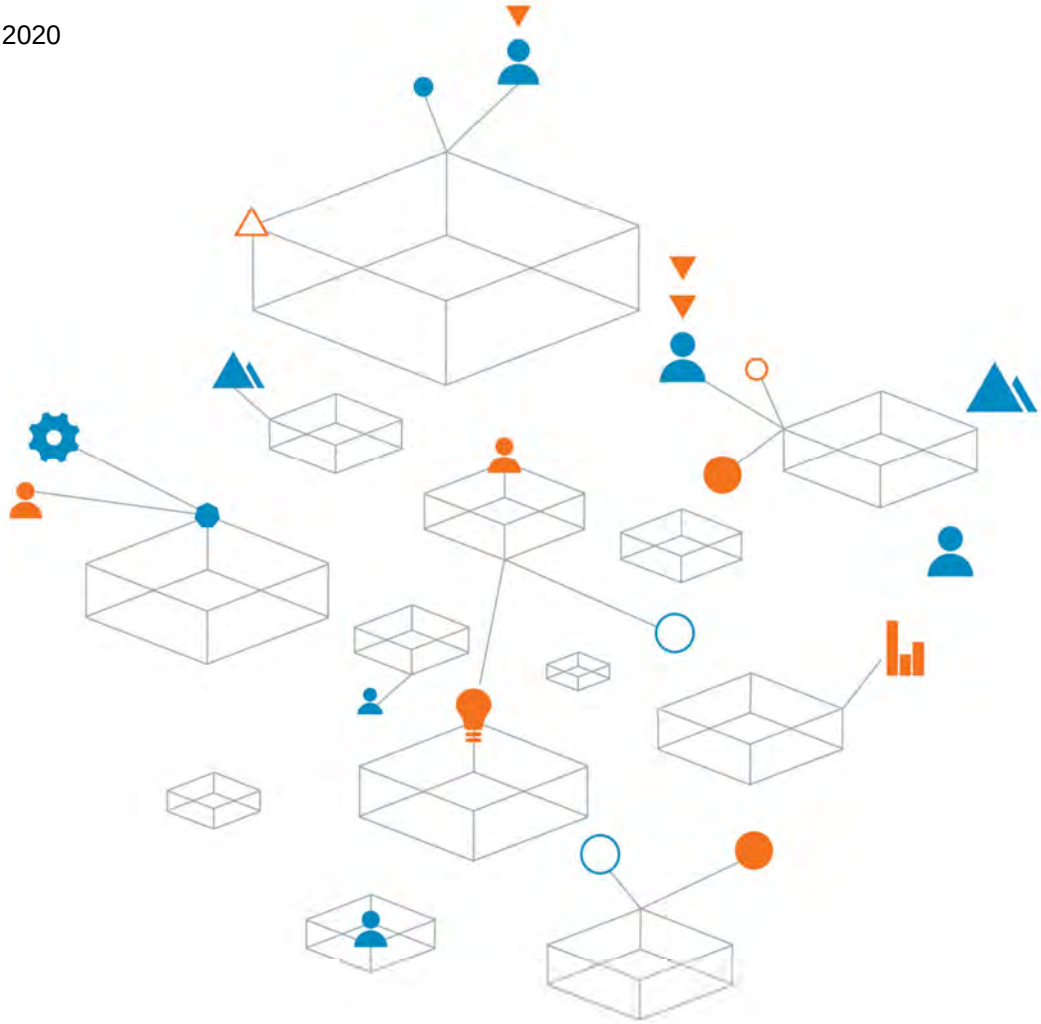
Mirvac Projects Pty Ltd

Preliminary Remedial Action Plan

Harbourside Shopping Centre
Darling Drive, Darling Harbour, Sydney

8 October 2020



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Preliminary Remedial Action Plan

Prepared for
Mirvac Projects Pty Ltd

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1. Introduction

1.1. General

Coffey Services Australia Pty Ltd (Coffey) was engaged by Mirvac Projects Pty Ltd (Mirvac) to prepare a Preliminary Remedial Action Plan (RAP) for the proposed redevelopment of the Harbourside Shopping Centre (the 'site'), which is situated on the western foreshore of Darling Harbour. The location of the site is shown in Figure 1.

The work was commissioned by Mr. Lachlan Attiwill on behalf of Mirvac. The commission was in response to a proposal submitted by Coffey dated 30th July 2018 (ref: GEOTLCOV25340AB-AA).

1.2. Proposed Development

Coffey understands that Mirvac will apply for planning approval for a development concept to replace the existing Harbourside Shopping Centre with a multi-storey retail centre and residential tower with a four level basement car park provided in the centre of the site with a finished floor level of -9.5m to -13.2mAHD. Mirvac proposes to demolish the existing Harbourside Shopping Centre to facilitate this development.

Coffey understands that the ground floor and Levels 1 to 3 of the development will be used for commercial retail and offices. Levels 4 and 5 will form communal open space. A tower structure will be constructed in the central part of the site to an elevation of 166.95mAHD, and Levels 6 to 47 will be used for residential apartments.

Coffey understands that the proposed development will fall within the footprint of the existing Harbourside Shopping Centre and does not require modification of the existing seawall.

Information, including a more detailed description of the proposed development concept is provided in Appendix A.

1.3. Objectives

The objectives of the preliminary RAP are to:

- Summarise the available information to describe ground conditions at the site and the potential sources of contamination.
- Present a preliminary conceptual site model, identifying potential contamination risks that may require remedial action and/or management as the site is developed.
- Identify a preferred remediation strategy from a range of feasible remediation options to mitigate the potential risks identified that may arise during site development and for future use of the proposed development.
- Provide an opinion on the suitability of the site for the proposed development with reference Clause 7 of State Environmental Planning Policy No. 55 – Remediation of Land (SEPP55) should this concept plan be accepted.

The purpose of this preliminary RAP is to support Mirvac's planning application for approval of the development concept. Coffey acknowledges that the preliminary RAP will form the basis for a detailed RAP which would be prepared once Mirvac completes a programme of intrusive investigation and as specific design details become available to describe the proposed development.

1.4. Available Reports

The following reports were reviewed in preparing this preliminary RAP:

- Coffey (Sept, 2020a); *Preliminary Site Contamination Assessment; Harbourside Shopping Centre, Darling Drive, Darling Harbour, Sydney* (Ref: GEOTLCOV25340AC-AB v7)
- Coffey (Sept, 2020b); *Preliminary Acid Sulfate Soil Management Plan; Harbourside Shopping Centre, Darling Drive, Darling Harbour, Sydney* (Ref: GEOTLCOV25340AC-AC v3)
- Coffey (Aug 2013a); *Detailed Site Investigation Report for SSDA6 – International Convention Centre Hotel Development, Sydney International Convention, Exhibition & Entertainment Precinct* (Ref: GEOTLCOV24303AH-AD)
- Coffey (Aug 2013b); *Geotechnical Investigation Report for SSDA6 – Sydney International Exhibition and Entertainment Precinct – ICC Hotel* (Ref: GEOTLCOV24303AH-AH)
- Douglas Partners (June 2013); *Preliminary Geotechnical Assessment of Piles – Proposed Upgrade of Harbourside Shopping Centre, Darling Drive, Darling Harbour* (Project Ref: 73498)

2. Site Condition and Surrounding Environment

2.1. Site Identification

The generic information relating to the site is summarised in Table 2.1. The location and layout of the site are shown in Figures 1 and 2 respectively.

Table 2.1: Site Identification

Site Address:	Darling Drive, Sydney, NSW, 2000
Lot Number	Lot 1 of Deposited Plan (DP) 776815 Part Lot 2015, DP 1234971
Approx. Site Area:	1.5 ha
Current Land Use:	Commercial retail shopping facility
Land ownership	The site is owned by Sydney Harbour Foreshore Authority. Mirvac holds a long term lease to operate the Harbourside Shopping Centre.

2.2. Site Description

The site is occupied entirely by the Harbourside Shopping Centre, which comprises a collection of commercial retail outlets and related services areas immediately adjacent to the Darling Harbour foreshore. The site is relatively level and has an approximate elevation of 3mAHD.

Harbourside Shopping Centre comprises numerous individual retail outlets, amusement centres and restaurants spread across two floors. There is no basement in the site, apart from localised pits for lifts and sumps associated with the pumped sewer system.

A loading dock and storage area is present along the northwestern façade of the shopping centre, which is utilised by the retail outlets and restaurants. The loading dock was surfaced with concrete/asphalt hardstand and extended beyond the boundary of the site, extending beneath the Darling Drive overpass. Runoff from the loading dock is channelled towards drains which discharge to the local stormwater system. Cardboard and putrescible wastes are stored separately in the northwestern corner loading dock within the site. These wastes are collected periodically by licensed waste contractors.

Waste oils from restaurants are accumulated in a small above ground storage tank (approx. 1500L capacity) in the northwestern corner of the loading dock. Waste oil is decanted directly into this tank, and removed by vacuum truck periodically. Staining associated with oil spillages was evident on the paved surface around the tank. The tank was in a concrete hardstand area, and waste oils released to the ground drains to the local stormwater system.

Areas surrounding the remainder of the shopping centre are hard paved. The paved areas adjacent to the eastern façade of the shopping centre are use by various harbour-side restaurants for patron seating.

2.3. Surrounding Land Uses

Land uses surrounding the site are summarised in Table 2.2.

Table 2.2: Surrounding land uses

Direction	Land Use
North	Pyrmont Bridge beyond which lies the Australian Maritime Museum
East	Darling Harbour public realm and Cockle Bay
South	International Convention Centre and Darling Harbour public realm
West	Darling Drive beyond which lies the Sydney Light Rail corridor. To the southwest lies the International Convention Centre Hotel.

2.4. Geology

Published geological records indicate the site is underlain by medium to coarse grained sandstone with very minor shale and laminite lenses. Quaternary alluvial sediments comprising silty to peaty quartz sand, silt and clay encroach the southern extent of the site. Previous investigations (Coffey, Aug 2013a) installed seventeen boreholes within areas to the south and southwest of the site. A summary of the ground conditions recorded within these boreholes is presented in Table 2.3.

Table 2.3: Summary of ground conditions to the south and west of the site

Unit	Depth to Top of Unit (mbgs)	Approx. Unit Thickness	Material Description
Fill	0m	0.4m to 3.9m	Asphalt and concrete paving overlying FILL with the consistency of sand and gravelly sand: fine to coarse grained, brown, orange and grey, gravel is fine to coarse. FILL thickness increased toward Cockle Bay (east).
Alluvium	Observed in discrete horizons at 2.5m and 3.0m	0.4m to 0.7m	SAND: Medium to coarse, dark grey and brown, with a trace of clay and roots. Typically observed as loose to medium dense, and moist.
Residual Soil	0.6m to 3.4m	0.2m to 1.5m	Silty SAND: fine to coarse, orange brown mottled grey, with a trace of fine to medium sandstone gravel. Typically observed as medium dense to dense.
Sandstone	0.8m to 4.1m. Generally deepest at the southern boundary	Not proven	SANDSTONE: Fine to medium grained, orange brown mottled pale grey. Ranges from highly weathered to fresh with dark grey interlaminated shale seams up to 1m thick.

Analysis of alluvial soils collected from land immediately to the southeast provided a strong indication that these soils are classified as Potential Acid Sulfate Soils (ASS) (Coffey, Aug 2013a).

2.5. Hydrology and Hydrogeology

No water bodies are located within the site. Cockle Bay is the nearest surface water body and is approximately 30m east of the site.

Groundwater beneath the site is expected to be saline and tidally influenced, with a net flow gradient towards the Cockle Bay. Standing water levels recorded in monitoring wells installed to the southeast of the site ranged from 0.4m to 0.6mAHD.

2.6. Summary of Historical Site Uses

A detailed review of available records to describe the historic site uses is presented within the Preliminary Site Contamination Assessment (Coffey, Sept 2020a). A summary of this information is provided below:

- Prior to the development of the western foreshore of Cockle Bay, public records indicate that the western portion of the site historically formed part of a tidal mudflat. The eastern portion of the site was submerged within Cockle Bay. Land reclamation activities commenced in the 1860s to extend the Darling Harbour railway branch line towards the Pyrmont Bay wharves.
- Further land reclamation took place during the 1870s to enable the construction of a large goods yard, rail sidings and wharf infrastructure (referred to as the 'Darling Harbour Goods Yards' and associated 'Iron Wharf'). The site was in the western part of the goods yard and adjacent to Iron Wharf. At this time, land uses surrounding the site included warehouses, livestock agencies, meat market etc. which interacted with the adjoining goods yards and maritime freight facility.
- The Darling Harbour Goods Yard went through a period of expansion between the 1880s and 1920 where two additional goods sheds were established; one of these sheds was positioned substantially within the site. The Pyrmont Power Station was established approximately 350m north of the site at this time.
- The Darling Harbour Goods Yards remained operational until circa 1980s and were eventually dismantled as part of the redevelopment of the wider Darling Harbour precinct for public open space and exhibition/entertainment facilities, which opened for Australia's Bicentennial celebrations in 1988. The Harbourside Shopping Centre was part of this redevelopment of the wider Darling Harbour precinct and use of the site has remained substantially unchanged since that time.

2.7. Summary of Previous Investigations

Coffey is not aware of any intrusive contamination investigations having been completed within the site to date. Data from the Detailed Site Investigation Report prepared for the ICC Hotel development (Coffey, Aug 2013a), which is located approximately 10m to the southwest of the site, was reviewed to inform the preparation of this document.

2.7.1. Detailed Site Investigation – ICC Hotel Development (Coffey, Aug 2013a)

The location of the sampling points relevant to the site are shown on Figure 2. The following summary outlines the main findings of this investigation:

- The ICC Hotel site historically formed part of the Darling Harbour Goods Yard, until being redeveloped as a passenger pick-up/drop off area during the 1980s.
- The subsurface comprised heterogeneous fill materials over a thin layer of alluvial deposits. The thickness of fill generally increased in an easterly direction towards Cockle Bay. Sandstone bedrock was encountered beneath the natural soil.

- Standing water levels recorded in monitoring wells ranged from 0.4m to 0.6mAHD, although some tidal influence was expected due to the proximity of Cockle Bay.
- Analysis of soil and groundwater samples collected from the site reported concentrations of COPC below health assessment criteria for commercial/industrial land use. Coffey concluded that the soil and groundwater present beneath the site did not pose unacceptable potential health risks to future construction workers or the future users of the ICC hotel, which included a single level services basement.
- Undisturbed alluvial deposits beneath this site are likely to comprise PASS or actual ASS. Coffey concluded that these materials would require management if disturbed during construction.
- Groundwater samples collected from three monitoring wells installed within the ICC Hotel site recorded TRH, naphthalene, toluene, copper and nickel at concentrations exceeding the laboratory Limit of Reporting (LOR). Coffey noted that the source of these COPC had not been identified and may derive from fill material placed within the ICC Hotel site and/or historic land uses. Coffey noted, that given the tidally influenced groundwater, the source of impact may derive from materials beyond the site boundary.

Groundwater data collected as part of this investigation was reviewed in the context of the proposed development (refer Appendix B). In summary, based on the data currently available to describe groundwater quality near the site, it is assessed that groundwater is unlikely to pose a significant risk to human health or aquatic receptors within Cockle Bay although further assessment is outlined within Section 4.4.

3. Preliminary Conceptual Site Model

Coffey's review of the current and historic land uses of the site identified the following sources of contamination:

Table 3.1: Summary of Potentially Contamination Activities / Sources

Potentially Contaminating Activity/Source	Description of Potential Contamination
Fill of Unknown Origin and Quality	Historical records indicate that the site was reclaimed during the 1860s for establishment of rail corridor and the Darling Harbour Goods Yards and the adjoining Iron Wharf. The sequence of historic site development indicates that fill from several sources and of variable quality has been placed on site during historical land reclamation. The sequence of fill placement, and the heterogeneous nature of fill materials indicates that contamination impact (where present) will be randomly distributed, albeit certain contaminants associated with a particular fill event will be present in discrete horizons of fill where no disturbance has occurred during subsequent site development. *Contaminants of Potential Concern: TPH, BTEX, PAH, OCP, PCB, Metals and asbestos*
Waste Cooking Oil AST	Waste cooking oils from restaurants within the shopping centre are disposed to an AST within the northwestern part of the site. Evidence of oil spillages was noted on hardstand surfaces surrounding the tank during the walkover survey. The repeated application of high temperatures to cooking oils results in a waste product that is typically non-volatile and of low solubility. Partial oxidation of vegetable oils and food products being cooked may also introduce a source of heavy-end PAH compounds. The existing hardstand surface is assessed to restrict waste oil entering the sub-surface, where accidental spillages occur. Where waste oils enter the subsurface, these are anticipated to be concentrated within shallower fill locally, although some potential

Potentially Contaminating Activity/Source	Description of Potential Contamination
	impact to deeper soils and groundwater may have occurred. Coffey expects that this oil would be readily degraded naturally. *Contaminants of Potential Concern: Oil and Grease, and PAH*
Former Darling Harbour Goods Yard & associated Iron Wharf	Available records indicate that the site was within the footprint of the former Darling Harbour Goods Yards, which operated between c.1870 and 1980 and were used to convey freight between rail and maritime transportation modes. Activities within the goods yard and adjoining wharf are assessed to be varied, including heavy rail sidings (oils, asbestos, heavy metals), and minor maintenance activities potentially representing a source of heavy metal, TPH, PAH and possibly, VOC/SVOC contamination. Localised contamination may have also been caused through leaks or spillage from drums or bulk tanks stored on site during transit or as part of the historic storage of goods. Asbestos used within rail engines (boilers, brake linings etc.), structures and insulation products may have also entered the ground during the operation and subsequent demolition of the goods yard. The redevelopment of the goods yard during the mid 1980's may have removed contamination (if present) within shallow soils through minor re-grading of the site, but contamination within deeper fill and natural soils/rock may remain which could represent a source of groundwater contamination. *Contaminants of Potential Concern: TPH, PAH, BTEX, VOC/SVOC, Metals, Asbestos*

Abbreviations:

TPH = Total Petroleum Hydrocarbons

BTEX = Benzene, Toluene, Ethylbenzene, Xylene

PAH = Polycyclic Aromatic Hydrocarbons

Heavy Metals = arsenic, cadmium, chromium, copper, lead, nickel, mercury, zinc

OCP = Organochlorine Pesticides

PCB = Polychlorinated Biphenyls

VOC/SVOC = volatile and semi-volatile organic compounds

A preliminary conceptual site model was developed within the Preliminary Site Contamination Assessment (Coffey, Sept 2020a) and is included in Appendix C in this document. For the proposed development which would maintain hard paved surfaces with minimal landscaping, the following potential contamination risks were identified:

- Ingress and accumulation of vapours in indoor air derived from contamination in unsaturated soil and groundwater may pose a risk to future commercial workers and users of the basement car park via the inhalation pathway.
- Groundwater seepage into the basement may pose a risk to future commercial workers and residents who access the basement via possible dermal contact.
- Soil leaching and migration of potential contaminants in groundwater and/or along preferential flow paths may pose a risk to aquatic receptors within Cockle Bay.
- Surface water runoff from the site during development may pose a risk to aquatic receptors within Cockle Bay.
- Contact with soil and groundwater may pose a risk to workers involved in excavation during site development, or during future subsurface maintenance activities.

In consideration of the potential risks identified, Coffey recommends investigation of the nature and extent of potential contamination present on site prior to future bulk excavation. This would comprise a programme of intrusive investigation and laboratory testing of soil and groundwater. Data from this investigation would be used to refine the assessment of contamination risks and need for remediation.

In the absence of such data and the detailed design of the proposed development, Coffey has developed a preliminary remedial strategy to mitigate potential risks from the sources of contamination identified within the Preliminary Site Investigation report (Coffey, Sept 2020a).

4. Preliminary Remedial Strategy

4.1. Remediation Goal

The goal of remediation works implemented at the site is to make the site suitable for the proposed development and future use by mitigating potentially unacceptable risks associated with contamination. A further goal in implementing remediation works is to carry out the remediation works in a manner to minimise risks to the public in the areas surrounding the site, and Cockle Bay.

4.2. Remedial Options Evaluation

To achieve the remedial objectives, several feasible remediation options were considered to mitigate each of the potential risks identified. Each remediation option was evaluated qualitatively against a range of criteria including:

- Applicability – availability and applicability of option to the types of contaminants potentially present.
- Technical feasibility - assessment of the feasibility of the remediation option within the context of the site setting and types of contaminants potentially present.
- Effectiveness - efficiency of the remediation option to treat/manage contamination present within the site.
- Relative Implementation Timescales - evaluation of the relative timescales required to achieve the remediation objective/end point.
- Relative Sustainability Considerations – relative consideration of aspects including community impacts, resource use, waste generation and materials/energy consumption.
- On-going Liabilities – maintenance and monitoring requirements
- Stakeholder acceptance – including but not limited to Mirvac and their investors, the local community, NSW EPA and planning authorities.
- Relative Cost

The remediation options considered for each potential risk are summarised within the Remediation Options Screening Matrix presented in Appendix D. Each option has been scored against a qualitative scale. Comments associated with the scoring have been provided in summarised form alongside each option. A higher 'Final Score' indicates a more acceptable remediation option.

4.3. Preferred Remedial Strategy

Based on the remediation option screening assessment, Table 4.1 summarises the preferred remediation strategy to be implemented as part of the site's development.

Table 4.1: Preferred Remediation Strategy

Potential Risk	Preferred Remediation Method
Ingress and accumulation of vapours in indoor air derived from unsaturated soil and groundwater may pose a risk to future commercial and residential site users via the inhalation pathway	• Utilise low permeability soil retention system and slab to restrict gas ingress into basement. All service penetrations within basement floor and walls shall be fully lapped and sealed. • Utilise the plenum proposed within basement to sufficiently ventilate buoyant gases/vapours to surface. • Basement car park will require mechanical ventilation to ensure vehicle exhaust gases are effectively removed from basement, which will also remove non-buoyant VOC (if present). • Passive gas protection measures comprising an appropriate membrane and gas ventilation layer integrated in ground floor slab design could be provided in areas of the proposed shopping centre not above the basement.
Groundwater seepage into the basement may pose a risk to future commercial and residential site occupants who access the basement via possible dermal contact.	• Design and construct basement to restrict groundwater seepage into basement. • Install perimeter drains within basement to collect groundwater seepage and channel towards sump. • Groundwater seepage collected would be pumped to sewer/stormwater discharge point under consent. • Treatment of groundwater may be required to ensure compliance with consent conditions.
Soil leaching and migration of potential contaminants in groundwater and/or along preferential flow paths may pose a risk to aquatic receptors within the Cockle Bay.	• Excavation to remove soil materials that pose potential risks to groundwater quality and aquatic receptors in Cockle Bay and disposal of these materials offsite to an appropriately licensed landfill licensed. • At this stage, excavation of soil would include the basement excavation and other areas where localised contamination impacts are identified (e.g. Waste Oil AST). • Groundwater encountered during excavation can be treated ex-situ and discharged to sewer/stormwater under consent • The development would, to the extent practicable, retain hard pavements and appropriate stormwater drainage that would restrict infiltration.
Surface water runoff from the site during development may pose a risk to aquatic receptors within the Cockle Bay.	• Installation of effective sediment controls during site development to restrict the migration of sediment-laden runoff entering Cockle Bay.
Contact with soil and groundwater may pose a risk to construction workers involved in excavation during site development, or during future subsurface maintenance activities.	• Undertake effective health and safety planning prior to the commencement of construction works to reduce risk of exposure to workers involved in excavation. • This includes worker inductions, training for response to unexpected contamination, provision of appropriate Personnel Protective Equipment (PPE) and monitoring, where appropriate.

Available information for the site indicates that the natural alluvial soils are likely to comprise PASS. The following document provides further detail on how PASS encountered during development would be managed for disposal off-site if required and to mitigate risks to the surrounding environment:

- Coffey (Sept 2020b); *Preliminary Acid Sulfate Soil Management Plan; Harbourside Shopping Centre, Darling Drive, Darling Harbour, Sydney* (Ref: GEOTLCOV25340AC-AC v3)

4.4. Approach to Remediation Design

At this stage, the following measures are recommended to refine the preferred remediation strategy to ensure that remediation goals are met:

1. Complete a programme of site investigation to characterise soil and groundwater quality within the site. Data collated from this assessment shall be presented within a Detailed Site Investigation report that is prepared in accordance with guidelines published or endorsed by the NSW EPA, and assesses whether contamination poses potentially unacceptable risks to health or the environment.

2. Where potentially unacceptable contamination risks are identified, further investigation and/or a human health and environmental risk assessment (HHERA) may be used to refine the scope and extent of remediation works required. For example, a HHERA would consider site-specific factors that may modify the exposure routes and durations and calculate risk-based remediation criteria for the site.

3. Prepare a site-specific RAP to outline the procedures to manage surplus soils and mitigate the potential risks identified in the preceding stages. The site-specific RAP would also provide further detail on the validation and environmental management plan proposed for the works.

4. Develop a remediation specification or Works Plan which details the remediation measures (supported by engineering design) for the remediation contractor to implement on site.

5. Prepare a Construction Environmental Management Plan (CEMP) for the remediation works, which provides an overview of the remediation process, and describes controls to mitigate potential health and safety, and environmental risks associated with remediation works. The CEMP would also describe monitoring programmes demonstrate that these works are not posing an unacceptable risk to the surrounding public and/or environment.

6. If relevant, prepare an EMP which addresses long term requirements following completion of remediation and construction works.

5. Update of Preliminary RAP

This Preliminary RAP collates data available to describe current and historic site uses of the site, which has been used to identify potential contamination sources within the site and its immediate surrounds. A preferred remediation strategy has been developed to mitigate the potential risks identified. In summary, the proposed strategy aims to utilise the form of the development concept to mitigate risks. Impacted soils would be excavated for removal where unacceptable contamination is identified outside of the proposed basement footprint. Effective site management will also be required to mitigate risks to workers and aquatic receptors in Cockle Bay during site development.

Experience from other recent developments along the western foreshore of Darling Harbour has showed that the former Darling Harbour Goods Yard and associated port facility that occupied the site and surrounding land has not resulted in significant contamination issues. Measures required to properly manage contamination issues that may be present can be effectively implemented during construction, and it is considered that a similar approach at this site is feasible.

Coffey proposes that the preliminary remediation strategy is refined as the detailed design of the proposed development is prepared, and a programme of investigation within the site is completed. The detailed RAP would address the following aspects:

- Define the scope and extent of remediation measures, and the responsibilities of different parties in implementing those measures, required to meet the remediation goals, and a contingency plan if any remediation measure does not achieve its objective.

- Develop a validation plan, outlining the type and extent of data that will be collected to demonstrate the contamination risks have been effectively managed.

- A Construction Environmental Management Plan that outlines the controls required during remediation to mitigate risks to the surrounding environment and public. This would include controls to manage soil, wastes, stormwater, and fugitive emissions.
- An unexpected finds protocol, outlining procedures for identifying and managing potential risks associated with unexpected finds of contamination that are encountered during site redevelopment.
- Regulatory compliance requirements to implement the remediation works, including licenses, notification requirements and approvals required under the approved development consent, and demonstrating mitigation of potential risk.
- The scope of an EMP, if required to manage risks arising from residual contamination over the long term.

6. Conclusions and Recommendations

Based on:

- The findings of the Preliminary Site Investigation report (Coffey, Sept 2020a), and
- Identification of a preferred remedial strategy which consists of several conventional measures which have a proven track record to mitigate the potential risks identified in the Preliminary Site Investigation report (Coffey, Sept 2020a); and
- Our experience of successfully integrating remedial action plans with complex construction programs in the Darling Harbour precincts;

Coffey considers that sufficient information has been presented to conclude that the site can be made suitable for the proposed commercial and residential development concept outlined in Appendix A in accordance with the decision-making process outlined in the Planning Guidelines for SEPP 55 – Remediation of Land.

At this stage, Coffey recommends a detailed investigation of contamination conditions at the site to provide information for development of a site-specific RAP which will direct effective mitigation of contamination risks during construction. The key components are:

- Implement a programme of investigation to characterise ground contamination conditions within the site and assess the need for remediation to manage contamination in the context of the proposed development concept.
- If required, prepare a site-specific RAP to outline the procedures to manage surplus soils and mitigate contamination risks
- Develop a CEMP which outlines the controls required to mitigate potential health and safety, and environmental risks associated with the remediation works.

Important information about your **Coffey** Environmental Report

Introduction

This report has been prepared by Coffey for you, as Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice,

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but

steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Coffey prepared the report and has familiarity with the site, Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Coffey disowns any responsibility for such misinterpretation.

Data should not be separated from the report

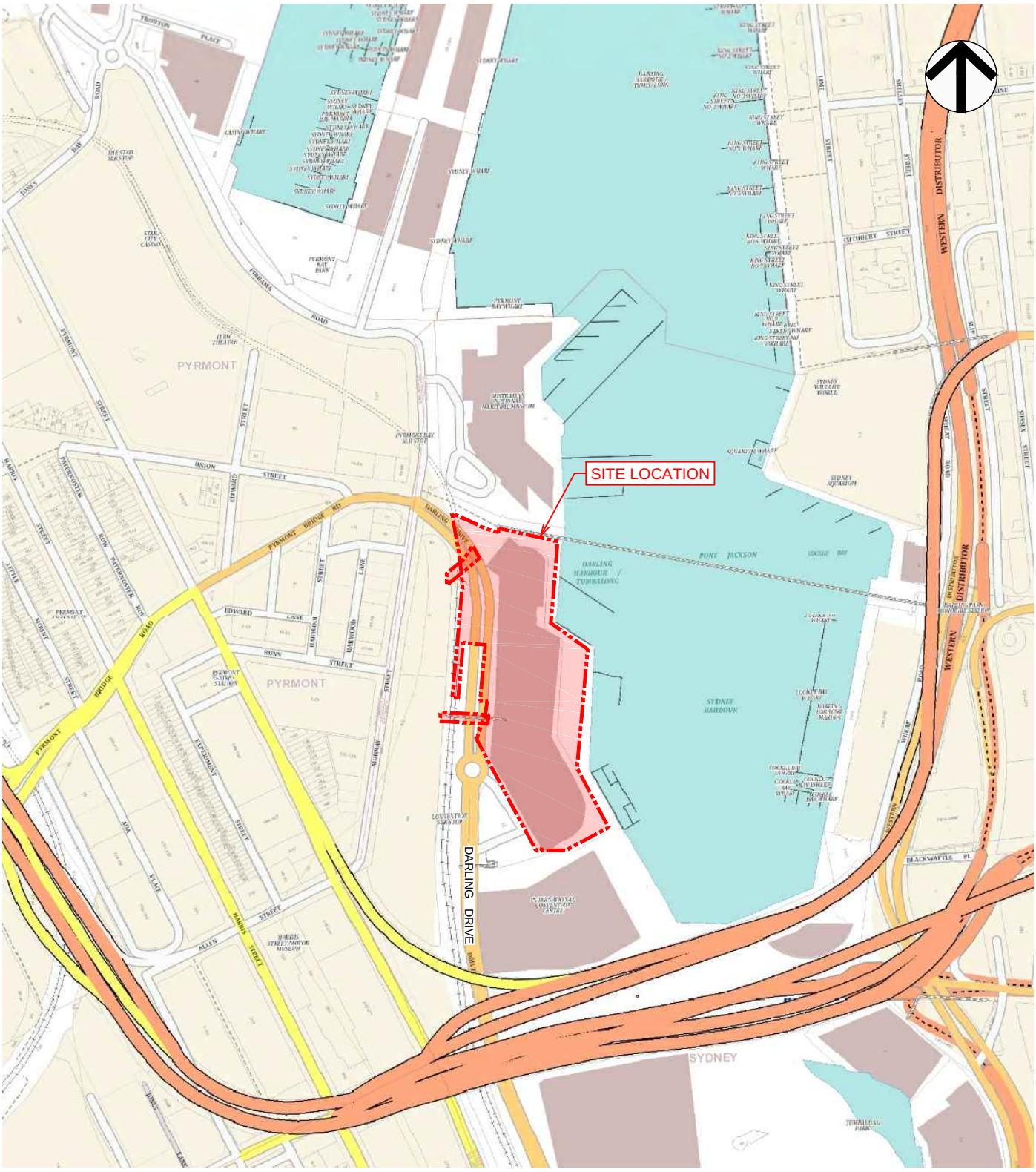
The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

Figures



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Scale (metres) 1:5000

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drawn	ML / AW
approved	-
date	6 / 08 / 18
scale	AS SHOWN
original size	A4

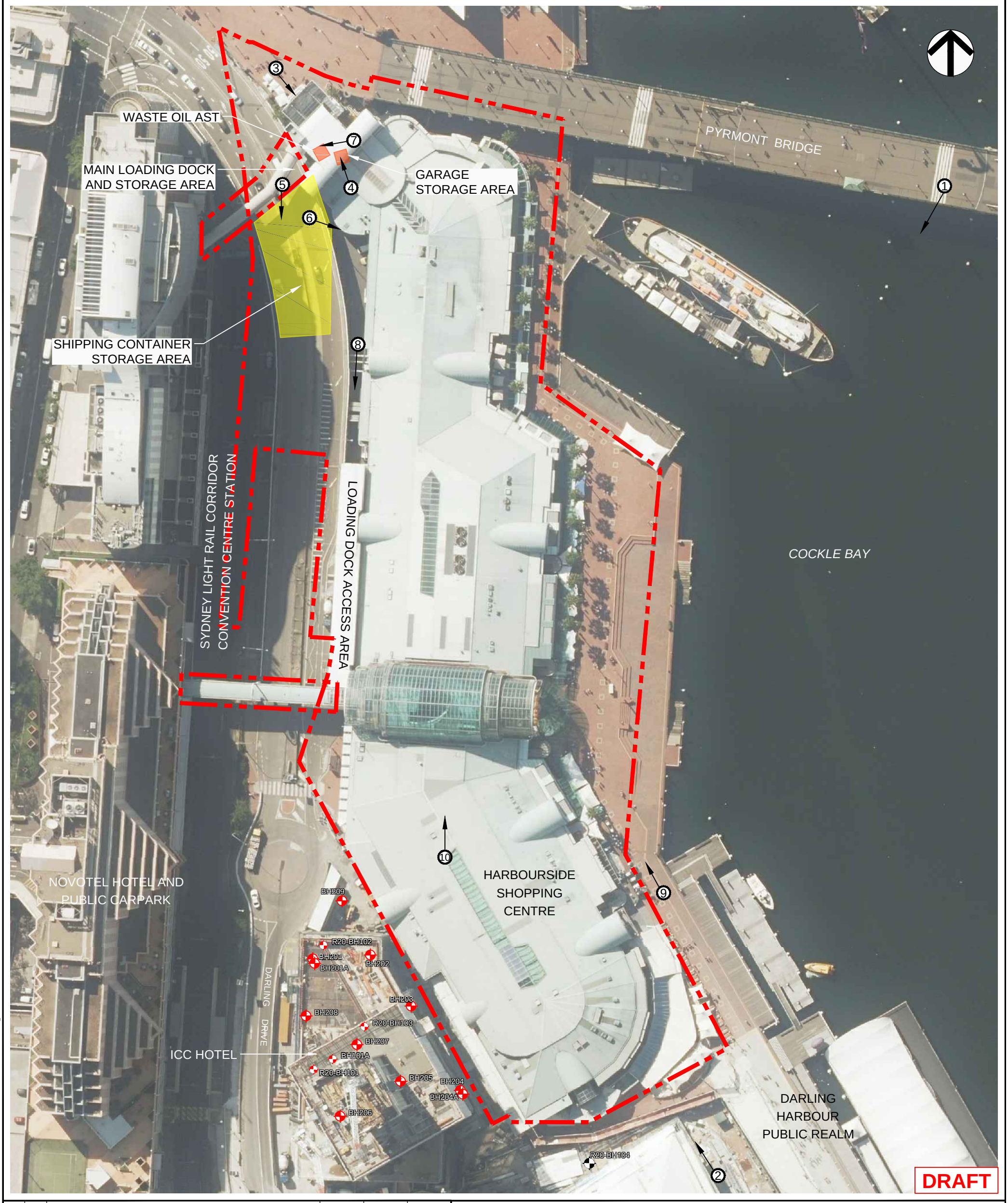
coffey
A TETRA TECH COMPANY

client: MIRVAC PROJECTS PTY LTD

project: HARBOURSIDE SHOPPING CENTRE
DARLING HARBOUR, SYDNEY, NSW

title: SITE LOCATION PLAN

project no: 754-GEOTLCOV25340AB-AB | figure no: FIGURE 1 | rev: A



revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE			

LEGEND

- APPROXIMATE SITE BOUNDARY
- SITE PHOTOGRAPH AND DIRECTION
- PREVIOUS INVESTIGATION LOCATIONS (COFFEY AUG 2013a)

10 0 10 30 50

Scale (metres) 1:1000

drawn	ML / AW
approved	-
date	6 / 08 / 18
scale	AS SHOWN
original size	A3

coffey
A TETRA TECH COMPANY

client: MIRVAC PROJECTS PTY LTD

project: HARBOURSIDE SHOPPING CENTRE
DARLING HARBOUR, SYDNEY, NSW

title: SITE LAYOUT PLAN

project no: 754-GEOTLCOV25340AB-AB | figure no: FIGURE 2 | rev: A

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Appendix A - Proposed Development Concept

Summary

Mirvac had previously lodged State Significant Development (SSD) Development Application (DA) for the redevelopment of the Harbourside Shopping Centre (Harbourside) (SSD 7874).

The SSD DA was publicly exhibited for a second time from 2 April to 29 April 2020. During this time, six (6) submissions were received from government agencies and City of Sydney Council and 57 submissions were received from the general public and organisations.

Proposed Amended Development

Since exhibition of the proposal and given the nature and range of submissions made from agencies and the pubic, Mirvac has reviewed the overall approach and elements of the Concept Proposal. This has accordingly led to developing a Further Amended Concept Proposal. This further and final Concept Proposal includes amendments made by Mirvac pursuant to Clause 55 of the Environmental Planning & Assessment Regulation, in the main to address matters raised in the submissions and deliver an overall significantly improved outcome on the site and for the broader Darling Harbour precinct and Pyrmont Peninsula.

In addition to the further amendments made to the Concept Proposal, Mirvac are also now including detailed Stage 1 Early Works, comprising demolition of existing site improvements down to ground slab level (no ground disturbance). Revised SEARs were accordingly issued by the Department on 12 May 2020.

The following further key amendments have been made to the Concept Proposal since its April 2020 public exhibition:

Increase in Height of the Tower

The height of the tower has been increased to be consistent with the height originally proposed (from RL 153.75 to RL 166.95). The tower height has been increased in order to better align with the place outcomes identified within the Draft Pyrmont Place Strategy for Harbourside. This opportunity for additional height is supported with the provision of additional public benefit through the creation of a new significant public accessible area of open space on the northern podium rooftop.

Reduction in Height of the Northern Podium

A portion of the podium height at its northern extent has been further reduced from RL 25 to part RL 17.6 and part 13.75. The reduction in height provides for an improved relationship to the state heritage listed Pyrmont Bridge, further improve view sharing from 50 Murray Street, along with providing an opportunity to create a new publicly accessible open space area.

Gross Floor Area / Land Use Mix

The amended proposal retains the same overall 87,000sqm of GFA, however there is a minor adjustment in the split between non-residential and residential. The final proposal now includes:

- Non-residential uses floor space – 45,000sqm; and
- Residential uses floor space – 42,000sqm

In response to market demand and the focus of local and regional strategic planning policies, it is proposed for the podium to now include predominantly commercial land uses along with supporting retail. Indicatively, comprising ~28,000sqm net lettable area of commercial office and ~8,500sqm gross lettable area of retail.

The podium enables large campus sized commercial floor plates that are favoured by large multinational tech, media, finance and professional services companies.

Apartment numbers

No change is proposed to the indicative number of apartments (357), with the minor increase in the tower height resulting in a review of the mix and sizing of apartments. Note, this yield is on the 'Indicative Design' only and will be subject to future design development and a Stage 2 DA. This Stage 1 DA only seeks approval for land uses and the building envelope comprising a total of 87,000sqm GFA.

Car Parking

The overall footprint of the basement has been reduced, but there is proposed to be an additional basement level of parking (increase from 3 levels to 4 levels). There is no change to proposed indicative parking spaces, remaining at 306 spaces. As above, this is based on the 'Indicative Design' only.

Landscaped Open Space and Public Domain

The key concepts and public benefits as originally proposed are retained under the amended Concept Proposal, with the addition of a new significant area of publicly accessible open space created on the rooftop of the northern podium (referred to as "Guardian Square").

Description of Development

The Harbourside Shopping Centre Redevelopment application will include a Concept Proposal and detailed Stage 1 Early Works.

The final Concept Proposal seeks approval for the following key components and development parameters:

- A network of open space areas and links generally as shown within the Public Domain Concept Proposal, to facilitate re-integration of the site into the wider urban context;
- Building envelopes;
- Land uses across the site, non-residential and residential uses;
- A maximum total Gross Floor Area (GFA) across the Harbourside site of 87,000sqm for mixed use development (45,000sqm non-residential and 42,000sqm residential development);
- Basement car parking;
- Car parking rates to be utilised in subsequent detailed (Stage 2) Development Applications);
- Urban Design and Public Realm Guidelines to guide future development and the public domain; and
- Strategies for utilities and services provision, drainage and flooding, and ecological sustainable development.

The Stage 1 Early Works comprises:

- Demolition of the existing site improvements, including the Harbourside Shopping Centre, obsolete monorail infrastructure, and associated tree removal.

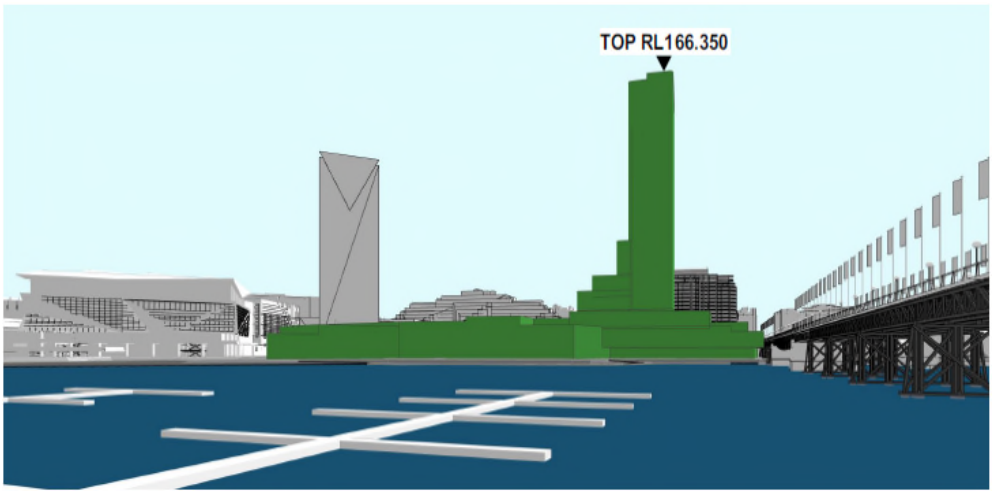


Figure 1 Original submitted Concept Proposal

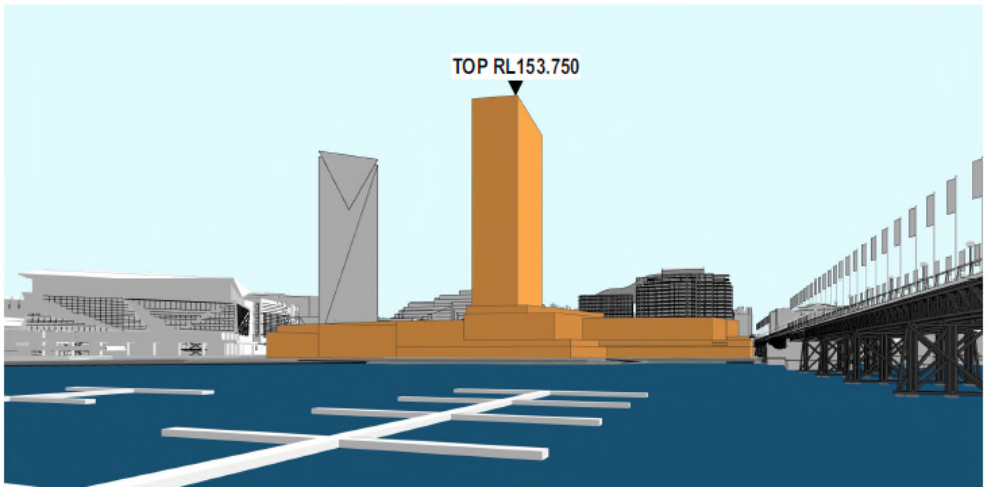


Figure 2 Amended Concept Proposal

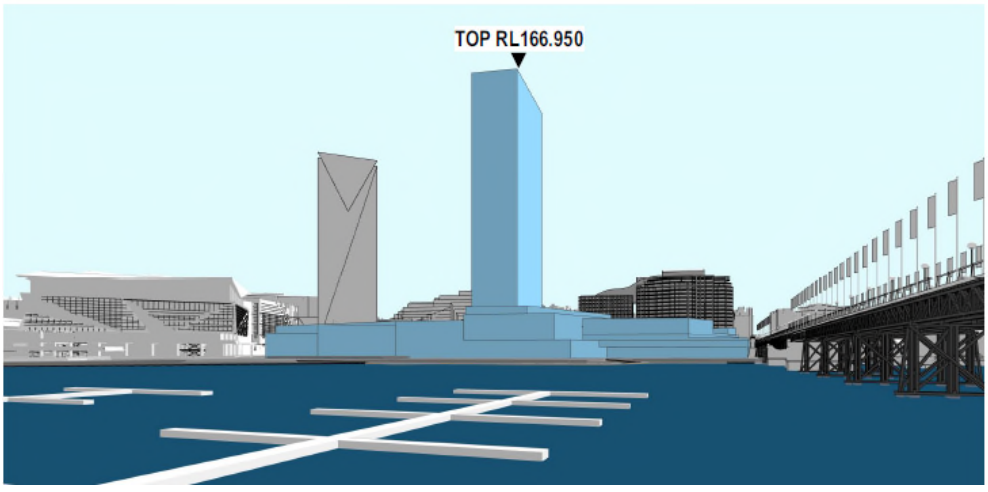


Figure 3 Further and Final Amended Concept Proposal

WORK IN PROGRESS

DA BOUNDARY BRIDGE CONNECTION
DA BOUNDARY BRIDGE CONNECTION
DA BOUNDARY GROUND
DA BOUNDARY GROUND
DA BOUNDARY MONORAIL LINK
DA BOUNDARY EXTENT GROUND
DA BOUNDARY EXTENT GROUND
DA BOUNDARY
DA BOUNDARY
DA BOUNDARY
DA BOUNDARY
DA BOUNDARY
3
1
2 x EXISTING SUBSTATIONS
EXPANSION SPACE IF SUBS NEED TO BE REPLACED
E.05
E.01
M.13
E.09
E.02
E.03
E.07
F.04
F.03
H.15
F.05
Store
Retail
Resi Lobby
Lifts/Plant
Lobby
Lifts
Risers/Amenities
Lifts/Egress/ Amenities
Lifts / Services / Amenities
Lobby
Lift
G L
BASEMENT FOOTPRINT
PROLONGATION OF HERITAGE WALL (IF IT EXISTS)
SHOTCRETE AND CONCRETE COLUMNS
H.14
29
28

RETAIL
COMMERCIAL
RESIDENTIAL

fjmt

Indicative Plan Only - Ground Floor Retail

Mirvac - Harbourside

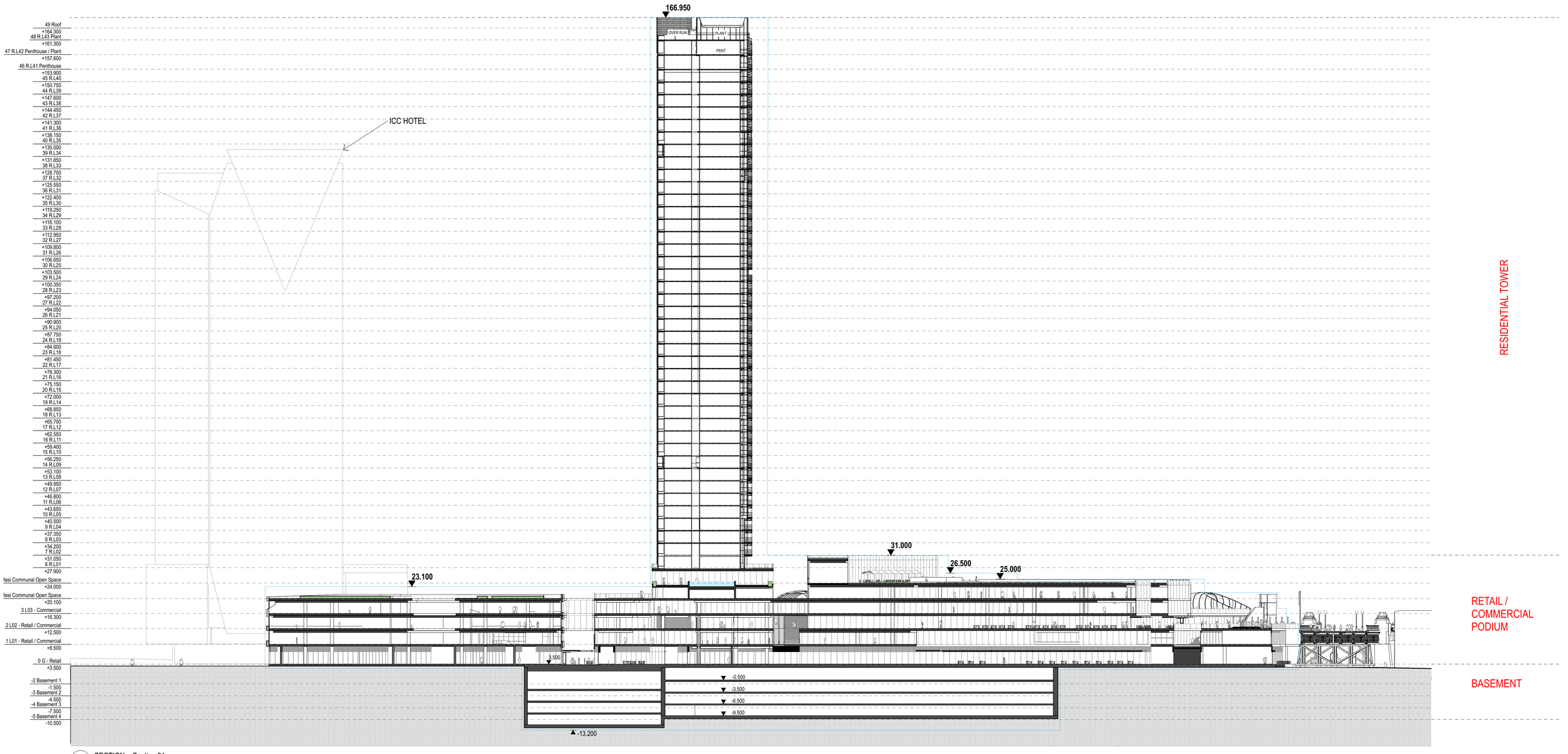
0 5 10 20m

1:500 @ A1

7/9/20

For Information

SSDA1-303



1 SECTION Section 01
1:500

BOUNDARY LEGEND

ENVELOPE EXTENT

fjmt

Indicative Only - Section (23.1)

Mirvac - Harbourside

1:150 @ A1

29/9/20

For Information

SSDA1-318

WORK IN PROGRESS

LEGEND

MECHANICAL
M1 COMMERCIAL COOLING TOWERS
M2 CHILLED WATER PLANT
M3 AIR HANDLING UNITS
M4 HOT WATER HEATERS
M5 FUTURE COMMERCIAL TENANT PROVISION
M7 STAIR PRESSURISATION PLANT
M8 COMMERCIAL FAN PLANT
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M31 STAIR PRESSURISATION RELIEF RISERS
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M33 KITCHEN EX
M24 OUTSIDE AIR
M35 RESIDENTIAL CONDENSER WATER RISER

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E.01 NEW 3 x 1500LVA AUSGRID TRIPLEX SUBSTATION
E.02 MSB ROOM (COMMERCIAL)
E.03 MSB ROOM (RETAILS)
E.04 MSB ROOM (RESIDENTIAL)
E.05 GENERATOR ROOM
E.05a DIESEL BULK FUEL TANK
E.06 TYPICAL ELECTRICAL DB CUPBOARD
E.07 TYPICAL ELECTRICAL DB CUPBOARD
E.08 ELECTRICAL RISER FOR RESIDENTIAL TOWER
E.09 GENERATOR ROOM - RETAIL
C.01 MDF ROOM
C.02 TYPICAL COMMS/SEC/MATV RISER CUPBOARD
C.03 DAS ROOM

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H.02 SUB-SOIL PUMP-OUT (IN GROUND)
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F.05 FIRE CONTROL ROOM
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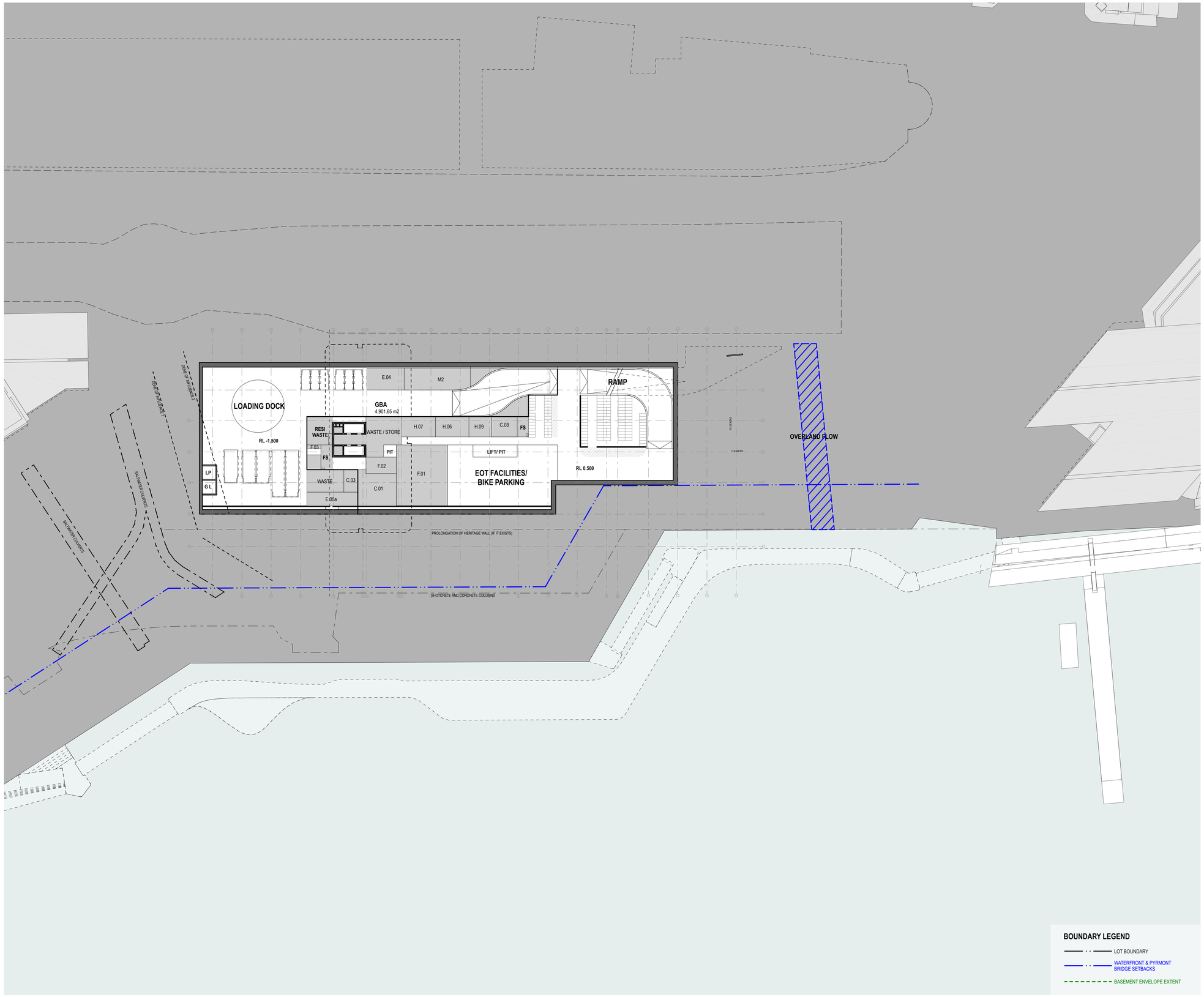

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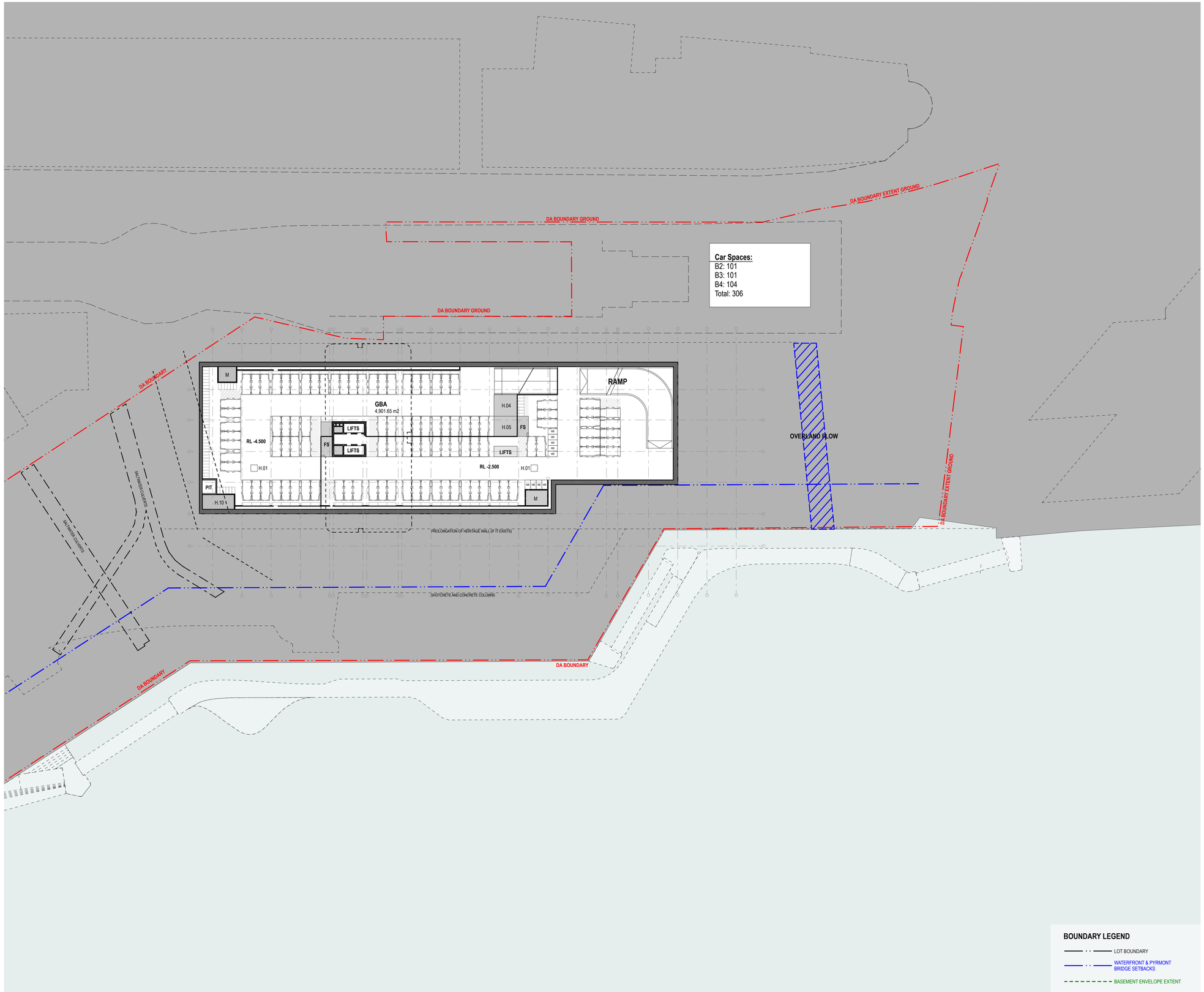

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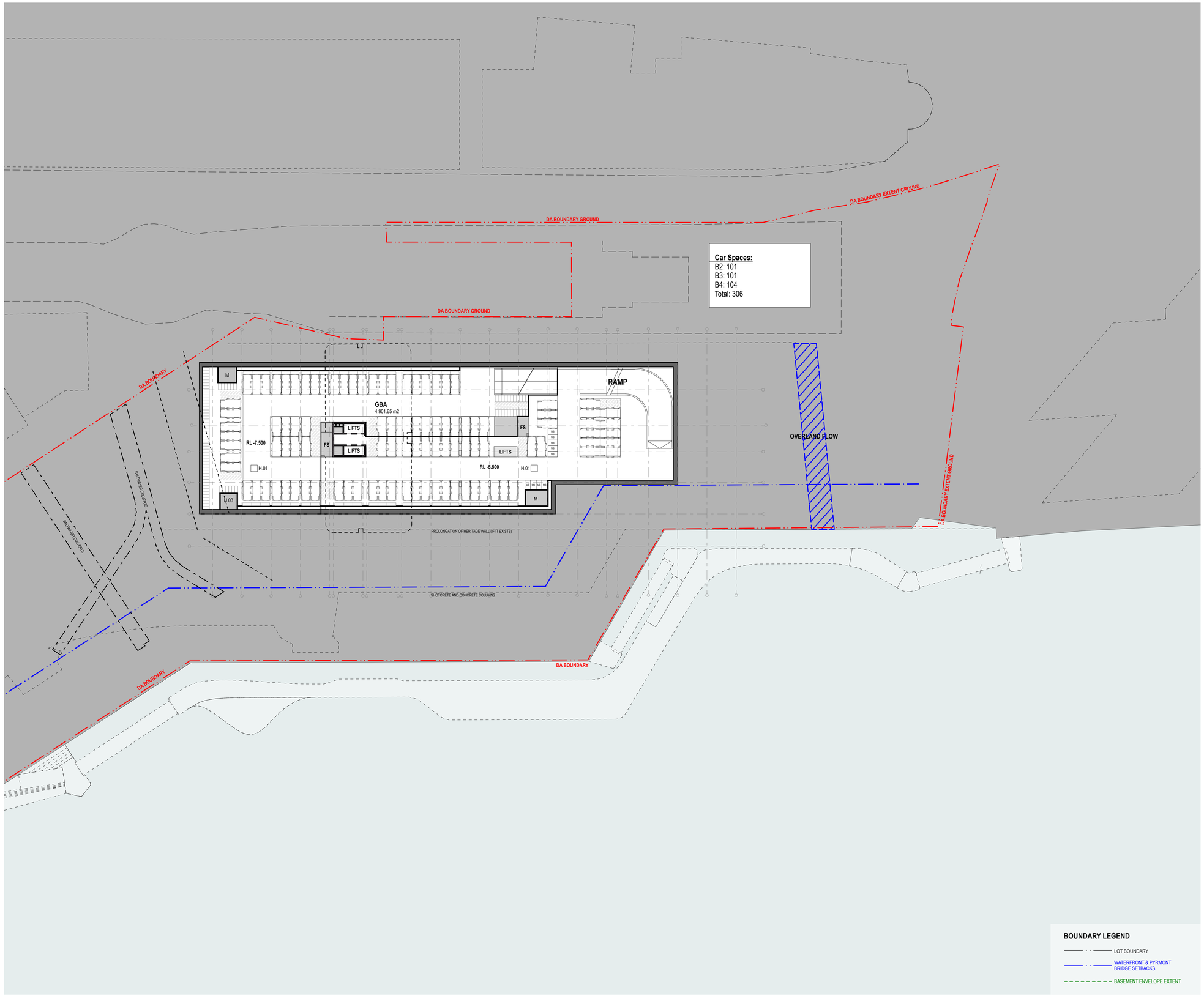

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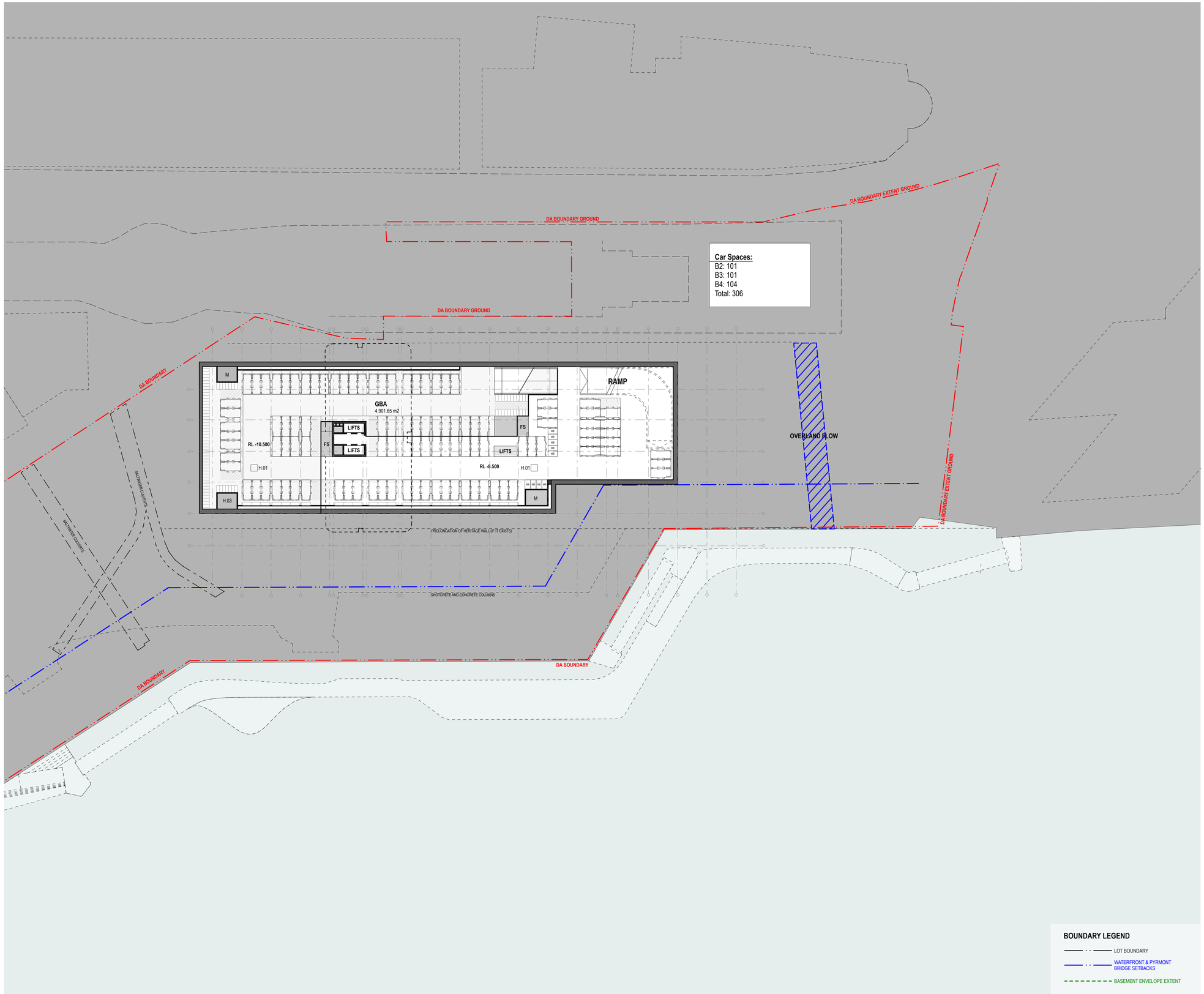
F.05 FIRE CONTROL ROOM
F.06 COMMERCIAL SUB FIP/EWIS PANEL



Appendix B – Available Groundwater Quality Data; ICC Hotel Development Site

Table 6
Groundwater Analytical Results - Comparison Against Marine Trigger Values for Protection of 95%/99% of Species (ANZECC/ARMCANZ, 2000)

ICC Hotel Development, Darling Harbour, Sydney NSW

			LOR	Groundwater Investigation Levels (ANZECC 2000)	BH203_F BH203 7/06/2013	BH203 BH203 7/06/2013	BH204_F BH204 7/06/2013	BH204 BH204 7/06/2013	BH205_F BH205 7/06/2013	BH205 BH205 7/06/2013	RB RB 7/06/2013
Heavy Metal	Arsenic (Filtered)	mg/L	0.001	0.0023	-	<0.001	-	<0.001	-	0.002	<0.001
	Cadmium (Filtered)	mg/L	0.0001	0.0007	-	<0.0001	-	<0.0001	-	0.0004	<0.0001
	Chromium (Filtered)	mg/L	0.001	0.0044	-	<0.001	-	<0.001	-	<0.001	<0.001
	Copper (Filtered)	mg/L	0.001	0.0013	-	0.001	-	<0.001	-	0.052	<0.001
	Lead (Filtered)	mg/L	0.001	0.0044	-	<0.001	-	<0.001	-	<0.001	<0.001
	Mercury (Filtered)	mg/L	0.0001	0.0001	-	<0.0001	-	<0.0001	-	<0.0001	<0.0001
	Nickel (Filtered)	mg/L	0.001	0.007	-	0.005	-	<0.001	-	0.052	<0.001
	Zinc (Filtered)	mg/L	0.005	0.015	-	0.017	-	<0.005	-	0.044	<0.005
PAH	Acenaphthene	µg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Acenaphthylene	µg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Anthracene	µg/L	0.05	0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Benzo(a)anthracene	µg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Benzo(a)pyrene	µg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Benzo(g,h,i)perylene	µg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Benzo(k)fluoranthene	µg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1
	Chrysene	µg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Benzo[b+j]fluoranthene	mg/L	0.00001	-	<0.00001	<0.00001	<0.00001	<0.00002	<0.00001	<0.00001	<0.001
	Dibenz(a,h)anthracene	µg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Fluoranthene	µg/L	0.05	1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Fluorene	µg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Indeno(1,2,3-c,d)pyrene	µg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Phenanthrene	µg/L	0.05	0.6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Pyrene	µg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1
	Total PAHs	µg/L	0.05	-	0.06	0.05	0.06	0.05	<0.05	<0.05	<1
	Naphthalene	µg/L	0.05	50	0.06	0.05	0.06	0.05	<0.05	<0.05	<1
TPH	C10 - C14	µg/L	50	50	-	<50	-	170	-	<50	<50
	C15 - C28	µg/L	100	100	-	<100	-	100	-	<100	<100
	C29 - C36	µg/L	100	100	-	<100	-	<100	-	<100	<100
	C10 - C36 (Sum of total)	µg/L	100	-	-	<100	-	300	-	<100	<100
Volatile	Benzene	µg/L	1	500	-	<1	-	<1	-	<1	<1
	Toluene	µg/L	1	180	-	2	-	<1	-	<1	<1
	Ethylbenzene	µg/L	1	5	-	<1	-	<1	-	<1	<1
	Xylene (m & p)	µg/L	2	75	-	<2	-	<2	-	<2	<2
	Xylene (o)	µg/L	1	350	-	<1	-	<1	-	<1	<1
	Xylene Total	µg/L	3	-	-	<3	-	<3	-	<3	<3

Notes:
1. Samples with the suffix 'F' refer to samples that were filtered within the laboratory using a glass fibre 0.45micron filter

Table 7
Groundwater Analytical Results - Comparison Health Screening Levels (NEPC, 1999)

ICC Hotel Development, Darling Harbour, Sydney NSW

			LOR	Groundwater HSL (NEPC, 1999)	BH203_F BH203 7/06/2013	BH203 BH203 7/06/2013	BH204_F BH204 7/06/2013	BH204 BH204 7/06/2013	BH205_F BH205 7/06/2013	BH205 BH205 7/06/2013	RB RB 7/06/2013
TPH	F2-NAPHTHALENE	mg/L	0.05	NL	-	<0.05	-	0.19	-	<0.05	<0.05
	C6 - C9	µg/L	20	NL	-	<20	-	<20	-	<20	<20
	Naphthalene	µg/L	20	NL	-	<20	-	<20	-	<20	<20
	C6-C10 less BTEX (F1)	mg/L	0.02	6	-	<0.02	-	<0.02	-	<0.02	<0.02
	C10 - C16	mg/L	0.05	NL	-	<0.05	-	0.19	-	<0.05	<0.05
	C16 - C34	mg/L	0.1	NL	-	<0.1	-	0.1	-	<0.1	<0.1
	C34 - C40	mg/L	0.1	NL	-	<0.1	-	<0.1	-	<0.1	<0.1
	C6 - C10	mg/L	0.02	NL	-	<0.02	-	<0.02	-	<0.02	<0.02
	C10 - C14	µg/L	50	NL	-	<50	-	170	-	<50	<50
	C15 - C28	µg/L	100	NL	-	<100	-	100	-	<100	<100
	C29 - C36	µg/L	100	NL	-	<100	-	<100	-	<100	<100
	C10 - C36 (Sum of total)	µg/L	100	NL	-	<100	-	300	-	<100	<100
Volatile	Benzene	µg/L	1	5000	-	<1	-	<1	-	<1	<1
	Toluene	µg/L	1	NL	-	2	-	<1	-	<1	<1
	Ethylbenzene	µg/L	1	NL	-	<1	-	<1	-	<1	<1
	Xylene (m & p)	µg/L	2	NL	-	<2	-	<2	-	<2	<2
	Xylene (o)	µg/L	1	NL	-	<1	-	<1	-	<1	<1
	Xylene Total	µg/L	3	NL	-	<3	-	<3	-	<3	<3

Notes:
1. Samples with the suffix 'F' refer to samples that were filtered within the laboratory using a glass fibre 0.45micron filter

Appendix C – Preliminary Conceptual Site Model

Table 5.1: Summary of Potentially Contaminating Activities, Potential Areas of Environmental Concern, Likelihood of Contamination and Potential Chemicals of Concern

Potentially Contaminating Activity/Source	Sub Component / Description	Potential Areas of Environmental Concern	Likelihood of Contamination	Chemicals of Potential Concern
Fill of Unknown Origin and Quality	Historical records indicate that the site was reclaimed during the 1860s for establishment of rail corridor and the Darling Harbour Goods Yards and the adjoining Iron Wharf. The source and quality of fill is understood to derive from spoil generated from the Sydney rail terminus although may have also included sandstone cut to form the rail corridor immediately east of the site. Available records suggest fill may have also included 'old wharf and pier structures'. The site was redeveloped in c.1980 in its current configuration. During this period, a proportion of the historic fill materials may have been removed and/or additional fill materials introduced to the site.	Fill material comprises the upper portion of the subsurface, and is suspected to be present across the entire site. *Soil and groundwater media potentially affected.*	*Low to moderate likelihood of contamination.* The sequence of historic site development indicates that fill of different origins and quality has been placed on site during different periods. The sequence of fill placement, and the heterogeneous nature of fill materials indicates that contamination impact (where present) will be randomly distributed throughout the fill on site, albeit certain contaminants associated with a particular fill event will be present in discrete horizons of fill where significant reworking of fill has not occurred during subsequent site development.	TPH, BTEX, PAH, OCP, PCB, Metals and asbestos
Waste Cooking Oil AST	Waste cooking oils from restaurants within the shopping centre are disposed to an AST within the northwestern part of the site. Oils are reportedly decanted into the tank, and subsequently removed via vacuum truck. Evidence of oil spillages was noted on hardstand surfaces surrounding the tank during the walkover survey.	The waste cooking oil AST is considered to be a point source of potential contamination within the northwestern portion of the site, due to likely impact on aesthetics. *Soil and groundwater media potentially affected*	*Low to moderate likelihood of contamination.* The repeated application of high temperatures to cooking oils results in a waste product that is typically non-volatile and of low solubility. Partial oxidation of vegetable oils and food products being cooked may also introduce a source of heavy-end PAH compounds. The existing hardstand surface and associated drain is assessed to restrict waste oil entering the sub-surface, where accidental spillages occur. Where waste oils enter the subsurface, these are anticipated to be concentrated within shallower fill locally, although some potential impact to deeper soils and groundwater may have occurred.	Oil and Grease and PAH
Former Darling Harbour Goods Yard & associated Iron Wharf	Available records indicate that the site was within the footprint of the former Darling Harbour Goods Yards, which operated between c.1870 and 1980 and were used to convey freight between rail and maritime transportation modes.	The site was situated within the western-most shed within the former goods yard. As little information is available to describe the types of activities undertaken within specific areas of the goods yard, contamination impacts from this historic use may be present across the entire site. *Soil and groundwater media potentially affected.*	*Moderate likelihood of contamination* Activities within the goods yard and adjoining wharf are assessed to be varied, including heavy rail sidings (oils, asbestos, heavy metals), and minor maintenance activities potentially representing a source of heavy metal, TPH, PAH and VOC/SVOC contamination. [2] Localised contamination may have also been caused through leaks or spillage from drums or bulk tanks stored on site during transit or as part of the historic storage of goods. Asbestos used within rail engines (boilers, brake linings etc.), structures and insulation products may have also entered the ground during the operation and subsequent demolition of the goods yard. The redevelopment of the goods yard during the mid 1980's may have removed contamination (if present) within shallow soils through minor re-grading of the site, but contamination within deeper fill and natural soils/rock may remain which could represent a source of groundwater contamination.	TPH, PAH, BTEX, VOC/SVOC, Metals, Asbestos

Notes: TPH = Total Petroleum Hydrocarbons; BTEX = Benzene, Toluene, Ethylbenzene, Xylene; PAH = Polycyclic Aromatic Hydrocarbons; Heavy Metals = arsenic, cadmium, chromium, copper, lead, nickel, mercury, zinc; OCP = Organochlorine Pesticides; PCB = Polychlorinated Biphenyls, VOC/SVOC = volatile and semi-volatile organic compounds.

[2] It is noted that the main rail engineering works were situated in Eveleigh, approximately 3km south of the Goods Yards. It is assessed that major maintenance and repair works would have occurred in Eveleigh, rather than within the Darling Harbour Goods yards. It is considered possible that minor maintenance/repairs works may have been undertaken within the Goods Yards however.

5.2. Potential exposure pathways

The following pathways and exposure routes have been identified by which potential contaminants have been identified at the site may reach environmental and/or human receptors:

- Dermal contact with soil and/or groundwater.
- Incidental ingestion of soils and dust and/or groundwater.
- Inhalation of dusts, vapours and fibres.
- Seepage of groundwater into Cockle Bay.
- Surface runoff / overland flow.

5.3. Potential receptors

In the context of the current and proposed use of the site, the following potential receptors have been identified

- Current site users – site visitors and commercial workers.
- Future site users – commercial (retail and office) workers, and residents occupying dwellings within the upper floors of the development, users of the basement car park.
- Construction workers and maintenance workers involved in excavation.
- Aquatic species in Cockle Bay.

5.4. Preliminary conceptual site model

Table 5.2 presents a preliminary conceptual site model, discussing the plausible pollutant linkages between the potential AECs and receptors. The following nomenclature was used in Table 5.2 to annotate the nature of pollutant linkages considered:

P = plausible complete pathways

p = partially complete pathway depending on site conditions/exposure scenario

n = pathway not complete

n/a = pathway not applicable

Table 5.2: Preliminary Conceptual Site Model

Receptor	Media	Plausible Exposure Pathway (No Mitigation)					Discussion of Plausible Pollutant Linkages
		Dermal Contact	Ingestion	Inhalation	Seepage into Cockle Bay	Runoff / Overland Flow	
Current Site Users	Soil / Groundwater	n	n	n	n/a	n/a	Current site users comprise commercial workers (retail and office) and site visitors. Hardstand surfaces exist across the site, restricting these users to be exposed to underlying fill via the dermal contact, inhalation/ingestion exposure pathways. Commercial (retail and office) workers may be exposed to waste oils via dermal contact pathway although given that these oils derive from a food-grade facility, and the frequency/duration of exposure is low, this exposure pathway is not considered complete. The assessment has not identified a significant source of volatile contamination, albeit the former goods yard may have introduced volatile contaminants into the subsurface. In consideration of the open plan nature of the existing shopping centre and lack of basement/accessible subsurface structure, it is assessed that current site users are unlikely to be exposed to unacceptable levels of vapours within an indoor environment.
Future Site Users	Soil / Groundwater	n	n	**P**	n/a	n/a	Future site users will comprise both retail/office workers and site visitors within the proposed commercial complex, and residents occupying the upper floors of the development. The proposed development plans indicate hard stand surfaces will be retained as part of the development, which will restricting these users to be exposed to underlying fill via the dermal contact, soil inhalation/ingestion exposure pathways. The proposed development will introduce a four-storey basement car park. It is anticipated that the basement will remove fill within the central part of the site that may contain contamination. Fill will remain within the northern and southern portions of the site, and commercial workers (i.e. car park attendant, maintenance worker accessing plant rooms etc.) and frequent

Receptor	Media	Plausible Exposure Pathway (No Mitigation)					Discussion of Plausible Pollutant Linkages
		Dermal Contact	Ingestion	Inhalation	Seepage into Cockle Bay	Runoff / Overland Flow	
							users of the car park (i.e. residents, site visitors) may be exposed to vapours derived from volatile contaminants present in soil and groundwater, if present.
Construction & Maintenance Workers	Soil / Groundwater	**P**	**P**	**P**	n/a	n/a	Workers during the redevelopment of the site and during future maintenance events may be exposed to potentially contaminated fill materials via direct exposure routes; namely; dermal contact, inhalation/ingestion of dust/fibres, and inhalation of vapours.
Aquatic Species in Cockle Bay	Soil / Groundwater	n/a	n/a	n/a	**P**	**P**	Potentially impacted soils and groundwater within the site could adversely affect aquatic receptors within Cockle Bay via soil leaching and lateral groundwater transport pathways. These pathways may be enhanced by existing services which can act as a preferential flow pathway. The removal of existing hardstand surfaces may enable soils to be transported via surface water runoff/overland flow directly into Cockle Bay, or via existing stormwater drainage conduits.

Appendix D – Remediation Options Screening Assessment

Remediation Options Screening Assessment: Harbourside Shopping Centre

Risk	Method	Method Description	Applicability	Technical Feasibility	Effectiveness	Stakeholder Acceptance	Relative Cost	Timing	Sustainability	Ongoing Liabilities	Final Score	Comments
Ingress and accumulation of vapours in indoor air derived from unsaturated soil and groundwater may pose a risk to future commercial and residential site users via the inhalation pathway	Do nothing	Base case for comparison.	1	1	0	0	4	4	0	0	10	The do nothing scenario provides no mitigation to restrict gas ingress into basement.
	Utilise proposed building form to restrict gas ingress	Method relies on the use of building form and features to restrict gas ingress into structures. 1. Basement - utilise a low permeability soil retention system and basement slab to restrict gas ingress to basement. Basement plenum installed to sufficiently ventilate gases/vapour. Services penetrations within basement wall and floor are fully lapped and sealed to restrict gas ingress. Basement car park ventilation is designed to meet the Australian Standard to mitigate risks. 2. Remainder of Proposed Structure - gas membrane and ventillation layer that is integrated into the ground floor slab design in areas of the proposed shopping centre outside the footprint of the basement.	4	4	4	4	2	2	3	2	25	Basement will need to be constructed in a manner to prevent water ingress, which is also considered to be effective at mitigating risks associated with gas/vapour ingress. Relatively low cost and sustainable as plenum will passively ventilate gases. Basement car park will also require mechanical ventillation system, which offers further protection.
	Source removal	Excavation and remove fill and natural soil within the site that are susceptible to generate gases. Backfill areas beyond the footprint of the basement with materials that will not generate gas	2	2	1	2	1	2	0	2	12	Source removal unlikley to be effective to mitigate potential vapour. Option generates a large volume of waste, which is costly and less sustainable
Groundwater seepage into the basement may pose a risk to future commercial and residential site occupants who access the basement via dermal contact pathway	Do nothing	Base case for comparison.	1	1	0	0	4	3	3	2	14	The do nothing scenario provides no mitigation to prevent basement users coming in contact with groundwater seepage.
	Design and install basement drainage system to collect groundwater seepage, and restrict basement users being exposed to groundwater. Groundwater collected in sump would be discharged to sewer/stormwater discharge point under consent. Treatment of groundwater may be required to ensure compliance with consent.	Utilise low permeable soil retention system and slab to restrict groundwater seepage. Installation of perimeter drains within basement to collect groundwater seepage, and restrict exposure.	4	4	4	4	2	2	2	2	24	Basement drainage system with sufficient capacity should be effective at restricting basement users coming in contact with seepage. Pumped system required to remove collected water periodically.
Soil leaching and migration of potential contaminants in groundwater and/or along preferential flow paths may pose a risk to aquatic receptors within the Cockle Bay	Do nothing	Base case for comparison.	0	0	0	0	4	4	0	0	8	The do nothing scenario provides will not reduce contaminant mass in soil or groundwater within the site.
	Source removal	Excavation and remove soil materials that pose potential risks to groundwater quality, and aquatic receptors within Cockle Bay. Groundwater encountered during excavations can be treated ex-situ and discharged to sewer/stormwater under consent.	2	2	2	3	2	3	2	3	19	Basement excavation will remove soil materials from a large part of the site. Source removal may also be used to excavate impacted materials from other areas outside of the basement footprint (e.g. Wasste Oil AST), if required. This option is considered applicable, feasible and relatively effective. However, as there would be limited space on site to enable reuse, it is considered likely that soil materials excavation would be disposed off site to a licensed landfill. May not be wholly effective to treat groundwater impacts.
	Source containment through pathway interception	Install a containment structure to prevent impacted media leaching into the water environment	2	2	2	2	2	2	3	1	16	Relies on aspects of the development to restrict exposure to contamination, through breaking the pathway. This option may be effective for certain types of contaminants, yet may not be wholly effective for contamiannts with high solubilities.
	Insitu treatment of impacted soils and/or groundwater	Deploy a treatment technology to treat potential contaminants in-situ	2	2	1	1	1	1	2	2	12	In-situ treatment may not be effective or feasible to treat the range of contaminants present that require treatment. Timescales for implementation may also not be acceptable to project stakeholders.
Surface water runoff from the site during development may pose a risk to aquatic receptors within the Cockle Bay.	Do nothing	Base case for comparison.	0	0	0	0	3	3	0	0	6	The do nothing scenario will not reduce sediment load entering Cockle Bay. The do nothing option is likely to be unacceptable from a regulatory perspective.
	Effective site management procedures to restrict sediment laden runoff entering Cockle Bay	Installation of effective sediment controls. Stage excavation works	3	3	3	3	3	3	3	3	24	Option is the preferred solution to prevent sediment laden runoff entering Cockle Bay
Contact with soil and groundwater may pose a risk to construction workers during site development, or during future subsurface maintenance activities.	Do nothing	Base case for comparison.	0	0	0	0	1	0	0	1	2	The do nothing scenario will not reduce risks to construction workers. The do noting option is unlikley to be acceptable from a regulatory perspective.
	Health and safety controls implemented during works	Effective health and safety planning to reduce risk of exposure to construction and maintenance workers. This includes worker inductions, provision of appropriate Personnel Protective Equipment and monitoring, where appropriate.	3	3	3	3	4	3	3	3	25	Option is the preferred solution to mitigate risks to construction workers, and future maintenance workers.

	Score				
	0	1	2	3	4
Applicability	Not applicable to contamination or not available	←		→	Widely available and applicable to contamination
Technical Feasibility	Unfeasible on site	←		→	Feasible
Effectiveness	Limited effectiveness for intended purpose	←		→	Highly effective for intended purpose
Stakeholder Acceptance	Unlikely to be acceptable to stakeholders (e.g. Mirvac, local community, regulators)	←		→	Highly likely to be acceptable to stakeholders
Cost	Relatively expensive in comparison to other considered options	←		→	Relatively inexpensive in comparison to other considered options
Sustainability	Unsustainable	←		→	Sustainable option in terms of environmental management & CSR
Timing	Long treatment/ implementation	←		→	Short treatment/ implementation
Cost Management	Large initial cost for site closure	←		→	Small initial Cost with cost spread over treatment duration

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