



## APPENDIX E - ENVIRONMENTAL RISK ASSESSMENT AND MITIGATION MEASURES

The following section provides recommendation for mitigation measures in response to potential impacts identified in Section 6 of the EIS. The structure of mitigation measures is based on the DPE's hierarchy of approaches for managing impacts identified in the *Draft Environmental Impact Assessment Guidance Series* released by DPE in June 2017, as:

- **Performance based measure** – identify performance criteria that must be complied with to achieve an appropriate environmental outcome but do not specify how the outcome is to be achieved.
- **Prescriptive measure** – require action to be taken or specify something that must not be done.
- **Management based measure** – identify one or more management objectives that must be achieved through the implementation of a management plan.

Following the implementation of appropriate mitigation measures as recommended, it is determined that the proposal will not result in any significant adverse impacts on the surrounding environment. The following table illustrates how the matters raised within the SEARs will be addressed.

This analysis comprises a qualitative assessment consistent with AS/NZS ISO 31000:2009 *Risk Management–Principles and Guidelines* (Standards Australia 2009). The level of risk was assessed by considering the potential impacts of the proposed development prior to application of any mitigation or management measures. In accordance with the SEARs, the Environmental Risk Assessment addresses the following significant risk issues:

- The adequacy of baseline data;
- The potential cumulative impacts arising from other developments in the vicinity of the site; and
- Measures to avoid, minimise, offset the predicted impacts where necessary involving the preparation of detailed contingency plans for managing any significant risk to the environment.

Risk comprises the likelihood of an event occurring and the consequences of that event. For the proposal, the following descriptors were adopted for 'likelihood' and 'consequence'.

Likelihood		Consequence	
A	Almost certain	1	Widespread and/or irreversible impact
B	Likely	2	Extensive but reversible (within 2 years) impact or irreversible local impact
C	Possible	3	Local, acceptable or reversible impact

Likelihood		Consequence	
D	Unlikely	4	Local, reversible, short term (<3 months) impact
E	Rare	5	Local, reversible, short term (<1 month) impact

The risk levels for likely and potential impacts were derived using the following risk matrix.

		LIKELIHOOD				
		A	B	C	D	E
CONSEQUENCE	1	High	High	Medium	Low	Very low
	2	High	High	Medium	Low	Very low
	3	Medium	Medium	Medium	Low	Very low
	4	Low	Low	Low	Low	Very low
	5	Very low	Very low	Very low	Very low	Very low

The results of the environmental risk assessment for the proposed development are presented in the below table and are based upon the range of technical and specialist consultant reports appended to the EIS. The table has directly related mitigation measures responding to each impact also based upon the range of technical and specialist consultant reports appended to the EIS.

**N.B.** 'O' – Operational; 'C' – Construction

'Pe' – Performance based mitigation measure; 'Pr' – Prescriptive based mitigation measure 'Ma' – Management based mitigation measure

SEAR	Potential Impact	Stage of Project	Likelihood	Consequence	Risk Level	Approach	Mitigation Measure (Pe/Pr/Ma)	Residual Impact
<b>Traffic and Transport</b>	The proposed construction works are anticipated to result in typical construction vehicle activity of about four trucks per hour (40 trucks per day) which may impact the existing vehicular and pedestrian traffic flow in the area.	C	A	4	Low	<p>Standard management actions and measures are recommended in the Traffic, Transport and Accessibility Statement at <b>Appendix I</b>. These measures include:</p> <ul style="list-style-type: none"> <li>▪ A Traffic Guidance Scheme (formerly known as a Traffic Control Plan) will be prepared post DA to manage and regulate construction vehicle traffic movements.</li> <li>▪ Pedestrian and cyclist movements will be maintained through the retention of Class A hoarding that is currently erected around the site, with accredited traffic controllers to manage interaction with construction vehicles, and pedestrian and cyclists movements along Barton Street.</li> <li>▪ The construction work would be monitored to ensure that it proceeds as set out in the Construction</li> </ul>	Ma	Low

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						<p>Management Plan prepared by the appointed contractor</p> <ul style="list-style-type: none"> <li>▪ Liaison would be maintained with the police and emergency services agencies throughout the construction period and a 24-hour contact would be made available for 'out-of-hours' emergencies and access.</li> <li>▪ All staff employed on the site by the appointed contractor (including sub-contractors) would be required to undergo a site induction.</li> <li>▪ Queuing or marshalling of construction vehicles will not be permitted on the CBD road network</li> </ul>		
<b>Noise and Vibration</b>	Adverse noise generation during construction on surrounding neighbours. This includes a Hickson Road commercial, Lend Lease	C	C	4	Low	<p>The proposed development will implement the best practice measures recommended in the Acoustic Report at <b>Appendix J</b>.</p> <p>Prior to construction commencing:</p> <ul style="list-style-type: none"> <li>▪ Should construction of the proposed works commence following the completion of other works in the vicinity (primarily One Sydney Harbour in Barrangaroo South), background noise levels at residential receivers in High Street and Barangaroo South should be re-confirmed using long-term</li> </ul>	Pe, Pr and Ma	Acoustic environment to be monitored during proposed development.

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	<p>Towers, High Street residences and the child care centre minor exceedances of 1-2 dB(A) are predicted. High Street residences south of the child care centre will be exposed to noise levels up to 10 dB(A) above the applicable management levels.</p>					<p>measurements of background noise levels.</p> <ul style="list-style-type: none"> <li>▪ It is noted the construction of the proposed works after the completion of One Sydney Harbour (Barangaroo South) is unlikely, as the anticipated timing for completion of construction in Barangaroo South is 2025. As identified in the CEMP at Appendix W and described in Section 3.2.7, the anticipated commencement of the proposed works is December 2023.</li> <li>▪ Alternatively, additional short-term monitoring of background noise levels during designated builder's rostered days off (if available) should be undertaken to supplement the existing data. The results of the monitoring should be included within the project-specific Noise and Vibration Management Plan (NVMP) and the management measures modified accordingly.</li> <li>▪ Preparation of a detailed NVMP on behalf of the contractor prior to commencement of construction. The NVMP is to be prepared in accordance with the EPA Interim Construction Noise Guideline and is to detail description of the main noise or vibration producing activities, processes and equipment, an indicative construction programme, proposed construction hours, a</li> </ul>		

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						<p>monitoring plan and further detail on recommended management procedures.</p> <p>During construction:</p> <ul style="list-style-type: none"> <li>▪ In the event complaints are received from neighbours, Acoustic Logic identify active monitoring may be undertaken during the construction work phase of the project. Should complaints be received, Acoustic Logic recommend the following process: <ul style="list-style-type: none"> <li>•Assessing impacts and determining the offending plant/equipment/process and.</li> <li>•Locating the plant/equipment/process further away from the affected receiver(s) if possible.</li> <li>•Implementing additional acoustic treatment in the form of localised barriers, silencers etc.</li> <li>•Selecting alternative equipment/processes</li> </ul> </li> <li>▪ Complaints associated with noise and vibration generated by site activities shall be recorded on a Noise Complaint Form.</li> <li>▪ Application of the noise control methods where required, as determined by the contractor. Examples of potential noise control methods are provided in Section 7 of the Noise Impact Assessment, and include selection of alternative appliances, acoustic barriers, silencing</li> </ul>		

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						devices, treatment of plant, establishment of site practices and notification to surrounding residents during noisy periods.		
<b>Geotechnical and Structural Engineering</b>	Impact on in-situ ground conditions immediately adjacent to Hickson Road and Barangaroo Station	C	D	2	Low	<p>The proposed development will implement the best practice measures recommended in the Geotechnical Report at <b>Appendix L</b>. These measures include:</p> <ul style="list-style-type: none"> <li>▪ Use of positive ground support mechanisms until the pile bore has been backfilled with concrete.</li> <li>▪ Use of a temporary casing to ensure no loss of surrounding ground material during installation.</li> </ul>	Pe	No likely risk of pile excavation instability.
<b>Water Quality and Water Quantity</b>	Water quality impacts caused by noise, dust, erosion and sedimentation. Impacts to the quantity of stormwater discharge. These may have impacts onto the receiving	C	C	2	Medium	<p>The proposed development will implement the best practice measures recommended in Stormwater Management and Flooding Report at <b>Appendix M</b>. These measures include:</p> <ul style="list-style-type: none"> <li>▪ Completion of drainage diversion works diverting stormwater that is currently piped through Central Barangaroo (the site) from external catchments.</li> <li>▪ Development of appropriate water quality objectives for the discharge of stormwater from site.</li> </ul>	Ma	Stormwater quantity and quality to be monitored and maintained

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	water bodies (Sydney Harbour).					<ul style="list-style-type: none"> <li>A rigorous bunding and monitoring protocol that will ensure that all rain falling on potentially contaminated areas of the site during construction (e.g. construction excavations, earth mounds and stockpiles, contaminated machinery) can be collected for treatment prior to disposal.</li> </ul>		
<b>Contamination and Remediation</b>	Potential contamination sources or area of environmental concern (AEC) within site	C	D	1	Low	Completion of remedial works outlined in the Remedial Works Plan and future Remedial Works Plan, as well as the implementation of a Long-Term Environmental Management Plan.	Pr, Ma	Ongoing, long term management of site.
<b>European Heritage</b>	Adverse impact on heritage items	C	D	1	Low	<p>The Urbis Heritage Impact Statement recommends the following mitigation measures:</p> <ul style="list-style-type: none"> <li>A vibration assessment should be undertaken prior to the issue of a construction certificate to assess any potential impacts caused by the proposed excavation and works on the heritage items in the vicinity and HCA. This assessment should be reviewed by the Heritage Consultant</li> </ul>	Pe, Ma	No adverse impact to heritage items.

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						<p>and should be submitted to City of Sydney Heritage Specialist for review. Monitoring should also take place during the construction.</p> <ul style="list-style-type: none"> <li>▪ Heritage Interpretation should be used to highlight the history and significance of the site, the area and relevant heritage items in the vicinity. Therefore, a Heritage Interpretation Strategy that considers the history of the site and identifies opportunities for Interpretation displays and elements to be incorporated into future proposed development should be prepared as part of the future programme. Specifically with consideration to any future stages that propose permanent built structures.</li> <li>▪ Liaison with City of Sydney Council and Heritage NSW should be undertaken during the design development of permanent built structures in future stages. This is due to the vicinity heritage items.</li> </ul>		
<b>Aboriginal Cultural Heritage</b>	Disturbance to sub-surface Aboriginal	C	D	1	Low	The following mitigation measures have been identified for the construction of the proposed development:	Pe, Ma	No likely impact to

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	archaeological objects and artefacts					<ul style="list-style-type: none"> <li>▪ Consultation with RAPs should continue until the finalisation of the proposed development to ensure the opportunity for community input.</li> <li>▪ In accordance with the Government Architect's guidelines, the Proponent should prepare a 'Connecting with Country Framework for Central Barangaroo' that informs and guides the concept design and detailed design stages of the project. This framework should include a Cultural Interpretation Plan (CIP), as recommended by the RAPs.</li> <li>▪ Archaeological Finds Procedure - Should any archaeological deposits be uncovered during any site works, the following steps must be followed:               <ol style="list-style-type: none"> <li>1. All works within the vicinity of the find must immediately stop and the area should be cordoned-off and secured. The find must not be moved 'out of the way' without assessment.</li> <li>2. The site supervisor or another nominated site representative must contact either the project archaeologist (if relevant) or Heritage NSW (Enviroline 131 555) to contact a suitably qualified archaeologist.</li> <li>3. The nominated archaeologist must examine the find, provide a preliminary assessment of significance, record the</li> </ol> </li> </ul>		archaeological finds.

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						<p>item and decide on appropriate management measures. Such management may require further consultation with Heritage NSW, preparation of a research design and archaeological investigation/salvage methodology and registration of the find with the Aboriginal Heritage Information Management System (AHIMS).</p> <p>4. Depending on the significance of the find, reassessment of the archaeological potential of the subject area may be required and further archaeological investigation undertaken.</p> <p>5. Reporting may need to be prepared regarding the find and approved management strategies.</p> <p>6. Works in the vicinity of the find can only recommence upon receipt of approval from Heritage NSW.</p> <ul style="list-style-type: none"> <li>▪ Human Remains Procedure - In the unlikely event that human remains are uncovered during the proposed works, the following steps must be followed:             <ol style="list-style-type: none"> <li>1. All works within the vicinity of the find must immediately stop and the area should be cordoned-off and secured. The find must be cordoned-off and signage installed to avoid accidental impact.</li> </ol> </li> </ul>		

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						<p>2. The site supervisor or other nominated manager must notify the NSW Police and Heritage NSW (Enviroline 131 555).</p> <p>3. The find must be assessed by the NSW Police, which may include the assistance of a qualified forensic anthropologist.</p>		
<b>Historical Archaeology</b>	Disturbance to sub-surface historical archaeological objects and artefacts	C	C	2	Medium	<p>The following mitigation measures have been identified for the construction of the proposed development:</p> <ul style="list-style-type: none"> <li>▪ Recommendation 1 – Submission of Report</li> </ul> <p>A copy of this report should be submitted with the Environmental Impact Statement (EIS) in support of State Significant Development Application SSD-39587022.</p> <ul style="list-style-type: none"> <li>▪ Recommendation 2 – Archaeological Investigation</li> </ul> <p>In view of the potential for subsurface archaeological remains having Local historical heritage significance to be retained within the zone of impact of the proposed works, an archaeological monitoring and</p>	Pr, Ma	Nil

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						<p>excavation program should be undertaken to investigate the nature, extent and significance of the potential archaeological resource prior to commencement of the proposed works and thereby mitigate the potential for harm to archaeological resources. The archaeological monitoring and excavation program should be undertaken under the supervision and direction of a qualified archaeologist who meets the current Excavation Director Criteria for State significant sites as published by the NSW Heritage Council.</p> <ul style="list-style-type: none"> <li>▪ Recommendation 3 – Archaeological Research Design &amp; Methodology</li> </ul> <p>An Archaeological Research Design and Methodology (ARD&amp;M) should be prepared in accordance with the NSW Heritage Council's guidelines, which outlines an archaeological excavation program and any other archaeological investigation (e.g. monitoring) deemed appropriate. The ARD&amp;M should be prepared for the approval of the Director of the Heritage Branch, Department of Planning. The ARD&amp;M</p>		

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						<p>should outline archaeological chance finds and human remains procedures. The ARD&amp;M should ensure that locally significant relics are identified, assessed and recorded prior to their removal. The ARD&amp;M should also detail a procedure for the unlikely event that State significant relics are identified. Implementation of this program would mitigate the potential heritage impacts posed by the proposed works.</p> <ul style="list-style-type: none"> <li>▪ Recommendation 4 – Archaeological Excavation Report</li> </ul> <p>Following completion of the archaeological excavation program, an Archaeological Excavation Report should be prepared detailing the findings of the program. The finalised Archaeological Excavation Report should be submitted to the Heritage Branch of the Department of Planning, the State Library of NSW and the Local Studies Library in the City of Sydney.</p> <ul style="list-style-type: none"> <li>▪ Recommendation 5 – Storage of Relics</li> </ul>		

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						<p>A repository for any relics salvaged during the archaeological excavation program should be nominated by Infrastructure NSW.</p> <ul style="list-style-type: none"> <li>Recommendation 6 – Updating HAA for Future Work</li> </ul> <p>In the event that works are to be undertaken within the subject area that fall outside the scope of the currently proposed works, the HAA should be updated to reflect the amended scope of works and their potential impact on archaeological resources.</p>		
<b>Air Quality and Odour</b>	Dust soiling and human health impacts generated by dust from piling rig and plant and emissions from drilling, piling and injection works.	C	A	3	Medium	<p>The Qualitative Air Quality Impact Assessment by EDP details a series of mitigation measures for dust, contaminated material, and combustion emissions which include:</p> <ul style="list-style-type: none"> <li>Implement an Air Quality Monitoring Program; particularly for the secant pile wall excavation and construction works (refer to Section 6.2 of the AQIA). The program should include air monitoring locations along the southern and eastern boundaries to assess air quality compliance against criteria provided in table 4 with consideration of existing</li> </ul>	Pe, Ma	Air quality and equipment to be monitored during proposed development.

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						<p>background data as presented in Section 4.3.1 of the AQIA. Odour monitoring should also form part of the AQMP to confirm no unacceptable odour impacts are presented to identified receivers. The specifics of the air quality (and odour) monitoring program will be captured in an updated Construction Environmental Management Plan (CEMP).</p> <ul style="list-style-type: none"> <li>▪ Where there are complaints or elevations above the adopted criteria, corrective actions should be outlined in the CEMP to mitigate against the exceedance or complaint occurring again.</li> <li>▪ Dust suppression of any stockpiled excavated or bare soil, exposed areas and roads when required to maintain a moisture content that minimises dust generation;</li> <li>▪ Use water sprays and/or surfactants wherever and whenever necessary. Surfactants effectively reduce the surface tension of the applied water enabling the water to penetrate more deeply into the treated soil and reduce the dust generation capacity of the treated soil. The surfactant also forms a microscopic liquid film to increase the adhesion of dust particles to the material's surface, which further prevents their regeneration. Surfactants also greatly reduce the water needed for suppressing dust. Noting the proximity to</li> </ul>		

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						<p>the Harbour, surfactants should only be used where in excess of 40 m from the Harbour edge with appropriate erosion and sediment controls in place;</p> <ul style="list-style-type: none"> <li>▪ Restrict vehicle movements to within designated access paths; and minimise haul road lengths where possible;</li> <li>▪ Ensure plant and equipment is maintained and operating correctly. In the event of visible smoke and fumes being emitted from the plant and equipment, the relevant equipment should be inspected and either replaced or fitted with filters to minimise emissions;</li> <li>▪ Remove excavated material and any dust generating materials from the site as soon as possible, unless the material has been allocated for re-use onsite or cannot be disposed of immediately. In this case, the re-use or temporarily stored material should be kept damp and covered with geotextile material to minimise wind erosion. The condition of the stockpile covers, and associated erosion and sediment controls should be managed in accordance with the CEMP. The re-use of material is considered unlikely, given that the main works comprises the bulk excavation of the site to facilitate basement construction</li> <li>▪ Dust suppression of exposed areas and stockpiles would be undertaken as</li> </ul>		

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						<p>required using a water cart or equivalent piece of equipment;</p> <ul style="list-style-type: none"> <li>▪ Planning of the works to avoid dry (&lt;1 mm of rainfall in the last 24 hours) and windy (&gt;20 km/hour wind speeds) conditions;</li> <li>▪ Erect windbreak barriers at the site boundary or around the working area, if required;</li> <li>▪ Implement site speed limits;</li> <li>▪ Cover loads during off-site transportation;</li> <li>▪ Maintain the complaints management system and actively resolve issues (stop work followed by investigation of the issue and resolution) when raised;</li> <li>▪ Undertake good housekeeping practices to minimise dust on hardstand areas; and</li> <li>▪ Implementation of any additional mitigation options as required by the Project's Environmental Manager or as identified in future development applications.</li> </ul>		
<b>Infrastructure and Utilities – Electrical</b>	Impact on existing infrastructure assets and risk to	C	C	4	Low	Safe work assessments will be undertaken at each stage of the electrical infrastructure works which are adjacent	Ma	To be outlined in safe work assessment post-DA

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	contractor safety					any Ausgrid assets and City of Sydney smart poles.		
<b>Infrastructure and Utilities – Sewer Pump Station</b>	Impact on existing Pumping Station SPS1129	C	D	4	Low	<p>The preliminary Specialist Engineering Assessment at Appendix U details a series of preliminary mitigation measures, which will be revised and updated in the final SEA prior to construction. Preliminary mitigation measures include:</p> <ul style="list-style-type: none"> <li>▪ Installation of Appropriate trigger alarms with corresponding actions will be included during construction.</li> <li>▪ Advice from specialist piling and excavation contractors will be sought to investigate whether reducing vibrations when excavating the medium and high strength sandstone is required.</li> </ul>	Ma	Nil
<b>Demolition and Construction Waste Management</b>	Excess waste generation	C	D	4	Low	<p>The Demolition and Construction Waste Management Plan at Appendix S details a series of preliminary mitigation measures, including:</p> <ul style="list-style-type: none"> <li>▪ Management of hazardous waste associated with the localised remediation works will be in accordance with the procedures outline in the Remedial Action Plan prepared by JBS Environmental and Remedial Works Plan prepared by EDP.</li> </ul>	Ma	Nil

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						<ul style="list-style-type: none"> <li>▪ Site-specific management measures including training and site inductions, waste avoidance opportunities and site procedures.</li> </ul>		