. This will be achieved through two dressing rooms in the back of house will be upgraded to become accessible and a wheelchair lift will be installed in the orchestra pit with access paths widened to facilitate wheelchair movement. These project will ensure performers have dignified and equitable access.

2.2 Auditorium seat refurbishment

These works involve the refurbishment or renewal of the auditorium seating Options being considered range from renewal of upholstery only and treatment of the timber frame to renewal of the entire seat.

2.3 Alterations to fire curtain

These works involve alterations to the existing iron fire curtain immediately upstage of the proscenium arch. Options being considered are removal of the existing flap which covers the gap between the stage and the auditorium or the replacement of the iron curtain with a new light weight fabric curtain.

2.4 JST Follow Spot Room

These works involve the construction of a new follow spot room at the rear of the auditorium to provide operators with acceptable working conditions and the correct angles for the spotlights to reach all areas of the stage.

2.5 Eastern office accommodation

In space realised by a separate Renewal Project, The Theatre Machinery Project (TMP) addressed in a separate construction management plan, it is proposed to provide typical office accommodation for up to 42 staff.

2.6 Entry Foyer

The area currently known as the Box Office Foyer will be upgraded into the new Entry Foyer with digital ticketing, cloaking, information and a welcoming lounge area. The area has been substantially redesigned to best deal with the multiple uses required, the different character of daytime and night time operations and improved pedestrian flows. The upgrade will be done in 3 stages in line with the overall Building Renewal plan.

This first stage which encompasses the east of the foyer is aligned with the Joan Sutherland Theatre closure and includes the replacement of the Utzon Room stairs with 2 escalators, a new lift from the Entry Foyer level to the Joan Sutherland Theatre Southern Foyer (Lift 36), a new ticketing and cloaking area and a new retail footprint.

As SOH will continue to function during the construction period acoustic hoardings will be required to address noise impacts on adjacent operational areas.

3 PROJECT AREA

The project area is largely contained to the Eastern side of the Opera House; within the Joan Sutherland Theatre (including the foyer spaces), the Box Office Foyer, working title Entry Foyer, and current plantroom spaces which will be converted in Eastern Accommodation.

The impact on external areas will be primarily;

- The creation of a new slot window in the eastern façade of the building which will affect the Eastern Broad walk; and
- In some instances there will be impact on external areas with the delivery and/or collection of materials to the Opera House site.

The project area includes:

- The auditorium and back of house follow spot rooms
- The stage interface with the auditorium and the downstage area where the existing fire curtain is installed
- The orchestra pit
- The Northern, Western and Southern Foyers
- The scenery dock – this will be a staging area for deliveries and storage of materials awaiting removal
- The Box Office Foyer
- The area beneath the Northern Foyer
- The Eastern Broad walks

The project will look to utilise the same construction hoardings provided for the Theatre Machinery Project in order to delineate their construction zones. Additional hoardings will be provided as required in the Northern, Western and Southern Foyers. Where required these hoardings will be acoustic to assist with noise control.

The Entry Foyer works will be undertaken sequentially with the eastern end of the Box Office Foyer hoarded off first to allow the Entry Foyer upgrade including the installation of 2 new escalators and 1 lift. Access to the Utzon Room will be maintained throughout the construction period. Detailed construction staging and sequencing will be developed with our successful contractor. Once the eastern end of the Entry Foyer is operational the central then western areas will be closed and constructed.

Specialist hoarding will need to be installed to facilitate the creation of the proposed slot window in the eastern façade of the building. This hoarding will need to ensure the safety of the public whilst free access is maintained along the Eastern Broad walk. Acoustic isolation of the works is also a major factor. It is our intention to maintain free pedestrian access completely around the building as much as possible.

4 CONSTRUCTION

The following construction methodology and associated details and procedures are indicative and will be refined by the Contractor engaged to undertake the project prior to commencing construction. This methodology has been prepared by Sydney Opera House to provide a basis for assessment of the environmental impacts of the project.

4.1 Construction Methodology

The project works can be described in the following components:

- Joan Sutherland Theatre (JST) Accessibility Projects
- Joan Sutherland Theatre (JST) Seat Refurbishment
- Joan Sutherland Theatre (JST) Alterations to the Fire Curtain
- Joan Sutherland Theatre (JST) Follow Spot Room
- Eastern Accommodation
- Entry Foyer
- Associated Builder's works

(a) JST Accessibility Projects

These works involve the following 'packages' of works;

i) Wheelchair Accessible Seating- All works are confined to the JST theatre and light demolition will be required within the JST theatre. Wherever possible new seats and equipment will be delivered in sections or 'pre-fabricated' to reduce construction works within the space. Typically only light construction methods will be required to undertake the works.

ii) Vertical and Horizontal Connections- These works will require heavy demolition of the concrete structure in the Western foyer to create the passage way through the stairs. Also concrete demolition works will be required to achieve the installation requirements of new lift 31. These works can largely be contained within the envelope of the JST foyers; however there is an external façade interface with lift 31 in the Northern Foyers.

iii) Patron Amenities- Medium to light demolition and construction is required to install the new patron amenities. This is in the form of demolition of concrete and stud/ frame walling and then subsequent construction of light weight walling (i.e. stud and track). Once again these works can be contained within the JST northern foyers. General construction methodology required for the construction of bathroom including fixtures and fittings.

iv) Performer Accessibility- Medium to light demolition and construction is required to install the new performer accessible amenities. This is in the form of demolition of concrete and stud/ frame walling and then subsequent construction of light weight walling (i.e. stud and track). Once again these works can be contained within the SOH green room and JST dressing rooms, which should not have a great impact on the ongoing functions of the House.

(b) Auditorium Seating Refurbishment

These works are proposed to be tendered as part of a specialist contractor procurement process, which will require extensive prototyping to ensure the refurbished seat complies with the SOH Conservation Management Plans. It is anticipated that seating will be able to be removed from site, re-fitted and treated as required, and subsequently re-installed in the theatre. Works will be contained to within the theatre with majority of construction works undertaken off site.

(c) Alterations to Fire Curtain

These works involve alterations to the existing iron fire curtain immediately upstage of the proscenium arch. Options being considered are removal of the existing flap which covers the gap between the stage and the auditorium or the replacement of the iron curtain with a new light weight fabric curtain. Construction will be contained to within the Theatre during its planned closure and therefore should have no subsequent impact on the rest of the House.

(d) New Follow Spot Room

Works will be undertaken at height, in and around the catwalk at the rear of the JST. Demolition and modification is required to the existing catwalk, however not on the structural framing. Works will also be required on the JST ceiling lining, which will be closely monitored for heritage implications. Typically demolition and construction will be light however care will need to be taken as works will be undertaken at height.

(e) Eastern Office Accommodation

A concurrent project, the JST Theatre Machinery Project (TMP) upgrade makes existing winch power and dimmer rooms redundant, releasing space for a new offices. Medium weight demolition will be required to remove existing machinery, concrete mezzanine floor and existing partitions. Heavy demolition works will be undertaken on the Eastern façade of the Opera House for the installation of a new slot window, as documented. These works will have a public & external interface and will therefore require hoardings and acoustic treatment of the works. Construction will be of a lighting weight nature with a new Bondek mezzanine slab and associated light weight partitions. All external construction will be in materials to seamlessly blend the new window into the external façade (i.e. granite).

(f) Entry Foyer

The area currently known as the Box Office Foyer will be upgraded into the new Entry Foyer with digital ticketing, cloaking, information and a welcoming lounge area. Medium weight demolition works will be undertaken to remove existing walls and partitions throughout the entry foyer. Heavy demolition will be required for the installation of lift 36 and two new escalators. Heavy construction works associated with the installation of the lift and escalators will have the greatest impact on the space.

Typically the design of the built elements within the Entry Foyer is modular and therefore construction will be medium to light weight with elements being built off site and assembled within the space.

Depending on advice from contractors and sub-contractors the works to the Entry Foyer are currently planned to be executed in three stages; east, central and west. During the eastern area of construction ongoing access will be provided to the Utzon Room. The central area will then be done with the western area last. This sequencing is yet to be finalised.

(g) Associated Builder's Works

These works involve demolition and removal of materials to create the new western accessible passageways, penetrations to accommodate the new lift cores (Lifts 36 & 31), the replacement of the Utzon Room stairs and the slot window in the eastern façade of the building; major construction activities include creation of the new lift cores (Lifts 36 & 31), the creation of a mezzanine floor in the Eastern Office Accommodation and the creation of the new Follow Spot room structure; removal of redundant services and adaption of existing services and installation of new services; the construction of masonry and partition walls as required.

4.2 Construction Duration and Timing

Most components of the project are scheduled to be completed within the already planned 7 month closure of the Joan Sutherland Theatre in the second half of 2017. Some works, such as the fit out and commissioning of Lifts 36

& 31, are programmed to continue after the 7 month closure period. As many enabling works as possible will be done prior to this closure to ease the time pressure.

Those components of the project wholly contained within the Joan Sutherland Theatre internal spaces will generally not be audible outside of the building and therefore will be scheduled to occur outside standard construction hours. Works in the Northern, Western and Southern and Box Office Foyers will be enclosed to isolate works from the public and the ongoing operation of the House. All possible solutions will be investigated, such as acoustic hoardings and scheduling of works outside standard construction hours, to alleviate impacts of the work. Works associated with the creation of the slot window in the eastern façade of the building will be a specific focus for these innovative approaches as they have the greatest likelihood of affecting neighbours.

(a) Construction Works

Throughout the construction of these works it is proposed that the other functions around the House continue to function with as little disruption as possible. To facilitate the daily operations of Sydney Opera House noisy work shifts will be scheduled overnight, wherever possible.

To achieve the works within planned closure periods for the theatre and to mitigate disruption to the ongoing operations of the Opera House the works will be undertaken 24 hours a day and 7 days a week in the following shift pattern:

- 18:00-23:30 – planning and quiet activities which are compatible with live performances occurring in other venues within the site
- 23:30-10:30 – works which would otherwise be disruptive to SOH operations
- 10:30-18:00 – no major noise but general construction, allowing daily SOH operations (i.e. matinee's)

This proposal to work 24/7 in controlled shifts, outside standard construction hours, is consistent with previous approvals granted for works on the site and is crucial to the delivery of the project within the closure timeframe.

The delivery and collection of building materials and equipment will be managed so as not to unreasonably impact on the amenity of the patrons of Sydney Opera House and the surrounding neighbours. The works will be completed in accordance with City of Sydney Code of Practice for Construction Hours/Noise 1992 and Australian Standard 2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites.

4.2.a.1 Construction Noise Management Plan (CNMP)

The Opera House recognises noise issues affecting nearby neighbours during external works. Therefore Arup have been engaged to provide direction during the design phase on the implications of construction works on nearby neighbours, refer to the Noise Impact Assessment completed by Arup.

The Opera House will enforce that their Contractor identifies mitigation measures for external construction work in a Construction Noise Management Plan (CNMP) prior to works commencing on site.

Noise Mitigation:
This CNMP will consider, as a minimum, all mitigation proposed by Arup in their Noise Impact Assessment. This includes:

- CNMP to be reviewed by SOH and their noise consultants prior to approval and implementation on site
- CNMP will be audited by SOH during construction
- The SOH Contractor will also be required to coordinate the Renewal Program to avoid cumulative effects of concurrent construction projects
- The Contract with the SOH Contractor includes a clause allowing SOH to disallow any equipment that it considers to be excessively noisy

- Where the Arup Noise Impact Assessment identified potential exceedances of the Noise Affected Level (NAL) the Managing Contractor will be required to develop mitigation measures which reduce the NAL or program the works, around SOH daily activities in order to remain within the proposed noise affected level
- Only in extreme circumstances with SOH allow exceedances of the proposed noise affected level, as allowed in the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009)

4.2.a.2 Noise Monitoring

A noise logger will be installed and maintained which can be interrogated remotely by SOH staff as well as SOH's Contractor. The logger will also be required to automatically send a text message to SOH's Contractor's representative on site once the 'warning' threshold is breached. The SOH representative on site during the works will also be copied in with the warning texts.

The following noise limits will be applied:

Receiver	**Time Period**	**Warning level, $L_{Aeq(15min)}$**	**Maximum Level, $L_{Aeq(15min)}$**
Bennelong Apartments	Day (standard hours)	65 dB	68 dB
	Day (outside hours)	60 dB	63 dB
	Evening	59 dB	62 dB
	Night	50 dB	53 dB
	Day (standard hours)	61 dB	64 dB
	Day (outside hours)	56 dB	59 dB
	Evening	54 dB	57 dB
	Night	48 dB	51 dB
	Day (standard hours)	58 dB	61 dB
	Day (outside hours)	53 dB	56 dB
	Evening	53 dB	56 dB
	Night	47 dB	50 dB

The maximum level has been developed by Arup (Refer Noise Impact Assessment August 2016) though the process outlined by the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009), as applicable for State Significant Developments.

Should any complaints be received that cannot be resolved by cessation of works, attended acoustic monitoring will be undertaken to validate the remote logger data and address specific work practices and locations to better alleviate noise complaints from that particular activity. Following identification that all noise levels have returned to being below the above maximum levels the monitoring will revert back to remote monitoring.

4.2.a.3 Notification to Residents

The Opera House will manage the notification of nearby residents which informs them of the nature of the works, the duration and the extent of works being undertaken. 24hr contact details will be provided to allow complaints to be logged and addressed as soon as possible by the Opera House and the Managing Contractor.

4.3 Workforce

The size of the workforce is dependent on the specific construction methodology and sequencing employed by the Contractor engaged to undertake the works and is unable to be identified at this stage. An indicative peak construction workforce is estimated to be approximately 70-100 persons.

4.4 Construction Equipment

A definitive list of proposed construction equipment is not currently available as this would be dependent on the specific methodology and sequencing used by the Contractor engaged to undertake the works. The following is an indicative list of the equipment that may be used during construction:

- Jackhammers
- Concrete saws
- Mobile crane
- Piling rig
- Semi-trailers for delivery of materials
- Dump trucks for removal of rubble
- Concrete trucks
- Concrete pumps
- Concrete vibrators
- Cherry pickers and Elevated work platforms
- Hand power tools
- Elevated work platforms

4.5 Construction Impacts

(a) Safety and the Public

The Opera House is to continue operations as normal during the construction period. The majority of the works will be confined within the Joan Sutherland Theatre and foyers. Public areas affected by the works such as the new windows for the Eastern Office Accommodation and the Entry Foyer works will be enclosed by construction hoardings and sealed off from public access.

The successful contractor will be required to address the detailed requirements of circulation and pedestrian interfaces with the construction work faces throughout the program of works.

It is anticipated that any interface between the public, Sydney Opera House staff, performers and the building activities will be minimal.

4.5.a.1 Circulation Impacts

This package of works is largely contained within the Joan Sutherland Theatre or internally within the back of house areas of the Opera House and therefore interface and effect on circulation should be minimal. It is a priority

of the Opera House to ensuring the public, SOH staff and performers are safe throughout and will be a key factor in the staging and planning of construction activities.

Deliveries and removal of materials will be mainly via the new underground loading dock, which will not be affected by the proposed works. It is envisaged that wherever possible the loading dock will be used for construction deliveries and to supply the site with materials/ equipment. The exception to this approach will be for oversized items which will be managed via delivery across the forecourt. In order to limit the impact on circulation and pedestrians it is anticipated that these works will be completed overnight.

4.5.a.2 Pedestrian Access

This package of works is largely contained within the Joan Sutherland Theatre or internally within the back of house areas of the Opera House and therefore interface with pedestrians should be minimal. Once again, ensuring the safety of the public, SOH staff and performers will be a key factor in the staging and planning of construction activities.

The Eastern Broad walk is likely to be affected by the installation of the new slot window in the façade however it is proposed that appropriate hoardings will be installed to ensure ongoing access to this side of the Opera House. It is however anticipated that the Broad walk will need to be closed for safety reasons at some stage of the construction. These closures will be kept to a minimum and/or done overnight to facilitate public access around the building.

Prior to commencing construction the Contractor engaged to undertake the works will prepare a fully detailed works staging strategy which addresses appropriate access and circulation impacts which ensures safety of public and patrons.

(b) Noise and Vibration

Generally construction activities with the proposed scope of works will be confined within the Joan Sutherland Theatre are not anticipated to generate noise and vibration which will impact the external site. The works in the Box Office Foyer and the eastern façade of the building are likely to cause more noise and vibration which will impact the external site or neighbours. This will be mitigated in consultation with the contractor and the acoustic consultant, and measures such as discrete construction techniques (i.e. cutting rooms), isolation by acoustic hoardings and off site manufacture will all be explored to limit impacts of noise and vibration of the Sydney Opera House site or its neighbours.

An initial assessment of the construction noise impacts associated with the works to the eastern accommodation has been completed by Arup in August 2016. It proposed the following mitigation measures;

- Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise
- Ensure site managers periodically check the site and nearby residences for noise problems so that solutions can be quickly applied
- Avoid the use of radios or stereos outdoors during night time works
- Avoid the overuse of public address systems
- Avoid shouting, and minimise talking loudly and slamming vehicle doors, especially during night time works
- Use non-“beeper” reversing/movement alarms such as broadband (non-tonal) alarms or ambient noise-sensing alarms
- Turn off all vehicles, plant and equipment when not in use
- Use residential-grade mufflers on plant
- Ensure all doors/hatches are shut

- Conduct work behind temporary hoardings/screens wherever possible. Site hoardings should be located as close to the noise source as possible, and should be as high as feasible considering the structural support of the hoarding. Site hoardings may not be effective at screening noise to upper floors of sensitive receivers, but can be an effective noise mitigation measure for receivers located on lower floors.
- Provide resilient damping material on bin trucks or receptacles to minimise impact noise from materials loaded on truck
- Avoid metal-to-metal contact on equipment wherever possible
- Fit mufflers/silencers to pneumatic tools (e.g. breakers)
- Use dampened bits on impulsive tools such as jackhammers to avoid “ringing” noise
- Avoid dropping materials from height
- Use of concrete pulverisers or “munchers” as a lower-noise alternative to concrete breakers

These measures are considered reasonable and prior to commencing construction the Contractor will be required to prepare a Construction Noise and Vibration Management Plan and determine where noise and vibration loggers will need to be placed to monitor construction activity. The engagement of a consultant will be considered to provide ongoing monitoring throughout the construction.

(c) Access and Traffic

Typically vehicle movements will be within standard construction hours (7am-6pm). With the impact of traffic on Macquarie Street being limited to construction deliveries and removals. There will be no contractor parking provided on site, with contractors directed to public transport or the nearby Opera House carpark. Note there will be no standing of construction vehicles along Macquarie Street; this will be monitored by the Opera House gatehouse.

All deliveries and removals from site will be via the underground loading dock, accessed from Macquarie Street, with the exception of oversized items. Oversized items which will be delivered to the site will be undertaken at off peak periods (i.e. overnight) at time periods agreed with the contractor and the SOH facilities.

The contractor will be required to produce and adhere to a Traffic Management Plan which will have the following headline requirements;

- Vehicle movements on the forecourt will be managed by accredited traffic controllers.
- Vehicle movements will be separated from the general public to ensure minimal interface with pedestrians across the site.
- Large deliveries and vehicle movements will be managed through a process, such as disruption notice, which is to be approved by SOH prior to large vehicle movements/ deliveries. This will also help to coordinate ongoing activities within the House.

General public access will still be maintained via the vehicle concourse, via controlled entry at the gatehouse, via for the duration of the works to provide less mobile person’s access to the site.

(d) Air Quality

The project has the potential to generate dust from demolition works. Measures will be taken to ensure that the dust is localised within the construction zone. A dust management plan will be prepared by the Contractor engaged to undertake the works prior to commencing construction. Refer also to section (f) Waste for the management of asbestos and associated dust control methods.

Construction plant and equipment selected will be suitable for an internal construction environment to ensure no impact on air quality within the work site, or the Opera House.

(e) Water Quality

All necessary measures will be taken to control potential impacts from external works on Sydney Harbour. This will be managed by the development of a Construction Environmental Management Plan by the contractor which will be reviewed and approved by the Sydney Opera House. The contractor will be required to carefully consider the construction technique to avoid potentially affecting the water quality of the harbour, the proposed works do not pose a major threat to the harbour however.

The proposed construction of new Lift 36 is unlikely to result in any water quality impacts. Historical geotechnical and hydrology reports have been completed around this location for previous projects and works. The construction on lift 36 is the only construction which will have implications for the sub-grade and the reports indicate that the proposed area is above high sea tide level. It is therefore unlikely to be a large tidal inflow or influence on the lift pit or piling locations. A borehole was drilled as part of the earlier geotechnical investigations and water ingress due to tidal variation was noted as being subdued.

The rock level found in this area is about 2-3 metres below the surface and therefore the depth of the proposed piles, with a socket into the sandstone, is likely to be a maximum of 5 metres.

The following construction process is anticipated for the new lift:

- Saw cut existing slab for access
- Bore pier and install lining
- Spoil removed by the contactor
- Cast new pier

The proposed lining will minimise potential concrete leaching and, coupled with the unlikely ingress of sea water, will reduce the risk of pollution to the harbour.

The Opera House will undertake geotechnical investigations during the detailed design of the project to understand the existing water quality in detail. Where excavation is required into the bed rock the process will be once again be highlighted in the Construction Environmental Management Plan. Appropriate controls, monitoring and mitigation measures, such as sediment controls, ‘wet-vacuuming’ or off-site removal of the item to undertake the works. will be investigated to limit the possibility of contamination of groundwater/ harbour as a result of the construction works.

(f) Waste

It is expected that the following waste will be generated during construction:

- Brick / concrete materials
- Steel
- Lighting, fittings and electrical equipment
- Redundant control equipment, plant and electrical boards
- Services waste such as wiring, pipe cut offs and sheet metal cut offs
- General waste from construction activities such as packaging, scraps and paper

The management of waste will be in accordance with relevant NSW legislation and the principles of the waste management hierarchy as set out in the NSW ‘Waste Avoidance and Resource Recovery Strategy 2014-21’. The figure below illustrates the hierarchy for management of wastes.

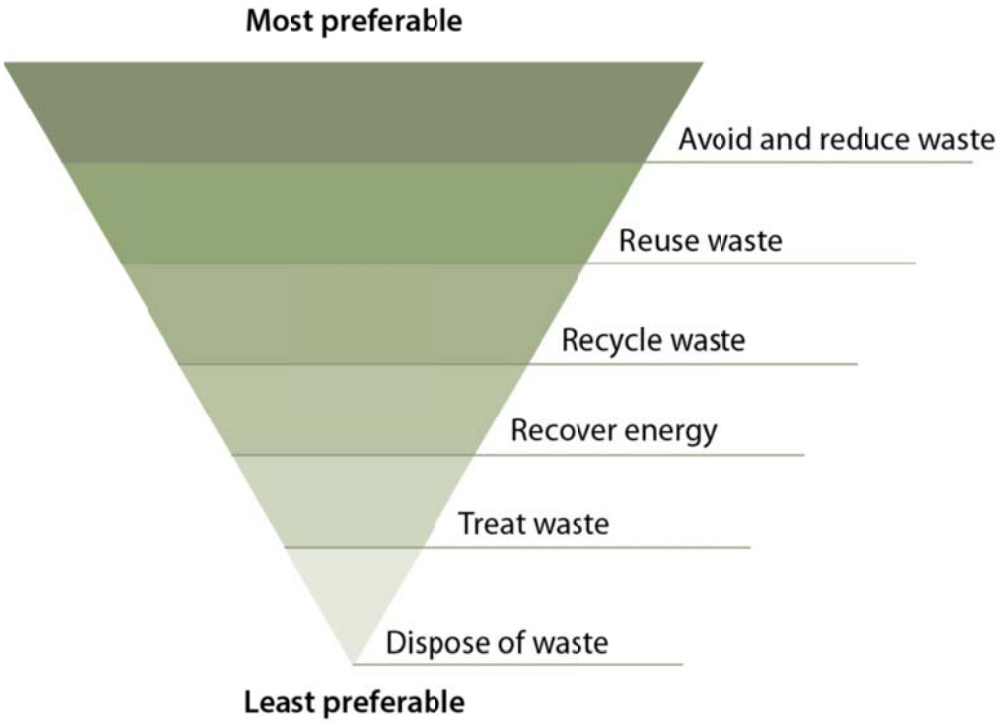

Figure 1 – The Waste Hierarchy

The proposed waste management measures for the project are as follows:

- Concrete materials – recycle materials and/ or dispose to appropriately licensed landfill
- Steel and steel cable – recyclable materials will be collected separately and recycled
- Redundant winches and control equipment – recyclable materials will be collected separately and recycled
- Services waste – Recycling bins will be provided on site. Recyclable materials will be collected separately and recycled
- General waste – Recycling bins will be provided on site. Recyclable materials will be collected separately and recycled

A fully detailed Waste Management Plan will be developed by the Contractor engaged to undertake the project. The plan will be framed using the waste management hierarchy principles outlined above. The plan will be prepared prior to construction commencing and will be consistent with the Waste Avoidance and Resource Recovery Act 2001 and the 'Waste Classification Guidelines'.

The plan will:

- Identify requirements for waste avoidance, reduction, reuse and recycling
- Provide procedures for handling, stockpiling and reuse of wastes
- Provide procedures for disposal of hazardous materials
- Identify disposal sites as well as transport options

4.5.f.1 Construction Environmental Management Plan

Sydney Opera House maintains an Asbestos Management Procedure to which the successful contractor will be required to also adhere, or build upon.

As part of this procedure the Opera House maintains a Hazardous Materials Register which documents all asbestos contaminated materials (ACM), hexavalent chromium and lead paints within the building. The hazardous materials are managed by the Sydney Opera House Asbestos Risk Management Plan (Hibbs & Associates Pty Ltd 2013) and the Sydney Opera House Hazardous Materials Action Plan (2015).

For works undertaken within the Joan Sutherland Theatre a Dust Risk Assessment (Hibbs & Associates Pty Ltd 2016) has been undertaken which provided an assessment and management procedure for the cleaning of dust that is found throughout the JST.

As well as the Opera House documentation the removal and disposal of any hazardous materials must comply with all relevant laws, regulations and guidelines including, but not limited to, Protection of the Environment Operations Act 1997, Protection of the Environment Operations (Waste) Regulation 2014 and Protection of the Environment Operations (Illegal Waste Disposal) Act 2013.

4.6 Other Construction Plans

Prior to commencing construction the Contractor engaged to undertake the works will prepare in conjunction with SOH the following documents:

- Construction Environmental Management Plan
- All relevant safety documentation, including Safe Work Method Statements

(a) Construction Environmental Management Plan

A Construction Environmental Management Plan will be prepared and implemented. The plan will outline environmental management practices and procedures to be followed during site preparation and construction. The plan will cover the environmental protection practices, resources and sequence of activities required to comply with relevant environmental legislation, conditions of any applicable licences, approvals and permits.

The plan will be prepared in accordance with Guideline for Preparation of Environmental Management Plans (DIPNR 2004) and include:

- A description of activities to be undertaken on the site during site preparation and construction stages of the project
- Details of construction impacts as per section *4.5 Construction Impacts*.
- Statutory approvals and other obligations that would be fulfilled during site preparation and construction
- Details of how the environmental performance of the site preparation and construction works will be monitored, and what actions will be taken to address adverse environmental impacts. In particular the following environmental performance issues will be addressed:
  - Measures to minimise impacts to heritage
  - Measures to minimise the discharge of sediment and other pollutants to land and/or water drainage systems during construction
  - Measures to monitor and control noise emissions during construction and commissioning
  - Measures to manage traffic and site access during construction
- A description of roles and responsibilities for all relevant employees involved in the construction of the project
- Complaints handling procedures during construction

(b) Safety Documentation

A Safety Management Plan and Safe Work Method Statement will be provided explaining the delivery and installation of the project whilst ensuring the surrounding heritage fabric. An indicative description of the methodology likely to be adopted to construct the works is provided in this report and referred documentation. This is based on the available stage of the design documents.

Once the detailed schematic documentation is complete the Contractor engaged to undertake the works will develop a detailed safe work method statement which addresses the various activities to be undertaken during the construction phase, and ensures the safety of the site fabric, construction personnel and all relevant stakeholders.

5 Conclusion

This report provides and indicative construction methodology and associated procedures, which identify how the project may be constructed and how the various environmental issues may be addressed.

This document outlines the minimum requirements for the construction of the works associated with DA2 and will be expanded upon by the successful contractor for the works on site. Largely these works are contained within the Building Footprint and can be serviced via the underground loading dock, reducing their impact on the general public, throughout their construction.

This document coupled with contractor involvement and development of plans such as Construction Environmental Management Plan, Safety Management Plan, Noise & Vibration Construction Plan, Traffic Management Plan and Waste Management Plan will provide a robust framework from which to deliver the proposed works.