## Chlor-Alkali Plant Boiler | SSD

# MODIFICATION REPORT

Prepared for IXOM Operations Pty Ltd | 18 December 2025



element.



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Prepared for IXOM Operations Pty Ltd
18 December 2025

PR457

| | Prepared by | Reviewer | Reviewer |
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| Date | 19 December 2025 | 19 December 2025 | 19 December 2025 |

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| 0 | 18 December 2025 | For IXOM review | Element Environment | IXOM Operations Pty Ltd |

# Certification Page

Submission of a modification report prepared under Part 4 of the NSW *Environmental Planning and Assessment Act 1979*.

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| In respect of | Port Botany Chlor-Alkali Plant (CAP), State significant development consent (DA35/98) – Modification 7 | | |
| Applicant name | IXOM Operations Pty Ltd | | |
| Responsible person/applicant | Gerry Fitzpatrick | | |
| Responsible person/applicant address | 16-20 Beauchamp Road, Banksmeadow NSW 2019 | | |
| Proposed development | Modification to Port Botany CAP State significant development consent (DA35/98 ). | | |
| Land to be developed | IXOM operates the following lots (the site) within the Botany Industrial Park (BIP) at 16–20 Beauchamp Road, Banksmeadow NSW 2019: Lot 1101, Lot 1102, Lot 1103, Lot 1104, and Lot 1115 in DP 1227173. The site is privately owned by Orica and leased by IXOM. IXOM also utilises the Orica-owned administration building located on Lot 1105 in DP 1227173. | | |
| Proposed development description | Installation of a gas-fired boiler, including a semi-enclosed roofed shelter (boiler house), ancillary equipment, and extensions to existing pipework to provide a reliable long-term steam supply for the CAP. | | |
| Environmental assessment | This modification report addresses the requirements of Section 4.55 (1A) of the *NSW Environmental Planning & Assessment Act 1979.* | | |
| Preparation | This modification report has been prepared by Element Environment Pty Ltd on behalf of IXOM Operations Pty Ltd (IXOM). In preparing the report, Element Environment has relied on data, designs, plans, and other information provided by IXOM and other individuals and organisations referenced herein. | | |
| Signature |  |  |  |
| Name | Tarryn Dale | Jacob Vickers | Linda Zanotto |
| Date | 19 December 2025 | 19 December 2025 | 19 December 2025 |

# EXECUTIVE SUMMARY

## Introduction

This modification report has been prepared by Element Environment Pty Ltd (Element) on behalf of IXOM Operations Pty Ltd (IXOM) to support a modification under Section 4.55(1A) of the Environmental Planning and Assessment Act 1979 (EP&A Act). The modification seeks approval to install a permanent 6 megawatt (MW) natural gas-fired boiler, associated pipework extensions, and semi-enclosed roofed boiler house at the Botany Chlor-alkali Plant (CAP). The new boiler would replace the temporary 3 MW diesel-fired boiler that was installed in early 2025 following the cessation of steam supply from the Qenos utilities plant.

## Justification and need for the modification

Steam is critical to CAP operations, including brine treatment, electrolysis and downstream chemical production. Qenos recently ceased operations in the Botany Industrial Park (BIP), which included the closure of the Qenos utilities plant that had been providing steam to the site. The resulting loss of steam supply necessitated the installation of a temporary diesel-fired boiler. While effective as a contingency, a diesel-fired boiler is not considered a suitable long-term solution due to its emissions, fuel handling, and operational inefficiencies. The proposed permanent gas-fired boiler provides a secure, efficient, and lower-emission source of steam using existing infrastructure within the industrial footprint.

The modification does not alter the approved development's scale, intensity or land use. All works are confined to existing hardstand areas within the CAP.

## Site description

The site is in Banksmeadow, an industrial suburb over 8 kilometres (km) south of Sydney Central Business District (CBD). It covers approximately 67,500 square meters ($m^2$), including private internal two-way roads that it shares with other users of the BIP.

The site is in the Bayside Council local government area (LGA) and is zoned IN1 General Industrial under Chapter 5 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP) (Figure 2.1).

The site is bordered by a rail corridor to the west, Beauchamp Road to the south, Denison Street to the east and other users of the BIP to the north, including Indorama Ventures, Orica and Qenos. Following recent public announcements, Qenos and Indorama major hazard facilities have ceased operations in the BIP, reducing the overall societal risk from the BIP.

The closest residents are in Hillsdale, near the east of the BIP, on the eastern side of Denison Street. Banksmeadow is bordered by the residential suburbs of Hillsdale and Matraville to the east, Botany and Pagewood to the west, Daceyville to the north and the industrial suburb of Port Botany to the south.

## Description of the modification

The modification includes:

- Installation of a 6 MW natural gas-fired boiler capable of supplying up to 8.8 tonnes per hour (t/hr) of 1 megapascal (MPa) steam.
- Construction of a 10 m × 10 m × 8.6 m boiler house. The proposed boiler house will be a roofed, semi-enclosed structure designed to accommodate the new industrial steam boiler and associated equipment. The building will consist of a steel-framed roof supported by columns, with wall sheeting installed on two of the four sides to provide weather protection and structural

integrity. The remaining two sides will remain open to allow for ventilation, equipment access, and compliance with operational safety requirements. This design ensures adequate airflow while offering partial enclosure for environmental and operational considerations.
- A 12 meter (m) boiler stack.
- Commissioning and reuse of redundant Qenos ethylene and pygas pipelines for natural gas supply following requalification.
- Approximately 30 m of aboveground utility pipework extensions to connect the boiler to the existing steam header.
- Decommissioning and removal of the temporary diesel-fired boiler.

It is anticipated that the proposed infrastructure can be installed on top of the existing concrete hardstand without the need for excavations, however, this will be confirmed during detailed design. Should excavation be required for footings, it is expected to be limited in extent and minor in nature, with reinstatement of concrete hardstand to maintain sealed surfaces.

The modification does not require vegetation removal, does not expand the operational footprint, and does not alter vehicle movements, employment, hours of operation or site access.

## Environmental impact assessment

Environmental impacts were assessed in accordance with Section 4.15(1)(b) of the EP&A Act.

### Operational hazards

Hazard studies 1 and 2 confirmed that the boiler presents well-understood risks controlled through Australian Standards, a high-integrity burner management system, and engineered safety features. Further, a risk consultant, Sherpa Consulting Pty Ltd (Sherpa) was engaged to assess any potential risk interactions posed by the modification. Sherpa advised that the boiler does not materially change the CAP's off-site risk profile.

### Air quality

The low-NOx burner would comply with relevant criteria. Emissions are minor in relation to existing site activities and would be effectively dispersed due to the stack height and prevailing winds.

### Noise

Modelling shows the boiler would not increase off-site noise levels and complies with EPL limits. Construction noise would occur within standard hours and is not expected to exceed daytime criteria.

### Flooding and stormwater

Works will occur on existing sealed surfaces and are not expected to alter site levels or drainage patterns. The modification will maintain current stormwater performance, with any minor excavations (if required) for footings managed to avoid adverse effects on runoff or flood behaviour.

### Other matters

No material impacts are expected on biodiversity, heritage, land, contamination, or traffic. If during detailed design it is determined that minor excavations are required to install plinths or footings; these will be managed in accordance with the soil and water management plan (Appendix H), as well as through consultation with Orica to ensure consistency with existing contamination controls. Construction traffic will be low (3–4 light vehicles and 1–2 heavy vehicles per day) and will not materially change local traffic conditions or site access arrangements.

## Conclusions

The modification would have no or minimal environmental impact, would remain substantially the same development as originally approved under DA35/98, and would ensure long-term operational continuity for the CAP. On this basis, the modification satisfies the requirements of Section 4.55(1A) and is recommended for approval.

# ABBREVIATIONS AND ACRONYMS

| Abbreviation/Acronym | Definition |
|---|---|
| AS | Australian Standard |
| BIP | Botany Industrial Park |
| CAP | Chlor-alkali Plant |
| CBD | Central Business District |
| CLP | Chlorine liquefaction plant |
| CO | Carbon monoxide |
| DCS | Distributed Control System |
| DPHI | NSW Department of Planning, Housing and Infrastructure |
| EPA | NSW Environment Protection Authority |
| EP&A Act | Environmental Planning and Assessment Act 1979 |
| EP&A Reg | Environmental Planning and Assessment Regulation 2021 |
| EPL | Environment Protection Licence |
| GHG | Greenhouse gas |
| GTP | Groundwater Treatment Plant |
| IXOM | IXOM Operations Pty Ltd |
| kL | kilolitres |
| LGA | Local government area |
| ML | megalitres |
| MPa | megapascal |
| MW | Megawatt |
| NPI | Noise Policy for Industry |
| NOx | Oxides of nitrogen |
| PIRMP | Pollution Incident Response Management Plan |
| POEO Act | Protection of the Environment Operations Act 1997 |
| SEPP | State Environmental Planning Policy |
| SSD | State significant development |
| SWMP | Soil and water management plan |
| t | Tonne |
| TISEPP | State Environmental Planning Policy (Transport and Infrastructure) 2021 |
| tpa | tonnes per annum |
| VSD | Variable speed drive |

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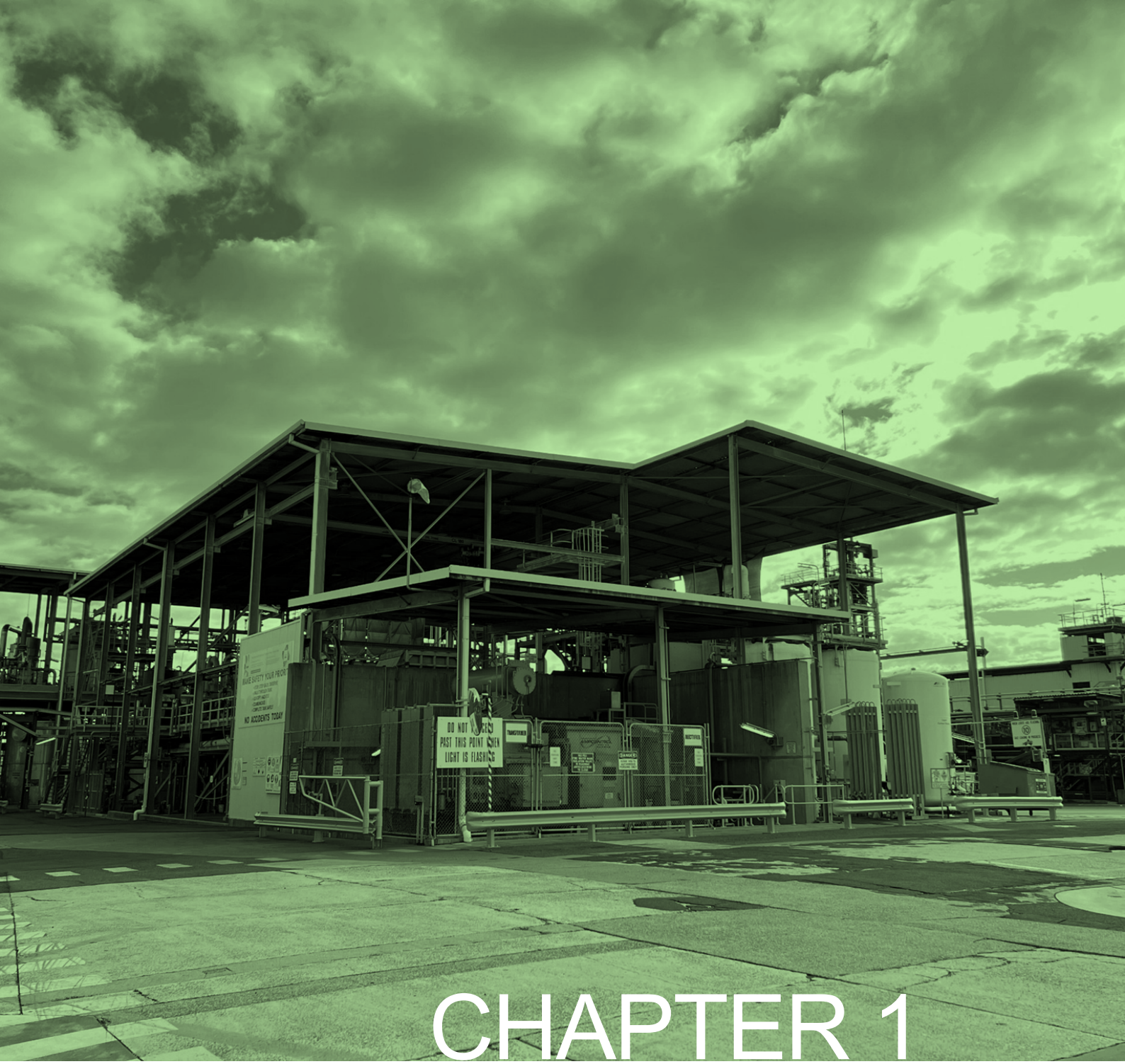
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# CHAPTER 1

## INTRODUCTION

# 1 INTRODUCTION

## 1.1 Overview

IXOM Operations Pty Ltd (IXOM) operates the Botany Chlor-alkali Plant (CAP) in the Botany Industrial Park (BIP), at 16-20 Beauchamp Road, Banksmeadow NSW 2019 (the site) in the Bayside local government area (LGA) (Figure 1.1 and Figure 1.2). IXOM are seeking under Section 4.55(1A) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to modify State Significant Development (SSD) consent (DA35/98) to install a gas-fired boiler, including a semi-enclosed roofed shelter (boiler house), ancillary equipment, and extensions to existing pipework (the modification) to provide a reliable long-term steam supply to the CAP.

## 1.2 The proponent

IXOM is the proponent for the modification and its company and contact details are provided in Table 1.1.

**Table 1.1 Proponent details**

| Item | Detail |
|---|---|
| Applicant | IXOM Operations Pty Ltd |
| Contact | Gerry Fitzpatrick |
| Contact number | +61 2 9352 2216 |
| Contact email | gerry.fitzpatrick@ixom.com |
| Postal address | 16-20 Beauchamp Road, Banksmeadow NSW 2019 |
| ABN | 51 600 546 512 |
| Report authors | Tarryn Dale (BSc (Hons) Zoology) |
| Site owner | Orica Australia Pty Ltd (Orica) |

IXOM plays a vital part in the lives of tens of millions of people every day as an established and trusted industry leader in water treatment and chemical sourcing, manufacturing, storage and distribution. Headquartered in Australia, IXOM's operations span four continents and ten countries, including New Zealand, Southeast Asia, the United Kingdom and the United States.

IXOM is one of Australia's largest manufacturers of chlor- alkali products including chlorine, caustic soda, sodium hypochlorite and hydrochloric acid due to IXOM's expansive storage and distribution infrastructure, safety and security systems and regulatory compliance. The supply of chlorine is crucial to Australia, as it is the primary method for disinfecting drinking water and managing wastewater safely.

## 1.3 Approved development

### 1.3.1 Summary

The former Minister of Urban Affairs and Planning originally granted consent DA35/98 to the development in 1998 under Part 4 of the EP&A Act for the installation of a replacement CAP to produce 35,000 tonnes per annum (tpa) of gaseous chlorine. The new CAP was commissioned in 2001 and replaced the older CAP that was based on mercury cell technology. The development has been modified five times since original approval:

- 2006 – Construction of sodium hypochlorite manufacturing facilities – Part 4 modification.
- 2006 – Demolition of old CAP – Part 4 modification.
- 2009 – Relocation of sodium hypochlorite manufacturing facilities – Part 4 modification.
- 2012 – Replacement of two 1.1 megalitre steel caustic tanks and demolition of two existing and disused steel caustic storage tanks – Part 3A modification.
- 2018 – Construction of repackaging facility – Part 3A modification.

The CAP manufactures chlorine and caustic soda through the electrolysis of salt using a mercury-free membrane technology. Hydrogen is generated as a by-product during this process, which is combined with chlorine to manufacture hydrochloric acid. The chlorine is also used to manufacture sodium hypochlorite and ferric chloride. These downstream processes are referred to as 'product plants', in which all chlorine produced on site is consumed.

A sixth modification (modification 6) is currently underway to gain approval for the construction and operation of a chlorine liquefaction plant (CLP). The CLP would be housed within a new containment building in the southwestern portion of Block L, with the sodium hypochlorite loading bay relocated to Block Q (Figure 1.3).

All liquefied chlorine is transported to the site from the IXOM-owned CLP at Laverton, Victoria, in both 33kg and 70 kg cylinders and 920 kg drums for distribution primarily to NSW and QLD customers. Following approval of modification 6, the site would also be used to manufacture and store and distribute liquefied chlorine.

Environment Protection License (EPL) 20547 applies to the site, which permits the scheduled activities of chemical production, chemical storage, waste processing (non-thermal treatment) and waste storage, including the:

- production of over 25,000 tonnes (t) of dangerous goods annually;
- storage of up to 100,000 kilolitres (kL) of general chemicals;
- non-thermal treatment of any amount of waste including hazardous waste; and
- storage of hazardous, restricted solid, liquid, clinical and related, and asbestos waste.

### 1.3.2 Site infrastructure

Existing site infrastructure comprises (Figure 1.3):

- Administration building.
- Brine treatment and electrolysers.
- Chlorine drying and compression plant.
- Hydrogen compression plant.
- Caustic evaporation plant.
- Caustic tanker loading bays.
- Caustic soda product tanks.
- Chlorine container storage (Block Q).
- Control room.
- Cooling water towers.
- Ferric Chloride Product Plant, product tanks and tanker loading bay.
- Hydrochloric acid (HCl) Product Plant, product tanks and tanker loading bay.
- Old Chlorine container filling facilities (decommissioned 2001).
- Repackaging facility.
- Salt storage pile.
- Sodium Hypochlorite Product Plant and product tanks,
- Sodium hypochlorite loading bay (Block L).
- Workshop.

The BIP is accessible via main gates (1-3) on Denison Street and Gate 4 provides access from Corish Circle, however, Gate 3 is the main access. Gate 5 is for emergency exit or entry.

### 1.3.3 Chlorine production and product plants

#### Chlorine electrolysis

The chlorine manufacturing process involves the electrolysis of a brine solution, which produces chlorine gas, caustic soda solution and hydrogen gas. Raw salt is imported and stored on-site to be dissolved into brine solution. The brine undergoes chemical pre-treatment to facilitate settling and filtration to remove impurities present in the salt, such as calcium and magnesium compounds. The filtered brine then passes through ion exchange columns to complete the purification process.

An electric current is passed through the brine solution with electrolysis. Caustic soda solution is bled from the electrolysis circuit and chlorine and hydrogen gas is separated for further processing.

#### Hydrochloric acid plant

Hydrochloric acid is produced by burning hydrogen in chlorine to form hydrogen chloride, which is immediately absorbed in water. HCl is sold to market primarily for use in the food and steel industries.

#### Ferric chloride plant

Ferric chloride is manufactured through the controlled reaction of chlorine and elemental iron. Ferric chloride and ferrous chloride are primarily used in municipal water treatment.

#### Sodium hypochlorite plant

Sodium hypochlorite is manufactured by contacting a diluted caustic soda solution with chlorine gas. Sodium Hypochlorite is primarily used for bacteriological control and water disinfection.

#### Chlorine liquefaction plant (subject of modification 6)

Liquefied chlorine would be produced through a shell and tube heat exchange unit and stored in one of two 50 t bunded stock tanks. The building would include a chlorine tanker loading station to fill 13-tonne tankers inside the building.

### 1.3.4 Hours of operation, vehicles and employment

The site operates 24 hours a day, seven days a week for 350 days a year. There is an allowance of 15 days per year for planned and unplanned maintenance work including scheduled plant shutdowns.

The site employs approximately 45 people in total (16 of which are on a 24/7 shift roster).

The site receives and dispatches heavy vehicles during salt delivery campaigns and normal operations. There are two eight-day salt delivery campaigns during the year, each involving approximately 1,000 truck movements per campaign.

There are approximately 76 truck movements per day during normal operations for delivery of raw materials and product dispatch.

Employees, contractors and visitors generate approximately 100 light vehicle movements per day.

## 1.4 Modification summary

Until recently, the CAP sourced steam from the site utilities plant operated by Qenos Pty Ltd (Qenos) within the BIP. Following Qenos entering voluntary administration in April 2024, the supply of 1.1 megapascal (MPa) steam ceased. To maintain operations, IXOM submitted a licence variation application to the NSW Environment Protection Authority (EPA) on 3 December 2024 under EPL 20547, seeking approval to install and operate a temporary diesel-fired boiler. The EPA approved the variation and issued a notice of licence variation on 13 January 2025 (Notice number 1645497).

IXOM now seeks a more permanent on-site solution and proposes to modify the consent under Section 4.55(1A) of the NSW EP&A Act. The modification would allow the installation and operation of a gas-fired boiler, including a semi-enclosed roofed shelter (boiler house), ancillary equipment, and extensions to existing pipework to provide a reliable long-term steam supply for the CAP. The works would involve:

- Installation of a 6 MW natural gas-fired boiler capable of supplying up to 8.8 tonnes per hour (t/hr) of 1 megapascal (MPa) steam.
- Construction of a 10 m × 10 m × 8.6 m boiler house. The proposed boiler house will be a roofed, semi-enclosed structure designed to accommodate the new industrial steam boiler and associated equipment. The building will consist of a steel-framed roof supported by columns, with wall sheeting installed on two of the four sides to provide weather protection and structural integrity. The remaining two sides will remain open to allow for ventilation, equipment access, and compliance with operational safety requirements. This design ensures adequate airflow while offering partial enclosure for environmental and operational considerations.
- A 12 meter (m) boiler stack.
- Commissioning and reuse of redundant Qenos ethylene and pygas pipelines for natural gas supply following requalification.
- Approximately 30 m of aboveground utility pipework extensions to connect the boiler to the existing steam header.
- Decommissioning and removal of the temporary diesel-fired boiler.

The works would be confined to the existing operational footprint and utilise existing infrastructure. It is anticipated that the proposed infrastructure can be installed on top of the existing concrete hardstand without the need for excavations, however, this will be confirmed during detailed design. Should excavation be required for footings, it is expected to be limited in extent and minor in nature, with reinstatement of concrete hardstand to maintain sealed surfaces. The modification ensures continued operational safety and steam supply without changing the approved land use or development intensity.

The site is licensed under EPL 20547. A licence variation would be required to reflect the removal of the existing temporary diesel-fired boiler and the commissioning and operation of the proposed gas-fired boiler. It is noted that the operation of the gas-fired boiler does not constitute a scheduled activity under Schedule 1 of the NSW *Protection of the Environment Operations Act 1997* (POEO Act).

A consolidated project description is provided in Appendix A.

## 1.5 Needs, benefits and alternatives

The IXOM CAP needs a constant and reliable steam supply for its operations. Historically, the CAP sourced steam externally from the Qenos-operated utilities plant within the BIP. However, following Qenos entering voluntary administration in April 2024, that supply ceased, leaving IXOM without a critical utility.

To maintain operations, IXOM installed a temporary diesel-fired boiler under agreement with the NSW EPA. While effective in the short term, this solution is not considered sustainable due to fuel type, emissions, and operational inefficiencies.

The proposed permanent gas-fired boiler would:

- replace the temporary diesel-fired unit, ensuring long-term operational continuity;
- provide on-site steam generation, removing reliance on external suppliers;
- be energy-efficient and low-emission, aligning with modern environmental standards, and;
- integrate with existing infrastructure, minimising environmental and visual impacts.

This transition is essential for maintaining the safe and efficient operation of the CAP and supports IXOM's long-term strategic and environmental objectives.

**Minimal ground disturbance:**

All infrastructure will be installed on top of existing concrete hardstand and excavations for structural footings are not anticipated, however this will be confirmed during final design. All other proposed works are confirmed to be aboveground, either on existing concrete slabs or using existing infrastructure, thereby avoiding impacts to soil, groundwater, or potential contamination.

**Use of existing infrastructure:**

The modification makes efficient use of existing gas connection points, pipelines and structural elements, reducing the need for new construction and associated environmental impacts.

**Minimal visual and amenity impact:**

To maintain plant operations, a 3 megawatt (MW) diesel-fired boiler has been installed as a temporary measure, as approved by the NSW EPA on 13 January 2025 through a notice of licence variation (Notice number 1645497). This would be replaced by a new permanent gas-fired boiler, designed to ensure operational continuity while minimising visual and amenity impacts. The new boiler house and stack are consistent with the site's existing industrial character and would be situated adjacent to existing site infrastructure (see Figure 1.3). The 12 m stack height is proportionate to surrounding structures and would not significantly alter the visual landscape or introduce any elements taller than existing structures, such as the proposed 18.7 m CLP scrubber stack and other industrial facilities within the BIP. The roofed boiler house would be semi-enclosed and in character with the industrial aesthetic of surrounding buildings. Further, the boiler housing would not be visible from public viewpoints. As such, the new infrastructure would integrate visually with the existing built form and is not expected to result in any significant change to the site's visual landscape or character.

**Operational continuity and safety:**

The modification ensures a permanent steam supply solution which is essential for the safe and continuous operation of the IXOM CAP.

**No change to approved land use or development footprint:**

The proposed modification does not alter the nature, scale, or intensity of the approved development. The new boiler and boiler house would be located entirely within the existing operational footprint of the IXOM CAP, consistent with the original development consent and land use zoning. No expansion of the site boundary or change in land use is proposed.

The modification is considered to have no or minimal environmental impact and is substantially the same as the development authorised by the existing consent and therefore is recommended to be approved under Section 4.55(1A) of the EP&A Act.

## 1.6 Document purpose

This modification report has been prepared by Element Environment Pty Limited (Element) on behalf of IXOM for submission to the NSW Department of Planning, Housing and Infrastructure (DPHI) to:

- support an application under Section 4.55(1A) of the NSW EP&A Act, and demonstrate the proposed works would involve minimal environmental impact and do not substantially alter the approved development. The report has been prepared with consideration of the provisions of Section 4.15 of the EP&A Act, including environmental, social, and economic impacts.
- inform the public, government authorities, and stakeholders about the proposed installation of a new gas-fired boiler and boiler house, and the measures to mitigate, manage, and monitor potential impacts.

This report has been prepared in accordance with the State Significant Development Guidelines – Preparing a Modification Report (DPE, 2022) and addresses the specific information requirements under Section 100(1) of the Environmental Planning and Assessment Regulation 2021. While SEARs are not applicable to this Section 4.55(1A) modification, the report includes input from technical specialists and outlines the environmental matters requiring qualitative assessment, including noise, air quality, and safety/risk.

Figure 1.1
**Regional context**

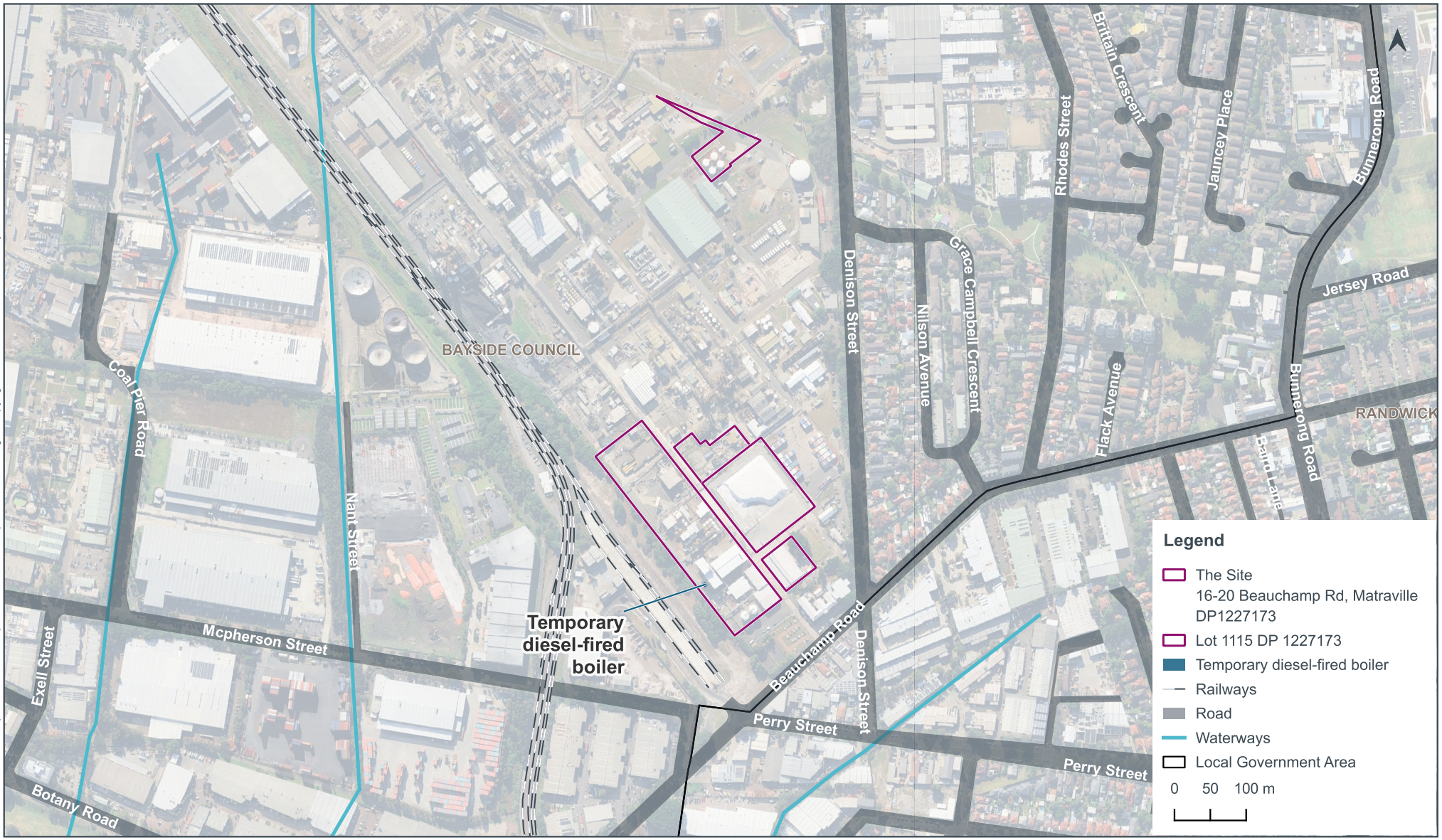





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Figure 1.2
**Local context**

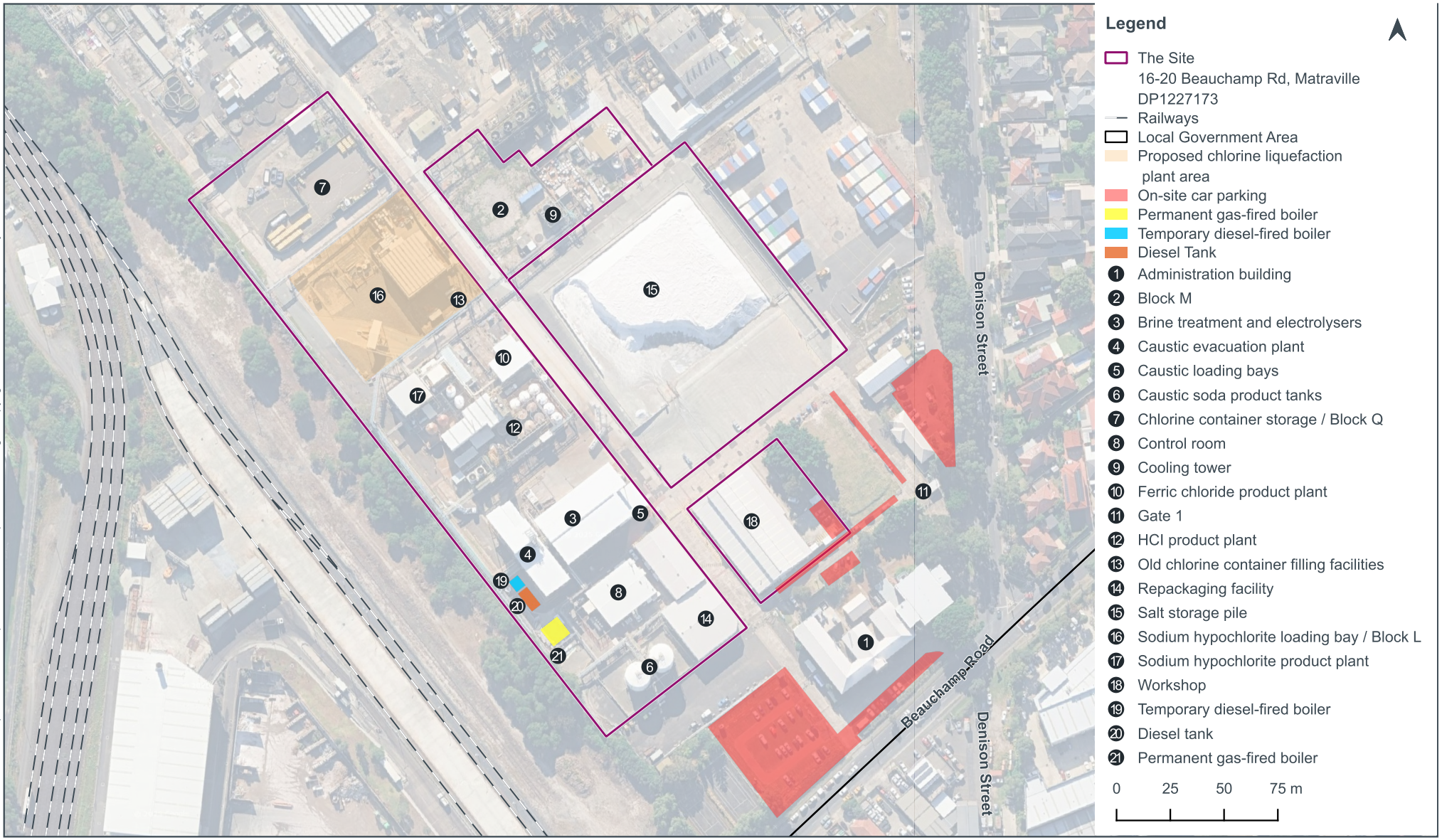
Chlor-Alkali Plant (CAP) Gas-fired boiler
Modification Report



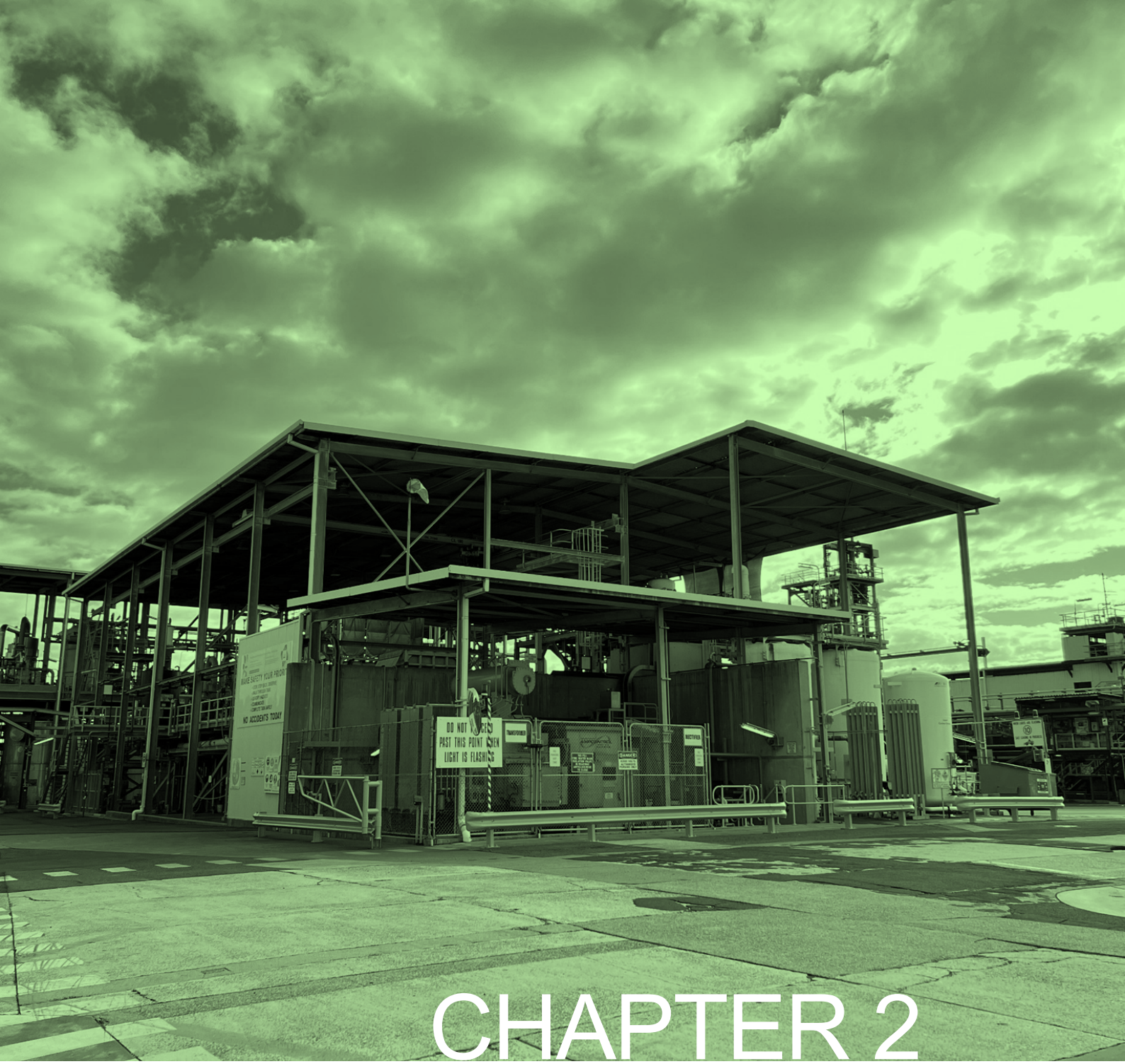

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Figure 1.3
**Approved site infrastructure**

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# CHAPTER 2

## STRATEGIC CONTEXT

# 2 STRATEGIC CONTEXT

## 2.1 Site features

### 2.1.1 Site details

IXOM operates the following lots (the site) in the BIP at 16-20 Beauchamp Road, Banksmeadow NSW 2019 (Figure 1.1 and Figure 1.2).

- Lot 1101 DP 1227173
- Lot 1102 DP 1227173
- Lot 1103 DP 1227173
- Lot 1104 DP 1227173
- Lot 1115 DP 1227173

The site is privately owned by Orica and leased by IXOM. IXOM also utilise the Orica-owned administration building on Lot 1105 DP 1227173.

### 2.1.2 Site location, character and surrounding land use

The site is in Banksmeadow, an industrial suburb over 8 km south of Sydney Central Business District (CBD). It covers approximately 67,500 $m^2$, including private internal two-way roads that it shares with other users of the BIP.

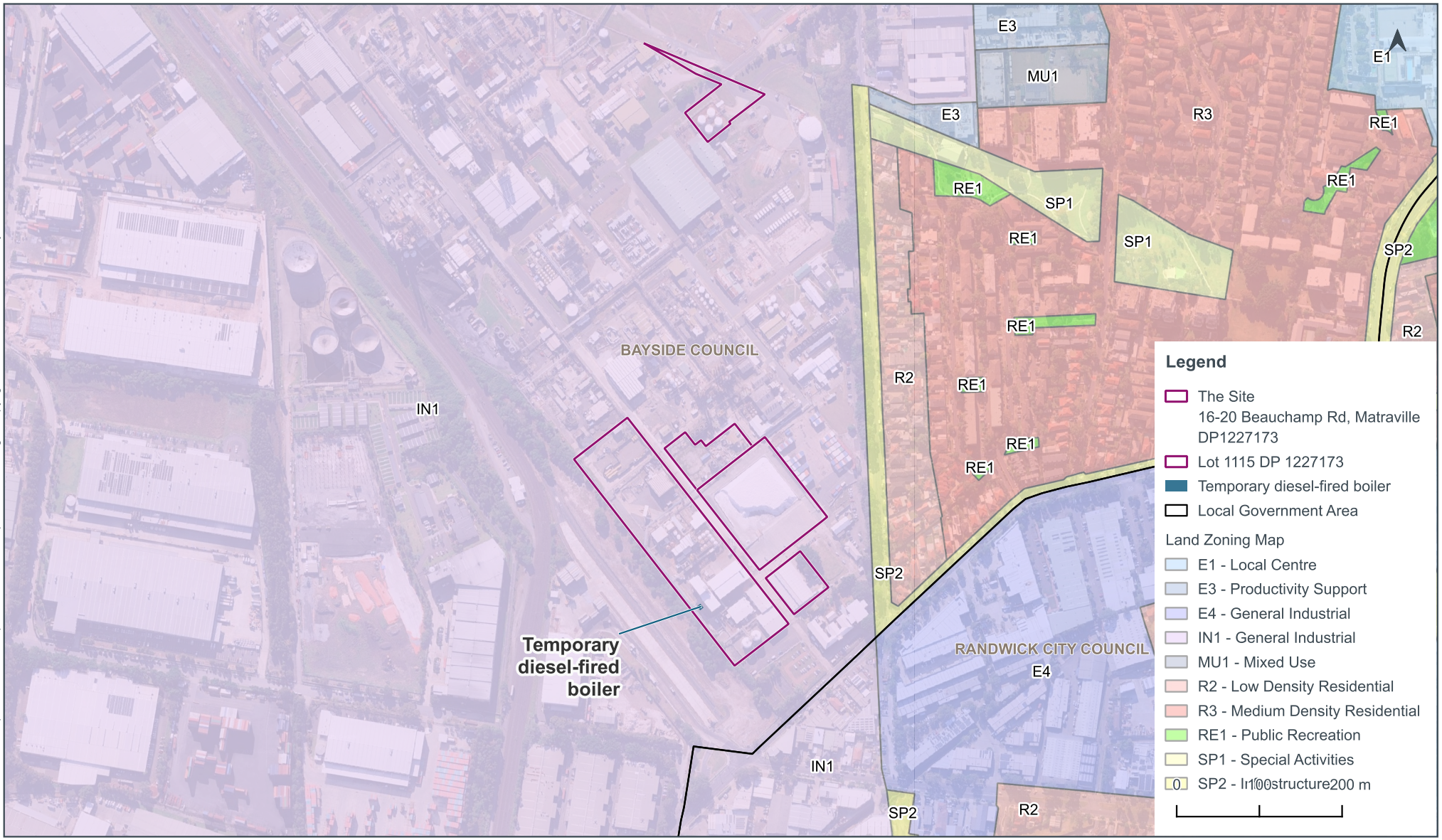
The site is in the Bayside Council LGA and is zoned IN1 General Industrial under Chapter 5 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP) (Figure 2.1).

The site is bordered by a rail corridor to the west, Beauchamp Road to the south, Denison Street to the east and other users of the BIP to the north, including Orica and until recently, Indorama Ventures and Qenos, who have since ceased operations following recent public announcements.

The closest residents are in Hillsdale, near the east of the BIP, on the eastern side of Denison Street. Banksmeadow is bordered by the residential suburbs of Hillsdale and Matraville to the east, Botany and Pagewood to the west, Daceyville to the north and the industrial suburb of Port Botany to the south.

Figure 2.1
**Land zoning**

Chlor-Alkali Plant (CAP) Gas-fired boiler
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### 2.1.3 Access and road network

#### Road network

The site is accessed via the following State roads (see Figure 2.2):

- From south – Botany Road, Beauchamp Road and Denison Street.
- From north – M1 Motorway, Wentworth Avenue and Denison Street.

The site borders Beauchamp Road and Denison Street, which are both four-lane two-way roads with parking on both sides, although parking is limited on some sections of these roads.

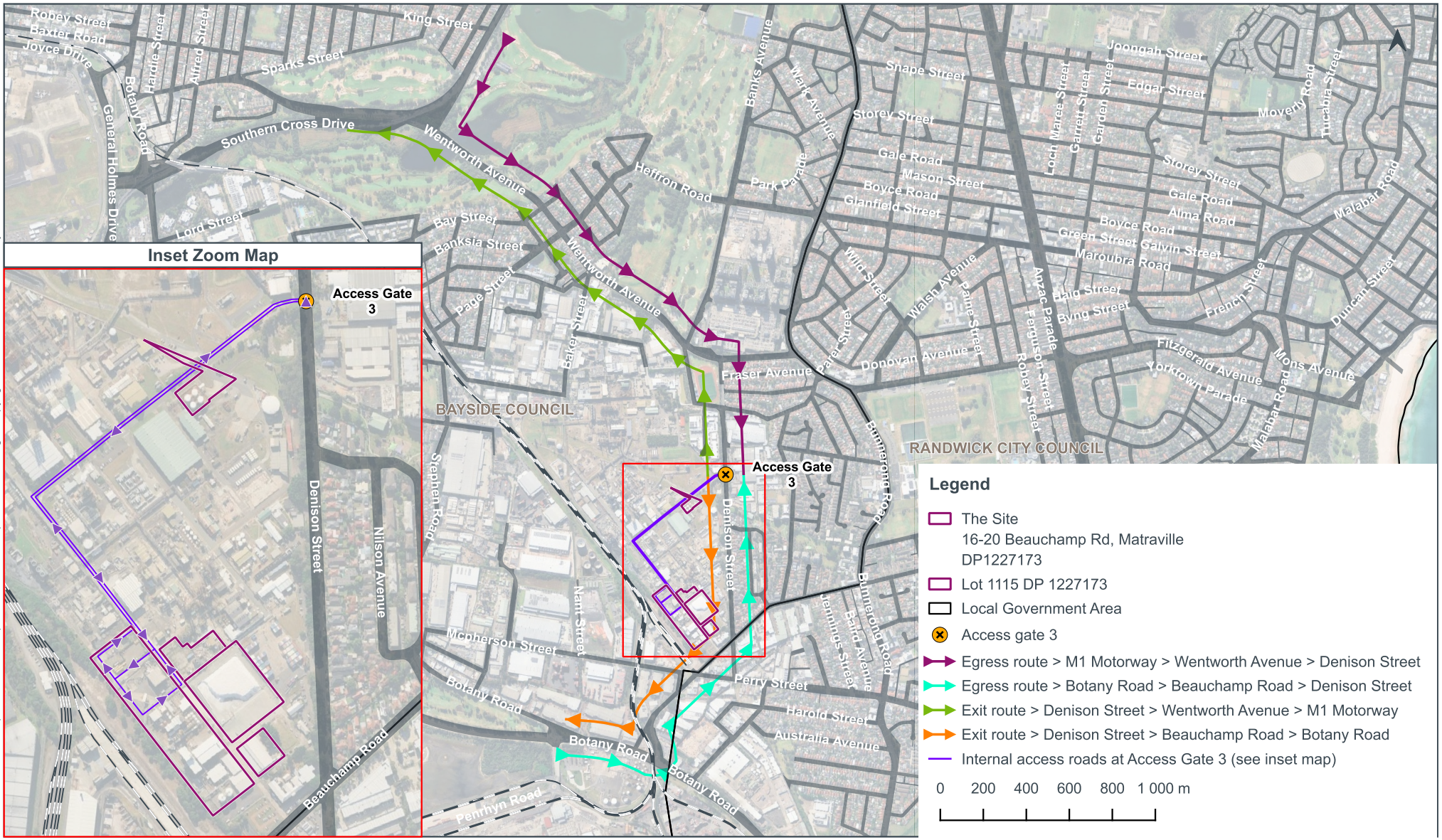
Heavy vehicles primarily access the BIP from an access gate (Gate 3) on Denison Street, from which they travel on internal private two-way roads to their on-site destination. All internal roads are speed restricted to 25 km/h or lower. Access is also possible from Gate 1 at the southern end of the BIP off Beauchamp Road and Gate 4 from the north. Vehicles greater than 6 m high cannot access the site due to height restrictions.

All vehicles entering the site must operate in strict accordance with IXOM's Botany traffic management plan and must drive on designated sealed internal roads only and must only travel to areas for which clearance has been granted from the appropriate control room. All employees and contractors entering the site must be authorised by the Operations Manager.

Employees use the provided on-site car parks external to the plant, and all visitors must park outside of a security fence and report to reception.

Figure 2.2
**Access and road network**

Chlor-Alkali Plant (CAP) Gas-fired boiler
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### 2.1.4 Sensitive receivers

The IXOM site is located within the BIP, bordered by a rail corridor to the west, Beauchamp Road to the south, Denison Street to the east, and other BIP users to the north. Surrounding land is predominantly zoned IN1 – General Industrial and E4 – General Industrial.

The nearest sensitive receivers are residential properties in Hillsdale, located east of the BIP on the opposite side of Denison Street. These receivers are zoned R2 – Low Density Residential along the street frontage and R3 – Medium Density Residential further inland. One isolated residence at 105 Beauchamp Road, Matraville, approximately 100 m south of the site, is zoned industrial and assessed as an industrial receiver under the NSW Noise Policy for Industry (NPI).

### 2.1.5 Services and utilities

Site water demands are met by a connection to the Sydney Water reticulated potable network and Orica Ground Water Treatment plant treated water. The site uses water for dilution of caustic, electrolysis, cooling and demineralisation for use in the production of hydrochloric acid and sodium hypochlorite.

Electricity is provided from a grid-connected 33 kilovolt (kV) supply and distributed across the BIP by substations. The substations include transformers to step the high voltage supply down to 415 Volts and less for use by equipment.

Steam is supplied by an on-site 3 MW diesel-fired boiler. The site consumes an average of 4,123 kg of steam per hour.

## 2.2 Biophysical factors

### 2.2.1 Climate

Long-term climatic data from the Bureau of Meteorology (BoM) weather station at Sydney Airport Aeronautical Meteorological Office (AMO) (Site No. 066037) were analysed to characterise the local climate in the proximity of the site. The Sydney Airport AMO weather station is located approximately 4.7 km northwest of the site.

Average climate data recorded at this AMO are summarised in Table 2.1.

**Table 2.1 Summary of climate data recorded at the Sydney Airport AMO**

| Parameter | Period | Measurement | Month |
|---|---|---|---|
| Mean maximum temperature (˚C) | Annual | 22.4 | - |
| | Highest monthly | 26.7 | January |
| | Lowest monthly | 17.2 | July |
| Mean minimum temperature (˚C) | Annual | 13.6 | - |
| | Highest monthly | 19.2 | February |
| | Lowest monthly | 7.4 | July |
| Mean rainfall (mm) | Annual | 1,096.5 | - |
| | Highest monthly | 124.1 | June |
| | Lowest monthly | 59.8 | September |
| Mean 9 am wind speed (km/h) | Annual | 14.2 | - |
| | Highest monthly | 16.3 | October |
| | Lowest monthly | 12.6 | May |

The data indicate that January is the hottest month with a mean maximum temperature of 26.7 degrees Celsius (ºC) and July is the coldest month with a mean minimum temperature of 7.4ºC. Rainfall peaks during the first half of the year and declines during the latter, with an annual average rainfall of 1096.5 millimetres (mm) over 96.3 days. The data indicate that June is the wettest month, with an average rainfall of 124.1 mm over 8.8 days, and September is the driest month, with an average rainfall of 59.8mm over 6.8 days.

Relative humidity exhibits little variability across the year. The mean relative humidity at 9 am ranges from 61% in October to 74% in June. Mean 3 pm relative humidity levels range from 49% in August to 63% in February.

Wind speeds during the warmer months have a greater spread between the 9 am and 3 pm conditions compared to the cooler months. Mean 9 am wind speeds range from 12.6 kilometres per hour (km/h) in May to 16.3 km/h in October. Mean 3 pm wind speeds range from 17.1 km/h in May to 25.3 km/h in November.

### 2.2.2 Topography and waterways

The site is flat and predominantly sealed with hardstand or surfaced with gravel, with a grassed area around the office building and the overflow car parking off Beauchamp Road, where there are also several exotic and native plantings.

There are no waterways in or adjacent to the site. The Botany Bay foreshore area is approximately 1 km south-west of the site, with Botany dams and Mills Stream approximately 2 km to the north.

The site is approximately 1 km west of the maximum extent of land subject to the Botany Bay Foreshore Beach Floodplain Risk Management Strategy. Bayside Council flood mapping shows that all lots within the BIP are flood affected as they are within the 1% annual exceedance probability (AEP) flood level plus 0.5 m freeboard and probable maximum flood (PMF) level. The flood extent primarily impacts internal roads with only minor portions of IXOM-operated lots being in the 1% AEP and PMF flood levels.

### 2.2.3 Protected areas

There are no protected areas adjacent to the site, such as reserves or national parks protected under the NSW *National Parks and Wildlife Act 1974* (NPW Act).

### 2.2.4 Geology, soils and salinity

#### Geology

According to Sydney 1:100,000 Geological Series Sheet 9130 (NSW Department of Mineral Resources, 1983), the site is underlain by medium to fine-grained marine sand with podzols (Figure 2.3).

#### Soils

According to the Department of Environment, Climate Change and Water (DECCW, 2009) Soil landscapes of the Sydney 1:100,000 Sheet map, the site primarily comprises the 'Tuggerah' soil landscape (Figure 2.3) which consists of gently undulating to rolling coastal dune fields. This soil landscape is limited by extreme wind erosion and non-cohesive, highly permeable soil with very low fertility with localised flooding and permanently high waterbodies.

The site is also intersected by 'disturbed terrain', which features level plains to hummocky terrain, is extensively disturbed by human activity, and includes complete disturbance, removal or burial of soil. Limitations of this soil landscape are mass movement hazard, unconsolidated low wet strength materials, impermeable soil, poor drainage, localised very low fertility and toxic materials.

#### Acid sulfate soils

According to the NSW DPHI 'Environmental Planning Instrument – Acid Sulfate Soils' mapping, the site is mapped as class 3 acid sulfate soils land (Figure 2.4). The NSW Acid Sulfate Soil Management Committee's (1998) *Acid Sulfate Soil Manual* states that class 3 land has the potential to contain acid sulfate soils (ASS). However, the Bayside Council's Local Environmental Plan 2021 (LEP) mapping indicates that the site has a low probability of occurrence for ASS.

Development consent is required for the carrying out of works on class 3 ASS land where those works are more than 1 m below the natural ground surface and works by which the water table is likely to be lowered more than 1 m below the natural ground surface.

#### Salinity

The DEECW (2016) Hydrogeological Landscapes of New South Wales and the Australian Capital Territory map indicates that the site is not in an area where salting is evident. This means land in these areas have soil, geology, topography and groundwater that are unlikely to produce saline surface conditions.

## 2.2.5 Hydrology and flooding

### Site hydrology

**Surface water**

All surface water at the site is collected through a number of stormwater pits and conveyed through the BIP via sub-surface pipes. The majority of the sub-surface stormwater drainage network is effectively up-stream of Block L and Block Q. All stormwater collected at Block L and Block Q enters the stormwater network as it passes through the southern and western boundary of these blocks before discharging through a first flush collection system, to the Springvale Drain at the north-western corner of Block Q.

**Groundwater**

A search of DPIE Water's continuous water monitoring network identified numerous groundwater wells within 1 km of the site (Figure 2.4). The nearest borehole is approximately 250 m west of the site, which indicates that groundwater is approximately 8.4 m below ground level (bgl); however, it is noted that other groundwater wells within the BIP have encountered groundwater at depths as shallow as 2 m bgl. (http://allwaterdata.water.nsw.gov.au/water.stm)

### Flooding

The site is affected by flooding during both the 1% annual exceedance probability (AEP) flood event and the probable maximum flood (PMF) event, as identified in the Springvale Drain and Floodvale Drain Flood Study (BMT WBM Pty Ltd, 2014). The maximum recorded 1% AEP flood level on the property is 13.19 m AHD, and the site is classified as a flood storage area with a high hazard rating. Development on the site is subject to flood-related controls under the Bayside Council Development Control Plan 2022. Refer to Appendix B for the Flood Advice Certificate generated from the Floodvale Drain Flood Study.

## 2.2.6 Air quality

Strong winds are generally experienced in the area with wind directions predominantly coming from the northwest and south. Eastern winds are common in summer and western winds in winter, with varied winds from other directions in spring and autumn.

Potential air emissions from the modification will most likely be subject to similar wind patterns and be reasonably well distributed throughout the year. This means that it is unlikely for nearby residential receptors to remain downwind of the operations for extended periods of time.

The main sources of air pollutants in the area surrounding the site include emissions from industries within the local industrial area, vehicle exhaust, local anthropogenic activities (such as domestic wood heaters) and nearby commercial activities.

Available data from the nearest air quality monitors operated by the NSW Department of Climate Change, the Environment, Energy and Water (DCCEEW) were used to characterise the existing background level for nitrogen dioxide ($NO_2$) and carbon monoxide (CO). The monitors are located at Randwick, Alexandria and Earlwood, approximately 3.1 km northeast, 6 km north-northwest and 9 km northwest of the site, respectively.

The available background data collected from Randwick, Alexandria and Earlwood indicate $NO_2$ and CO concentrations are generally low and well below the applicable criteria. This is likely in part due to the location near to the coast which promotes dispersion and ventilation through moderate to strong coastal breezes.

### 2.2.7 Noise

The noise catchment is characterised by industrial and commercial activities and motor vehicle traffic. Noise sources include the operation of plant and equipment at industrial and commercial premises, as well as heavy and light vehicles within and outside the BIP.

Noise is monitored monthly at eleven locations around the BIP, including at the nearest residential receivers on Denison Street. The November 2023 noise report found that noise along Denison Street is primarily influenced by passing and distant road traffic and both BIP and non-BIP plant noise. All active plants within the BIP were observed to be below the 50 dB(A) $L_{Aeq\ (15\ minute)}$ criterion when measured at the nearest residential receivers on Denison Street.

### 2.2.8 Heritage

#### Aboriginal heritage

The *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* published by the former NSW Department of Environment, Climate Change and Water (DECCW) in 2010 assists individuals and organisations to exercise due diligence when carrying out activities that may harm Aboriginal objects, and to determine whether they should apply for consent in the form of an Aboriginal heritage impact permit.

The code of practice requires proponents to complete a due diligence process to determine whether their activities are likely to impact on an Aboriginal item or object. Part of this process involves assessing the area for known Aboriginal sites, previous disturbance, vegetation clearance, utility construction etc. and features of the landscape in which the site is located that may indicate previous Aboriginal activity, and a potential to uncover unidentified Aboriginal items.

Previous documentary and archaeological research indicates that archaeological evidence is likely to be found in certain landforms, largely as a result of the resources that were associated with these landforms, or their suitability for long-term and/or repeated occupation. Such landforms include areas:

- Within 200 m of waters.
- Within a sand dune system.
- On a ridge top, ridge line or headland.
- Within 200 m below or above a cliff face.
- Within 20 m of or in a cave, rock shelter, or a cave mouth.

The modification area is highly disturbed and is not near any landforms which may indicate historical Aboriginal occupation and potential for unidentified Aboriginal objects.

The Aboriginal Heritage Information Management System (AHIMS) was searched on 8 October 2025, and no Aboriginal places or items were identified in the vicinity of the site.

#### Non-Aboriginal heritage

State Environmental Planning Policy (Three Ports) 2013 (Three Ports SEPP) lists the ‘Main Administration Building “Orica” and Mature Ficus’ as listed heritage items, although it also states that these items are not State heritage items. There are no other items of heritage value on the site (Figure 2.5). The Matraville Public School is the nearest historic heritage item to the site (approximately 540 m east).

### 2.2.9 Biodiversity

There is no vegetation on the site other than several native and exotic plantings in the vicinity of the front office building. The only mapped native vegetation near the site is an area of Plant Community Type (PCT) 3806 Sydney Coastal Sand Mantle Heath, approximately 100 m south-west of the site (Figure 2.5).

Figure 2.3
**Geology, soil landscapes and soil classification**

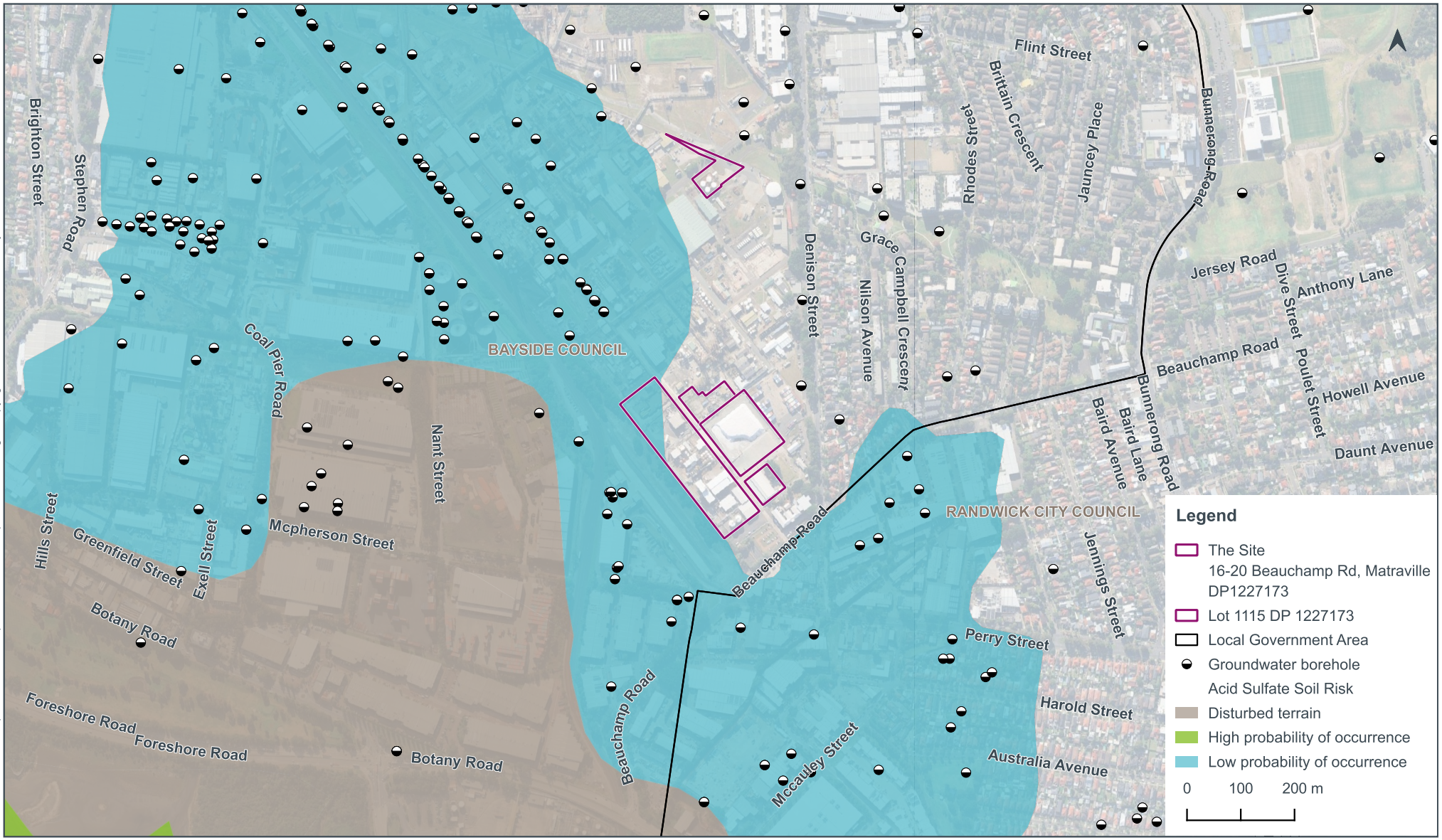
Chlor-Alkali Plant (CAP) Gas-fired boiler
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Figure 2.4
**Acid sulfate soils and groundwater**

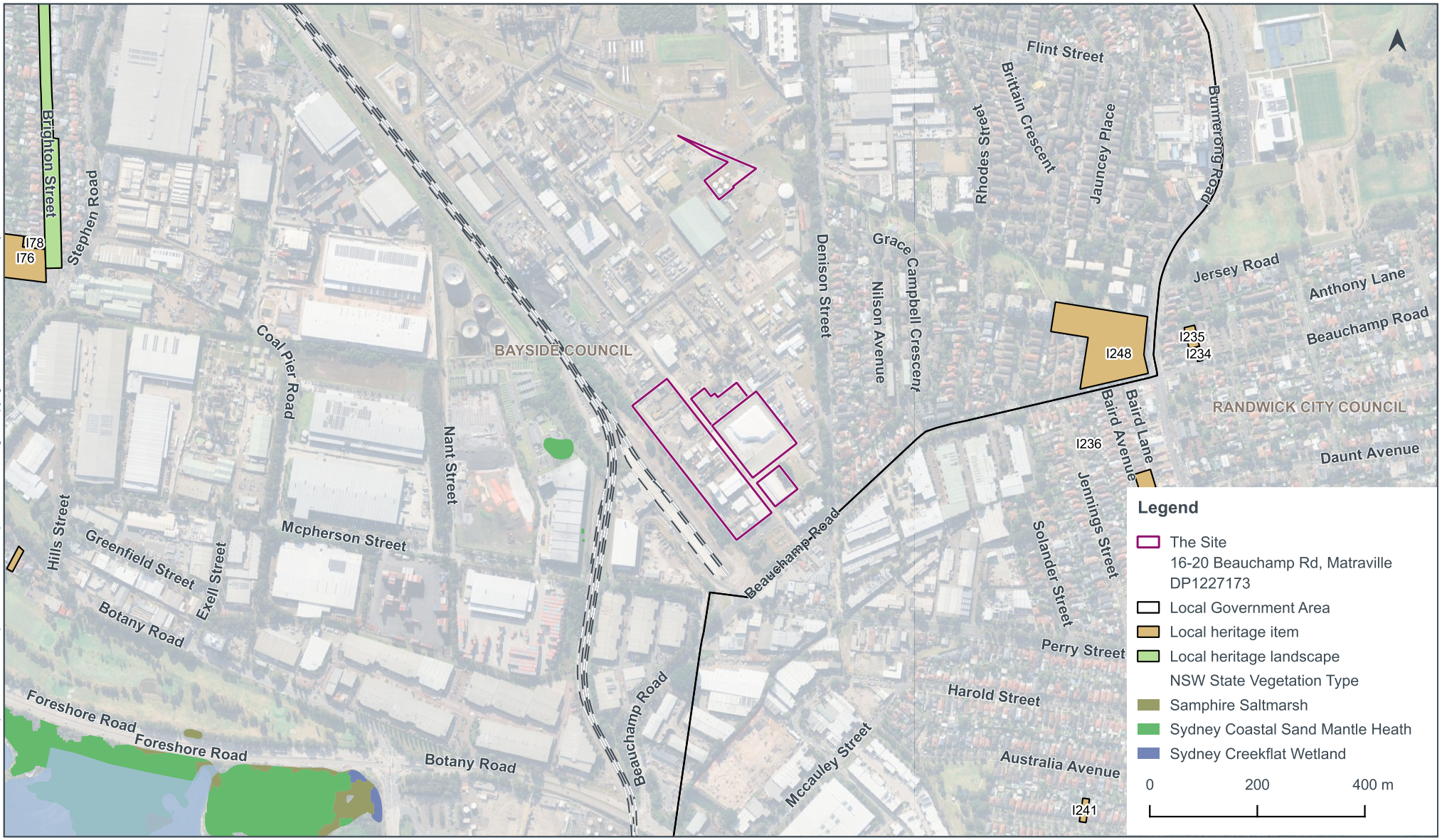
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Figure 2.5
**Heritage and Biodiversity**

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### 2.2.10 Contamination

The Botany Bay LGA is underlain by the Botany Sands Aquifer, a shallow coastal sand bed aquifer that has historically served as a significant groundwater resource. However, due to legacy industrial activities, including chemical manufacturing and poor waste disposal practices, parts of the aquifer have been contaminated with substances such as chlorinated hydrocarbons, per- and poly-fluoroalkyl substances (PFAS), solvents, petroleum hydrocarbons, and heavy metals.

As a result, the NSW Government has declared a Groundwater Extraction Exclusion Area, prohibiting the use of groundwater for domestic purposes and restricting industrial use to monitored and approved activities. The current Temporary Water Restriction (Botany Sands Groundwater Source) Order 2024 prohibits groundwater extraction in designated areas until 30 June 2030, reinforcing long-standing bans in place since 2006.

The land above the contaminated aquifer, including the BIP and the IXOM site, has been declared Contaminated Land Area 3203 by the NSW EPA. The contamination is being actively managed by Orica under an Approved Voluntary Management Proposal (Notice No. 20201704), issued under Section 17(3) of the Contaminated Land Management Act 1997 (CLM Act).

Orica's management responsibilities include:

- Operating three containment lines to extract contaminated groundwater.
- Treating extracted water at the Groundwater Treatment Plant (GTP) to remove and destroy contaminants.
- Monitoring and reporting under EPA-approved performance schedules.

A search of the EPA's contaminated land records confirms that Area 3203 is the only formally recorded contaminated land in the immediate vicinity of the IXOM site.

## 2.3 Socio-economic factors

### 2.3.1 Community profile

#### Population

The population of Bayside was 175,184 at the time of the 2021 census of population and housing data. 49.8% of the population of Bayside was male and 50.2% was female. The locality has a median age of 35, with an average of 2.5 people per household.

#### Indigenous Population

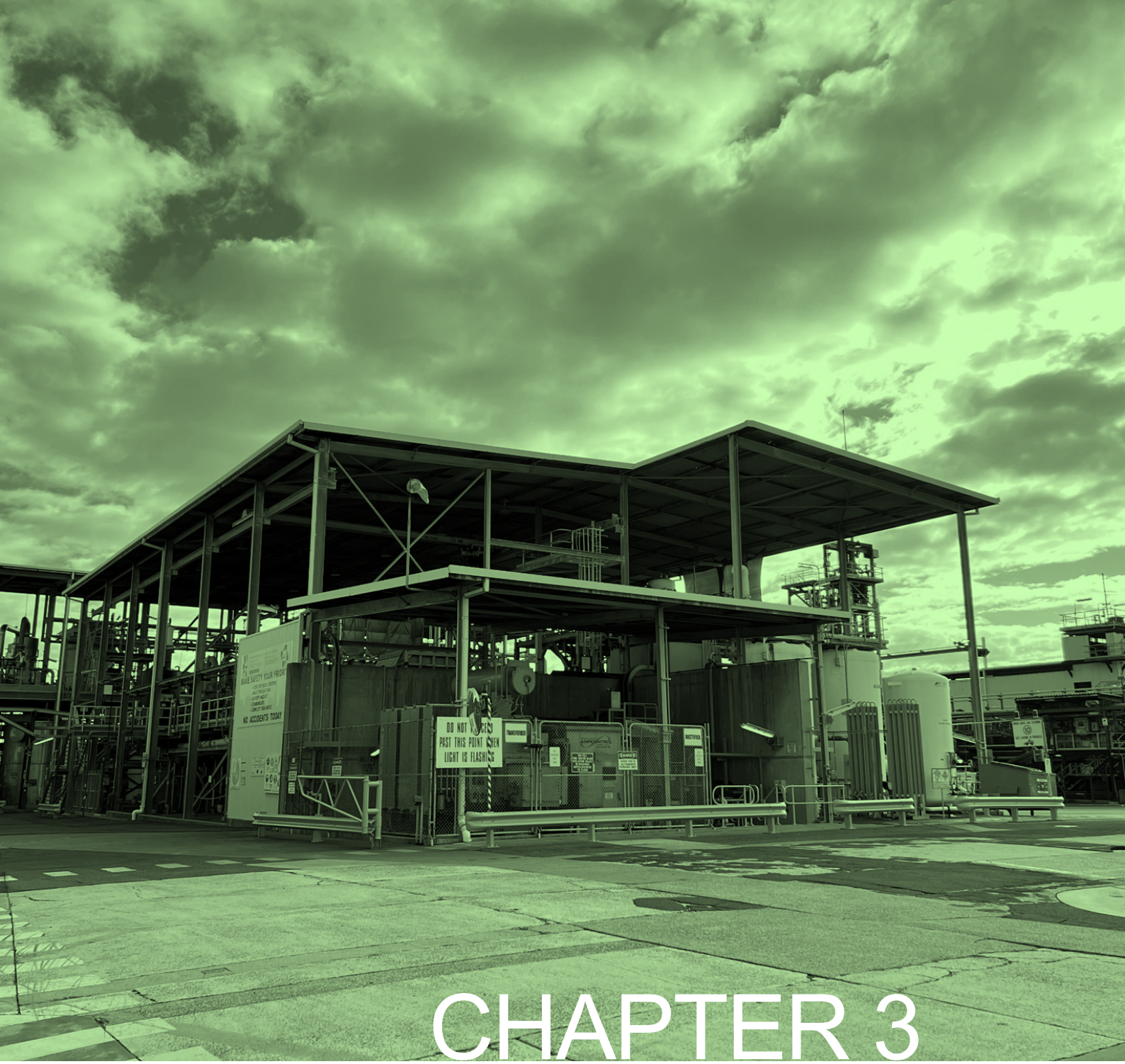
The Indigenous population makes up 1.1% of the Bayside population. This is below the national average of 3.2%. The Indigenous population is also characterised by a higher median age (27 years) compared to the median age of the wider national population (24 years), illustrating it as a relatively older population subgroup.

#### Employment

The Bayside population's participation in the labour force is slightly lower than the NSW population with 83.1% of people 15 years and older currently employed, compared to NSW at 84.9% (ABS, 2021). Regarding participants in the labour force in Bayside, 54.3% were employed full-time, 28.8% were employed part-time, and 16.9% were either away from work or unemployed and looking for work. These figures represent a 5.5% unemployment rate for the suburb, higher than the national average of 5.1% (ABS, 2021).

## Income

The median weekly household income of Bayside residents is $1,959, compared to $1,829 for the rest of NSW.




# CHAPTER 3

## MODIFICATION DESCRIPTION

# 3 MODIFICATION DESCRIPTION

## 3.1 Proposed modification

The proposed modification involves replacing the temporary diesel-fired boiler with a permanent 6 MW natural gas-fired water-tube boiler at the CAP. The system includes a semi-enclosed roofed boiler house, ancillary equipment, and extensions to existing pipework to ensure a reliable long-term steam supply. The boiler will deliver up to 8.8 tonnes per hour of 1 MPa steam, with a 10:1 turndown ratio, and will operate unattended with full automation.

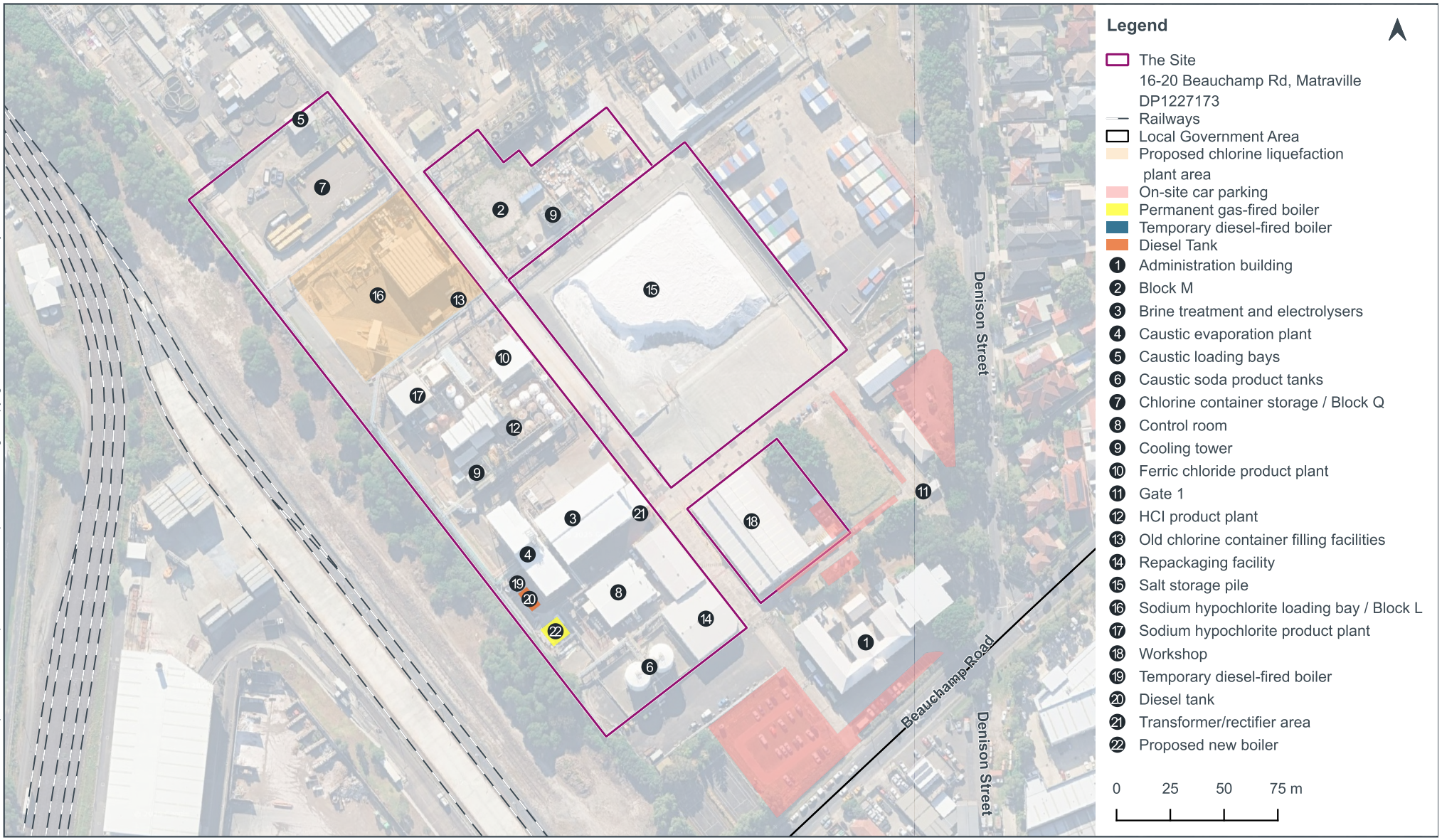
A summary of the modification is available in Table 3.1 and the indicative layout of the proposed modification is illustrated in Figure 3.1.

**Table 3.1 Modified project summary**

| Aspect | Approved project | Modification |
|---|---|---|
| Vehicle access | Primarily access through Gate 3, with options to access the site through Gate 1 and Gate 4. | No change. |
| Vehicle parking | Existing site office and overflow parking areas. | No change. |
| Land use | Industrial land use. | No change. |
| Operating hours | 24 hours per day, seven days per week, 350 days per year. | No change. |
| Employment | 45 full-time employees, 16 of which are on a 24/7 roster. | No additional employment is anticipated as part of this modification. |
| Traffic generation | Approximately 100 light vehicle and 76 heavy vehicle movements per day during normal operations.<br>There are also two eight-day salt campaigns, each involving approximately 1,000 truck movements per day. | There will be a temporary increase in vehicle movements during construction, limited to:<br>▪ Light vehicles/day: 3 – 4<br>▪ Heavy vehicle loads/day: 1 – 2<br>Once operational, the boiler system will not result in any significant increase in daily traffic volumes or impact on site logistics. |
| Services and utilities | Refer to Section 1.3. | Refer to Section 3.1.7 and 3.1.8. |
| Plant and equipment | A 3 MW diesel-fired boiler has been installed as a temporary measure to maintain plant operations. | A low nitrogen oxide (NOx) high-efficiency Natural Gas Weishaupt model WM-G50/1-A ZM-NR (integral fan) burner (or equivalent) has been specified for the proposed 6 MW gas-fired boiler. |

Figure 3.1
**Site layout**

Chlor-Alkali Plant (CAP) Gas-fired boiler
Modification Report




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### 3.1.1 Approval pathway

IXOM is seeking to modify the consent under Section 4.55(1A) of the EP&A Act.

Section 4.55(1A) of the EP&A Act allows a consent authority to modify a development consent if:

> (a) it is satisfied that the proposed modification is of no or minimal environmental impact, and
>
> (b) it is satisfied that the development to which the consent as modified relates is the same or substantially the same development as the development for which the consent was originally granted and before that consent as originally granted was modified (if at all).

As required by Section 4.55(3) of the EP&A Act, in determining an application for modification of a development consent, the consent authority is to take into account those matters listed under section 4.15(1) of the EP&A Act as they are relevant to the proposed modification.

Section 4.15(1)(b) of the EP&A Act requires the consent authority to consider the following when granting approval of a development application: *The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality.*

Chapter 6 of this modification report considers the likely impacts of the proposed modification, including environmental impacts on both the natural and built environments, and social and economic impacts on the locality, in accordance with Section 4.15(1)(b) of the EP&A Act.

Under Part 5, Division 1, Section 99 of the NSW Environmental Planning and Assessment Regulation 2021 (EP&A Reg), a modification application for SSD must be prepared having regard to the relevant SSD Guidelines prepared by the Planning Secretary.

Section 100(1) of the EP&A Reg specifies the information that must be included in a modification application.

The modification report has been prepared having regard to the *State Significant Guidelines – Preparing a Modification Report* (DPE, 2022) and has addressed the specific information requirements set out in Section 100(1) of the EP&A Reg.

The modification does not constitute a new SSD application or a modification under Section 4.55(2), and therefore, SEARs are not applicable or expected as part of this process.

The site is licensed under EPL 20547, which would continue to apply to the site. A licence variation would be required to reflect the removal of the existing temporary diesel-fired boiler and the commissioning and operation of the proposed gas-fired boiler. It is noted that the operation of the gas-fired boiler does not constitute a scheduled activity under Schedule 1 of the NSW *Protection of the Environment Operations Act 1997* (POEO Act).

### 3.1.2 Boiler location

The boiler will be installed at Lot 1101/DP1227173 within the BIP and accessed via Gate 3. The boiler house will be located adjacent to the existing control room on an existing sealed concrete slab (Figure 3.1).

### 3.1.3 Containment building

A Colourbond-clad boiler house (approx. 10 m × 10 m × 8.6 m) would be constructed to house the boiler and associated equipment. The building will consist of a steel-framed roof supported by columns, with wall sheeting installed on two of the four sides to provide weather protection and structural integrity. The remaining two sides will remain open to allow for ventilation, equipment access, and compliance with operational safety requirements. This design ensures adequate airflow while offering partial enclosure for environmental and operational considerations.

### 3.1.4 Geotechnical study

As part of the modification application for the proposed CLP at the site, a comprehensive geotechnical investigation was undertaken to assess subsurface conditions at two key locations:

- The proposed Chlorine Liquefaction Plant site.
- The relocation area for the Hypo Tanker Loading Bay.

This investigation was conducted to evaluate soil composition, bearing capacity, groundwater conditions, and potential geotechnical risks that may influence the design, construction, and long-term stability of the proposed infrastructure.

The findings and technical recommendations are documented in the report titled PC.20301993-11-101_0 – Geotechnical Investigation Report (Appendix C), which provides a detailed analysis, including borehole logs, laboratory test results, and site-specific geotechnical parameters.

Given that the proposed CLP is situated within 200 metres (m) of the planned boiler installation, the geotechnical conditions are expected to be consistent across both locations. Therefore, the existing investigation report would be referenced and applied to inform the planning, engineering design, and construction methodology for the boiler installation.

### 3.1.5 Inherent boiler safety features

The proposed boiler system incorporates a range of inherent safety features designed to ensure safe operation, compliance with regulatory standards, and protection of personnel and equipment. The boiler would be designed and installed in accordance with relevant Australian Standards, including AS1210 for pressure vessels, AS3788 for in-service inspection, AS3873 for operation and maintenance, and AS/NZS 5601 for gas installations.

A comprehensive hazard assessment was undertaken through Hazard Studies 1, 2, and 3 (HAZOP), facilitated by an IXOM-accredited specialist. These studies validate the design and identify any potential risks, with actions tracked and managed through the Velocity EHS system. The boiler supplier actively participated in these studies to ensure full integration of safety measures.

The boiler would be equipped with a combustion management system that includes a variable speed drive (VSD) for fan control, an oxygen probe for combustion monitoring, and flame detection systems. Safety valves, blowdown systems, and water gauges would be installed to manage pressure and prevent overpressure scenarios. Emergency stops would be hardwired into the control panel, and access to critical components would be provided for inspection and maintenance.

The gas-fired boiler would operate within the current industrial footprint and would be designed and installed in accordance with relevant Australian Standards, including AS1210 for pressure vessels. The use of natural gas would be managed via pipeline supply with no bulk on-site

storage. The modification is not expected to increase the site's overall risk profile, and existing safety protocols would be updated to reflect the new infrastructure. Hazard and operability studies (HAZOP) have been conducted to validate the design, facilitated by an IXOM-accredited specialist. All actions would be recorded and tracked in IXOMs existing environmental management system.

### 3.1.6 Hours of operation, employment and vehicles

The boiler is designed for continuous operation 24 hours per day, 7 days per week (24/7). It will operate in an unattended mode, with automated cycling and remote monitoring via the Distributed Control System (DCS). The system includes redundancy in feedwater pumps and safety features to ensure reliable performance.

Maintenance would be carried out by trained site personnel and supported by a service agreement with a qualified boiler engineering company. This agreement would ensure regular inspections, servicing, and compliance with all relevant standards. Licensed technicians, including Type B gasfitters, would be engaged for specialised maintenance tasks.

No additional employment is anticipated as part of this modification. Vehicle movements would be limited to construction, commissioning, and periodic maintenance activities. Once operational, the boiler system would not result in any significant increase in daily traffic volumes or impact on site logistics.

### 3.1.7 Services

#### Natural gas supply

Natural gas would be sourced from the existing Qenos-owned meter compound and conveyed to the IXOM CAP via currently redundant pipelines – specifically, the ethylene pipeline (decommissioned in 2024) and the Pygas pipeline (decommissioned in the 1990s).

To support this transition, the existing metre sets would need to be downsized to align with the boiler's gas consumption requirements. Additionally, the pipelines would require requalification and recertification to demonstrate compliance with the relevant Australian Standards, AS/NZS 5601 – Gas Installations and AS 2885.3 – Operations and Maintenance of pipelines.

Gas connections would mostly be reused piping (~550 m) with the exception of 30 m of new piping, including the following:

- <20 m of new piping required to tie in the piping from the gas meter compound to the existing ethylene pipeline.
- Approximately 2 m of interconnecting pipework required to tie the existing ethylene line into the existing pygas line.
- Approximately 10 m of new piping required to run from the existing pygas pipeline to the new boiler location.

New piping is shown in red, and existing/reused piping is shown in yellow in Figure 3.2 below.

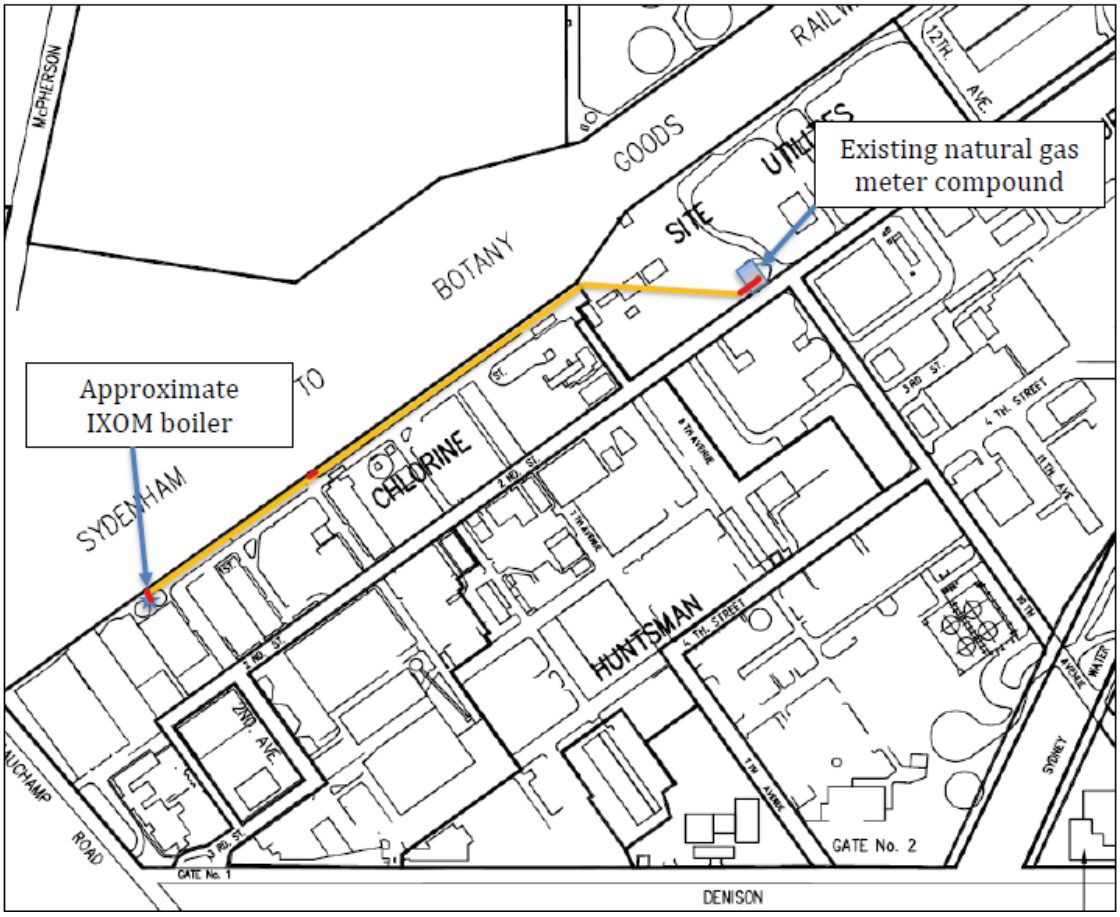



**Figure 3.2 Gas piping route (largely aboveground)**

## Electrical Supply

The boiler system would be powered via the site's existing electrical infrastructure. This includes supply to the boiler control panel, burner system, and internal lighting within the boiler house. The control system would interface with the plant's Distributed Control System (DCS), enabling remote monitoring, and alarming.

## Water Supply

A feedwater tank will be used to provide high quality boiler feedwater and would be integrated with the existing condensate recovery system from the plant.

The feedwater tank will be fitted with a condensate return sparge, and low water cutout wired back to the boiler controls.

A duplex stainless-steel economiser has been specified to heat the boiler feed water by using the waste heat contained in the boiler exit flue gas. The economiser is incorporated in the exhaust gas stream of the boiler to reduce flue gas temperatures to 145°C at MCR with 80°C feedwater and pre-heat feed water, thus significantly improving overall boiler efficiency. The increase of overall plant efficiency translates to a direct saving of fuel costs.

Where applicable, IXOM's vessel standards/specifications would be applied to the new boiler and feedwater tank. Access manholes would be fitted to either end of the boiler steam drum and water drum shell to support ventilation during confined space entries, and entry to the combustion chamber for internal clean out and inspections would be provided through the burner mounting flange (burner would be required to be removed to allow sufficient access).

Access to the feedwater tank would be via either a side or top mounted manway.

### Effluent Management

Wastewater discharges, particularly from chemical spills, would be transferred from the bunded boiler process area to the site's Effluent System.

The Effluent System transfers 'dirty' water from IXOM (and non IXOM) plant areas, designated sumps and dry weather stormwater flows captured at Interceptor Pits 1 and 2, to the sewer. The sewer feeds to the Sydney Water owned Southwestern Sydney Ocean Outfall System (SWSOOS) at Malabar. The discharge to sewer is permitted and regulated under a Sydney Water Trade Waste Service Agreement (No. 489), of which IXOM, Qenos, Orica and Indorama are joint customers.

The BIP Effluent System is fitted with an analyser house, capable of monitoring various pollutants in accordance with TWSA No. 489 and a diversion basin located downstream from the analyser house, capable of holding 2.1ML. Both of these are located upstream of the connection to sewer.

In the event trade wastewater substances in the effluent system are measured outside of the criteria specified in TWSA No. 489, flows are automatically diverted to the diversion basin for treatment or disposal via a licensed liquid waste contractor. In the event of an incident, IXOM personnel can monitor concentrations measured at the analyser house and manually divert if required.

The typical effluent flow from the BIP is 150$m^3$/hr. At this rate, the diversion basin can hold 6 hours of flow. If it is raining or the effluent flow rate is higher than normal, or the basin is already part full at the time of an incident, the holding time would be reduced accordingly. Once the diversion basin reaches full capacity, effluent would flow directly to sewer regardless of composition.

### Stormwater Management

Stormwater runoff from the boiler house would be managed in accordance with local authority requirements. The design would ensure that runoff is appropriately captured, segregated, and disposed of to prevent contamination and maintain site compliance.

### Lighting

Lighting would be installed within the boiler house to ensure safe access and visibility during both routine and emergency conditions. This includes task lighting for operational areas and general illumination for maintenance access. Lights would be positioned to ensure that no light spillage occurs on neighbouring sites.

## 3.1.8 Civil aspects and pipeline requirements

The modification involves several civil and structural components essential for the installation and operation of the new 6 MW natural gas-fired boiler system. Key civil works include:

### Plinths, Footings and Foundations

New steel-reinforced concrete plinths would be constructed to support the boiler house columns, steam boiler, feedwater tank stand, vent stack, and feedwater pumps. These would be designed in accordance with AS3600 Concrete Structures, ensuring they can withstand operational loads, prevent uneven settlement, and resist uplift or overturning forces due to wind. The design would consider soil bearing capacity and long-term structural stability.

### Bund

The boiler would be installed in an existing sealed concrete area that effectively operates as a bund, draining surface water into a sump connected to the site effluent system. No modifications to the bund are currently anticipated.

### Fixed Access Platforms

Fixed access platforms and ladders would be installed to provide safe and reliable access to the boiler and feedwater tank. These would be designed in accordance with AS1657 Fixed Platforms, Walkways, Stairways & Ladders. Access to the vent stack and emissions testing points would be provided via mobile elevated work platforms or scaffolding, as no fixed platforms are planned for these areas.

### Boiler Stack Support

The boiler stack, which would discharge at a height of 12 m above grade, would be laterally supported by the new economiser housing.

### Pipe Bridge Expansion

The existing pipe bridge would be expanded to accommodate new service lines required for the boiler system. These include:

- a 150 NB steam line; and
- a 50 NB condensate/feedwater return line.

The design would ensure safe routing, structural integrity, and compliance with applicable standards for pressure piping and support systems.

## 3.1.9 Construction

The construction phase of the modification encompasses the physical implementation of civil, structural, mechanical, and electrical components required to install and commission the new boiler system.

The construction stage would comprise:

- Concrete cut existing reinforced concrete slab. Remove and dispose of material.
- Drill holes/scabble concrete to tie in new footings/plinths to existing slab.
- Form up and pour new reinforced concrete footings/plinths.
- Erection of portal frame steel structure and roof sheeting.
- Installation of internal componentry (boiler and ancillary equipment, associated piping/cabling).
- Commissioning and testing.
- If excavation is required following detailed design, spoil will be managed in accordance with Section 6.4 and consultation with Orica.

The modification would take approximately 3 months to construct and would be constructed during standard construction hours, that is:

- Monday-Friday: 7 am-6 pm.
- Saturday: 8 am-1 pm.
- Sunday and public holidays: no construction.

There would be up to 10 construction personnel on site at any one time.

Construction equipment would likely comprise:

- Concrete saw.
- Hammer drill.
- Impact driver.
- Forklift.
- 55 t mobile crane.
- 25 t franna crane.
- Concrete agitator.
- Generator.
- Welder.
- Grinder.
- Cherry picker.
- Scissor lift.
- Concrete/delivery trucks.

Construction would generate the following vehicle movements:

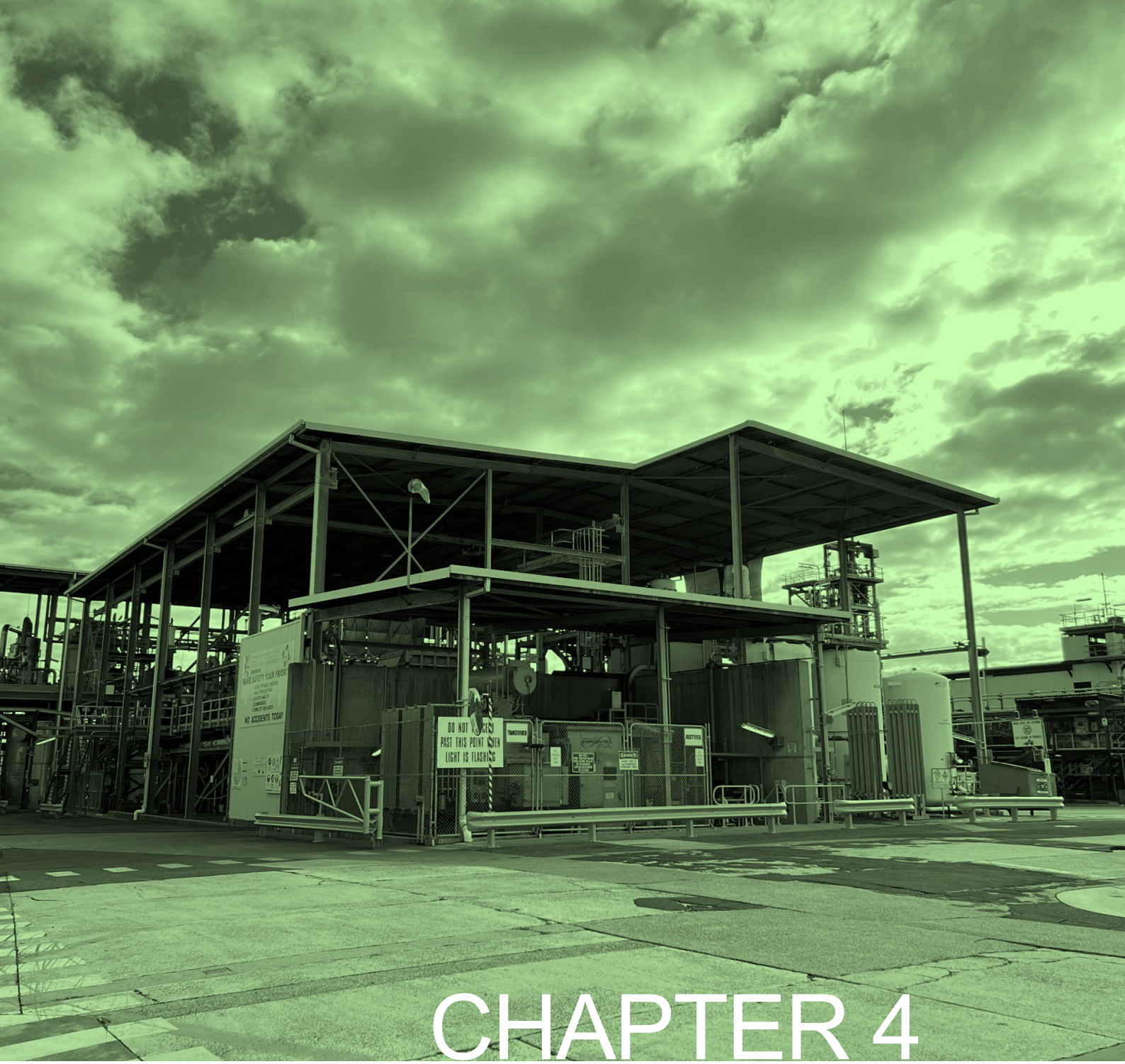
- Light vehicles/day: 3 – 4.
- Heavy vehicle loads/day: 1 – 2.

### 3.1.10 Maintenance

It is anticipated that the supplied equipment would be in use, or on stand-by, 7 days per week, 24 hours per day.

The boiler would be maintained and serviced in accordance with AS 3788 Pressure Equipment – In-Service Inspection, AS 3873 Pressure Equipment – Operation and Maintenance, and AS/NZS 5601 – Gas Installations.

Compliance would be ensured through regular inspections by trained shift personnel, continuous monitoring and alarming of key parameters via the Distributed Control System (DCS), and implementation of a structured maintenance program. A maintenance service agreement would be established with a qualified boiler engineering and maintenance company employing appropriately licensed technicians, including Type B gasfitters.




# CHAPTER 4

## STATUTORY CONTEXT

# 4 STATUTORY CONTEXT

## 4.1 Introduction

This chapter summarises the Commonwealth and NSW regulatory and policy framework applicable to the modification of an existing SSD under Section 4.55(1A) of the EP&A Act. This chapter describes the assessment pathway under these pieces of legislation and identifies other approvals under State and Commonwealth legislation which are required.

## 4.2 Commonwealth legislation

### 4.2.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

Approval by the Commonwealth Minister for the Environment and Water is required for any action that may have a significant impact on matters of national environmental significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). If an activity is likely to have a significant impact on a MNES then it may be a controlled action and should be referred to the Commonwealth Minister for the Environment and Water for consideration. MNES, as defined under the EPBC Act, are:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (Ramsar wetlands).
- Nationally threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mining).
- Water resources, in relation to coal seam gas development and large coal mining development.

An action that may affect a MNES has to be referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for determination as to whether it is a controlled action.

The Protected Matters Search Tool was reviewed which identified several MNES within 10 km of the site that may be relevant to the modification, including:

- Migratory species.
- Wetlands of international importance (Towra Point Nature Reserve).

The modification would not significantly impact on any MNES as no habitat would be impacted and the site is not near the Towra Point Nature Reserve. Therefore, the requirements of the EPBC Act are not relevant and a referral of the modification to DCCEEW is not required.

### 4.2.2 Commonwealth Native Title Act 1993

The Commonwealth *Native Title Act 1993* recognises and protects native title rights in Australia. It allows a native title determination application (native title claim) to be made for land or waters where native title has not been validly extinguished, for example, extinguished by the grant of freehold title to land.

Applications for compensation for extinguishment or impairment of native title rights can also be made. All native title claims are subjected to a registration test and will only be registered if claimants satisfy a number of conditions. A register of native title claims is maintained by the National Native Title Tribunal.

Proposed activities or development that may affect native title are called 'future acts'. Claimants whose native title claims have been registered have the right to negotiate about some future acts, including mining and granting of a mining lease over the land covered by their native title claim. Where a native title claim is not registered, a development can proceed through mediation and determination processes, though claimants will not be able to participate in future act negotiations.

The National Native Title Tribunal's Register of Native Title Claims was searched. No relevant native title claims were identified on the Register of Native Title Claims.

### 4.2.3 National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) establishes a national framework for reporting greenhouse gas emissions, energy production and energy consumption by corporations. It applies to facilities and controlling corporations that exceed specified thresholds.

IXOM is not currently registered as a large emitter or controlling corporation under the NGER Act. The proposed boiler modification will increase natural-gas combustion at the Botany CAP; however, the modification on its own is not expected to trigger NGER facility or corporate thresholds.

It is noted that under modification 6 IXOM may, in the future, approach or exceed NGER reporting thresholds depending on site-wide operational conditions. Should IXOM trigger NGER registration at either the facility or controlling corporation level, all emissions associated with this boiler modification would be incorporated into IXOM's NGER reporting obligations and reported in accordance with the Act.

### 4.2.4 Airports Act 1996 and Airspace Regulations 2018

The Airports Act 1996 establishes the framework for managing aviation safety and protecting prescribed airspace around airports. Under the Act, certain structures and activities must be assessed to ensure they do not create hazards for aircraft operations.

The Act is supported by the Airspace Regulations 2018, which set out the requirements for assessing obstacles that may penetrate or affect protected airspace at or near controlled aerodromes, including Sydney Airport. These instruments are administered by the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA), whose portfolio includes Transport, Infrastructure and Sport.

In accordance with the Airports Act and Airspace Regulations, developments must be assessed against Sydney Airport's prescribed airspace surfaces, including the Obstacle Limitation Surface (OLS) and Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surfaces.

The proposed boiler modification includes a 12-metre stack and a semi-enclosed roofed boiler house. These structures have been reviewed against the relevant Sydney Airport airspace protection surfaces. The maximum structure height is well below the applicable OLS and PANS-OPS thresholds for this location, and no penetration of prescribed airspace occurs. As such, the modification does not trigger a requirement for approval under the Airports Act or associated regulations.

### 4.2.5 Airports (Protection of Airspace) Regulations 1996

The Airports (Protection of Airspace) Regulations 1996, made under Part 12 of the Airports Act 1996, protect the airspace around federally leased airports—such as Sydney Airport—from encroachment by buildings, structures, or other activities that may interfere with aircraft operations. These Regulations define prescribed airspace, which includes Obstacle Limitation Surfaces (OLS) and Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surfaces, as outlined in Regulation 6. Any proposed development that intrudes into this airspace is classified as a controlled activity under Section 182 of the Airports Act 1996 and requires approval from the DITRDCA.

A review of Sydney Airport's prescribed airspace indicates that the site lies within an area subject to an Inner Horizontal Surface (IHS) of 51 m AHD. The proposed gas-fired boiler stack will extend approximately 12 m in height, with the top of the stack located about 4 m above the roof of the boiler house, remaining below the IHS threshold. The stack does not penetrate the prescribed airspace and, therefore, does not require approval as a controlled activity under the Airports (Protection of Airspace) Regulations 1996.

## 4.3 NSW Environmental Planning and Assessment Act 1979

The EP&A Act and EP&A Regulation form the statutory framework for planning approval and environmental assessment in NSW. Implementation of the EP&A Act is the responsibility of the Minister for Planning and Public Spaces, statutory authorities and local councils. It contains three parts that impose requirements for planning approval:

- Part 4, which provides for control of 'development' that requires development consent from the relevant consent authority. A division of Part 4 (Division 4.7) provides for the assessment of SSD where the Minister for Planning and Public Spaces (or delegate) or the Independent Planning Commission (IPC) is the consent authority.
- Part 5, which provides for control of 'activities' that do not require approval or development consent under Part 4.
- Division 5.2, which provides for control of State significant infrastructure that does not require approval or development consent under Part 4.

The requirement for development consent is set out in environmental planning instruments (EPIs), being State environmental planning policies (SEPPs) or LEPs.

The EP&A Act also determines the consent authority for a development application.

### 4.3.1 State significant development

Part 4, Division 4.7 of the EP&A Act relates to the assessment of development deemed to be significant to the State (i.e. SSD). Under Section 4.36(2), a development is SSD if it is declared by a SEPP.

The relevant SEPP to the modification is the State Environmental Planning Policy (Planning Systems) 2021 (PSSEPP). Clause 2.6(1) of the PSSEPP identifies certain classes of development to be 'State significant development' provided they meet the criteria in schedules 1 or 2 of the PSSEPP.

Section 10(3) of Schedule 1 to the PSSEPP is relevant to chemical, manufacturing and related industries and states that development is SSD if the development is for the purpose of the manufacture, storage or use of dangerous goods in such quantities that constitute the development as a major hazard facility within the meaning of Chapter 6B of the NSW Occupational Health and Safety regulation 2001.

The site is classified as a major hazard facility due to the storage of chlorine, and as such, the proposed development constitutes a modification to the existing SSD.

### 4.3.2 Power to grant approval

Under Section 4.5(a) of the EP&A Act, the Minister for Planning and Public Spaces (the Minister) is the consent authority for SSD applications, except in certain specified cases. For the purposes of this modification, the Minister is the relevant consent authority.

A modification may be granted under this section if the consent authority is satisfied that *"the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all)."*

The development as modified will be substantially the same development as the development for which consent was originally granted (see Section 4.3.4) and involves minimal environmental impact.

### 4.3.3 Permissibility

The site is zoned IN1 – General Industrial under Chapter 5 of the TISEPP. The development is consistent with the definition of a general industry, which by virtue of Part 5.2 of the TISEPP is permitted with consent in the IN1 land use zone. The modification will not alter the permissibility of the development.

### 4.3.4 Qualification as a modification

Section 4.55(1) of the EP&A Act allows for a modification of a development where the consent authority is "satisfied that the development to which the consent as modified relates is substantially the same development as the development for which the consent was originally granted and before that consent as originally granted was modified (if at all)".

The term 'substantially' means 'essentially or materially having the same essence'. Therefore, the assessment is not focused on whether the changes are 'minor' or 'minimal', but rather whether the resultant development (the development as modified) is still, in its essence, the same development that was originally approved.

Applying these principles, the determination is whether the modification will result in a development that is substantially the same as the development originally approved under DA35/98. This involves assessing if the modification retains essentially or materially the same essence and comprises alterations that are not a 'radical transformation'.

#### Quantitative assessment

The modification is substantially and materially the same development as originally approved in DA35/98 for the following reasons:

**No change to the approved development's function or scale**

The modification does not alter the purpose, nature or operational capacity of the approved CAP. The development would continue to operate as a chemical production facility. The modification replaces the temporary 3 MW diesel-fired boiler with a permanent 6 MW natural gas-fired boiler, restoring to long-term steam supply. No changes are proposed to production throughput, plant output, or chemical processing operations.

**No change to approved hours, employment levels or site logistics**

The modification would not change operating hours, employee numbers, or ongoing vehicle movements. Construction-related traffic would be minor and temporary, limited to 3–4 light vehicles and 1–2 heavy vehicles per day. Once operational, the boiler would not generate additional daily traffic.

**Minimal construction impacts and no expansion of footprint**

All works would occur on existing sealed hardstand areas within the current CAP boundary. Physical works are limited to a new boiler house structure, foundations and approximately 30 m of new above-ground pipework. There is no expansion of the approved development footprint, no vegetation removal and no works outside existing boundaries.

**Noise impacts remain consistent with existing industrial operations**

Noise modelling confirms the new boiler would not increase off-site noise emissions and would comply with EPL 20547 limits. Boiler sound power is more than 10 dB below the existing site sound power envelope, meaning no increase in cumulative plant noise. Construction noise would comply with standard hours.

**Traffic, air quality and risk profiles remain unchanged**

The modification would not change approved traffic levels, does not introduce new pollutants of concern or increase existing air emissions, and would not change the site's off-site risk contours. Hazard studies confirm the boiler's risks are well understood, well controlled, and would not introduce new major incident pathways influencing chlorine inventories or QRA outcomes.

**No upgrade to external services required**

The modification relies on existing pipelines, the existing gas metering compound (following requalification) and existing utilities. No off-site infrastructure upgrades or new service connections are required.

## Qualitative assessment

Qualitatively, the development retains the same essence, nature and purpose as the originally approved CAP:

**The fundamental land use remains unchanged**

The use of the site as a Chlor-Alkali Plant for chemical production remains entirely unchanged. Steam generation is already an essential supporting utility for CAP operations. The proposed permanent boiler simply replaces an interim arrangement and ensures reliability in an established industrial process.

**No additional disturbance or change in environmental context**

All works are within an existing heavily industrialised setting and confined to previously disturbed hardstand. No new environmental constraints are triggered, and no impacts arise to biodiversity, heritage, soil, groundwater or contamination beyond those already assessed and managed under existing approvals.

**Environmental impacts are minor and manageable**

Air, noise, flooding, risk and construction impacts have all been assessed as minimal. Emissions from the gas-fired boiler are lower than the temporary diesel-fired boiler and effectively dispersed via a 12 m stack. No meaningful change to amenity or environmental quality would occur.

**No radical transformation of the approved development**

The modification does not intensify the use, does not expand land area, does not change the nature of chemical production and does not introduce new processes. The plant continues to function in the manner originally assessed and approved. The modification is an incremental, utility-based improvement, not a transformation.

Given the above, the development as modified would not materially change the nature, purpose or intensity of the approved State Significant Development. The “essence” of the CAP is wholly retained.

**Summary**

Applying the three-stage “substantially the same” test and guided by relevant case law:

- The modification maintains the same essential character as the originally approved development.
- Both quantitative and qualitative comparisons confirm the modification is an alteration rather than a redescription or transformation of the approved development.
- Environmental impacts are minimal, localised, temporary (where construction-related) or neutral/improved (air quality, risk, noise).
- The modification is therefore substantially the same development for the purposes of Section 4.55(1A) of the EP&A Act.

Accordingly, the proposal can be appropriately assessed and approved under Section 4.55(1A).

### 4.3.5 Mandatory matters for consideration

#### Objectives of the EP&A Act

The objects of the EP&A Act are specified in Section 1.3 of the Act and seek to promote the management and conservation of natural and artificial resources, while also permitting appropriate development to occur. The consistency of the project with the objects of the Act is considered in Table 4.1.

**Table 4.1 Objectives of the Act**

| Objectives of the EP&A Act | Consistency of the project |
|---|---|
| to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State’s natural and other resources, | Specialist consultants have been engaged to assess and report on the potential for the project to impact upon the natural and artificial resources of the project area. Notably, impacts on the natural environment have been addressed in Chapter 6 of this modification report. |
| to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment, | The project is consistent with the principles of ecological sustainable development (ESD) as described below. |
| to promote the orderly and economic use and development of land, | The proposed boiler modification facilitates the continued safe and efficient operation of the IXOM CAP within its existing industrial footprint, thereby promoting the orderly use of land consistent with its zoning and approved use. By utilising existing infrastructure and connection points, the development avoids unnecessary expansion or disturbance, ensuring economic use of resources and minimising environmental impact. The replacement of the temporary diesel-fired boiler with a permanent gas-fired unit enhances operational reliability, reduces emissions, and aligns with broader sustainability goals. The infrastructure is visually compatible with the site's industrial character, ensuring the development integrates seamlessly into the existing |

| Objectives of the EP&A Act | Consistency of the project |
|---|---|
| | built form without disrupting surrounding land uses or amenity. |
| to promote the delivery and maintenance of affordable housing, | Not applicable to the project. |
| to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats, | Specialist consultants have been engaged to assess and report on the potential for the project to impact the local environment. As described in Section 2.2.9, the project will not impact flora and fauna. |
| to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage), | As described in Section 2.2.8, there are no items of State or local heritage significance on the site. |
| to promote good design and amenity of the built environment, | The design and scale of the proposed boiler and boiler house integrate with the existing industrial built form of the CAP. The new structures are consistent with surrounding infrastructure, do not introduce visually intrusive elements, and maintain the amenity of the established industrial setting. |
| to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants, | The buildings to be constructed under the project have been designed with a number of features to promote the protection of health and safety of occupants (see Chapter 3.1 and 6) and site users and would be constructed in accordance with the National Construction Code 2022 (NCC). |
| to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State, | As outlined in Section 4.3.2, the project is subject to the provisions of Part 4 of the EP&A Act, and the Minister for Planning and Public Spaces will be the consent authority. As outlined in Chapter 5, IXOM has consulted government agencies, the local community and other stakeholders. |
| to provide increased opportunity for community participation in environmental planning and assessment. | As outlined in Chapter 5, IXOM has consulted government agencies, the local community and other stakeholders. |

## Section 4.15 matters for consideration

Section 4.55(3) of the EP&A Act states that, when determining the modification, the consent authority must consider the relevant matters listed in section 4.15(1), as well as the reasons it originally gave for granting the consent being modified. The relevant sections are listed and addressed in Table 4.2.

**Table 4.2 Relevant matters under Section 4.15(1) of the EP&A Act.**

| Section and requirement | Comment |
|---|---|
| 4.15(1) Matters for consideration – general<br>In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:<br>(a) the provisions of - | - |
| (i) any environmental planning instrument, and | As outlined in Section 4.4 and 4.5. |
| (ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and | As outlined in Section 4.4 and Section 4.5 |

| Section and requirement | Comment |
|---|---|
| (iii) any development control plan, and | The alignment between the Bayside DCP 2022 and the modification has been discussed in Section 4.4.2. |
| (iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and | No planning agreements are relevant to the modification. |
| (iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph), | As discussed in Section 4.3.6. |
| (v) (Repealed) | - |
| that apply to the land to which the development application relates, | - |
| (b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality, | Environmental impacts of the modification have been detailed in Section 6. |
| (c) the suitability of the site for the development, | Suitability of the site has been discussed in Section 4.3.3 (Permissibility). |
| (d) any submissions made in accordance with this Act or the regulations, | - |
| (e) the public interest. | Consultation has been outlined in Section 5 of this document. |

## Requirements for modifications to a development consent

Part 5, clause 100 (1) of the NSW Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) outlines requirements for modifications to a development consent. Table 4.3 lists the relevant clause requirements and where they have been addressed in this report.

**Table 4.3: Requirements of Part 5, clause 100 (1) of the EP&A Regulation**

| Clause requirement | Comments |
|---|---|
| (1) An application for modification of a development consent under section 4.55(1), (1A) or (2) or 4.56(1) of the Act must contain the following information— | - |
| (a) the name and address of the applicant, | Section 1.2 |
| (b) a description of the development to be carried out under the consent (as previously modified), | Section 3.1 |
| (c) the address, and formal particulars of title, of the land on which the development is to be carried out, | Section 2.1 |
| (d) a description of the proposed modification to the development consent, | Section 3 |
| (e) a statement that indicates either—<br>(i) that the modification is merely intended to correct a minor error, misdescription or miscalculation, or<br>(ii) that the modification is intended to have some other effect, as specified in the statement, | Section 1.5 |
| (f) a description of the expected impacts of the modification, | Chapter 6 |
| (g) an undertaking to the effect that the development (as to be modified) will remain substantially the same as the development that was originally approved. | Section 3.1.1 |

## Ecologically sustainable development

One of the objects in Section 1.3 of the EP&A Act is "to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment". Section 1.4 (Definitions) of the EP&A Act defers to the NSW *Protection of the Environment Administration Act 1991* (POEA Act) for a definition of ESD. Section 6.2(2) of the POEA Act defines ESD as:

> …ecologically sustainable development requires the effective integration of social, economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:

a. the precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

   i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
   ii. an assessment of the risk-weighted consequences of various options,

b. inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,
c. conservation of biological diversity and ecological integrity - namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,
d. improved valuation, pricing and incentive mechanisms - namely, that environmental factors should be included in the valuation of assets and services, such as:

   i. polluter pays - that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
   ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,
   iii. environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The following sections consider how the project meets the principles of ESD.

**Precautionary principle**

Where there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent such damage.

The potential environmental impacts associated with the project are well understood and have been assessed to a level of detail proportional for each aspect of environmental risk, as described in Chapter 6.

Management measures have been proposed to avoid or minimise potential impacts where required..

**Inter-generational equity**

Inter-generational equity is the concept that the present generation should ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future

generations. Social equity is defined by intergenerational equity, which is centred on the concept that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

This modification report has addressed the principles of social equity through:

- engagement of suitably qualified and experienced technical specialists to ensure that the environmental assessment phase of the project has been independently undertaken and is transparent;
- engagement with neighbours and the local community and identifying mitigation and management measures to address those potential impacts; and
- management strategies and mitigation measures to minimise any potential adverse impact.

Therefore, the project would not detract from future generation's access to and equal enjoyment of environmental and social resources.

**Conservation of biological diversity and ecological integrity**

This is the concept that conservation of biological diversity and ecological integrity should be a fundamental consideration. As described in Chapter 2.2.9, the project would not adversely impact threatened species or ecological communities.

**Improved valuation, pricing and incentive mechanisms**

The principle of improved valuation, pricing and incentive mechanisms deems that environmental factors should be included in the valuation of assets and services, and that those who generate the pollution and waste should bear the cost of containment, avoidance or abatement.

IXOM acknowledges and accepts the financial costs associated with all the measures required for the project to avoid, minimise, mitigate and manage potential environmental and social impacts.

In terms of the polluter pays principle, that is those who generate pollution and waste should bear the cost of containment, avoidance or abatement. EPL 20547 applies to the site which regulates the fee-based activities of Dangerous goods *production*, *General chemicals storage, Non-thermal treatment of hazardous and other waste* and *Waste storage – hazardous, restricted solid, liquid, clinical and related waste and asbestos waste*.

Trade Waste Agreement 489 also applies to the site, which licenses the discharge of treated wastewater to the reticulated sewer system.

### 4.3.6 Other State legislation and regulations

In addition to the requirements under Part 4 of the EP&A Act, the project may require additional approvals, licences and/or authorisation under various other pieces of NSW legislation and regulations, which are summarised in Table 4.4.

**Table 4.4 Summary of NSW legislation**

| Legislation | Overview |
|---|---|
| NSW Protection of the Environment Operations Act 1997 (POEO Act) | The POEO Act aims to protect, restore and enhance the quality of the environment in the context of ecologically sustainable development and to reduce risks to human health and prevent degradation of the environment.<br>Section 48 of the POEO Act stipulates that an EPL is required for any scheduled activities to be undertaken at a premise at which Schedule 1 of the Act indicates that a licence is required.<br>The existing development required approval under the NSW *Protection of the Environment Operations Act 1997* (POEO Act) as it requires an EPL to |

| Legislation | Overview |
|---|---|
| | operate. The requirement for an EPL is a trigger for integrated development under Section 4.46 of the EP&A Act.<br>However, Section 4.46 also provides that integrated development does not include SSD, and as such this development is not classified as SSD. The modification will continue to operate under an EPL.<br>The site operates under EPL 20547, which will continue to apply to the site.<br>A licence variation would be required to reflect the removal of the existing temporary diesel-fired boiler and the commissioning and operation of the proposed gas-fired boiler. It is noted that the operation of the gas-fired boiler does not constitute a scheduled activity under Schedule 1 of the NSW *Protection of the Environment Operations Act 1997* (POEO Act). |
| Work Health and Safey Act 2011 (WHS Act) | The WHS Act establishes general duties to ensure the health and safety of workers and others. These duties apply to the installation and operation of the proposed gas-fired boiler, including safe design, construction, commissioning and maintenance.<br>The CAP is already a declared Major Hazard Facility due to its chlorine inventories. This modification does not change hazardous chemical quantities or trigger any new notification thresholds under the WHS Regulation. While the boiler will be incorporated into the site's existing Safety Case, the modification does not alter the facility's MHF classification or introduce new major incident hazards involving chlorine. |
| NSW National Parks and Wildlife Act 1974 (NPW Act) | The NPW Act contains provisions for the protection and management of national parks, historic sites, nature reserves and Aboriginal heritage. The NPW Act provides statutory protection for Aboriginal objects by making it illegal to move, damage, deface or destroy a relic without written permission from DPHI.<br>The modification will be on highly disturbed privately owned land and will not have impacts to national park reserves, historic sites, nature reserves and Aboriginal heritage values afforded protection under the NPW Act. |
| NSW Biodiversity Conservation Act 2016 (BC Act) | The BC Act provides protection for threatened plants and animals native to NSW (excluding fish and marine vegetation) and integrates the conservation of threatened species into development control processes under the EP&A Act.<br>There is no vegetation on the site other than several native and exotic plantings in the vicinity of the front office-building. No vegetation will require removal during construction or operation of the modification. |
| NSW Roads Act 1993 | Section 138 of the NSW *Roads Act 1993* requires consent to be obtained prior to disturbing or undertaking work in, on or over a public road.<br>The modification does not require any upgrades to the access driveways and will not require approval from TfNSW under section 138 of the NSW *Roads Act 1993*. |
| NSW Contaminated Land Management Act 1997 (CLM Act) | The CLM Act establishes a process for investigating, and where required remediating contaminated lands, that pose a risk to human health and the environment.<br>As discussed in Section 2.2.10, the land above the contaminated aquifer has been declared a contaminated land area (area 3203) by the EPA and includes the BIP and the project site. The contaminated aquifer is currently being managed by the site owner (Orica) under a voluntary management project (Notice number 20201704) as approved by the EPA under section 17(3) of the CLM Act.<br>A search of the EPA's contaminated land records identified the land associated with this contamination is the only contaminated land recorded in the vicinity of the site.<br>Soil excavated during installation would be managed off-site in consultation with Orica. |

## 4.4 Environmental planning instruments

Environmental planning instruments (EPIs) such as State environmental planning policies (SEPPs) and local environmental plans (LEPs) are legal documents that regulate land use and establish requirements for development consent in NSW.

### 4.4.1 State environmental planning policies

The SEPPs considered in relation to the modification are summarised in Table 4.5.

**Table 4.5 SEPPs that may be relevant to the modification**

| SEPP | Overview |
|---|---|
| State Environmental Planning Policy (Planning Systems) 2021 (PS SEPP) | Section 2.6 and Schedule 1 of the PS SEPP declare certain development to be SSD. The proposed modification will alter an approved SSD.<br>As the modification relates to SSD, in accordance with Section 4.5 (a) of the EP&A Act, the Minister for Planning and Public Spaces is the consent authority, unless certain other criteria are met, in which case the IPC is the consent authority. |
| State Environmental Planning Policy (Resilience and Hazards) 2021 (Hazards SEPP) | Chapter 4 – Hazardous and Offensive Development of the SEPP (Resilience and Hazards) applies to development that may pose a risk due to the storage, handling or processing of hazardous chemicals.<br>The IXOM CAP is a declared Major Hazard Facility, and the modification involves the installation of a gas-fired boiler and the repurposing of existing gas pipelines. As such, hazard-related matters are addressed through:<br>▪ Hazard studies and risk screening (consistent with former SEPP 33 and WHS Regulation requirements)<br>▪ Assessment of major incident scenarios and escalation pathways<br>▪ Consideration of existing and proposed safety controls<br>A detailed qualitative risk assessment is provided in Section 6.1 of this modification report, concluding that the modification:<br>▪ does not materially change the site's off-site risk profile,<br>▪ does not introduce new major incident pathways, and<br>▪ remains consistent with SSD consent conditions relating to site risk.<br>Chapter 3 – Contaminated Land of the SEPP (Resilience and Hazards) applies to land where contamination must be considered before granting development consent.<br>As described in Section 2.2.10, the site is located within Contaminated Land Area 3203 and above the Botany Sands aquifer, which is currently under management via an EPA-approved Voluntary Management Proposal.<br>For this modification:<br>▪ works are located on existing sealed hardstand,<br>▪ excavation, if required, is minimal and shallow, and<br>▪ no new interaction with groundwater or contaminated soils is expected.<br>If detailed design determines that ground disturbance is necessary for the installation of structural footings, excavations will be carried out in accordance with the soil and water management plan (see Section 6.4 and Appendix H), in consultation with Orica and in accordance with existing contamination management requirements for the BIP as outlined in Section 3.1.9 (construction) and Section 6.4 (soils and contamination). |
| State Environmental Planning Policy (Transport and Infrastructure) 2021 | Chapter 2 of the TISEPP aims to assist in the effective delivery of public infrastructure across the State by improving certainty and regulatory efficiency through a consistent planning assessment and approvals regime for public infrastructure and services and through the clear definition of environmental assessment and approval processes for public infrastructure and services facilities. This chapter does not apply to chemical manufacturing facilities and as such is not applicable to the project.<br>Chapter 5 of the TISEPP is applicable to the modification as the site is identified in the State Environmental Planning Policy (Three Ports) 2013 Land Application Map (Sheet LAP_001 Port Botany) as required under Section 5.3. The site is zoned IN1 – General Industrial under Section 5.11 of the TISEPP and the project is permissible on land zoned as IN1 under Part 5.2. |
| State Environmental Planning Policy (Sustainable Buildings) 2022 (Sustainable Buildings SEPP) | Given that the modification is permitted with consent by virtue of Part 5.2 of the TISEPP (see Section 4.3.3), Chapter 3 of the Sustainable Buildings SEPP is not applicable. |

### 4.4.2 Local environmental and development control plans

#### Bayside Local Environmental Plan 2021

The Bayside LEP does not apply to the land as it is not identified on the land application map (Sheet LAP_001) under Section 1.3 of the LEP. Chapter 5 of the TISEPP applies to the land as shown on the land application map under Section 5.3 of the SEPP.

#### Bayside Development Control Plan 2022

The Bayside Development Control Plan 2022 (BDCP) does not apply to the land as per Section 2.4 of the BDCP, which states that the plan applies to land within the Bayside LGA but excludes land subject to Chapter 5 of the TISEPP.

## 4.5 Other strategies, plans and policies

### 4.5.1 NSW Future Transport Strategy 2056

The NSW Future Transport Strategy 2056 (Strategy 2056) sets strategic directions to achieve world-leading mobility for customers, communities, businesses, and government. Its vision is built on six outcomes: customer focus, successful places, a strong economy, safety and performance, accessible services, and sustainability.

The modification supports the outcome of a strong economy by enabling the continued manufacture of liquefied chlorine, an essential chemical for the treatment of potable water across Australia. By ensuring a reliable steam supply through permanent infrastructure, the modification contributes to the resilience of critical industrial operations that underpin public health and infrastructure services.

### 4.5.2 Botany Bay Planning Strategy 2031

The Botany Bay Planning Strategy 2031 (the strategy) sets out seven strategy directions and several objectives to successfully achieve each direction. The strategic directions include:

- Strategy Direction 1: Enhancing Housing Choice and Liveability.
- Strategy Direction 2: Revitalising Botany Road and Traditional Centres.
- Strategy Direction 3: Managing Growth in the Eastern Centres.
- Strategy Direction 4: Reviving the Local Economy.
- Strategy Direction 5: Maintaining Sydney Airport as a Global Gateway.
- Strategy Direction 6: Maintaining Port Botany as a Global Gateway.
- Strategy Direction 7: Protecting the Natural Environment.

The modification supports Objective 6.1 under Strategy Direction 6, which seeks to maintain Port Botany as a global gateway by retaining Banksmeadow for general industrial activities. The modification ensures continued industrial use of the site through efficient infrastructure upgrades that support essential manufacturing operations, thereby promoting the effective and sustainable use of industrial land within the Port Botany precinct.

### 4.5.3 Greater Sydney Region Plan

The *Greater Sydney Region Plan: A Metropolis of Three Cities* (Greater Sydney Commission [GSC], 2018) provides the basis for strategic planning for the Greater Sydney region by setting out a 40-year vision and establishing a 20-year plan to manage growth and change. The GSC

was dissolved on 1 January 2024; however, these plans are now under the control of DPHI and remain relevant until a new plan is released for the region.

The Greater Sydney Region Plan establishes 10 directions supported by 40 objectives that outline the framework for the city's liveability, productivity and sustainability. The modification supports the following directions and objectives of the plan:

**Direction 1 – Infrastructure supporting new developments**

The modification introduces essential infrastructure that supports the safe and reliable production of liquefied chlorine, a critical input for potable water supply across NSW. This aligns with Objective 1: Infrastructure supports the three cities and Objective 4: Infrastructure use is optimised.

**Direction 7 – Jobs and skills for the city**

By reinforcing the industrial function of the BIP, the modification supports Objective 23: Industrial and urban services land is planned, retained and managed, ensuring continued use of appropriately zoned land for essential services.

**Direction 9 – An efficient city**

The modification supports Objective 33: A low-carbon city aims to contribute to net-zero emissions by 2050. The proposed gas-fired boiler will replace the temporary diesel-fired unit, resulting in lower NOx emissions, negligible particulate matter and reduced greenhouse gas emissions per unit of steam produced. The transition to natural gas provides a more energy-efficient and lower-emission long-term solution for steam generation at the CAP.

### 4.5.4 Eastern City District Plan

The site is in Sydney's eastern district, and the Eastern City District Plan sets out the planning priorities and actions for implementing the plan at a district level. The planning priorities relevant to the project are:

Planning priority E1 – Planning for a city supported by Infrastructure – the objectives directly relevant are:

- Objective 1 – Infrastructure supports the three cities.
- Objective 3 – Infrastructure adapts to meet future needs.
- Objective 4 – Infrastructure use is optimised.

The modification would ensure a reliable steam supply for the production of liquefied chlorine, a critical input for potable water treatment. This enhances infrastructure resilience and optimises its use to meet current and future needs.

Planning priority E12 – Retaining and managing industrial and urban services land – the objectives relevant to the project are:

- Objective 23 – Industrial and urban services land is planned, retained and managed.

The modification supports *Objective 23* by reinforcing the continued industrial use of land within BIP for essential services.

Planning priority E19 – Reducing carbon emissions and managing energy, water and waste efficiently:

- Objective 33 – A low-carbon city contributes to net-zero emissions by 2050 and mitigates climate change.

The modification would replace the temporary diesel-fired boiler with a permanent gas-fired unit, reducing greenhouse gas and particulate emissions associated with steam generation. Gas-fired infrastructure is more energy-efficient and produces fewer emissions than diesel, supporting the district's transition toward net-zero emissions by 2050.

The proposed boiler incorporates modern mechanical and control systems as detailed in the project definition and planning application documents. The installation includes a 6 MW John Thompson water-tube boiler with a membrane wall furnace and a "D" type configuration, consisting of two drums connected by vertical generating tubes and a fully cooled furnace.

The system includes a duplex stainless-steel economiser located in the exhaust gas stream to heat boiler feedwater using waste heat from the flue gas. The economiser reduces flue gas temperatures to 145°C at maximum continuous rating with 80°C feedwater.

A Weishaupt WM-G50/1-A ZM-NR (or equivalent) low-NOx natural gas burner has been specified for the boiler. The burner includes:

- a variable speed drive (VSD) for fan flow control;
- an oxygen probe for $O_2$ measurement;
- an ignitor; and
- a compact flame detector (F200s).

The packaged gas valve train incorporates:

- a fuel flow control valve and actuator;
- twin main and pilot shut-off valves;
- manual isolation valves;
- a high-pressure regulator with gas filter; and
- associated piping, fittings and pressure gauges.

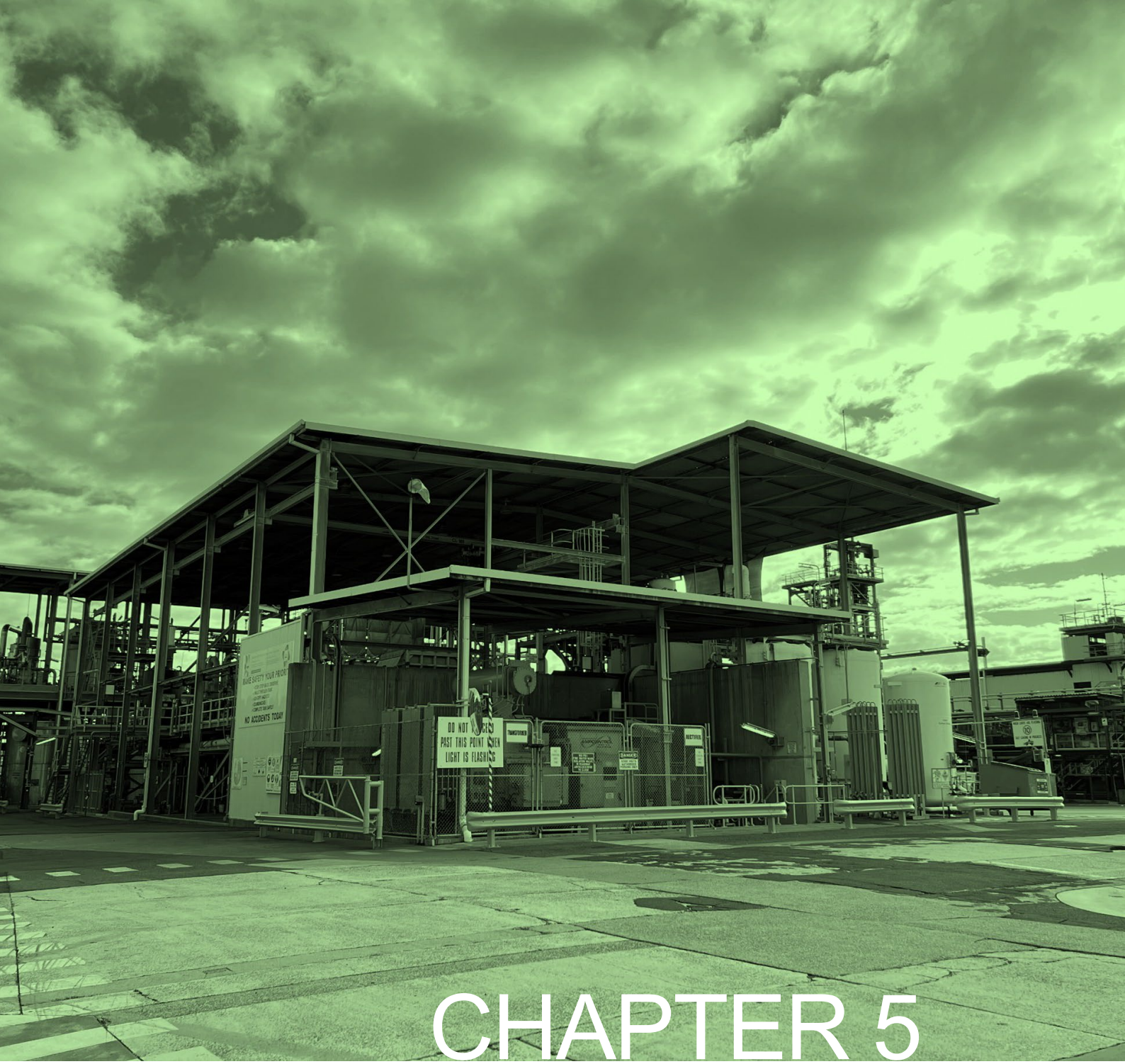
Boiler operation and safety functions are managed through a dedicated boiler control panel housing an Allen-Bradley CompactLogix PLC, with hard-wired emergency stops and discrete boiler function controllers. Communication between the boiler control system and the existing site Distributed Control System (DCS) would be via Modbus.

### 4.5.5 Bayside Local Strategic Planning Statement – A land-use vision to 2036

The planning priorities set out in the Bayside Local Strategic Planning Statement are grouped under the same themes identified in the Eastern City District Plan. The themes and planning priorities relevant to the project are:

- An efficient city – planning priority 23 – Reduce carbon emissions through improved management of energy, water and waste.

The modification, which is gas-fired infrastructure, is more energy-efficient and produces fewer emissions than diesel, supporting the district's transition toward net-zero emissions by 2050.




# CHAPTER 5

## CONSULTATION

# 5 ENGAGEMENT

## 5.1 Introduction

IXOM has undertaken targeted consultation with relevant stakeholders, including:

- Nearby residents and businesses.
- Early engagement with DPHI to outline the proposed modification, planning pathway, and assessment approach.
- Notification of neighbouring industrial and commercial properties within the BIP, particularly those adjacent to the proposed boiler location.
- Engagement with the NSW EPA regarding the transition from the temporary diesel-fired boiler to the permanent gas-fired unit, and confirmation whether a variation to EPL 20547 is required.

## 5.2 Community consultation

A total of 847 residents and businesses within 500 m of the site (shown in Figure 5.1 below) were consulted via letterbox drop on 30 October 2025, which provided information on the project and the upcoming approval process (provided in Appendix D). No comments or requests for further information have been received.

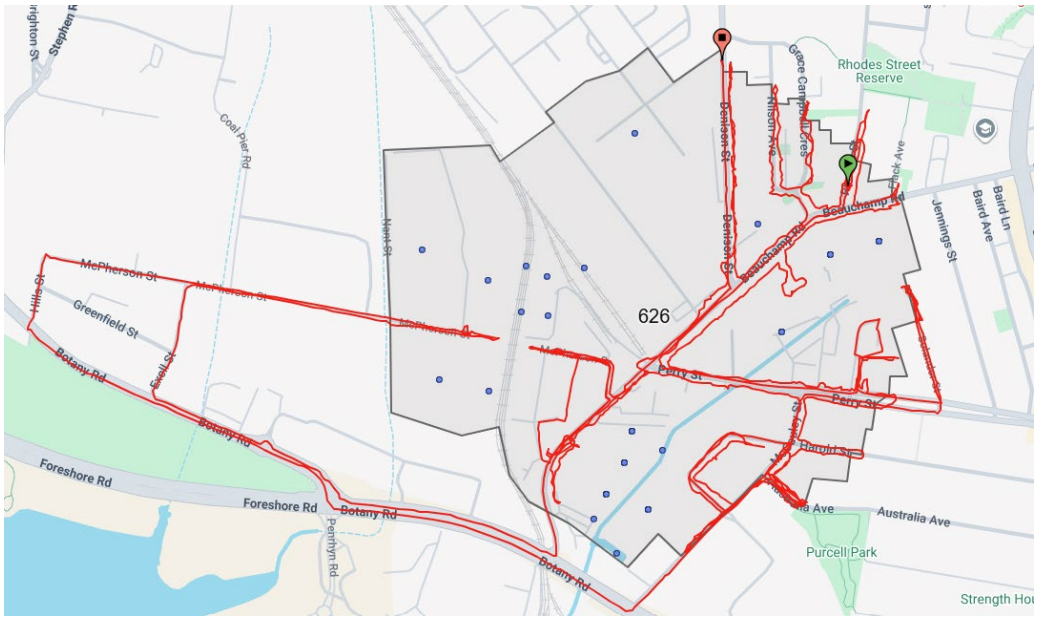



**Figure 5.1 Public notification distribution locations**

## 5.3 Government consultation

State government agencies including NSW EPA and DPHI were consulted during the preparation of this modification report to identify key issues for consideration and seek guidance on the assessment approach and approval pathway.

A letter providing an overview of the project, key matters requiring assessment, proposed consultation and project contact information was sent to Government agencies to invite feedback on matters to be addressed in the modification report.

Matters raised by agencies in response to the letter, as well as where these matters are addressed in the modification report, are summarised below.

### 5.3.1 NSW Environment Protection Authority

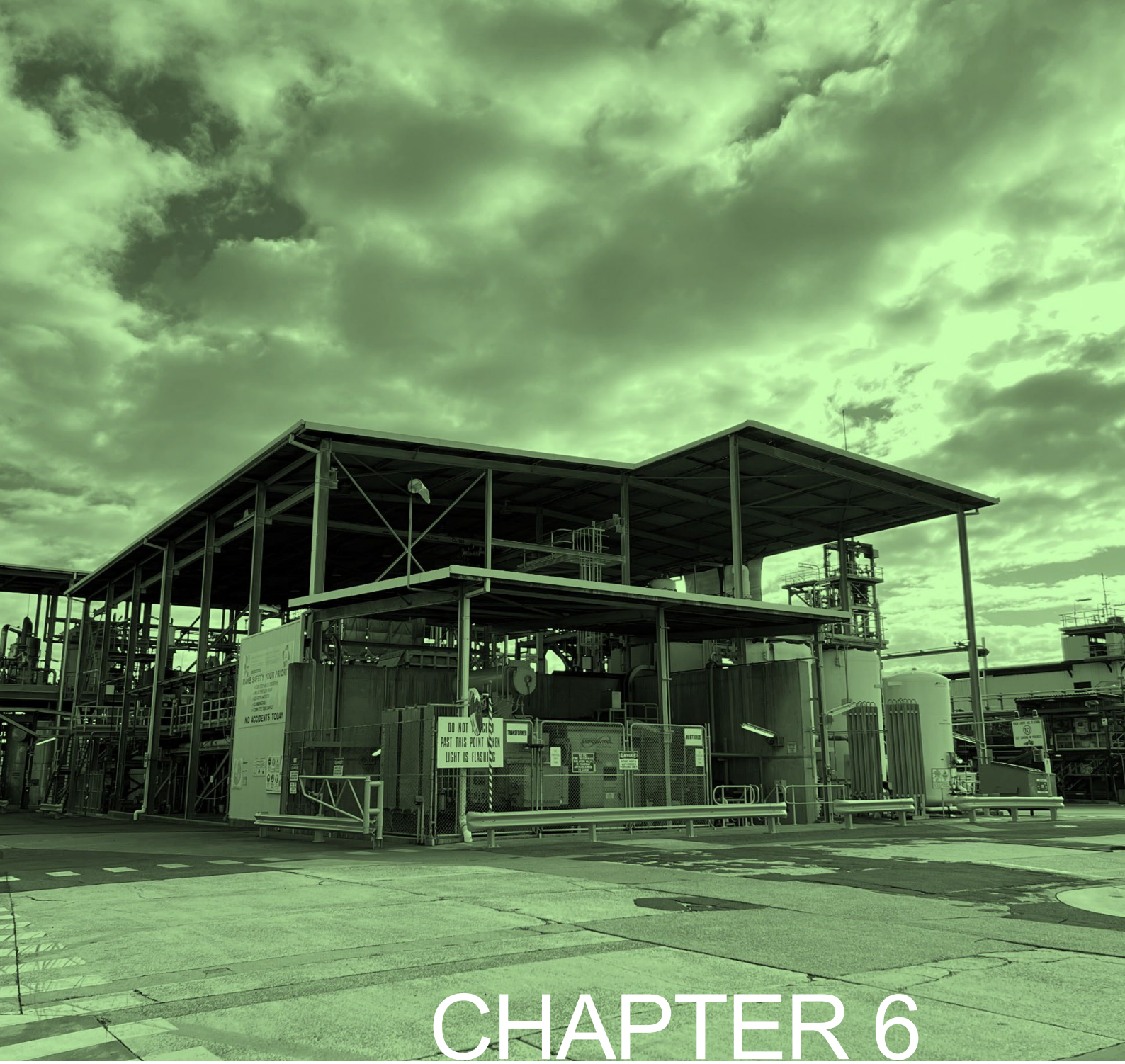
On 4 December 2025, the NSW EPA provided written comments on the proposed modification. In its response, the EPA recommends the following:

- The EPA's initial review indicates that a variation to EPL 20547 may be required to enable:
  - monitoring of air pollutants from the proposed 12 m boiler stack; and
  - assessment of potential noise impacts on nearby residents and other sensitive receivers.
- Following commissioning of the gas-fired boiler, the Pollution Incident Response Management Plan (PIRMP) and Environmental Management Plan will need to be updated to address incident risks associated with boiler operation.
- The proposed works are located on land declared Significantly Contaminated under the *Contaminated Land Management Act 1997*. Soil and groundwater contamination must be considered in the modification report and managed during development works.

The consultation letter issued to the NSW EPA and their response is provided in Appendix D.

### 5.3.2 Department of Planning, Housing and Infrastructure

IXOM and Element held a pre-lodgement meeting with DPHI on 2 October 2025. Key discussions included an overview of the modification and associated infrastructure, agreement on the environmental assessment and planning pathway under Section 4.55(1A) of the NSW EP&A Act, and the need to demonstrate that the modification would not increase overall site risk. It was agreed that a safety case and hazard study would be undertaken, and a statement addressing site risk would be included to support the planning pathway. Technical studies were confirmed to include air and noise assessments.




# CHAPTER 6

## ASSESSMENT OF IMPACTS

# 6 ASSESSMENT OF IMPACTS

This chapter summarises the likely impacts of the proposed modification, including environmental impacts on both the natural and built environments, and social and economic impacts on the locality.

The scoping exercise comprised determining the key potential environmental impacts during project definition workshops and conducting preliminary assessments by the project team and relevant environmental consultants. The scoping exercise and outcomes from engagement with DPHI were used to determine the environmental aspects that required a detailed assessment.

The aspects requiring detailed assessment were assessed by technical specialists and are summarised in Sections 6.1 to 6.3. Low-risk environmental aspects were not assessed in detail and are summarised in Section 6.4.

## 6.1 Operational hazards

### 6.1.1 Introduction

This section summarises the assessment of potential risk implications associated with the proposed installation of a gas-fired boiler (Sherpa, 2025; Appendix E).

The IXOM CAP is required to periodically submit an updated Quantitative Risk Assessment (QRA) to DPHI as part of existing conditions of consent, with potential risk primarily associated with chlorine manufacturing as shown in Figure 6.1 (reproduced from the 2025 CAP QRA, most recently submitted and approved by DPHI). IXOM has also recently submitted a QRA covering the proposed CLP to be located in Block L (northern part of layout in existing hypo loadout area) under modification 6, as shown in Figure 3.1. The QRAs were prepared for IXOM by Sherpa Consulting Pty Ltd (Sherpa).

During early engagement, DPHI requested that a risk statement be prepared to consider any potential risk implications from this modification in the context of the broader site, and confirm that the new boiler will not increase the overall risk profile of the IXOM site.

As the existing development is a MHF, IXOM will need to update the site's Safety Case following approval of the modification to:

- Identify any new or altered major incident (MI) hazards.
- Demonstrate that existing and new control measures are sufficient.
- Confirm that the Safety Management System remains adequate to manage these risks.

### 6.1.2 Assessment methodology

IXOM carried out internal comprehensive hazard and operability studies for the installation and operation of the new 6 MW gas-fired boiler at the IXOM Botany CAP facility. The studies assessed the boiler design, siting, utilities, operation, and shutdown modes, considering both process-related and external event scenarios.

Sherpa also prepared a letter in consideration of any risk implications that the modification may have on the broader site. Sherpa's advice does not cover the MHF update activities, which would occur later in the project schedule. However, the MIs associated with gas-fired boilers are well understood with clear statutory codes and standards specifying well-established control measures to minimise the likelihood of any of these scenarios.

## 6.1.3 Risk assessment

### Hazard and operability studies

The studies confirmed that the boiler package is supported by a high-integrity burner management system, multiple independent trips and interlocks, pressure and level safeguards, emergency isolation capabilities and established inspection and maintenance programs.

The overall outcome of the hazard studies is that the proposed boiler can be operated safely within the existing risk framework for the site, and no new intolerable risks were identified. Due to the sensitive nature of the hazard modelling and bow-tie outputs, the full studies will be provided to DPHI in parallel but are not intended for public release. All actions will be recorded and tracked in IXOMs environmental management system.

### Periodic risk assessment

The gas supply lines that would be repurposed from existing BIP infrastructure are not currently included in the IXOM QRA (as they are not currently in use for the IXOM CAP), but similar operations were historically included in the broader cumulative BIP QRA. The flammable gas pipelines were not a dominant risk contributor, as other larger flammable inventories/process equipment associated with Qenos presented a higher risk in the western area of the BIP than the pipelines.

Given that process equipment that was previously associated with Qenos will be removed from the site, the risk in this area will be lower than previously presented in the BIP QRA.

### Risk implications

The main concern from an offsite risk perspective is any scenarios that could escalate to cause a loss of containment of chlorine.

Table 6.1 summarises the potential scenarios associated with the proposed gas-fired boiler and qualitatively assesses the potential risk implications.

Based on the qualitative analysis of the MI scenarios (Table 6.1), the proposed gas-fired boiler is expected to have a minimal impact on the off-site risk profile of the existing IXOM CAP and proposed CLP, as the proposed boiler location and the use of an existing flammable gas pipe route minimise the risk of escalation to chlorine inventories.

## 6.1.4 Management measures and conclusions

It is not currently clear how the overall risk profile from the BIP would be managed in the context of changes to BIP approval and consent conditions considering the Qenos / Indorama shutdown and proposed BIP land sale. However, whilst the gas lines do not have an extensive risk profile they could continue to be allowed for in either the IXOM or BIP QRAs (if retained) by a modified condition of consent relating to risk, as agreed with DPHI when any changes to the consent are resolved.

In summary, this modification would not materially change the off-site risk profile from the existing IXOM CAP or proposed CLP.

**Table 6.1 Boiler MI scenarios**

| Scenario | Comments – effect on IXOM risk | Potential escalation to CAP | Potential escalation to CLP (Block L, Loc 16) | Effect on IXOM risk contours |
|---|---|---|---|---|
| Boiler explosion – internal explosion fired appliance | Frequency very low – numerous codes required control measures for fired appliances to prevent internal explosions. Frequencies typically of the order of 1x10-6 per year, i.e. well below industrial land use risk criteria of 50x10-6 per year.<br>Some potential for damage to IXOM control room (Loc 8) or caustic plant area (Loc 4). | Minimal<br>No escalation to pressurised or liquid chlorine handling areas<br>Nearest chlorine is electrolyser (Loc 5), low-pressure/vacuum gas, no significant inventory chlorine, shielded by<br>Loc 4 | None<br>Well separated in north part of IXOM land (Loc 16) | None |
| Boiler explosion – steam drum rupture | Frequency very low – numerous code required design measures for boilers to prevent overpressure/rupture.<br>Frequencies typically of the order of 1x10-6 per year, i.e. well below industrial land use risk criteria of 50x10-6 per year<br>Some potential for damage to IXOM control room (Loc 8) or caustic plant area (Loc 4). | | | |
| Gas supply line – loss of containment and fire/ explosion | No change - existing flammable gas lines, not included in IXOM QRA.<br>Mechanical integrity will be confirmed and relevant inspection tasks put in place by IXOM<br>Risk dominated by existing chlorine line along western boundary | No change<br>Existing flammable gas lines. | None – CLP will be within building and separation distance to pipe corridor. | None for IXOM QRA Risk will be less than existing BIP QRA in western area of BIP site as these are dominated by other process equipment (formerly Qenos) which will be removed. |

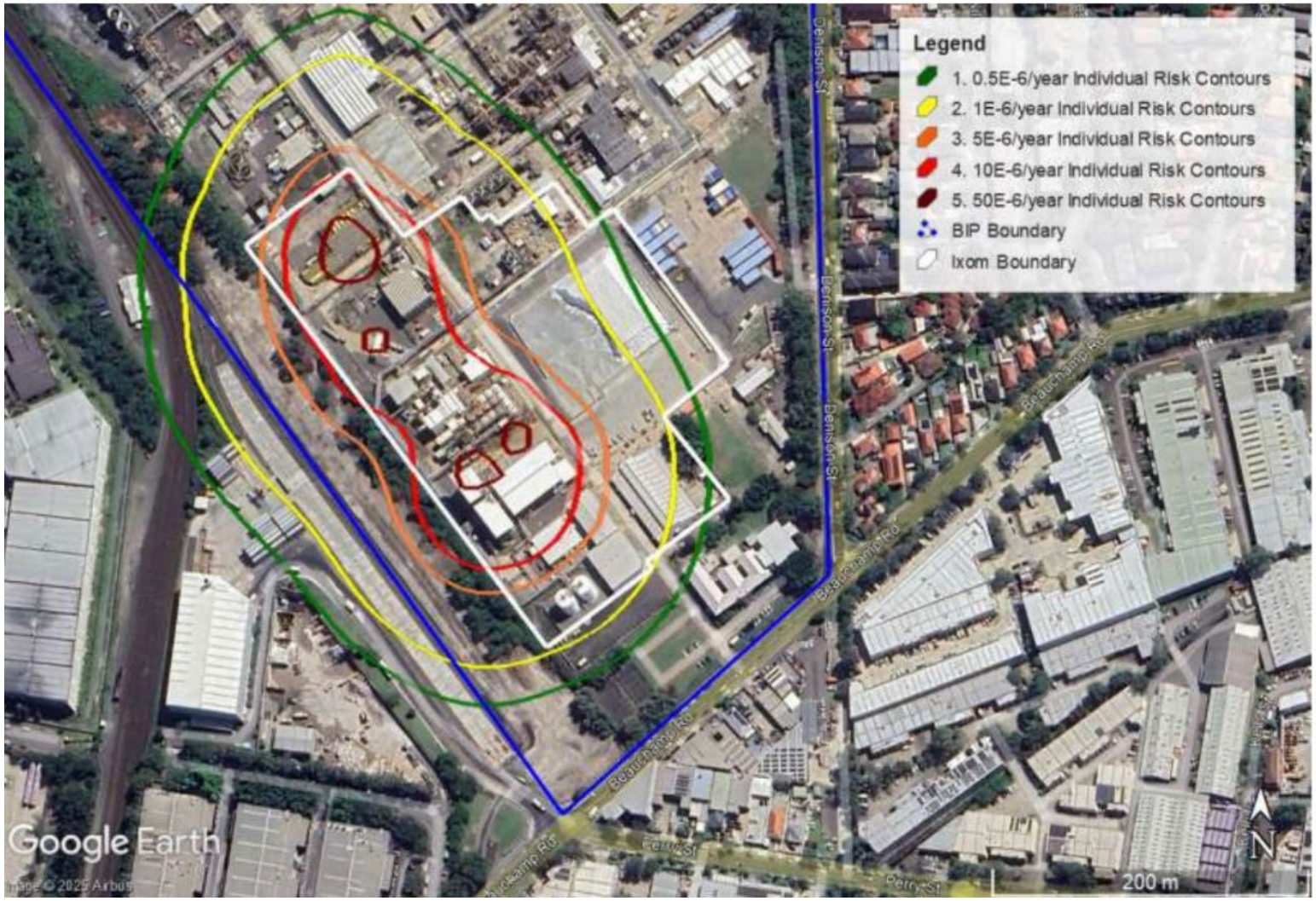



**Figure 6.1 CAP GRA 2025 risk contours (CAP QRA 2025)**

## 6.2 Noise

### 6.2.1 Introduction

An acoustic review was conducted by Muller Acoustic Consulting Pty Ltd (MAC) to assess the potential noise impacts of the proposed modification, including construction and operational noise associated with the new gas-fired boiler. This section summarises the acoustic review report, which is in Appendix F.

### 6.2.2 Assessment methods

The acoustic review assessment has been undertaken in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017; and
- NSW Department of Environment and Climate Change (DECCW) – NSW Interim Construction Noise Guideline (ICNG), July 2009.

#### Assessment against noise limits

**Operational noise limits**

The acoustic review assessed potential noise emissions generated by the modification and assessed them against operational noise criteria set out in Condition L4.2 of EPL No. 20547, as shown in Table 6.2.

**Table 6.2 Operational noise criteria from EPL #20547**

| Receiver location | Day<br>dB LAeq(15min) | Evening<br>dB LAeq(15min) | Night<br>dB LAeq(15min) |
|---|---|---|---|
| All privately owned residences | 65 | 55 | 50 |

Furthermore, Condition L4.4 of EPL No. 20547 states that new or replacement equipment is selected and/or installed so that no increase in noise emissions is thereby created when measured or computed at any point within one meter of the nearest boundary of any residence in the vicinity of the premises.

**Construction noise limits**

Condition L5.1 of EPL No. 20547 states that all activities likely to generate perceivable noise outside the boundaries of the lots on which the plant is located shall be restricted to the hours of 7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday, unless otherwise agreed to in writing by the EPA.

Construction activities that are not audible at the nearest affected receivers are permitted at any time.

It is noted that the EPL does not prescribe specific construction noise management levels (NMLs); hence, the operational noise criteria (Table 6.2) have been adopted for the assessment of potential construction noise impacts on residential receivers.

## 6.2.3 Potential impacts

### Operational Noise

The proposed new boiler would be a low NOx, high-efficiency Natural Gas Weishaupt model WM-G50/1-A ZM-NR (or equivalent) 6 MW Boiler, with an unattenuated sound pressure level (SPL) of 85 decibels A (dBA) at 1 m, equivalent to a sound power level (SWL) of 93 dBA.

Whilst this noise assessment conservatively assumed the boiler will have a SPL of 85 dBA, noise emissions could be mitigated through the use of sound absorbers on the burner fan, reducing sound pressure levels from 85 dBA to approximately 60 dBA. If a steam vent is incorporated, a silencer would be installed to further reduce noise.

The noise emission levels for acoustically significant existing plant and equipment on the IXOM site, are summarised in Table 6.3. The fleet SWL for the existing plant and equipment was calculated to be 112 dBA.

**Table 6.3 Significant existing equipment sound power levels, dB LAeq(15min)**

| Noise source/Item | Source power level (SWL) dBA | Source height (m) |
|---|---|---|
| Brine Treatment and Electrolysers | 105 | 5 |
| Caustic Evaporation Plant | 106 | 5 |
| HCL Product Plant | 99 | 5 |
| Sodium Hypochlorite Product Plant | 93 | 5 |
| Cooling Towers | 99 | 3 |
| Heavy Vehicles (low speed manoeuvring on site) | 103 | 1.5 |
| Excavator (20t or similar) | 105 | 2 |
| Front-end Loader (CAT930K or similar) | 104 | 2 |
| Chlorine Liquefaction Plant | 90 | Emitting façade up to 8 m |

Section 6.1 of the NPI indicates that where a development involves a discrete process, the criteria for the new/modified components may be set at 10 dBA or more below the existing requirements. The rationale for this guidance is based on simple decibel addition. Where two noise sources with a difference of 10 dBA or more are added together (logarithmic sum), there would be no net increase in the total noise generated. Hence, as the SWL for the new gas-fired boiler (unattenuated) is more than 10 dBA below the existing fleet SWL for the site, the project is not expected to result in an increase in noise emissions from the site.

### Construction Noise

The construction of the project involves the erection of a semi-enclosed roofed shelter, the installation of the new gas-fired boiler, and extension of the existing steam header and other utility pipelines by approximately 30 m from the existing CAP. The construction works would be progressive and are anticipated to occur over a period of greater than three weeks.

Construction details and methodology will be confirmed during detailed design, and excavation is not anticipated to be required to establish footings for the semi-open structure. However, as a conservative worst-case scenario, concrete cutting was modelled to assess potential construction noise impacts associated with footing installation in the event that excavations are required. This was assessed at the potentially most affected residential receivers on Denison Street, using the iNoise environmental noise modelling software.

The SWL of 118 dBA for concrete cutting was sourced from the Transport for NSW (TfNSW) Construction and Maintenance Noise Estimator Tool (CMNET). It is noted that the assessment assumed that the concrete saw would operate continuously for the duration of the assessment period (standard construction hours).

The results of the construction noise model (Figure 6.2), demonstrate that noise levels during concrete cutting are expected to be up to 52 dB LAeq(15min) at the nearest residential receivers on Denison Street (52 Denison Street). It is noted that the conditions of consent and EPL do not prescribe noise limits for construction activities; instead, they require that works audible at the boundary of nearby sensitive receiver locations must be undertaken during standard construction hours only.

Notwithstanding, a conservative assessment was undertaken to demonstrate that construction noise levels are expected to be below the operational noise limits of 65 dB LAeq(15min) for the day period during concrete sawing activities.

### 6.2.4 Management measures and conclusion

As described in Section 6.2.3, negligible noise impacts are predicted at all residential receivers. No additional noise attenuation and management measures are required to be incorporated into the operations or implemented at affected receivers, however existing good work practices and mitigation measures would continue to be implemented by IXOM in accordance with the existing approval, including:

- Construction work hours would be limited to Monday to Friday, 7 am to 6 pm, and Saturday from 7 am to 1 pm.
- Traffic associated with construction would follow already established truck routes.

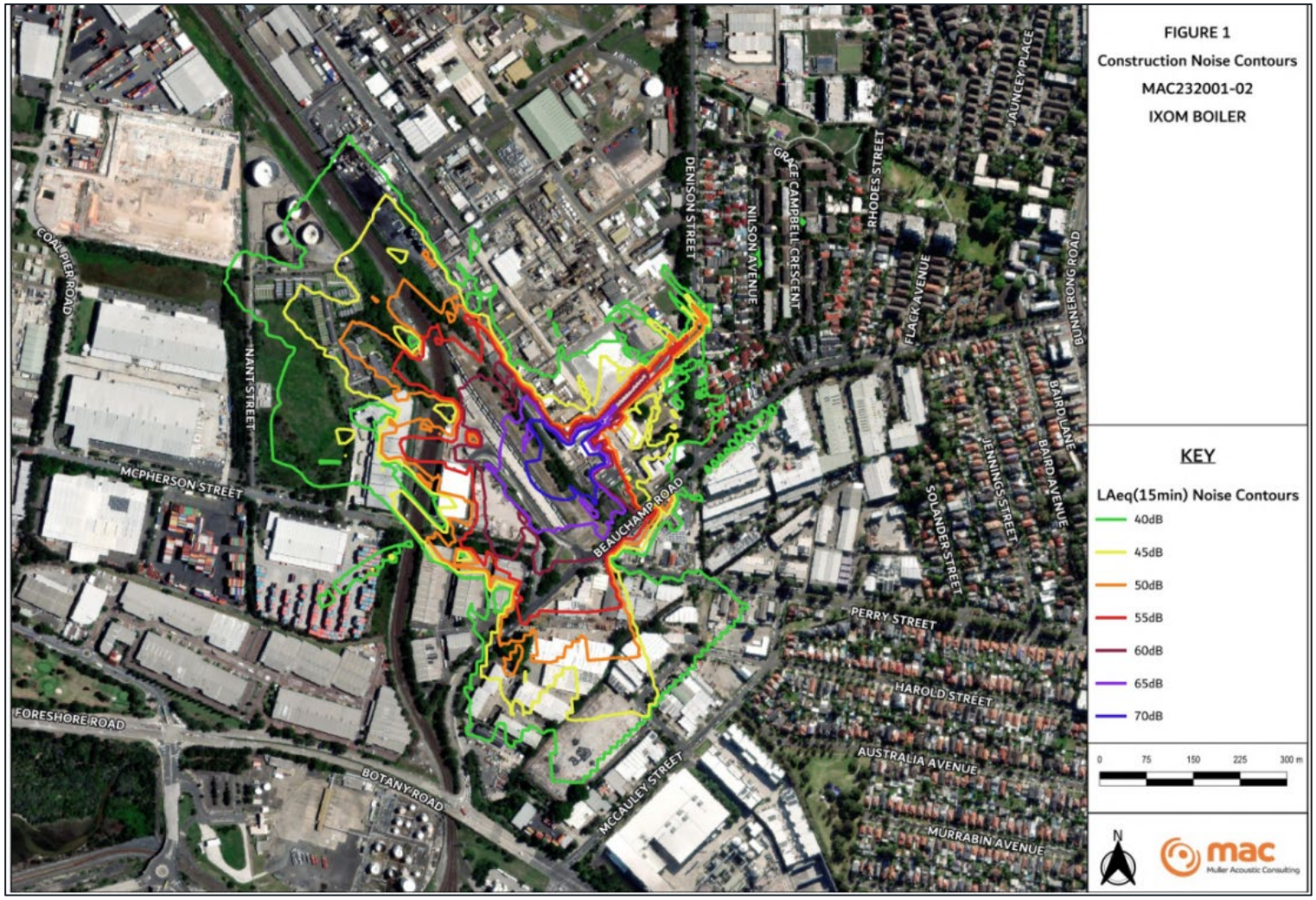



**Figure 6.2 Construction noise contours**

## 6.3 Air quality

### 6.3.1 Introduction

This section summarises the air quality impact assessment (AQIA) report prepared by Todoroski Air Sciences Pty Ltd (TAS), which is provided in Appendix G.

### 6.3.2 Overview of assessment methods

A qualitative assessment was carried out to assess the potential for air quality impacts from the modification, which includes the identification of potential air emission sources associated with the modification, a review of the proposed air quality control measures, and an assessment of the existing air quality levels in the vicinity of the site and local dispersion conditions.

### 6.3.3 Potential impacts

**Construction**

There is not expected to be any significant emissions of dust during the construction of the new boiler house, as the Colorbond-clad shed is to be installed over an existing concrete slab. However, construction of the proposal would involve minor concrete cutting and earthworks associated with the structural footings, which have the potential to generate minor quantities of dust, along with the temporary stockpiling of soils prior to collection for off-site disposal.

All internal vehicle routes used by construction vehicles are sealed, however diesel-powered equipment and vehicles would generate exhaust emissions during construction.

**Operation**

The potential air emissions associated with the proposed gas-fired boiler are expected to be minimal and meet the general standards for scheduled premises under the Protection of the Environment Operations (Clean Air) Regulation 2022. Combustion of natural gas produces negligible particulate matter and sulphur oxides; the principal combustion products are carbon dioxide (CO2), water vapour with small amounts of NOx and CO. The boiler is specified as a low-NOx unit and would discharge via a dedicated 12 m high vertical stack to promote effective dispersion above roof level.

The proposed boiler unit for the modification is a 6 MW high efficiency Weishaupt model WM-G50/1-A ZM-NR (integral fan) burner natural gas-fired boiler (or equivalent). The performance characteristics for the stack and expected emissions are outlined in Table 6.4.

**Table 6.4 Boiler emissions and stack characteristics**

| Parameter | Value |
|---|---|
| **Stack characteristics** | |
| Stack diameter | 0.55 m |
| Stack height | 12 m (4 m taller than the boiler house roof) |
| Flow rate | 3.48 $Am^3/s$ |
| Exit velocity | 14.6 m/s at 100% load |
| **Pollutants** | |
| CO | <50 ppm dry volume @ 3 % $O_2$ |
| NOx | <150 $mg/Nm^3$ dry @ 3 % $O_2$ & 1 atm |

As outlined in Table 6.4, the proposed modification would not result in any additional particulate matter or chlorine emissions which are the primary existing pollutants for the site. The operation of the new gas-fired boiler would result in some minor CO and NOx emissions, which include $NO_2$.

As stated in Section 2.2.6 the available background data indicate $NO_2$, and CO concentrations are generally low and well below the applicable criteria. With the prevailing wind conditions, potential air emissions from the modification would most likely be reasonably well distributed throughout the year. This means it is unlikely for nearby residential receptors to remain downwind of the operations for extended periods of time, and overall, the dispersion conditions should allow for air emissions from the modification to be reasonably well dispersed before reaching any residential receptors.

### 6.3.4 Management measures and conclusions

The proposed gas-fired boiler is expected to produce minimal air emissions, primarily carbon dioxide, water vapour, and small amounts of NOx and CO, with negligible particulate matter and sulphur oxides due to the use of natural gas. Emissions would be managed through good design and operational controls and effectively dispersed via a vertical stack 4 m above roof level.

Operational controls to manage emissions include:

- Use of a certified low-NOx burner (with flue-gas recirculation if needed),
- Proper commissioning and tuning to avoid rich firing,
- Maintaining clean air intakes and filters for efficient combustion,
- Routine inspections and maintenance per manufacturer guidelines,
- Installation of an uncapped vertical stack with sufficient exit velocity, positioned to prevent re-entrainment.

With the use of a low-NOx burner, proper commissioning and routine maintenance, the boiler's emissions are expected to be minimal and well within relevant criteria. Given the nature of the emission sources, the proposed controls, the receiving environment and prevailing winds, the modification is expected to result in no or minimal air quality impacts.

## 6.4 Other environmental matters

The environmental matters not requiring further assessment in the modification report are described in Table 6.5.

**Table 6.5 Other environmental matters**

| Group | Specific matter | Description |
|---|---|---|
| Amenity | Visual amenity | The 12 m stack height is proportionate to surrounding structures and would not significantly alter the visual landscape or introduce any elements taller than existing structures, such as the proposed 18.7 m high scrubber stack associated with the liquefaction plant and other large industrial facilities within the BIP. The roofed boiler house would be semi-enclosed and in character with the industrial aesthetic of surrounding buildings. As such, the new infrastructure would integrate visually with the existing built form and is expected to result in only minor change to the site's visual landscape or character. Further, the boiler housing would not be visible from public viewpoints. |
| Biodiversity | Vegetation | The project is within an intensely developed existing industrial development and does not involve the removal of vegetation or fauna habitat. The project would not have indirect impacts on biodiversity values adjacent to the site. |

| Group | Specific matter | Description |
|---|---|---|
| Contamination | Soil and groundwater | The site-wide Orica Voluntary Management Proposal (VMP) requires groundwater containment, monitoring and long-term management across the BIP, including operation of the hydraulic containment system and Groundwater Treatment Plant (GTP).<br>A soil and water management plan (SWMP; JBS&G, 2025; Appendix H) was prepared to document the procedures and standards to be followed in order to mitigate any potential risks to human health and the environment during construction of the modification, specifically if detailed design determines that minor excavation is required.<br>The SWMP found that, based on available sampling and analytical data within the BIP, the contaminants of potential concern include:<br>▪ Heavy metals (primarily mercury);<br>▪ Polycyclic aromatic hydrocarbons (PAHs);<br>▪ Total recoverable hydrocarbons (TRH);<br>▪ Benzene, toluene, ethylbenzene and xylenes (BTEX);<br>▪ Organochlorine pesticides (OCPs);<br>▪ Chlorinmated hydrocarbons (CHCs);<br>▪ Polychlorinated biphenyls (PCBs);<br>▪ Asbestos; and<br>▪ pH.<br>In the event that excavation is required, such as to allow for subsurface structural footings, the recommendations in Chapter 4 of Appendix H must be implemented, which includes a pre-construction soil assessment.<br>Further, any spoil excavated during construction activities within BIP land, including at the boiler location, must be managed in accordance with waste management provisions (Section 6.4) and consultation with Orica, consistent with existing contamination management frameworks. |
| Hazard and risk | Bushfire risk | Council mapping indicates the site is not bushfire prone. |
| | Flooding | As detailed in Section 2.2.5 there are minor proposed changes to the site layout aimed at mitigating flood risks to infrastructure; however, the existing stormwater network is expected to remain adequate to service the project. Flood mapping (Appendix B) indicates that the modification is not located within the 1% AEP Hazard area and would not negatively impact the existing flood behaviour, flood levels and velocity for floods up to and including the PMF within the site or the surrounding area.<br>Current water quality and quantity measures would continue to be implemented for the project, to ensure there are no adverse impacts on receiving waters from stormwater generated at the site. |
| Built environment | Private property, public domain, public infrastructure | Other than minor off-site vehicle movements, project structures and activities would be contained on the site and would not impact other private or public property or the public domain. |
| Economic | Livelihood, natural resource use, opportunity cost | The project would have a slight beneficial economic impact from the continuation of construction jobs in the local area. The modification represents excellent economic value in the context of sourcing a new supply of steam for the continued manufacturing of chlorine at the site, as the gas supply and majority of required pipework is existing. |
| Land | Land capability | The site is within the IN1 General Industrial zone and forms part of a wider industrial area. It is completely disturbed and cannot support agricultural uses. Therefore, its land capability class is not relevant to the project. |
| | Topography | There would be no changes to site topography as the boiler will be installed on existing hardstand. |

| Group | Specific matter | Description |
|---|---|---|
| Social | Community services and facilities | The project would not result in any change to operational employment and subsequent demand for community services. |
| | Health | Emissions from the project such as noise and air emissions are assessed in detail in Sections 6.2 and 6.3 and would not have a significant impact on sensitive receivers and would be managed in accordance with best practice. |
| | Housing availability | The project is for an industrial facility and would not result in an influx of workers or people and therefore would not increase demand for housing. |
| | Safety | The project involves a major hazard facility, and risk implications associated with the modification have been considered in Section 6.1, and provided in Appendix E. |
| | Social cohesion | The project would not result in an influx or change of profile of workers or other people and will not impact social cohesion. |
| Water | Groundwater quality | The modification will not alter groundwater quality or availability. Works are confined to existing sealed hardstand areas, and excavation, if required, will be minor and shallow. The site is under long-term groundwater containment and treatment managed by Orica in accordance with the EPA-approved Voluntary Management Proposal. The proposed boiler and associated infrastructure will not interact with groundwater or increase groundwater ingress risks. Any excavated material will be managed in consultation with Orica to ensure consistency with existing groundwater protection measures. As such, no change to groundwater quality or availability is expected from the modification. |
| | Water availability | |
| Waste | Waste management | Minor quantities of construction waste would be generated during construction, which may include concrete waste, steel offcuts, cardboard and plastic. Waste will be separated and recycled if possible, with any remaining waste taken off-site to an appropriately licensed waste disposal facility for recycling or landfill. If excavations are required during construction, any spoil generated will be managed in accordance with the specific management provisions outlined in the SWMP (Appendix H), as summarised below:<br>▪ Soils to be assessed and characterised by a qualified Environmental Consultant to facilitate waste classification reporting requirements in accordance with Waste Classification Guidelines, 2014, NSW EPA (EPA 2014) EPA Waste Classification Guidelines;<br>▪ Statements regarding materials being disposed via appropriately licenced facility or re-used under an order or exemption; and<br>▪ Requirements for recording waste disposal dockets or other waste documentation for any disposed waste.<br>During operation, the modification is expected to generate negligible operational waste associated with maintenance activities, and will not introduce any new waste streams to the site. All operational waste will be managed in accordance with existing waste management procedures at the site. |

## 6.5 Cumulative impacts

Potential cumulative impacts associated with the modification are outlined in the following sections.

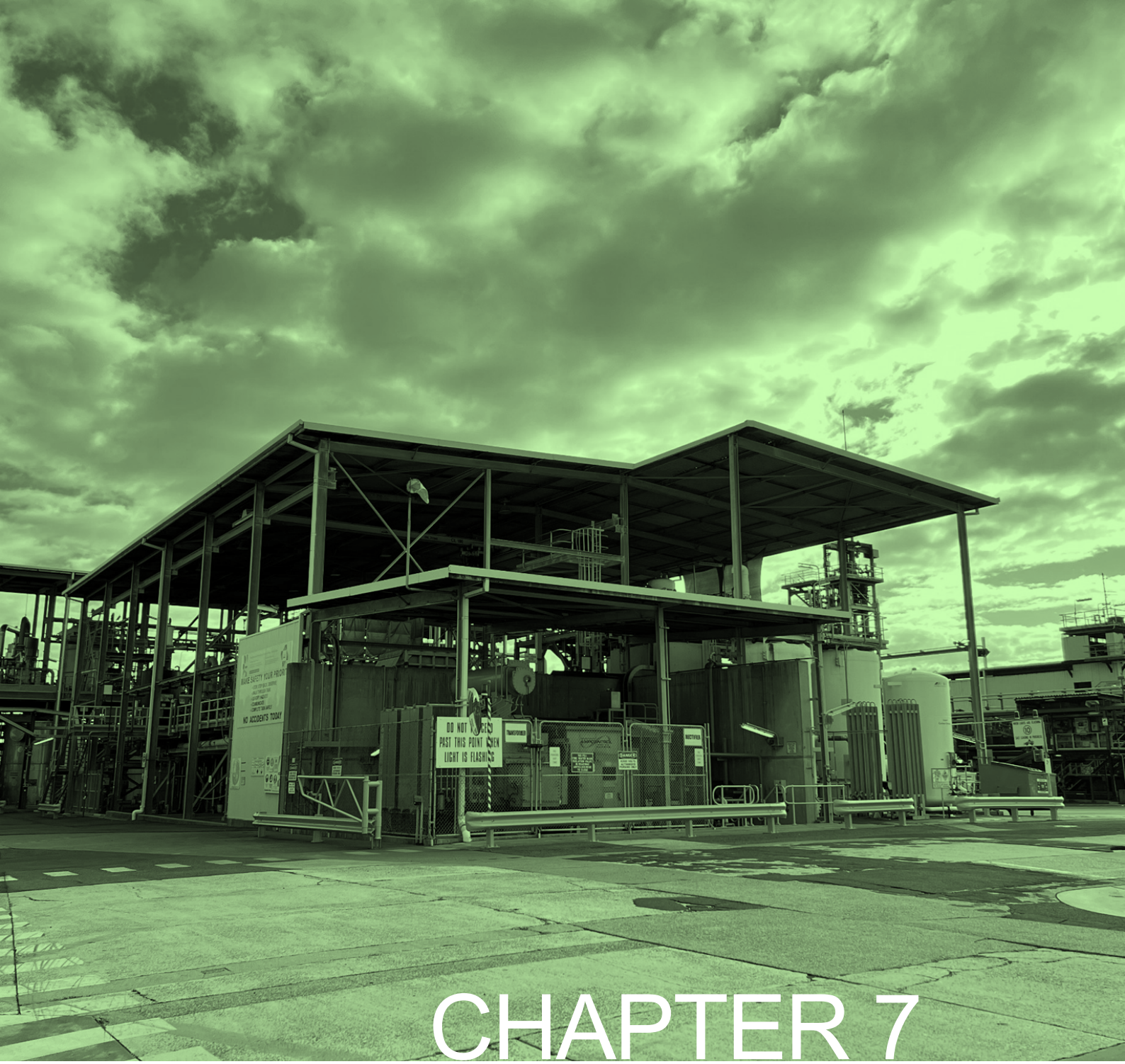
## Air quality

The modification is within the BIP, an established industrial area comprising operations generating particulates and gases. Emissions generated by the modification in combination with emissions from these other operations could potentially result in cumulative impacts.

However, the risk of significant cumulative impacts is considered low as the air emissions are well understood and effectively managed through modern design and operation in line with best practice operational standards mitigation measures (Section 6.3). Further, it is understood that both Qenos and Indorama have ceased operations in the BIP, reducing potential cumulative air impacts from the BIP.

## Noise

Like air quality, noise generated by the project could combine with noise from surrounding operations and result in cumulative impacts. However, as described in Section 6.2 the modification is expected to result in negligible noise impacts, and as such, cumulative impacts are considered unlikely, and no noise management measures are required.




# CHAPTER 7

## ENVIRONMENTAL MANAGEMENT, MONITORING AND REPORTING

# 7 ENVIRONMENTAL MANAGEMENT, MONITORING AND REPORTING

## 7.1 Introduction

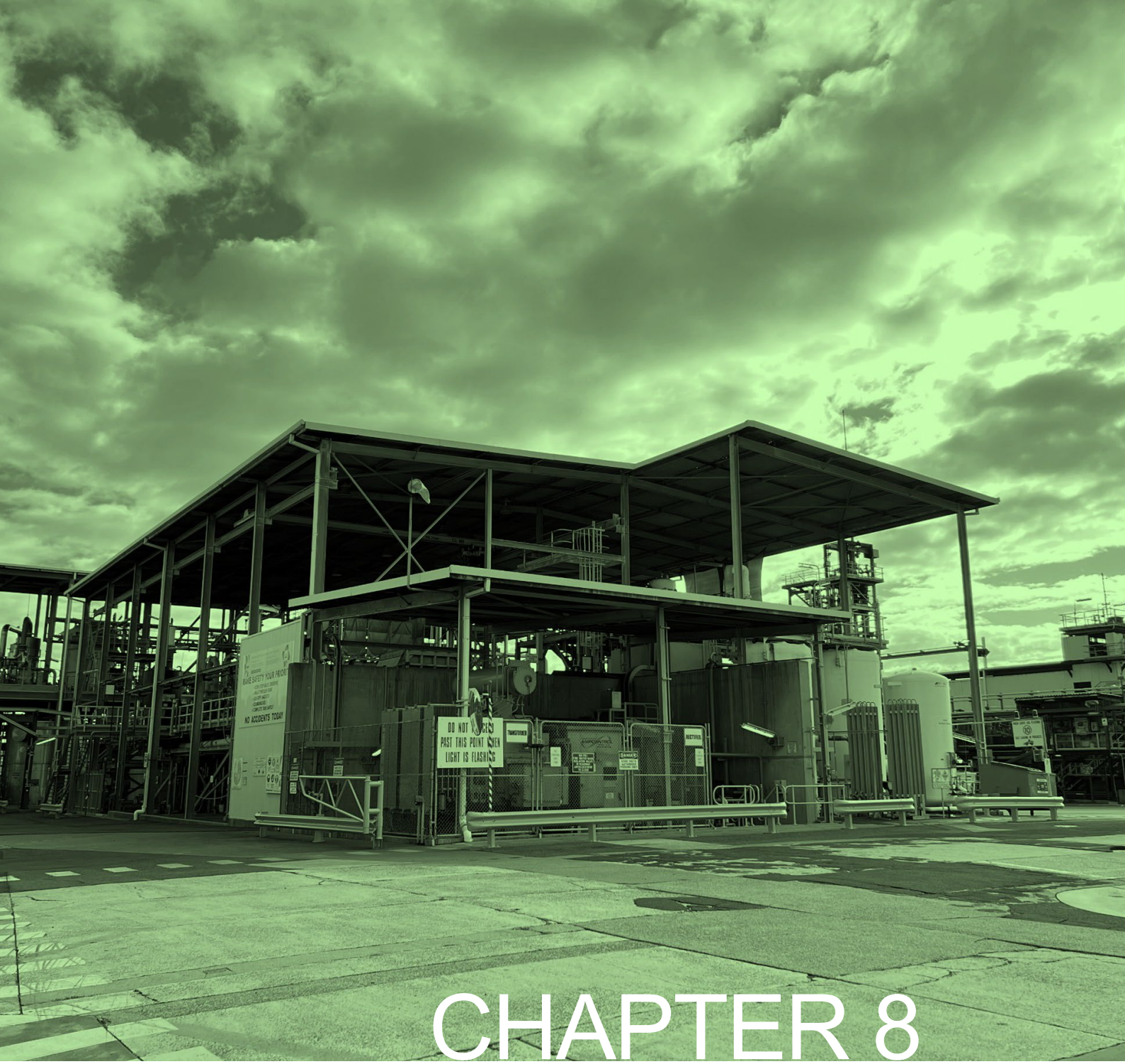
This chapter summarises the key management and mitigation measures for addressing the potential environmental impacts of the project.

## 7.2 Environmental management measures

The consolidated list of environmental management measures is in Table 7.1. These measures would be incorporated into the existing OEMP.

**Table 7.1 Consolidated environmental management measures**

| Management measures |
|---|
| **Operational hazards** |
| Whilst the gas lines do not have an extensive risk profile they could continue to be allowed for in either the IXOM or BIP QRAs (if retained) by a modified condition of consent relating to risk, as agreed with DPHI when any changes to the consent are resolved. |
| **Air quality** |
| Use of a certified low-NOx burner (with flue-gas recirculation if needed), |
| Proper commissioning and tuning to avoid rich firing, |
| Maintaining clean air intakes and filters for efficient combustion, |
| Routine inspections and maintenance per manufacturer guidelines, |
| Installation of an uncapped vertical stack with sufficient exit velocity, positioned to prevent re-entrainment. |
| **Noise** |
| No additional noise attenuation and management measures are required to be incorporated into the operations or implemented at affected receivers, however existing good work practices and mitigation measures would continue to be implemented by IXOM in accordance with the existing approval, including:.<br>▪ Construction work hours would be limited to Monday to Friday, 7 am to 6 pm, and Saturday from 7 am to 1 pm.<br>▪ Traffic associated with construction would follow already established truck routes. |
| **Contamination – soil and groundwater** |
| If soils are to be disturbed during construction works, Chapter 4 (Management Plan) of Appendix H must be implemented, which includes a soil assessment undertaken within the proposed disturbance footprint prior to commencement of those works. This will better inform the soil management procedures outlined in this report.<br>It is recommended that the assessment be conducted by an appropriately qualified environmental consultant, with soils characterised for the full suite of contaminants of potential concern (COPCs, as listed in Table 3.1 of Appendix H) to the anticipated depth of disturbance associated with the construction activities. |
| **Waste – waste management** |
| If excavations are required during construction, any spoil generated will be managed in accordance with the specific provisions outlined below:<br>▪ Soils to be assessed and characterised by a qualified Environmental Consultant to facilitate waste classification reporting requirements in accordance with Waste Classification Guidelines, 2014, NSW EPA (EPA 2014) EPA Waste Classification Guidelines;<br>▪ Statements regarding materials being disposed via appropriately licenced facility or re-used under an order or exemption; and<br>▪ Requirements for recording waste disposal dockets or other waste documentation for any disposed waste. |




# CHAPTER 8

## JUSTIFICATION FOR THE MODIFIED DEVELOPMENT

# 8 JUSTIFICATION FOR THE MODIFIED DEVELOPMENT

The IXOM CAP needs a constant and reliable steam supply for its operations. Historically, the CAP sourced steam externally from the Qenos-operated utilities plant within the BIP. However, following Qenos entering voluntary administration in April 2024, the existing 1.1 MPa steam supply ceased, leaving IXOM without a critical utility.

Steam is essential for CAP operations, including electrolysis, caustic evaporation, and downstream product plants. To maintain operations, a temporary 3 MW diesel-fired boiler was installed under a NSW EPA licence variation. However, this arrangement is unsustainable due to poor power output, risks associated with fuel storage and handling, and operational inefficiencies.

IXOM now seeks a more permanent on-site solution and proposes to modify the consent under Section 4.55(1A) of the NSW EP&A Act. The modification would allow the installation and operation of a gas-fired boiler, including a semi-enclosed roofed shelter (boiler house), ancillary equipment, and extensions to existing pipework to provide a reliable long-term steam supply for the CAP. Natural gas would be sourced from the existing Qenos-owned meter compound and conveyed to the IXOM CAP via currently redundant pipelines.

The modification will:

- replace the temporary diesel-fired unit, ensuring long-term operational continuity;
- provide secure on-site steam generation, removing reliance on external suppliers;
- be energy-efficient and low-emission, aligning with modern environmental standards, and;
- integrate with existing infrastructure, minimising environmental and visual impacts.

This transition is essential for maintaining the safe and efficient operation of the CAP and supports IXOM's long-term strategic and environmental objectives.

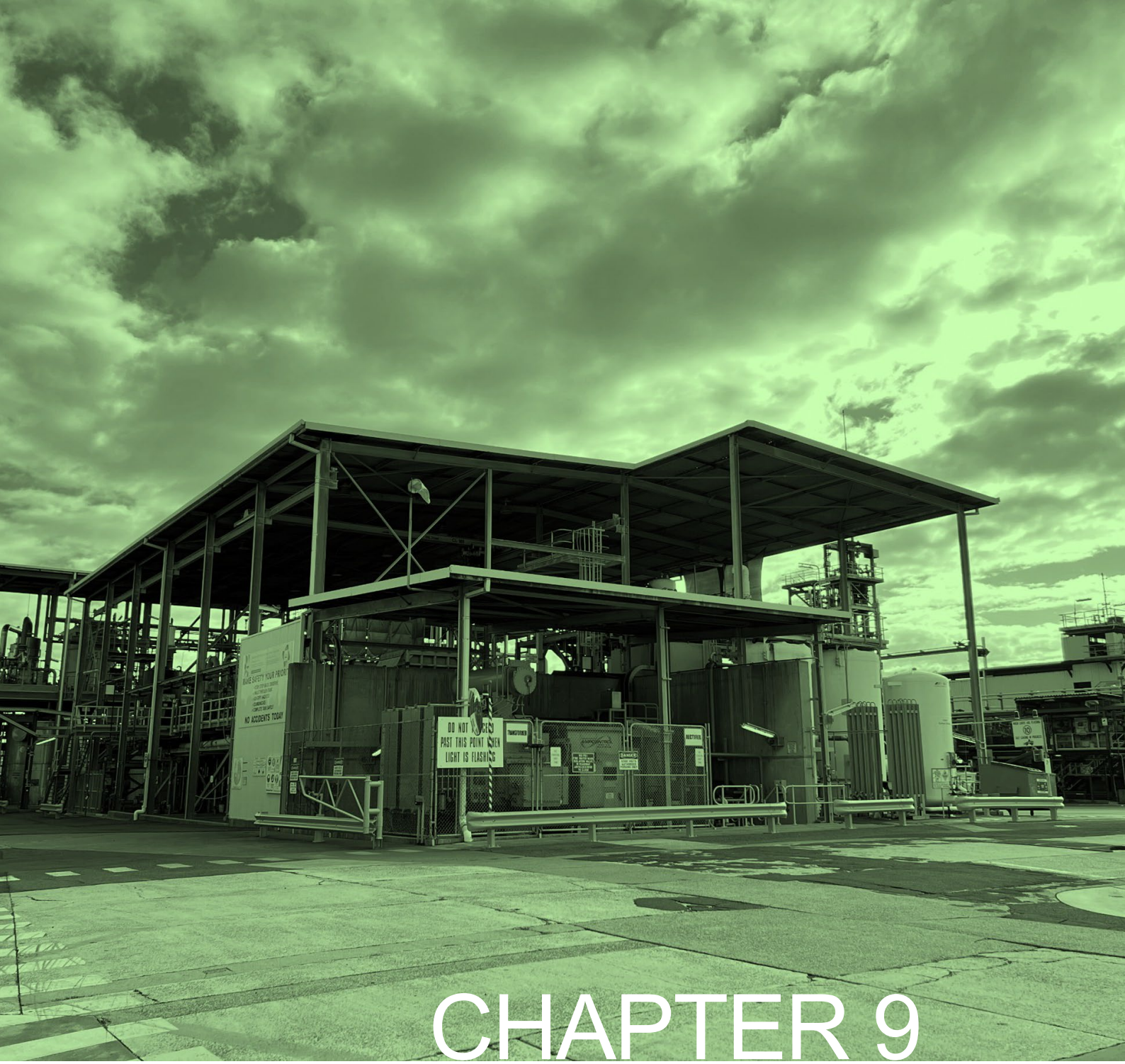
The Minister for Planning and Public Spaces is the consent authority and the modification application must be accompanied by a modification report. The modification is consistent with Section 1.3 of the EP&A Act by:

- supporting safe and efficient continuation of existing industrial operations;
- utilising existing infrastructure within a zoned industrial area;
- minimising environmental impacts through best-practice air and noise controls;
- contributing to economic resilience through reliable steam supply; and
- avoiding changes to biodiversity, heritage and community amenity.

The modification is consistent with the principles of ESD as follows:

- Precautionary principle: hazards and environmental impacts are well understood and controlled, and generate no new material risks or impacts.
- Intergenerational equity**:** upgrading to a cleaner, more efficient boiler reduces long-term emissions and maintains essential industrial capability.
- Conservation of biodiversity**:** no vegetation removal or habitat disturbance is required.
- Improved valuation, pricing and incentives: IXOM would bear the cost of emissions, compliance and control measures.

The modification enables the continued safe operation of the CAP, which produces essential water treatment chemicals used across NSW. The proposal ensures long-term operational stability without increasing environmental or off-site risk. Given its minimal impacts, reliance on existing infrastructure, and operational importance, the modification is in the public interest.




# CHAPTER 9

## REFERENCES

# 9 REFERENCES


Sherpa Consulting (2025). *CAP QRA 2025* (Document Ref. 21972-RP-001, Revision 1, 22 July 2025).

Muller Acoustic Consulting (2025). *Acoustic Review for the IXOM Boiler Modification*.

Todoroski Air Sciences (2025). *Air Quality Impact Assessment for the IXOM Boiler Modification*.

NSW Department of Planning and Environment (2022). *State Significant Development Guidelines – Preparing a Modification Report*.

NSW Environment Protection Authority (2017). *Noise Policy for Industry*.

NSW Department of Environment and Climate Change (2009). *Interim Construction Noise Guideline*.

NSW Environmental Planning and Assessment Act 1979.

NSW Environmental Planning and Assessment Regulation 2021.

NSW Protection of the Environment Operations Act 1997.

Sydney Airport Corporation (2025). *Airspace Protection Guidance*.




# APPENDIX A

## CONSOLIDATED PROJECT DESCRIPTION

## Consolidated project description

The Chlor-alkali Plant (CAP), located within the Botany Industrial Park (BIP) at 16-20 Beauchamp Road, Banksmeadow NSW 2019 is a State significant development (SSD) operated by IXOM Operations Pty Ltd (IXOM). The CAP was originally granted consent DA35/98 in 1998 for the installation of a replacement CAP with a production capacity of 35,000 tonnes per annum of gaseous chlorine.

The new CAP was commissioned in 2001, replacing an older mercury cell technology-based plant. The development has undergone seven modifications since its original approval, including construction and relocation of sodium hypochlorite manufacturing facilities, demolition of the old CAP, replacement of caustic tanks, and construction of a repackaging facility. The sixth modification allowed for the construction and operation of a chlorine liquefaction plant (CLP) at the site, whilst the seventh modification replaced a temporary diesel boiler with a modern gas-fired boiler to provide the site with an ongoing and reliable steam supply.

The CAP manufactures chlorine and caustic soda through the electrolysis of salt using mercury-free membrane technology. Hydrogen is generated as a by-product during this process and is combined with chlorine to manufacture hydrochloric acid. Chlorine is also used to manufacture sodium hypochlorite, ferric chloride and liquefied chlorine in downstream ‘product plants’, where all chlorine produced on site is consumed.

The site operates under EPL 20547, permitting chemical production, chemical storage, waste processing (non-thermal treatment), and waste storage.




# APPENDIX B

## FLOOD ADVICE CERTIFICATE

Monday 21 October 2024

Our Ref: FA – 2024/245
KBR
13/201 Kent Street
SYDNEY NSW 2000

**Flood Advice Certificate for 16-20A BEAUCHAMP ROAD BANKSMEADOW**

This certificate is automatically generated from the information provided from the flood study identified below. Council cannot comment on the accuracy of the result.

This certificate has been generated from the following study:

**Springvale Drain and Floodvale Drain Flood Study, BMT WBM Pty Ltd, 2014**

The information provided can be used to assist in understanding the extent of flooding affecting this property and can be used to assist in preparation of a development application and associated flood reports. It is recommended that the information in this report be interpreted by a suitably qualified professional.

The information is provided in good faith and in accordance with the provisions of s.733 of the Local Government Act.

For the purposes of complying development, this certificate identifies if the property is:

a) A flood storage area
b) A floodway area
c) A high hazard area

Flood maps are provided below. A suitably qualified engineer should be engaged to determine whether the property is:

d) A flow path
e) A high risk area

| | |
|---|---|
| Is this property affected during the 1% AEP Flood Event? | **Yes** |
| Is this property affected during the PMF Event? | **Yes** |
| 1% AEP Flood Hazard<br>Note Council considers flooding H3-H6 as high hazard. See below for more information. | **H3** |
| 1% AEP Flood Function | **Flood Storage** |
| 1% AEP Flood Level (maximum level for property) (m AHD) | **13.19** |

Flood related development controls are provided in Bayside Council Development Control Plan 2022, Section 3.10, and Section 9.5. Use the following link to download: https://www.bayside.nsw.gov.au/services/planning-and-building/development-approvals/planning-controls-and-constraints

Should you require advice regarding specific development controls related to your development proposal, please contact Council's Development Engineers at devengreferrals@bayside.nsw.gov.au.

Should you require additional information regarding flooding, please contact Council's Stormwater and Floodplain Engineer, Aaron Biffin, on 02 9366 3840.

## 1% AEP Flood Information

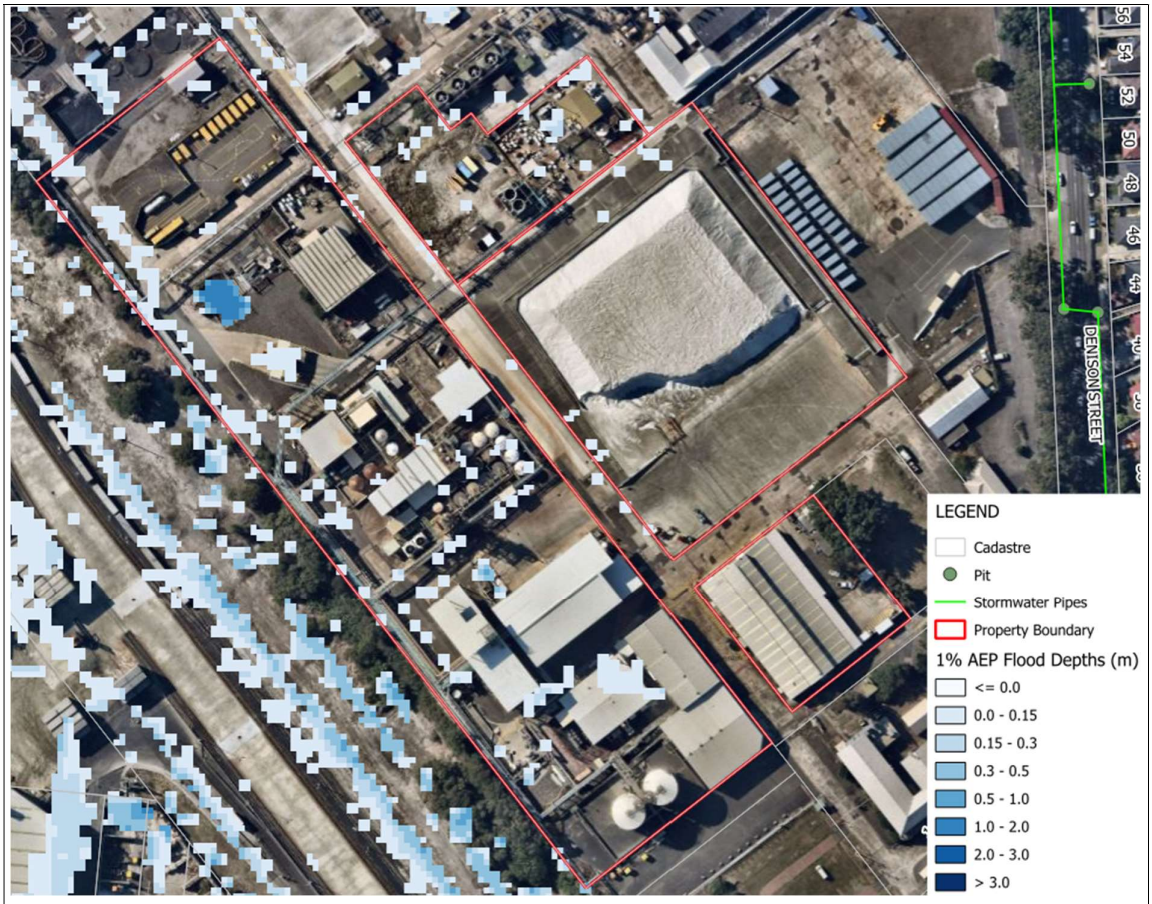
| Location | 1% AEP Flood Level (m AHD) | PMF Level (m AHD) |
|---|---|---|
| **1** | 8.07 | 8.16 |
| **2** | 9.97 | 10.26 |
| **3** | 10.32 | 10.38 |
| **4** | 12.66 | 12.69 |
| **5** | 12.86 | 12.88 |



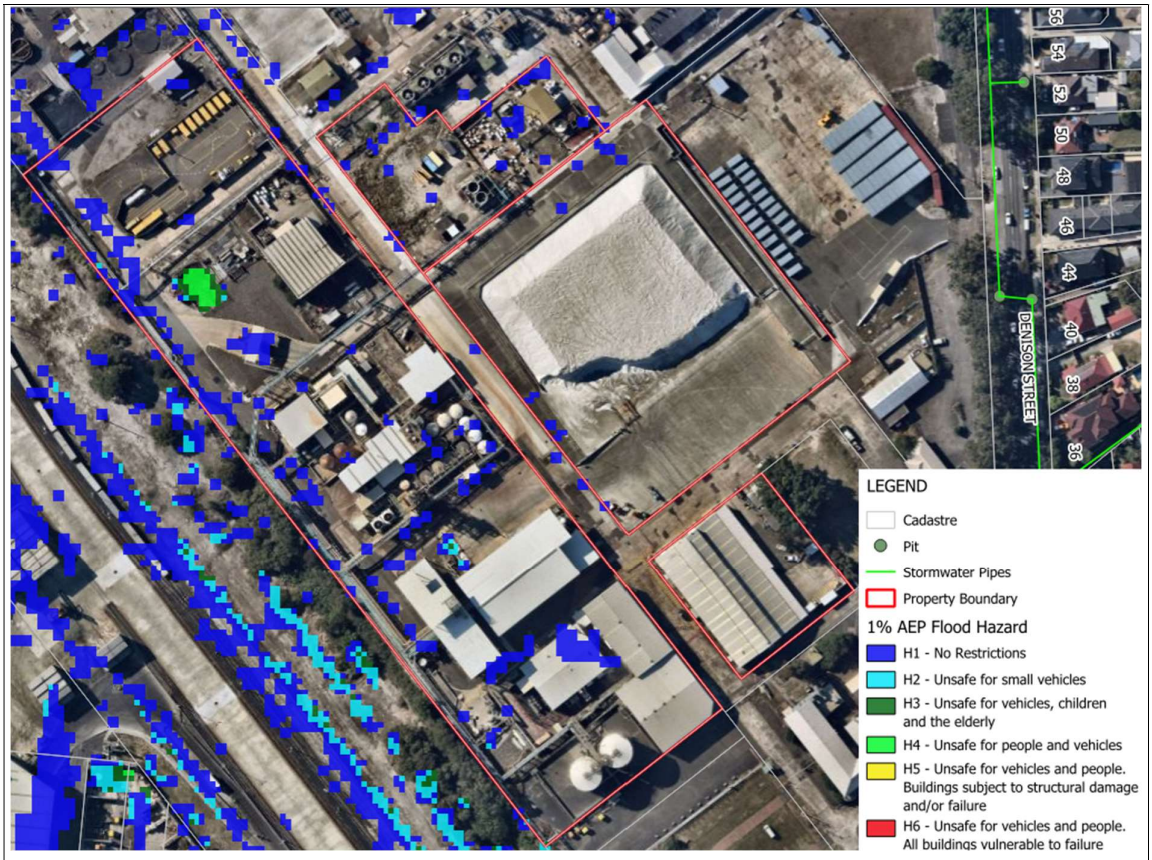

Flood Information Points

Property Boundary

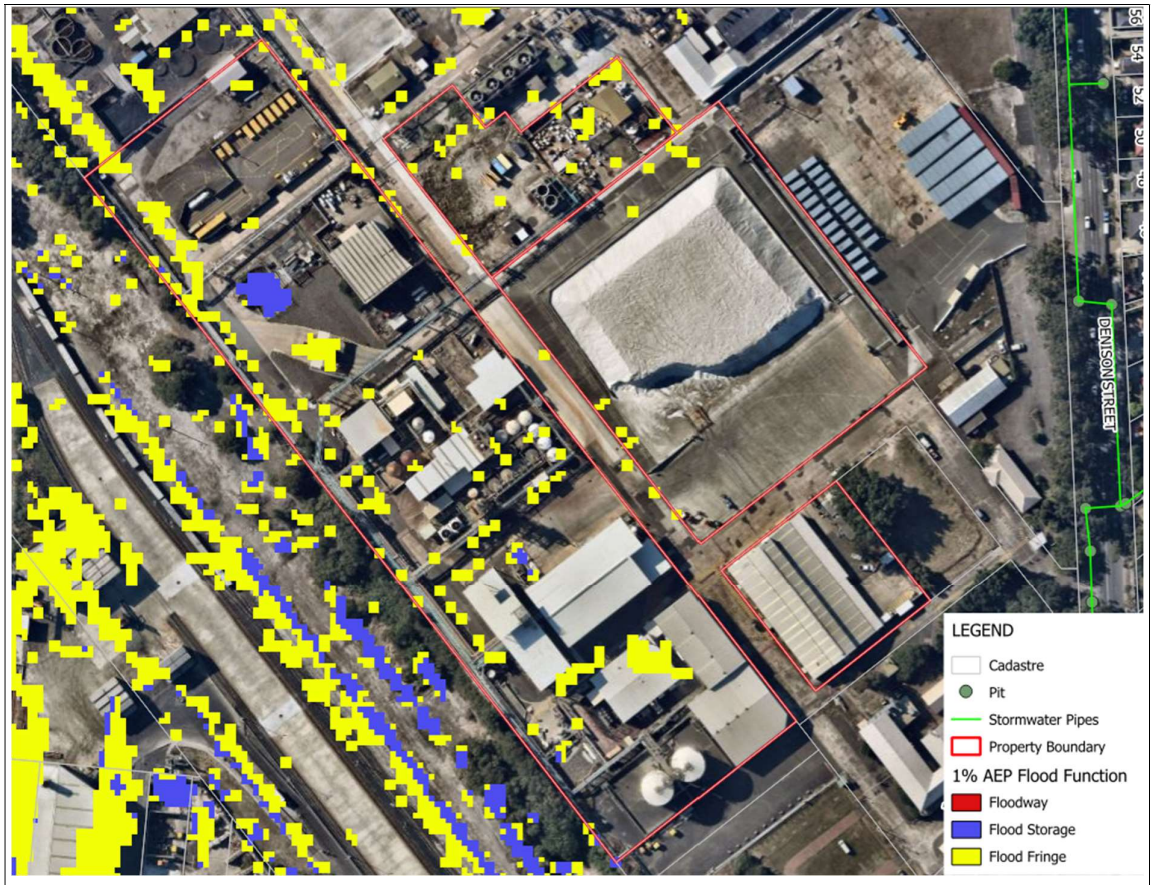
Stormwater Pipe




1% AEP Flood Extent Map




1% AEP Flood Hazard Map




1% AEP Flood Function Map

# PMF Information




PMF Flood Extent Map




# APPENDIX C

## GEOTECHNICAL INVESTIGATION

# Project Gemini
# Chlorine Liquefaction Plant
# Definitive Feasibility Study & Detailed Design

Geotechnical Investigation Report



# Project Gemini
# Chlorine Liquefaction Plant
# Definitive Feasibility Study & Detailed Design

## Geotechnical Investigation Report

Prepared for:
**IXOM OPERATIONS Pty Ltd**
Level 8, 1 Nicholson Street East Melbourne VIC 3002

Prepared by:
**Kellogg Brown & Root Pty Ltd**
ABN 91 007 660 317
Eora Country
Level 13, 201 Kent Street | Sydney NSW 2000 | Australia
GPO Box 1618 | Sydney NSW 2001 | Australia

11 March 2025

KBR Document Number:
SEG452-01-TD-GE-REP-0001-Rev0

IXOM Document Number:
PC.20301993-11-101_0

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## Acknowledgments

KBR acknowledges and respects the Traditional Custodians of the land on which it operates throughout Australia. We recognise their enduring connection to the land, waterways, cultural heritage, and communities. KBR also pays tribute to the wisdom and leadership of their Elders, both past and present.

We acknowledge and appreciate the permission granted to use copyright information, recognising the importance of intellectual property, and respecting all relevant laws and regulations. We are committed to upholding ethical and legal standards in our use of copyrighted material, and we value the contributions of creators and authors to knowledge and innovation.


## Limitations Statement

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to **provide geotechnical report (produced by Macquarie Geotech Pty Ltd) at IXOM Botany site** in accordance with the scope of services set out in the contract between KBR and **IXOM OPERATIONS Pty Ltd** ('the Client'). That scope of services was defined by the request of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from **subcontractor's report and the report has been reviewed as per relevant Australian and International Standards.** The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to **subcontractor's report** provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

The findings, observations and conclusions expressed by KBR in this report are not, and should not be considered, an opinion concerning **additional work outside of the scope of work**. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations, and conclusions are based solely upon **site conditions, information, drawings supplied by the client** in existence at the time of the investigation.

## Revision History

| Revision | Date | Comment | Signatures | | | |
|---|---|---|---|---|---|---|
| | | | Originated By | Checked By | Technical Approval | Project Approval |
| 0 | 11/03/25 | Issued for Use | Jack Chen | Mikkel Gade | Mahesh Dhargalkar | Mahesh Dhargalkar |
| | | | | | | |

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Section Page

**EXECUTIVE SUMMARY**

**APPENDIX A: MACQUARIE GEOTECH - GEOTECHNICAL INVESTIGATION REPORT**

# Executive Summary

As Macquarie Geotech is not ISO 9001 certified, this report is produced to attach geotechnical investigation report in the Appendix A below to assist with KBR Quality Control in issuing the document.

# Appendix A: Macquarie Geotech - Geotechnical Investigation Report

MACQUARIE GEOTECH



# Matraville Chlorine Liquefaction Plant

Job No.: G24469

IXOM Document No: PC.20301993-11-101

Submitted to:

Kellogg Brown and Root Pty Ltd

ABN 91 007 660 317

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Level 13, 201 Kenty Street

Sydney  NSW 2000

Attn: Mahesh Dhargalkar

Report No.: G24469

# Matraville Chlorine Liquefaction Plant, NSW 2036

REVISION CONTROL

| Revision | Date | Details | Prepared By | Reviewed By | KBR Project Manager |
|---|---|---|---|---|---|
| 00 | 20/1/2025 | DRAFT | Konstantine Routledge | Gavin Boyd | John Phipps |
| 01 | 24/02/2025 | Final | Konstantine Routledge | Gavin Boyd | John Phipps |
| 02 | 11/03/2025 | Final | Konstantine Routledge | Gavin Boyd | Mahesh Dhargalkar |

MACQUARIE GEOTECH

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## Appendices

Appendix A – Geotechnical Explanatory Notes
Appendix B – Site Plan & Borehole Locations
Appendix C – Borehole Logs
Appendix D – Laboratory Test Results

# 1 INTRODUCTION

At the request of Kellogg Brown & Root Pty Ltd (KBR). Macquarie Geotechnical (MG) has carried out a geotechnical investigation new Chlorine Liquefaction plant and relocation of the Hypo Tanker loading bay. It is understood from the project brief that geotechnical investigation is required.

The objective of the investigation is to provide a geotechnical investigation report.

The comments and opinions expressed in this report are based on the ground conditions encountered during the site work and on the results of tests carried out in the field and in the laboratory. There may, however, be special conditions prevailing on the site which have not been disclosed by this investigation and which have not been taken into account by this report.

# 2 PROPOSED DEVELOPMENT

It is understood that the proposed development will include the construction of a New Chlorine Liquefaction Plant in the place of an existing Sodium Hypochlorite (Hypo) Tanker Loading Bay. This Hypo Tanker Loading Bay is proposed to be relocated Northwest near the existing Sodium Hydroxide (caustic) Tanker Loading Bay. Figure 1 on the following page shows the proposed development plan provided by KBR.




**Figure 1: Proposed Development Plan provided by KBR**

# 3 SCOPE OF INVESTIGATION

The agreed scope of works are as follows:

- Undertake a brief desk study of the site to confirm the likely geological conditions of the site and to develop a geological model for the site.
- Undertake Before You Dig – Australia (BYDA) services search. Service locator provided by the client.
- Mobilisation of a one track/truck mounted rig. Drilling, logging and sampling of five boreholes to a depth of up to 6.45m as per Table 1. Additional boreholes were drilled due to obstruction.
- In-situ testing comprised of Dynamic Cone Penetrometer (DCP) and Standard Penetration Testing (SPT).

**Table 1: Borehole Scope**

| Hole ID | Eastings (m) | Northings (m) | RL (AHD) | Depth (m) | Termination Reason |
|---|---|---|---|---|---|
| BH01 | 335626 | 6241259 | 12.00 | 6.00 | Target Depth |
| BH02 | 335593 | 6241244 | 11.00 | 6.00 | Target Depth |
| BH02a | 335597 | 6241244 | 11.00 | 1.70 | Criteria Satisfied |
| BH03 | 335586 | 6241257 | 11.00 | 6.00 | Target Depth |
| BH04 | 335576 | 6241229 | 11.00 | 1.41 | Possible concrete obstruction |
| BH04a | 335574 | 6241225 | 10.00 | 6.00 | Target Depth |
| BH05 | 335535 | 6241314 | 9.00 | 0.40 | Concrete Obstruction |
| BH05a | 335534 | 6241313 | 9.00 | 0.40 | Concrete Obstruction |
| BH05b | 335534 | 6241315 | 9.00 | 0.51 | Concrete Obstruction |
| BH05c | 335532 | 6241314 | 9.00 | 6.45 | Target Depth |

- Samples were taken at regular intervals and at every change of strata to allow for laboratory testing and returned to our NATA accredited laboratory in Sydney, NSW and Envirolab. Laboratory testing comprised the following:
    - Five Moisture Content tests
    - One Atterberg Limits and Linear Shrinkage tests.
    - Three California Bearing Ratio (CBR) tests.
    - Three Maximum Dry Density/Standard Compaction tests
    - Five Particle size distribution tests
    - Four Direct Shear Box Tests (non-cohesive)
    - One Direct Shear Box Test (cohesive)
    - Four Soil Particle Density Tests
    - Four Soil Aggressivity Tests
    - One Total Organic Content Test

# 4 SITE DESCRIPTION

The site is located in located within the south-western corner of the Botany Industrial Park (BIP), off Denison street in Banksmedow NSW 2019 (Lot 1101 DP1227173).

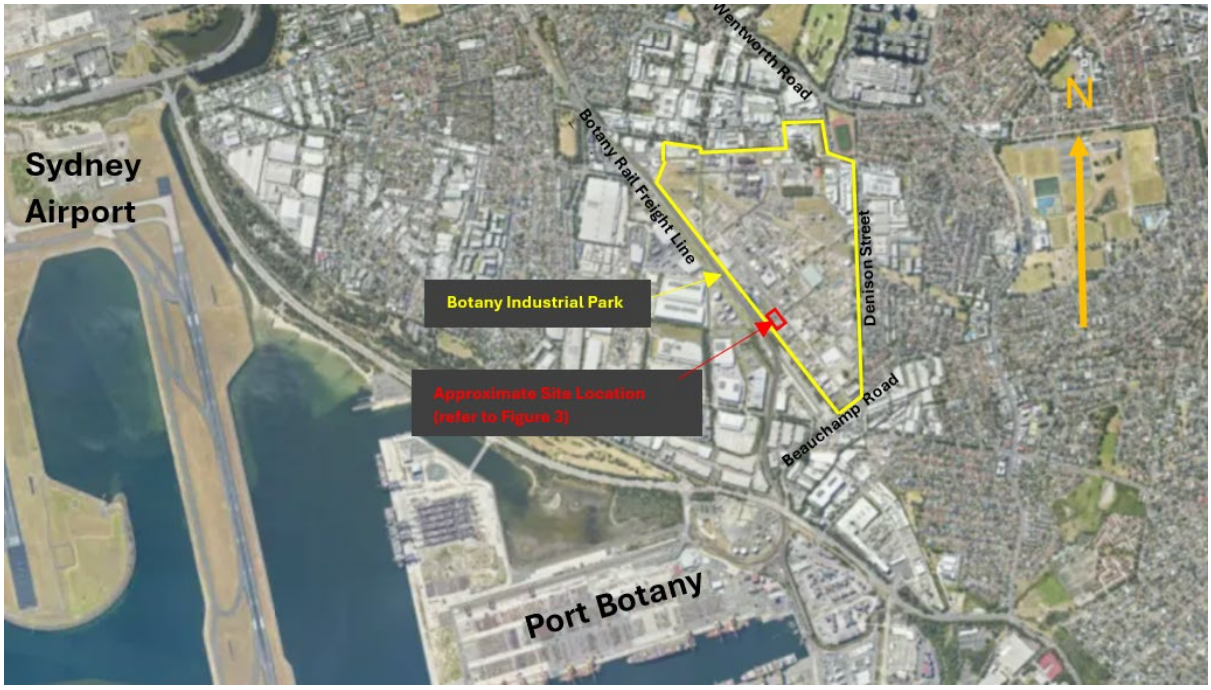



**Figure 2: Approximate Site Location**

The site covers two separate areas with a total approximate area of about 6500 m² (refer Figure 2)

The area of the site is relatively flat with a slight fall to the west of less than 1° ranging from in elevation 9.00 to 12.00 AHD. The site is occupied by loading bays and other chemical plant processing buildings predominantly located on hard standing and hard gravel fill layers with no vegetation or tree cover.

Historical imagery of the site indicates the plant has been operational since at least 1943 with significant structures present on site.

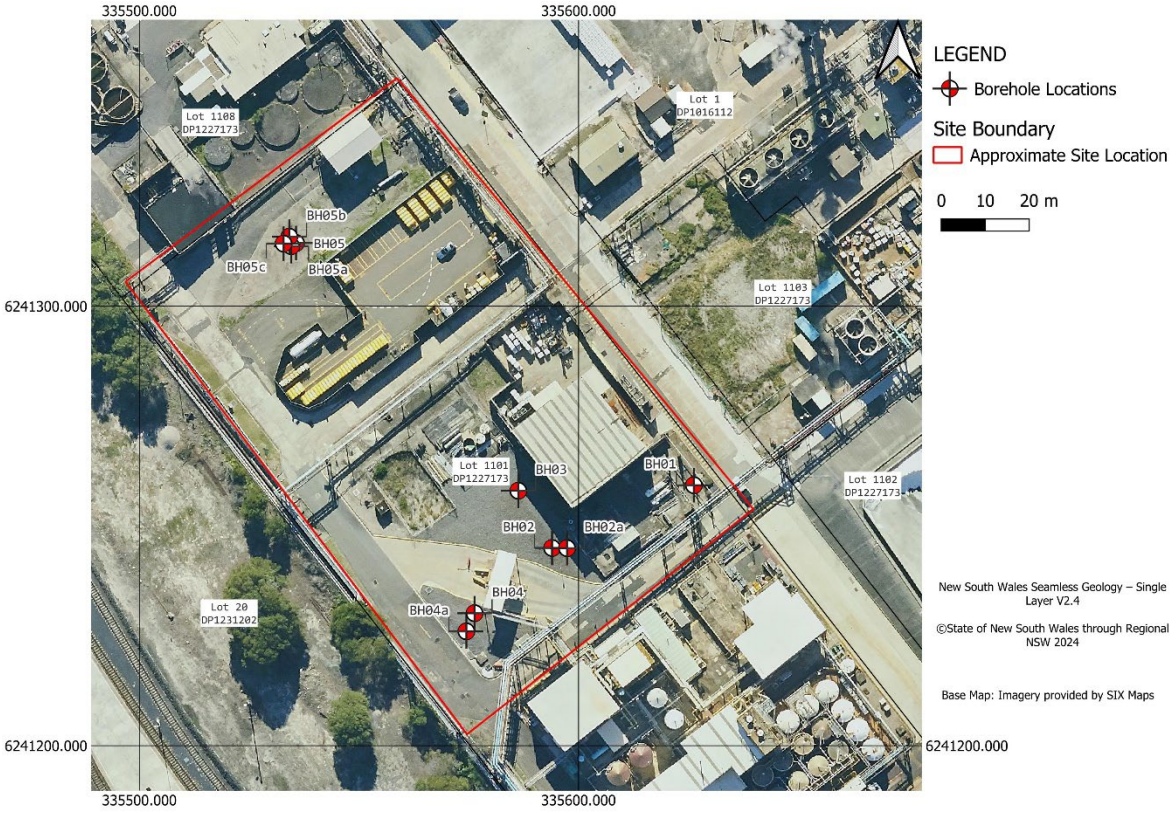



**Figure 3: Site Location**

## 5 DESK STUDY

A brief desk study was undertaken using readily available geological and geotechnical information and included the following:

- NSW Seamless Geological Map.
- Geology website – MinView.
- NSW Acid Sulfate Map.
- Published Literature.

## 5.1 Regional Geology

The NSW Seamless Geological map is shown in Figure 4 below:

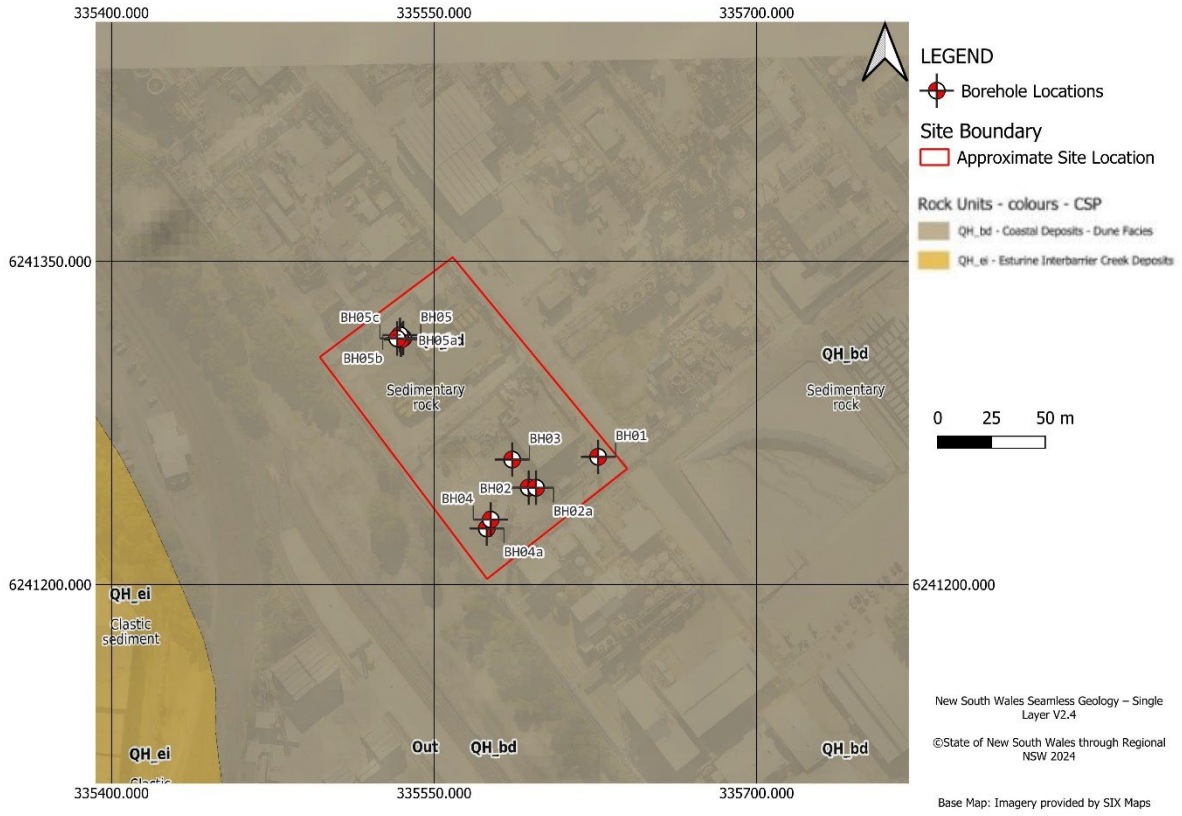



**Figure 4: Seamless Geological Map Overlay**

With reference to the Seamless Geological map in Figure 3, the site is underlain by the following:

**Table 2: Summary of Geology**

| Geological Symbol | Stratigraphic Unit | Description |
|---|---|---|
| QH_bd | Coastal Deposits – Dune Facies | Marine-deposited and aeolian-reworked coastal sand dunes. |
| QH_ei | Estuarine interbarrier creek deposits | Fine- to medium-grained lithic-carbonate-quartz sand (marine-deposited), silt, clay, organic mud, gravel, shell material. |

The site is generally underlain by coastal deposits including marine deposited and aeolian reworked sand dunes.

## 5.2 Groundwater Bores

There are various existing groundwater boreholes in the area. The closest recorded groundwater data is approximately 250m west of the site. This borehole indicates groundwater is approximately 8.40m below ground level. Other groundwater wells within the Botany Industrial Park have been drilled to 30 m to 35 m without encountering bedrock and groundwater at depths as shallow as 2 m. The logs, where the lithology was recorded, have predominantly been sands, however, include clay and peat layers ranging in thickness from 10 mm to 1.6 m.

One well (GW103437), located about 300 m south-west of the site, indicated sandstone at a depth of 20.7 m, however, other wells surrounding this well which we drilled up to 24.3 m to 29.9 m did not encounter sandstone bedrock.




**Figure 3: Groundwater Borehole Data**

## 5.3 Acid Sulphate Maps

Reference is made to the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Atlas of Australian Acid Sulphate Soils indicating extremely low to low risk of acid sulphate soils on site.

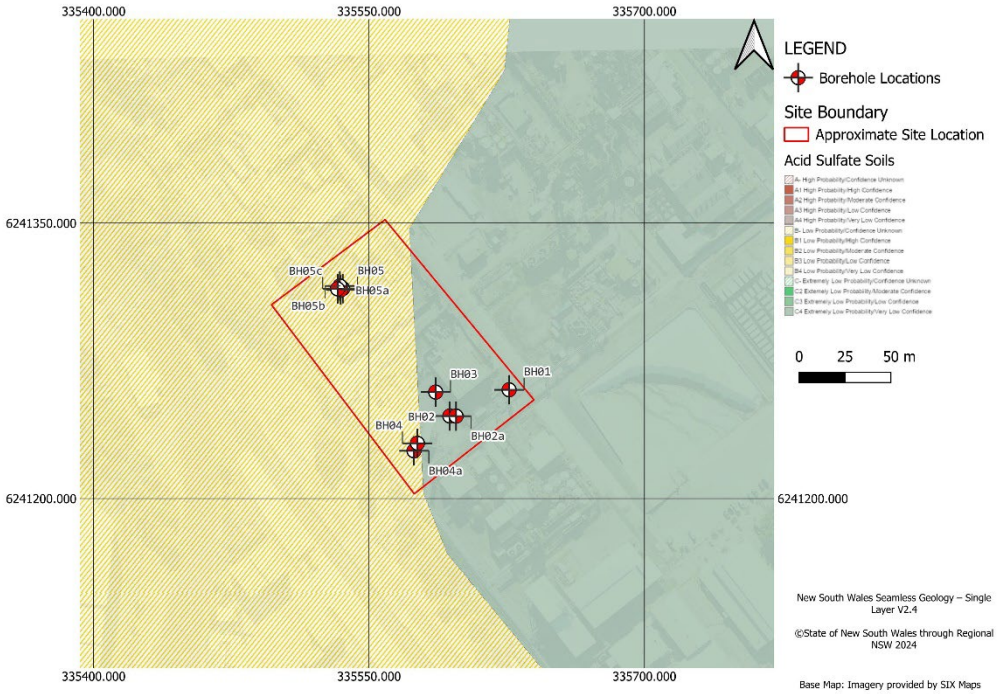



**Figure 4: Acid Sulphate Map overlay**

## 5.4 Published Information

Reference to the Sydney 1: 100 000 Geology Notes indicates that the Botany Bay is underlain by quaternary sediments up to 80 m thick that overlie an eroded bedrock surface (Hawkesbury Sandstone). The site is located in an area underlain by clean quartzose sand ("Marine Sand"). The "Marine Sand" together with other layers observed in the Marine Sand are described below;

- Marine Sand - up to 30 m thick and comprising clean, medium grained, well-sorted sand. It is shell free and 99 percent rounded quartz grains.
- Peat layers are often discontinuous, organic and typically occur in the upper part of the unit.
- Waterloo rock horizons which comprise indurated "sandrock" layers.

The depth to bedrock in the area is indicated as ranging from 15 m to 70 m depth. The greater depths to rock are associated with existing creek lines or drainage channels to the east and west.

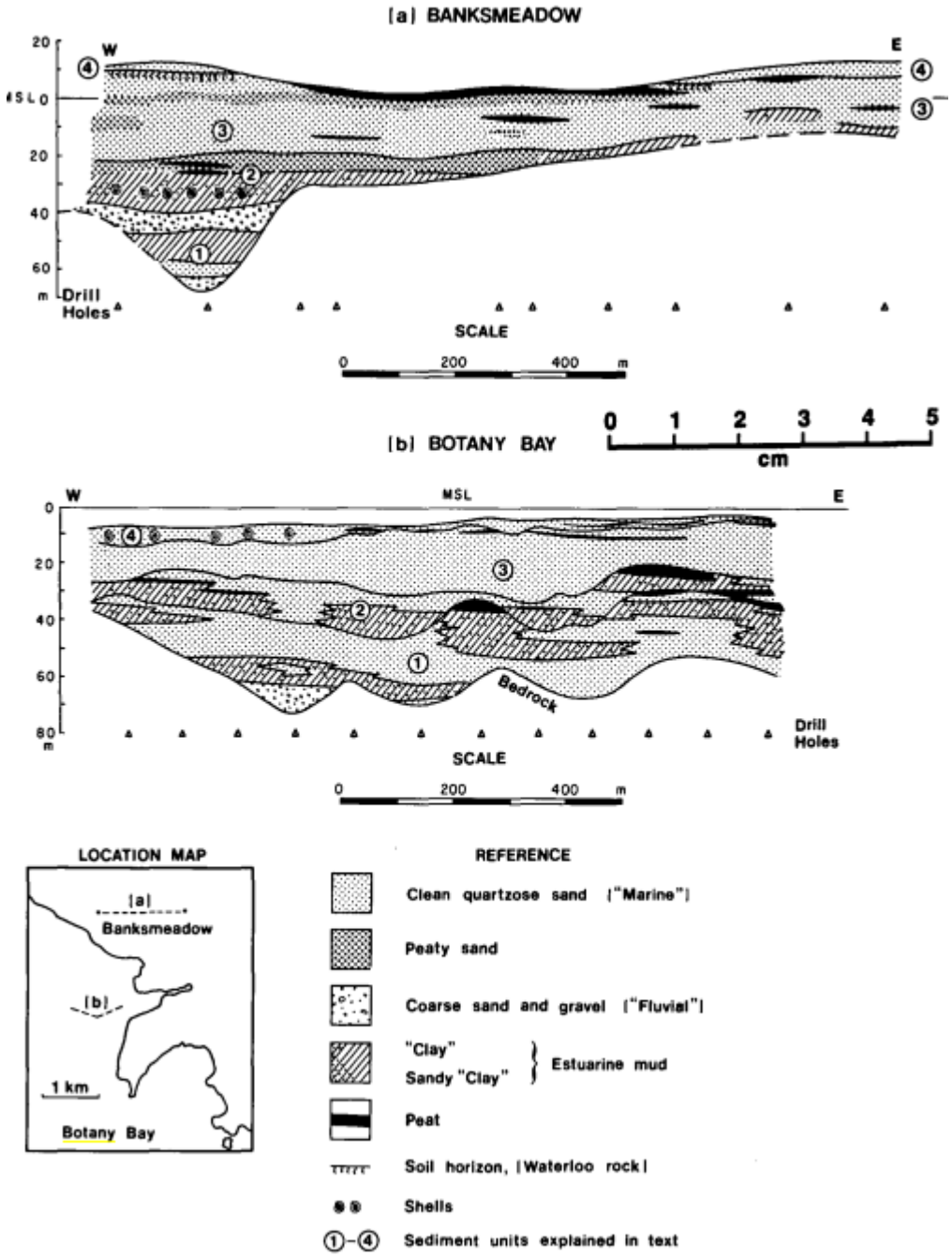



**Figure 7: Excerpt of the Sydney 1:100 000 Geology Sheet 9130 Notes**




**Figure 8: Excerpt of the Sydney 1:100 000 Geology Sheet 9130 Notes (Contours indicate depth to rock)**

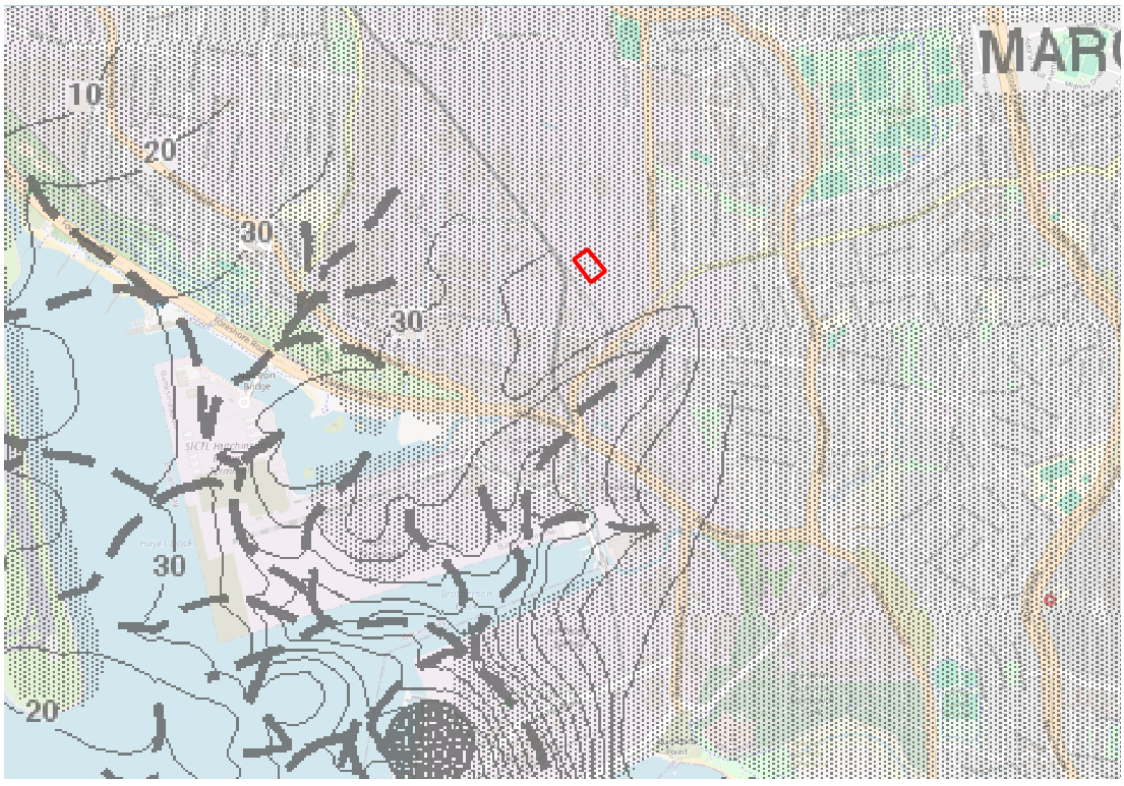



**Figure 8: Excerpt of The Botany Basin; It's Bedrock Topography and Recent Geology History indicated depth to rock**

# 6 FIELDWORK

Fieldwork was undertaken on 24 October 2024 to 6 November 2024 by a team of Drillers and Engineering Geologists from our Sydney office. The fieldwork was undertaken in accordance with the project proposal and the AS: 1726:2017 Geotechnical Site Investigation standard.

### 6.1.1 Service Location

Macquarie Geotechnical obtained underground services and utility plans through 'Dial Before You Dig (DBYD)' services. Service locating was conducted by the client.

### 6.1.2 GPS

All test locations were surveyed using a handheld GPS with co-ordinates recorded in the MGA Zone 56 format and elevations in Australian Height Datum (AHD).

### 6.1.3 Boreholes

The boreholes were drilled at locations nominated by Macquarie Geotechnical and are summarised in Table 1.

A Tracked Drill Rig was used to drill nine boreholes to depths of up to 6.00m utilising a 110mm diameter solid flight auger and 280mm bulk auger.

BH05c was initially cored by a concrete coring subcontractor to drill through the concrete layer found at 0.30m utilising a 305mm diameter corer. A Truck mounted drill rig was then used to drill one borehole to a depth of 6.45m utilising 110mm solid flight augers and 280mm bulk auger.

In-situ testing comprised of Dynamic Cone Penetrometer (DCP) and Standard Penetration Testing (SPT). The boreholes were backfilled with arisings/sand backfill and grout/cement mix for BH01 and BH05c which had concrete layers present. The borehole logs are presented in Appendix C.

## 6.2 Sampling

The sampling was undertaken in general accordance with AS:1289 1.2.1 and based on that defined in the proposal and considered the engineering requirements of the investigation and the nature of the materials encountered.

## 6.3 In-Situ Testing

In-situ testing as specified by our proposal was carried out in the exploratory holes in accordance with the techniques outlined in the relevant Australian Standards and Macquarie Geotech Quality procedures. The results are presented on the borehole hole logs in Appendix C.

## 6.4 Dynamic Cone Penetration Testing

Dynamic Cone Penetrometer (DCP) testing was carried out in the boreholes with techniques outlined in AS1289 6.3.2 in order to determine the relative density and consistency of the strata encountered. The numbers of blows per 100mm penetration were recorded.

## 6.5 Standard Penetration Testing

Standard Penetration Tests (SPT) were carried out in the boreholes with techniques outlined in AS1289.6.3.1 in order to determine the relative density and consistency of the strata encountered. The SPT "N" value (number of blows per 300mm penetration) or the blow count / penetration were recorded for each test.

## 6.6 Laboratory Testing

The samples were returned to Macquarie Geotechnical NATA accredited laboratory in Sydney and Envirolab in Sydney for further assessment and testing. The laboratory tests were carried out as per the laboratory test schedule indicated in the proposal.

A summary of the laboratory tests is provided in Table 3 below.

**Table 3: Summary of Laboratory Tests**

| Laboratory Test | Quantity |
|---|---|
| Moisture Content (AS 1289.2.1.1) | 5 |
| Atterberg and Linear Shrinkage (AS 1289.3.1.1, 3.2.1, 3.3.1, 3.4.1) | 1 |
| Soil Particle Density (AS 1289.3.5.1) | 4 |
| Particle Size Distribution (AS 1289.3.6.1) | 5 |
| MDD - Dry density/moisture content relation of a soil using standard compactive effort) (AS 1289.5.1.1) | 3 |
| CBR - California Bearing Ratio of a soil – standard laboratory method for a remoulded specimen (4-day soak) (AS 1289.6.1.1) | 3 |
| Direct Shear - Non-cohesive - Peak only - 3 single stage (AS 1289.6.2.2) including MDD | 4 |
| Direct Shear - Cohesive - Peak only - 3 single stage (AS 1289.6.2.2) including MDD | 1 |
| Soil Aggressivity | 4 |
| Total Organic Content | 1 |

# 7 SUB SURFACE CONDITIONS

## 7.1 Ground Conditions

The ground conditions observed in the boreholes are broadly summarised in Table 6 below. Detailed descriptions of the strata can be found within the borehole logs provided in Appendix C.

**Table 4: Borehole Summary**

| Unit | Name | Depth to Top of Unit (m) | Maximum Thickness (m) | Material Description |
|---|---|---|---|---|
| 1 | Fill | 0.0 m | 1.5 m | Concrete and gravelly sand/sand fill – the soil appears variably compacted |
| 2 | Sand – Variably compacted sand | 0.1 – 1.5 m | 3.0 m | Sand with or trace silt trace gravel– medium dense but with some very loose and loose layers. Borehole 4a also includes a 0.5 m thick, soft to firm clay layer. Trace vegetation was encountered in some layers |
| 3 | Sand – loose to medium dense | 3.6 – | >2.4 m | Sand – typically medium dense with some loose and dense layers |

## 7.2 Groundwater

The comments on groundwater are based on the observations made at the time of the investigation. Groundwater was encountered at between 2.80mbgl to 5.30mbgl. It is possible that elevated groundwater levels may occur during wet periods or due to seasonal variation and should be considered as part of the design process.

**Table 5: Summary of Groundwater Ingress during Drilling**

| Hole ID | Groundwater Level Observed (mBGL) | Hole Depth (m) | Date |
|---|---|---|---|
| BH01 | 5.30 | 6.00 | 25/10/2024 |
| BH02 | 5.00 | 6.00 | 24/10/2024 |
| BH03 | 3.90 | 6.00 | 24/10/2024 |
| BH04a | 5.00 | 6.00 | 24/10/2024 |
| BH05c | 2.80 | 6.45 | 06/11/2024 |

# 8 LABORATORY TEST RESULTS

The laboratory tests were carried out on the samples nominated by Macquarie Geotechnical. Summaries of test results are shown in Tables 7 to 13 below.

**Table 6: Laboratory Test Results – Classification**

| Hole ID | Depth (m) | Atterberg Limits | | | Moisture Content (%) |
|---|---|---|---|---|---|
| | | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | |
| 01 | 1.0 – 1.5<br>1.5 – 2.2 | - | - | - | 4.3 |
| 01 | 2.6 – 5.5 | - | - | - | 9.6 |
| 02 | 3.75 – 4.0 | - | - | - | 17.7 |
| 4a | 4.0 – 4.5 | NO | NO | NP | 29.6 |
| 5c | 2.0 – 2.7 | - | - | - | 14.0 |

**Table 7: Laboratory Test Results - California Bearing Ratio (CBR)**

| Hole ID | Depth (m) | California Bearing Ratio (CBR) | | | | |
|---|---|---|---|---|---|---|
| | | FMC (%) | MDD (t/m$^3$) | OMC (%) | CBR (%) | CBR Swell (%) |
| 1 | 0.5 – 1.0<br>1.0 – 1.5<br>1.5 – 2.2 | 4.3 | 1.66 | 14.3 | - | - |
| 1 | 4.6 – 5.5<br>5.5 – 6.0 | 9.6 | 1.68 | 15.5 | - | - |
| 2a | 0.1 – 1.2 | - | 1.68 | 14.0 | 25 | 0.0 |
| 2a | 1.2 – 1.7 | - | 1.66 | 13.3 | 13 | -0.1 |
| 5c | 1.0 – 2.0 | - | 1.71 | 12.9 | 25 | 0.0 |
| 5c | 2.0 – 2.7 | 14.0 | - | - | - | - |

Note: FMC = Field Moisture Content, MDD – Maximum Dry Density, OMC – Optimum Moisture Content, CBR = California Bearing Ratio

**Table 10: Laboratory Test Results – Particle Size Distribution and Soil Density**

| Hole ID | Depth (m) | Soil Particle Density (g/cm$^3$) | Percent Passing (%) | | | | |
|---|---|---|---|---|---|---|---|
| | | | 0.3 mm | 1.18 mm | 2.36 mm | 4.75 mm | 19.0 mm |
| 1 | 0.5 – 1.0<br>1.0 – 1.5<br>1.5 – 2.2 | 2.63 | - | - | - | - | |
| 2 | 3.75 – 4.0<br>4.0 – 4.5 | 2.58 | 38 | 98 | 98 | 99 | 100 |
| 04a | 1.5 – 2.5 | - | 40 | 99 | 99 | 99 | 100 |
| 04a | 4.0 – 4.5 | - | 46 | 98 | 99 | 100 | 100 |
| 05c | 2.0 – 2.7 | 2.64 | 48 | 99 | 99 | 100 | 100 |
| 05c | 3.0 – 3.5 | 2.47 | 48 | 96 | 97 | 98 | 100 |

**Table 11: Laboratory Test Results – Soil Chemical Properties**

| Hole ID | Depth (m) | Soil Chemical Properties (SCP) | | | | Total Organic Matter |
|---|---|---|---|---|---|---|
| | | pH | $SO_4$ (mg/kg) | Cl (mg/kg) | EC (uS/cm) | mg/kg |
| BH01 | 0.15 – 0.50 | 8.2 | 21 | <10 | 45 | - |
| BH03 | 0.95 – 1.50 | 9 | 10 | 20 | 76 | - |
| BH04a | 0.10 – 0.50 | 8.7 | 30 | <10 | 86 | - |
| BH05c | 0.70 – 1.15 | 8.4 | 20 | 210 | 190 | - |
| BH05c | 2.70 – 3.00 | - | - | - | - | 36 000 |

Note: $SO_4$ – Sulphate, Cl – Chloride, EC – Electrical Conductivity;

**Table 12: Laboratory Test Results – Direct Shear Test Results**

| Hole ID | Depth (m) | Peak Values | | | Ultimate Values | | |
|---|---|---|---|---|---|---|---|
| | | Friction Angle ° | Cohesion (kPa) | Correlation | Friction Angle ° | Cohesion (kPa) | Correlation |
| BH1 | 1.0 - 2.25[1] | 33.5 | 0.2 | 0.99 | 33.4 | 0.8 | 0.99 |
| BH1 | 4.6 – 5.5<br>5.5 – 6.0 | 29.2 | 8.3 | 0.98 | 32.9 | 0.5 | |
| BH02 | 2.5 – 3.0<br>3.0 – 3.5 | 32.7 | 2.8 | 0.99 | 33.8 | 0.6 | 0.99 |
| BH03 | 1.5 – 2.55<br>2.5 – 3.5[1] | 31.9 | 2.9 | 0.9968 | 32.1 | 0.8 | 0.9980 |
| BH5c | 3.0 – 3.5 | 37.3 | 3.2 | 0.99 | 37.4 | 0.0 | 0.99 |

Note: 1. Two Samples

# 9 GEOTECHNICAL ASSESSMENT

## 9.1 Geological Model

The site comprises a variable layer of fill (Unit 1) overlying Natural Sands (Unit 2) of variable consistency but including very loose sands and soft clay layers to 4.5 m depth. The variability of the natural sands of Unit 2 are consistent with the marine and aeolian depositional environments with clay layers possibly deposited in an estuarine environment. At other nearby locations, this surface layer has been observed to have a similar depositional sequence where a variable profile, with differing densities (for sand)/shear strength (for clay) over short distances. In addition this layer often includes discontinuous zones of loose sands and clay layers together with indurated (or cemented) layers, however, indurated layers were not encountered during the investigation on-site. The variability in the depositional profile may also be a result of erosion that has been overlain by subsequent marine and aeolian deposition together with estuarine deposits. The underlying sand (Unit 3) appears to consistently be medium dense with loose and dense layers.

The sandstone on-site is likely to be at a depth of greater than 25 m. Published information together with a groundwater well to the west that encountered sandstone bedrock at 20 m suggests that the rock level is falling to the east or south-east, towards an old creek line where the published information suggests the rock level ranges between 20 m and 50 m. Given that the rock it as approximately 20 m depth in a well to the west, the rock level appears to be dipping to the east, towards the creek line identified

Groundwater levels have been recorded at depths of 2.8 – 5.3 m. Water levels are expected to fluctuate with changing climatic conditions.

It is noted that this report has not included a contamination assessment. A contamination assessment is understood to be separately undertaken by JBS&G.

# 10 EXCAVATION AND STABILITY

## 10.1 Soil

Excavation in sandy soils should be achievable using standard conventional earthmoving equipment (e.g. excavators with a toothed bucket).

## 10.2 Temporary Excavation Support

All excavations deeper than 1 m or within soils will require either battering (or benching) or retention support due to the presence of very loose sands and uncontrolled fill in the upper portion of the profile. This is a shallower depth than specified by Safework "Code of Practice – Excavation Work" (2020) but is recommended due to the inherent variability of the fill and surface sands together with the risk of premature collapse of deeper excavations.

For temporary work battering or benching in the cohesive soils at effective slope angles of 2.5:1 H:V (or up to 22 degrees) in non-cohesive or granular soils (at least loose density) are considered appropriate for the site materials. Geotechnical inspection should be carried out for lower strength/density materials or where groundwater seepage is present to assess if flattening of these slopes is required.

## 10.3 Retaining Structures

Retaining walls up to 1 m in height may occur as part of the development. It is recommended that design be based on a unit weight of 18 $\mathrm{kN/m^3}$ and a triangular earth pressure distribution with an effective friction angle of 30° (effective cohesion of 0 kPa). These parameters assume adequate drainage is provided, level ground conditions are present at the crest of the wall and surcharge loads (including construction loads) are considered in the design. If localised deeper retaining walls up to 3 m are proposed then these design parameters are considered suitable for preliminary design, however, specific further advice will need to be sought regarding the construction of these walls.

Design of retaining structures should be carried out in accordance with AS4678 (2002) "Earth-Retaining Structures".

## 10.4 Drainage

Drainage should be installed at the top of the cuttings to divert surface water runoff from the excavation and cut face during rainfall events.

## 10.5 EARTHWORKS

### 10.5.1 Re-use of Site Material

From a geotechnical perspective, the majority of the site won soil material from the cuttings is considered suitable for use as general structural fill material on-site. If the material is proposed to be used as engineered fill within the permanent works then some blending of the material with coarser particle sizes may be required to comply with Specification grading requirements.

Careful extraction and stockpile management will be required to optimise the potential volume of site won materials. Where feasible, material should be trucked directly to the placement site to avoid double handling and associated time and cost implications.

The majority of the site won material from the rock cuttings (moderately weathered rock or stronger) is likely to be suitable for use as general fill and selected material zone fill providing it can be adequately broken down to a suitable size for re-use as fill. Screening and processing of the raw material will be required to comply with earthwork specification and design requirements.

### 10.5.2 Building Pad and Subgrade Preparation

Building pad and subgrade preparation for pavements will generally require the following;

- Test roll the exposed surface with at least six passes of a minimum 12 tonne smooth drum roller (or similar) without vibrations in the presence of a geotechnical professional. Any soft or loose layers identified should be removed and replaced;
- Boxed-out excavations are expected to experience some groundwater infiltration if moisture ingress into the excavation is allowed to occur. Notwithstanding this infiltration, water accumulation in the excavation will result in other associated problems such as sidewall collapse (upon draining through a rapid drawdown type failure mechanism). Management of this water ingress must occur due to the potential adverse effects on the integrity of the excavation. ;
- Place approved cohesive filling, where required, in layers not greater than 250 mm (vertical thickness placed loosely), with each layer compacted to a density ratio between 98 % and 102 % (Standard Compaction) or 100% within 300 mm of any subgrade levels of pavements. Moisture contents should be maintained within 2% dry and 1 % wet of Standard optimum moisture content (OMC). Where cohesionless materials are proposed then the sand should be compacted to a density index of at least 75%. ;
- New filling should be free of oversize particles (>75 mm) and deleterious material;
- Moisture conditioning of clay soils may be required if soils are saturated (e.g. air drying, blending with dryer material or lime stabilisation);
- New filling placed under structures to be placed under Level 1 testing conditions as defined in AS 3798–(2007) “Guidelines on Earthworks for Commercial and Residential Developments”. Level 2 testing is recommended for filling in other areas.

Vibrations could be generated due to the compaction process in vibratory mode. It is recommended that vibrations be limited to a peak particle velocity of 5 mm/sec and that vibration monitors be installed on sensitive adjacent structures to monitor vibrations during the construction process.

### 10.5.3 Fill Batters

Fill batters should be overfilled by at least 1 m and trimmed back to the design profile to ensure adequate edge compaction.

Slope angles of 1.5:1 (H:V) and 2:1 (H:V) are considered appropriate for compacted embankment fill materials in the temporary and permanent conditions respectively, up to a maximum height of 3 m

provided the embankment is constructed on a competent foundation with controlled fill soils/natural soils. Higher embankments may require specific stability consideration.

# 11 FOUNDATIONS

## 11.1 Site Classification

The classification of a site involves a number of geotechnical factors such as depth of bedrock, the nature and extent of subsurface soils and any specific problems (slope stability, soft soils, filling, reactivity, etc).

AS2870 specifically relates to construction of low rise residential dwellings and is not technically appropriate for industrial or commercial structures. Given the depth of filling on-site the site is assigned a "P" classification requiring design in accordance with engineering principles.

Notwithstanding the “P” classification, the natural site soils are expected to have shrink-swell movements consistent with a “S” classification, with shrink-swell movements less than 20 mm.

An appropriate footing system should be designed in accordance with the above code to accommodate these anticipated movements. The possibility of additional movements, due to abnormal moisture variations, should be minimised by proper "site management" procedures as provided on the attached sheet.

It should be noted that this assessment is based on site conditions being represented by the natural soil profile. Any change in conditions noted during development, including cut or fill should be referred to Macquarie Geotechnical for appropriate inspection and assessment.

## 11.2 Geotechnical Design Parameters

The geotechnical design parameters estimated for this site are provided in Table 13 on the following page.

**Table 13: Estimated Geotechnical Engineering Parameters**

| Soil Description | Unit Weight (kN/m³) | Effective Stress Parameters | | Undrained Shear Strength | Poisson's Value | Concrete to Soil Friction Angle δ (degrees) | Young's Modulus [1] (MPa) | Modulus of Subgrade Reaction (MN/m³) Ks |
|---|---|---|---|---|---|---|---|---|
| | | ϕ' Degrees | c' (kPa) | Cu (kPa) | | | | |
| Unity 1 - FILL | 16 | 25 | 0 | 0 | 0.35 | 23 | 2 | NA |
| Unit 2 – Variable Sand | 17 | 28 | 0 | 0 | 0.35 | 23 | 7 | 5 |
| Unit 3 – Medium Dense Sand | 18 | 30 | 0 | 0 | 0.3 | 23 | 20 | 10 |

1. Layers are sensitive to vibration and Young's Modulus values can be affected by excessive and/or prolonged nearby vibration.

## 11.3 Foundation Types

Design of foundations should achieve uniform founding conditions throughout the structure. Given the presence of very loose sands in Unit 2, it is recommended that all structural loads be transferred to the medium dense sands of Unit 3. Consideration could be given to shallow footings, however, given the presence of very loose sands it is likely that testing of the base of at least some footings during construction will result identify unsuitable materials that will require significant deepening of the footings in order to limit the potential for excessive settlement. It is recommended that pile footings comprise either displacement piles (driven timber or concrete piles), continuous flight auger (CFA) piles or concrete screw piles due to the presence of collapsing ground conditions and the relatively high and fluctuating groundwater levels.

Noise and vibration may be associated with driven piles and will need to be considered by the designer due to potential disruption of adjacent facilities.

It is likely that a working platform will be required for any piling rigs operating on-site. The size of the working platform will be dependent on applied rig loads together with the subgrade condition during construction.

## 11.4 Shallow Foundations

Shallow footings could be considered provided each footing is tested during construction to confirm the suitability of the base of the footing to support the applied loads. Various shallow footing types are outlined in Table 14.

**Table 14: Vertical Design Parameters for Shallow Foundations**

| Unit | Footing Type | Dimensions | Embedment Depth below ground surface (m) | Allowable End Bearing Pressure (kPa) |
|---|---|---|---|---|
| 2 | Pad Footing | 1 m square | 1 m | 100 |
| 2 | Strip Footing | 0.5 m wide and at least 2 m long | 1 m | 100 |

These shallow footings are to be founded on consistent loose sands and are expected to have 10 – 20 mm of settlement upon load application.

It is imperative that the integrity of the ground conditions adjacent to each shallow footing be maintained. The stability of shallow footings can be compromised by any adjacent excavations (e.g. service trenches, other footings) resulting in bearing capacity failure. Any proposed excavations adjacent to shallow footings must be assessed by an experienced geotechnical engineer on a case-by-case basis.

## 11.5 Pile Foundations

Due to the weaker nature of the near surface soils, the anticipated loadings and the possibility of erosion of sediments, it is anticipated that the new structure will require support by pile foundations

Piles should be designed based on AS 2159-2009 'Piling – Design and Installation'. Account should also be taken of lateral loading on the piles (for example Broms 1965, Design of Laterally Loaded Piles).

The design ultimate geotechnical strength (Rd.ug) of a pile in compression can be approximated using the following relationship:

$R_{d.ug} = f_{m.s} A_s + f_b A_b$

Where: $f_{m.s}$ = average shaft friction for condition of full mobilisation (compression)

$f_b$ = ultimate base pressure (compression)

$A_s$ = shaft surface area of pile in contact with soil

$A_b$ = base area of pile

The design geotechnical strength ($R_{d.g}$) is calculated as the design ultimate geotechnical strength ($R_{d.ug}$) multiplied by a geotechnical strength reduction factor ($\phi_g$).

$R_{d.g} = R_{d.ug}\ \phi_g$

The geotechnical strength reduction factor is dependent on a risk assessment and any associated load testing of the installed piles.

It should be noted that a nominal length of 1.5 times the pile diameter (D) below the soil surface is normally ignored in the estimation of design ultimate geotechnical strength due to a potential gap (between pile and soil) that may occur within this depth due to cyclic loading and other factors.

Shaft friction ($f_s$) is calculated using the following equation(s) specific to the type of ground encountered:

$f_s = K_s\ \sigma_v'\ \tan\ \delta$ (for cohesionless soil)

$f_s = C_u\ \alpha$ (for cohesive soil)

Where: $K_S$ = horizontal pressure coefficient

$\sigma_v'$ = effective vertical stress (taking into account groundwater pressures)

$\delta$ = pile to soil friction angle

$C_u$ = undrained shear strength

$\alpha$ = adhesion factor

End bearing ($f_b$) is calculated using the following equation(s) specific to the type of ground encountered:

$f_b = N_q\ \sigma_v'$ (for cohesionless soil)

Where: $N_q$ = bearing capacity factor

Piles need to be embedded a minimum of 5 x diameter in order to generate the required bearing capacity factors.

For tension piles, the pullout resistance would be wholly dependent on skin friction.

## 11.6 Pile Design Parameters

Based on our investigation, and our experience in this region, we recommend the following parameters in Table 13 have been estimated from SPT 'N' values.

Design parameters for vertical loadings of piled footings are provided in Table 15 on the following page. These parameters assume that the piled footings are constructed in accordance with industry's best practice.

**Table 15: Vertical Design Parameters for Piled Foundations**

| Unit | Serviceability Values | | Ultimate Values | |
|---|---|---|---|---|
| | Allowable End Bearing Pressure (kPa) | Allowable Shaft Adhesion (kPa) | Ultimate End Bearing Pressure (kPa) | Ultimate Shaft Adhesion (kPa) |
| 2 | NA | 5 | NA | 15 |
| 3 | 400 | 20 | 1000 | 50 |

Higher values may be able to be adopted with additional cone penetration testing to a greater depth to confirm the geological profile.

Where uplift loads are to be considered then design should be based on 50% of the shaft adhesion values outlined in Table 15. Cone pullout failure should also be considered and designed in accordance with the method outlined in AS4678 "Earth Retaining Structures".

## 11.7 Geotechnical Strength Reduction Factor (AS2159)

The geotechnical strength reduction factor for pile design is defined in the Piling Code. Selection of the geotechnical strength reduction factor ($\phi_g$) is based on a series of individual risk ratings (IRR) which are weighted and lead to an average risk rating (ARR). The individual risk ratings and final value of ($\phi_g$) depend on the following factors:

- Site: the type, quantity and quality of testing.
- Design: design methods and parameter selection.
- Installation: construction control and monitoring.
- Pile testing regime.
- Redundancy.

Without clear details about the pile type, design method, testing regime and other construction factors it is not possible to calculate the appropriate ($\phi_g$) value. Assuming no pile testing, limited specialist geotechnical supervision during construction, and the limited/basic investigation and testing, a $\phi_g$ value of 0.45 is considered appropriate.

## 11.8 Exposure Classification - Concrete

Reference is made to Table 6.4.2 (C) Exposure Classification for Concrete Piles AS2159 – 2009 'Piling – Design and Installation'. The soil condition is classified as 'Condition A' (Soils within groundwater). Given the minimum pH value of 6.5, the soils at this site are classified as mildly aggressive to steel and concrete.

## 11.9 Seismic Classification

In accordance with Part 4 of AS1170.4 – 2024, the site is assessed to have a Site Sub-Soil Class of "Ce". This is based on the expectation that the rock profile is less than 45 m depth.

# 12 PAVEMENT DESIGN PARAMETERS

Where sand fill is proposed as subgrade material, it is recommended that the design be based on a California bearing ratio of 10 %.

The subgrade should be formed in accordance with the methods outlined in Section 10.5.2.

Drainage should be incorporated into the design of the pavement hardstand, in both the short and long-term by the civil designer. Regular maintenance must be carried out on the drainage and pavement to extend the life of the pavement.

## 13 CONCLUSION

The findings of our report were based on our fieldwork, in-situ testing, laboratory testing and technical assessment for this site.

We trust the foregoing is sufficient for your present purposes, and if you have any questions, please contact the undersigned.


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Geotechnical Engineer
BSc (Hons) Physical Geography and Geology

Gavin Boyd
Sydney Geotechnical Manager
BE (Civil) MEng Sc CPEng


Attached: Limitations of Geotechnical Site Investigation

References:

Australian Standard 1726 – 2017 Geotechnical Site Investigations
Australian Standard 3798 - 2007 Guidelines on Earthworks for Commercial and Residential Structures
Austroads 2024 – Guild to Pavement Technology Part 5: Pavement Evaluation and Treatment
Geological Survey of NSW: Department of Mineral Resources 1983 - "Geology of the Sydney 1:100 000 Sheet 9130"
Albani and Rickwood – 1998 "The Botany Basin; It's Bedrock Topography and Recent Geology History" in "Collected Case Studies in Engineering Geology, Hydrogeology and Environmental Geology, Geological Society of Australia.

# LIMITATIONS OF GEOTECHNICAL SITE INVESTIGATION

## Scope of Services

This report has been prepared for the Client in accordance with the Services Engagement Form (SEF), between the Client and Macquarie Geotechnical.

## Reliance on Data

Macquarie Geotechnical has relied upon data and other information provided by the Client and other individuals. Macquarie Geotechnical has not verified the accuracy or completeness of the data, except as otherwise stated in the report. Recommendations in the report are based on the data.

Macquarie Geotechnical will not be liable in relation to incorrect recommendations should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed.

## Geotechnical Investigation

Findings of Geotechnical Investigations are based extensively on judgment and experience. Geotechnical reports are prepared to meet the specific needs of individual clients. This report was prepared expressly for the Client and expressly for the Clients purposes.

This report is based on a subsurface investigation, which was designed for project-specific factors. Unless further geotechnical advice is obtained this report cannot be applied to an adjacent site nor can it be used when the nature of any proposed development is changed.

## Limitations of Site investigation

As a result of the limited number of sub-surface excavations or boreholes there is the possibility that variations may occur between test locations. The investigation undertaken is an estimate of the general profile of the subsurface conditions. The data derived from the investigation and laboratory testing are extrapolated across the site to form a geological model. This geological model infers the subsurface conditions and their likely behavior with regard to the proposed development.

The actual conditions at the site might differ from those inferred to exist.

No subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

## Time Dependence

This report is based on conditions, which existed at the time of subsurface exploration. Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report.

Macquarie Geotechnical should be kept appraised of any such events and should be consulted for further geotechnical advice if any changes are noted.

## Avoid Misinterpretation

A geotechnical engineer or engineering geologist should be retained to work with other design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

No part of this report should be separated from the Final Report.

## Sub-surface Logs

Sub-surface logs are developed by geoscientific professionals based upon their interpretation of field logs and laboratory evaluation of field samples. These logs should not under any circumstances be redrawn for inclusion in any drawings.

## Geotechnical Involvement During Construction

During construction, excavation frequently exposes subsurface conditions. Geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed.

## Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendations and should make their own enquiries and obtain independent advice in relation to such matters.

Macquarie Geotechnical assumes no responsibility and will not be liable to any other person or organisations 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 organisations arising from matters dealt with or conclusions expressed in the report.

## Other limitations

Macquarie Geotechnical will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

## Other Information

For further information reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, 1987.

# Appendix A – Geotechnical Explanatory Notes

MACQUARIE GEOTECH

# Geotechnical Explanatory Notes

# Soil Description

In engineering terms soil includes every type of uncemented or partially cemented inorganic material found in the ground. In practice, if the material can be remoulded by hand in its field condition or in water it is described as a soil. The dominant soil constituent is given in capital letters, with secondary textures in lower case. The dominant feature is assessed from the Unified Soil Classification system and a soil symbol is used to define a soil layer as follows:

## UNIFIED SOIL CLASSIFICATION

The appropriate symbols are selected on the result of visual examination, field tests and available laboratory tests, such as, sieve analysis, liquid limit and plasticity index.

| USC Symbol | Description |
|---|---|
| GW | Well graded gravel |
| GP | Poorly graded gravel |
| GM | Silty gravel |
| GC | Clayey gravel |
| SW | Well graded sand |
| SP | Poorly graded sand |
| SM | Silty sand |
| SC | Clayey sand |
| ML | Silt of low plasticity |
| CL | Clay of low plasticity |
| OL | Organic soil of low plasticity |
| MH | Silt of high plasticity |
| CH | Clay of high plasticity |
| OH | Organic soil of high plasticity |
| Pt | Peaty Soil |

## MOISTURE CONDITION

Dry – Cohesive soils are friable or powdery
Cohesionless soil grains are free-running

Moist – Soil feels cool, darkened in colour
Cohesive soils can be moulded
Cohesionless soil grains tend to adhere

Wet – Cohesive soils usually weakened
Free water forms on hands when handling

For cohesive soils the following codes may also be used:

MC>PL Moisture Content greater than the Plastic Limit.
MC~PL Moisture Content near the Plastic Limit.
MC<PL Moisture Content less than the Plastic Limit.

## PLASTICITY

The potential for soil to undergo change in volume with moisture change is assessed from its degree of plasticity. The classification of the degree of plasticity in terms of the Liquid Limit (LL) is as follows:

| Description of Plasticity | LL (%) |
|---|---|
| Low | <35 |
| Medium | 35 to 50 |
| High | >50 |

## COHESIVE SOILS – CONSISTENCY

The consistency of a cohesive soil is defined by descriptive terminology such as very soft, soft, firm, stiff, very stiff and hard. These terms are assessed by the shear strength of the soil as observed visually, by the pocket penetrometer values and by resistance to deformation to hand moulding.

A Pocket Penetrometer may be used in the field or the laboratory to provide approximate assessment of unconfined compressive strength of cohesive soils. The values are recorded in kPa, as follows:

| Strength | Symbol | Pocket Penetrometer Reading (kPa) |
|---|---|---|
| Very Soft | VS | < 25 |
| Soft | S | 20 to 50 |
| Firm | F | 50 to 100 |
| Stiff | St | 100 to 200 |
| Very Stiff | VSt | 200 to 400 |
| Hard | H | > 400 |

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## COHESIONLESS SOILS – RELATIVE DENSITY

Relative density terms such as very loose, loose, medium, dense and very dense are used to describe silty and sandy material, and these are usually based on resistance to drilling penetration or the Standard Penetration Test (SPT) 'N' values. Other condition terms, such as friable, powdery or crumbly may also be used.

The Standard Penetration Test (SPT) is carried out in accordance with AS 1289, 6.3.1. For completed tests the number of blows required to drive the split spoon sampler 300 mm are recorded as the N value. For incomplete tests the number of blows and the penetration beyond the seating depth of 150 mm are recorded. If the 150 mm seating penetration is not achieved the number of blows to achieve the measured penetration is recorded. SPT correlations may be subject to corrections for overburden pressure and equipment type.

| Term | Symbol | Density Index | N Value (blows/0.3 m) |
|---|---|---|---|
| Very Loose | VL | 0 to 15 | 0 to 4 |
| Loose | L | 15 to 35 | 4 to 10 |
| Medium Dense | MD | 35 to 65 | 10 to 30 |
| Dense | D | 65 to 85 | 30 to 50 |
| Very Dense | VD | >85 | >50 |

## COHESIONLESS SOILS PARTICLE SIZE DESCRIPTIVE TERMS

| Name | Subdivision | Size |
|---|---|---|
| Boulders | | >200 mm |
| Cobbles | | 63 mm to 200 mm |
| Gravel | coarse | 19 mm to 63 mm |
| | medium | 6.7 mm to 19 mm |
| | fine | 2.36 mm to 6.7 mm |
| Sand | coarse | 600 μm to 2.36 mm |
| | medium | 210 μm to 600 μm |
| | fine | 75 μm to 210 μm |

# Rock Description

The rock is described with strength and weathering symbols as shown below. Other features such as bedding and dip angle are given.

## ROCK QUALITY

The fracture spacing is shown where applicable and the Rock Quality Designation (RQD) or Total Core Recovery (TCR) is given where:

$$\text{RQD (\%)} = \frac{\text{Sum of Axial lengths of core > 100mm long}}{\text{total length considered}}$$

$$\text{TCR (\%)} = \frac{\text{length of core recovered}}{\text{length of core run}}$$

## ROCK STRENGTH

Rock strength is described using AS1726 and ISRM – Commission on Standardisation of Laboratory and Field Tests, "Suggested method of determining the Uniaxial Compressive Strength of Rock materials and the Point Load Index", as follows:

| Term | Symbol | Point Load Index $I_{s(50)}$ (MPa) |
|---|---|---|
| Very Low | VL | 0.03 to 0.1 |
| Low | L | 0.1 to 0.3 |
| Medium | M | 0.3 to 1 |
| High | H | 1 to 3 |
| Very High | VH | 3 to 10 |
| Extremely High | EH | >10 |

## ROCK MATERIAL WEATHERING

Rock weathering is described using the following abbreviation and definitions used in AS1726:

| Abbreviation | Term |
|---|---|
| RS | Residual soil |
| XW | Extremely weathered |
| DW | Distinctly weathered |
| HW | Highly weathered |
| MW | Moderately weathered |
| SW | Slightly weathered |
| FR | Fresh |

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## DEFECT SPACING/BEDDING THICKNESS

Measured at right angles to defects of same set or bedding.

| Term | Defect Spacing | Bedding |
|---|---|---|
| Extremely closely spaced | <6 mm | Thinly Laminated |
| | 6 to 20 mm | Laminated |
| Very closely spaced | 20 to 60 mm | Very Thin |
| Closely spaced | 0.06 to 0.2 m | Thin |
| Moderately widely spaced | 0.2 to 0.6 m | Medium |
| Widely spaced | 0.6 to 2 m | Thick |
| Very widely spaced | >2 m | Very Thick |

## DEFECT DESCRIPTION

| Type: | Description |
|---|---|
| B | Bedding |
| F | Fault |
| C | Cleavage |
| J | Joint |
| S | Shear Zone |
| D | Drill break |

**Planarity/Roughness:**

| Class | Description |
|---|---|
| I | rough or irregular, stepped |
| II | smooth, stepped |
| III | slickensided, stepped |
| IV | rough or irregular, undulating |
| V | smooth, undulating |
| VI | slickensided, undulating |
| VII | rough or irregular, planar |
| VIII | smooth, planar |
| IX | slickensided, planar |

The inclination if defects are measured from perpendicular to the core axis.

## WATER


Water level at date shown


Partial water loss


Water inflow


Complete water loss

*Groundwater not observed:* The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

*Groundwater not encountered:* The borehole/test pit was dry soon after excavation, however groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

# Graphic Symbols for Soils and Rocks

Typical symbols for soils and rocks are as follows. Combinations of these symbols may be used to indicated mixed materials such as clayey sand.

**Soil Symbols**

*Main components*


CLAY - CL


CLAY - CH


SAND


GRAVEL


BOULDERS / COBBLES


TOPSOIL


SILT

*Minor Components*


Clayey


Silty


Sandy


Gravelly

**Other**


FILL


BITUMEN


CONCRETE

**Rock Symbols**

*Sedimentary Rocks*


SANDSTONE


SILTSTONE


CLAYSTONE, MUDSTONE


SHALE


LAMINITE


ASPHALT


LIMESTONE


CONGLOMERATE

*Igneous Rocks*


GRANITE


BASALT


UNDIFFERENTIATED IGNEOUS

*Metamorphic Rocks*


SLATE, PHYLLITE, SCHIST


GNEISS



QUARTZITE

MACQUARIE GEOTECH

# Engineering Classification of Shales and Sandstones in the Sydney Region – A Summary Guide

The Sydney Rock Class classification system is based on rock strength, defect spacing and allowable seams as set out below. All three factors must be satisfied.

## CLASSIFICATION FOR SANDSTONE

| Class | Uniaxial Compressive Strength (MPa) | Defect Spacing (mm) | Allowable Seams (%) |
|---|---|---|---|
| I | >24 | >600 | <1.5 |
| II | >12 | >600 | <3 |
| III | >7 | >200 | <5 |
| IV | >2 | >60 | <10 |
| V | >1 | N.A. | N.A. |

## CLASSIFICATION FOR SHALE

| Class | Uniaxial Compressive Strength (MPa) | Defect Spacing (mm) | Allowable Seams (%) |
|---|---|---|---|
| I | >16 | >600 | <2 |
| II | >7 | >200 | <4 |
| III | >2 | >60 | <8 |
| IV | >1 | >20 | <25 |
| V | >1 | N.A. | N.A. |

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## UNIAXIAL COMPRESSIVE STRENGTH (UCS)

For expedience in field/construction situations the uniaxial (unconfined) compressive strength of the rock is often inferred, or assessed using the point load strength index ($Is_{50}$) test (AS 4133.4.1 – 1993). For Sydney Basin sedimentary rocks the uniaxial compressive strength is typically about 20 x ($Is_{50}$) but the multiplier may range from about 10 to 30 depending on the rock type and characteristics. In the absence of UCS tests, the assigned Sydney Rock Class classification may therefore include rock strengths outside the nominated UCS range.

## DEFECT SPACING

The terms relate to spacing of natural fractures in NMLC, NQ and HQ diamond drill cores and have the following definitions:

| Defect Spacing (mm) | Terms Used to Describe Defect Spacing[1] |
|---|---|
| >2000 | Very widely spaced |
| 600 – 2000 | Widely spaced |
| 200 – 600 | Moderately spaced |
| 60 – 200 | Closely spaced |
| 20 – 60 | Very closely spaced |
| <20 | Extremely closely spaced |

[1]After ISO/CD14689 and ISRM.

## ALLOWABLE SEAMS

Seams include clay, fragmented, highly weathered or similar zones, usually sub-parallel to the loaded surface. The limits suggested in the tables relate to a defined zone of influence. For pad footings, the zone of influence is defined as 1.5 times the least footing dimension. For socketed footings, the zone includes the length of the socket plus a further depth equal to the width of the footing. For tunnel or excavation assessment purposes the defects are assessed over a length of core of similar characteristics.

Source: Based on Pells et al (1978), as revised by Pells et al (1998).
Pells, P.J.N, Mostyn, G. and Walker, B.F. – Foundations on Sandstone and Shale in the Sydney Region. Australian Geomechanics Journal, No 33 Part 3, December 1998.

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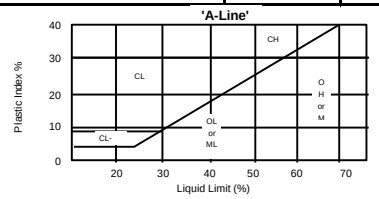
# Summary of Soil Logging Procedures

**Coarse Material:** grain size - colour - particle shape - secondary components - minor constituents - moisture condition - relative density - origin - additional observations.

**Fine Material:** plasticity - colour - secondary components - minor constituents - moisture w.r.t. plasticity - consistency - origin - additional observations.

## Guide to the Description, Identification and Classification of Soils

| Major Divisions | | | | SYMBOL | Typical Names |
|---|---|---|---|---|---|
| > 200mm | BOULDERS | | | | |
| 60 to 200mm | COBBLES | | | | |
| COARSE GRAINED SOILS | More than 65% by dry mass less than 63mm is greater that 0.075mm | GRAVEL | More than 50% of coarse fraction > 2.36mm | GW | Well-graded gravels, gravel-sand mixtures, little or no fines. |
| | | | | GP | Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels. |
| | | Gravelly Soils | | GM | Silty gravels, gravel-sand-silt mixtures. |
| | | | | GC | Clayey gravels, gravel-sand-clay mixtures |
| | | SANDS | More than 50% of coarse fraction < 2.36mm | SW | Well-graded sands, gravelly sands, little or no fines. |
| | | | | SP | Poorly graded sands and gravelly sands; little or no fines, uniform sands. |
| | | Sandy Soils | | SM | Silty sands, sand-silt mixtures. |
| | | | | SC | Clayey sands, sand-clay mixtures. |
| FINE GRAINED SOILS | More than 35% by dry mass less than 60mm is less than 0.076mm | Liquid Limit < 50% | | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts |
| | | | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays. |
| | | | | OL | Organic silts and organic silty clays of low plasticity. |
| | | Liquid Limit > 50% | | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. |
| | | | | CH | Inorganic clays of high plasticity, fat clays. |
| | | | | OH | Organic clays of medium to high plasticity, organic silts. |
| HIGHLY ORGANIC SOILS | | | | Pt | Peat and other highly organic soils. |




| Grain sizes | | | |
|---|---|---|---|
| Gravel | | Sand | |
| Coarse - | 63 to 19mm | Coarse - | 2.36 to 0.6mm |
| Medium - | 19 to 6.7 mm | Medium - | 0.6 to 0.21mm |
| Fine - | 6.7 to 2.36mm | Fine - | 0.21 to 0.075mm |

**GEOLOGICAL ORIGIN:-**

**Fill** - artificial soils / deposits
**Alluvial** - soils deposited by the action of water
**Aeolian** - soils deposited by the action of wind
**Topsoil** - soils supporting plant life containing significant organic content
**Residual** - soils derived from insitu weathering of parent rock.
**Colluvial** - transported debris usually unsorted, loose and deposited

**Field Identification of Fine Grained Soils - Silt or Clay?**

**Dry Strength** - Allow the soil to dry completely and then test its strength by breaking and crumbling between the fingers.
High dry strength - Clays; Very slight dry strength - Silts.

**Toughness Test** - the soil is rolled by hand into a thread about 3mm in diameter. The thread is then folded and re-rolled repeatedly until it has dried sufficiently to break into lumps. In this condition inorganic clays are fairly stiff and tough while inorganic silts produce a weak and often soft thread which may be difficult to form and readily breaks and crumbles.

**Dilatancy Test** - Add sufficient water to the soil, held in the palm of the hand, to make it soft but not sticky. Shake horizontally, striking vigorously against the other hand several times. Dilatancy is indicated by the appearance of a shiny film on the surface of the soil. If the soil is then squeezed or pressed with the fingers, the surface becomes dull as the soil stiffens and eventually crumbles. These reactions are pronounced only for predominantly silt size material. Plastic clays give no reaction.

## Descriptive Terms for Material Portions

| COARSE GRAINED SOILS | | FINE GRAINED SOILS | |
|---|---|---|---|
| *% Fines* | *Term/Modifier* | *% Coarse* | *Term/Modifier* |
| ≤ 5 | Omit, or use "trace" | ≤ 15 | Omit, or use "trace" |
| > 5, ≤ 12 | "with clay/silt" as applicable | > 15, ≤ 30 | "with sand/gravel" as applicable |
| > 12 | Prefix soil as "silty/clayey" | > 30 | Prefix as "sandy/gravelly" |

## Moisture Condition

*for non-cohesive soils:*

| | |
|---|---|
| Dry - | runs freely through fingers. |
| Moist - | does not run freely but no free water visible on soil surface. |
| Wet - | free water visible on soil surface. |

*for cohesive soils:*

| | |
|---|---|
| MC > PL | Moisture content estimated to be greater than the plastic limit. |
| MC ~ PL | Moisture content estimated to be approximately equal to the plastic limit. The soil can be moulded |
| MC < PL | Moisture content estimated to be less than the plastic limit. The soil is hard and friable, or powdery. |

The plastic limit (PL) is defined as the moisture content (percentage) at which the soil crumbles when rolled into threads of 3mm dia.

## Consistency - For Clays & Silts

| *Description* | *UCS(kPa)* | *Field guide to consistency* |
|---|---|---|
| Very soft | < 25 | Exudes between the fingers when squeezed in hand |
| Soft | 25 - 50 | Can be moulded by light finger pressure |
| Firm | 50 - 100 | Can be moulded by strong finger pressure |
| Stiff | 100 - 200 | Cannot be moulded by fingers. Can be indented by thumb. |
| Very stiff | 200 - 400 | Can be indented by thumb nail |
| Hard | > 400 | Can be indented with difficulty by thumb nail |
| Friable | - | Crumbles or powders when scraped by thumbnail |

## Relative Density for Gravels and Sands

| *Description* | *SPT "N" Value* | *Density Index (ID) Range %* |
|---|---|---|
| Very loose | 0 - 4 | < 15 |
| Loose | 4 - 10 | 15 - 35 |
| Medium dense | 10 - 30 | 35 - 65 |
| Dense | 30 - 50 | 65 - 85 |
| Very dense | > 50 | > 85 |

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# Summary of Rock Logging Procedures

**Description order:** constituents - rock name - grain size - colour - weathering - strength - minor constituents - additional observations.
- minor constituents - moisture w.r.t. plasticity - consistency - origin - additional observations.

## Definition - Sedimentary Rock

| | |
|---|---|
| Conglomerate | more than 50% of the rock consists of gravel (>2mm) sized fragments |
| Sandstone | more than 50% of the rock consists of sand (0.06 to 2mm) sized grains |
| Siltstone | more than 50% of the rock consists of silt sized granular particles and the rock is not laminated |
| Claystone | more than 50% of the rock consists of clay or mica material and the rock is not laminated |
| Shale | more than 50% of the rock consists of clay or silt sized particles and the rock is laminated |

## Weathering

| | | |
|---|---|---|
| Residual Soil | RS | Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a change in volume but the soil has not significantly transported. |
| Extremely Weathered | EW | Rock is weathered to such an extent that it has 'soil' properties; ie. it either disintegrates or can be remoulded, in water. |
| Distinctly Weathered | DW | **Highly Weathered (HW)** - Rock is wholly discoloured and rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals<br>**Moderately Weathered (MW)** - The whole of the rock is discoloured, usually by iron staining and bleaching. Shows little or no change in rock strength. |
| Slightly Weathered | SW | Rock is slightly discoloured but shows little or no change of strength from fresh rock. |
| Fresh | FR | Rock shows no sign of decomposition or staining. |

## Stratification

| | | | |
|---|---|---|---|
| thinly laminated | <6mm | medium bedded | 0.2 - 0.6m |
| laminated | 6 - 20mm | thickly bedded | 0.6 - 2m |
| very thinly bedded | 20 - 60mm | very thickly bedded | >2m |
| thinly bedded | 60mm - 0.2m | | |

## Discontinuities

**order of description:** depth - type - orientation - spacing - roughness / planarity - thickness - coating

| | Type | Class | Roughness/Planarity | Class | Roughness/Planarity |
|---|---|---|---|---|---|
| B | Bedding | I | rough or irregular, stepped | VI | slickensided, undulating |
| F | Fault | II | smooth, stepped | VII | rough or irregular, planar |
| C | Cleavage | III | slickensided, stepped | VIII | smooth, planar |
| J | Joint | IV | rough or irregular, undulating | IX | slickensided, planar |
| S | Shear Zone | V | smooth, undulating | | |
| D | Drill break | | | | |

## Rock Strength

| Term | | Is (50) | Field Guide |
|---|---|---|---|
| | | 0.03 | |
| Very low | VL | | Material crumbles under firm blows with sharp end of pick; can be peeled with knive. Pieces up to 30mm thick can be broken by finger pressure. |
| | | 0.1 | |
| Low | L | | A piece of core 150 mm long x 50 mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling. |
| | | 0.3 | |
| Medium | M | | A piece of core 150 mm long x 50 mm dia. can be broken by hand with considerable difficulty. Readily scored with knife. |
| | | 1 | |
| High | H | | A piece of core 150 mm long x 50 mm dia. core cannot be broken by unaided hands, can be slightly scratched or scored with knife. |
| | | 3 | |
| Very High | VH | | A piece of core 150 mm long x 50 mm dia. May be broken readily with hand held hammer. Cannot be scratched with pen knife. |
| | | 10 | |
| Extremely High | EH | | A piece of core 150 mm long x 50 mm dia. Is difficult to break with hand held hammer. Rings when struck with a hammer. |

* - rock strength defined by point load strength (Is 50) in direction normal to bedding

## Degree of fracturing

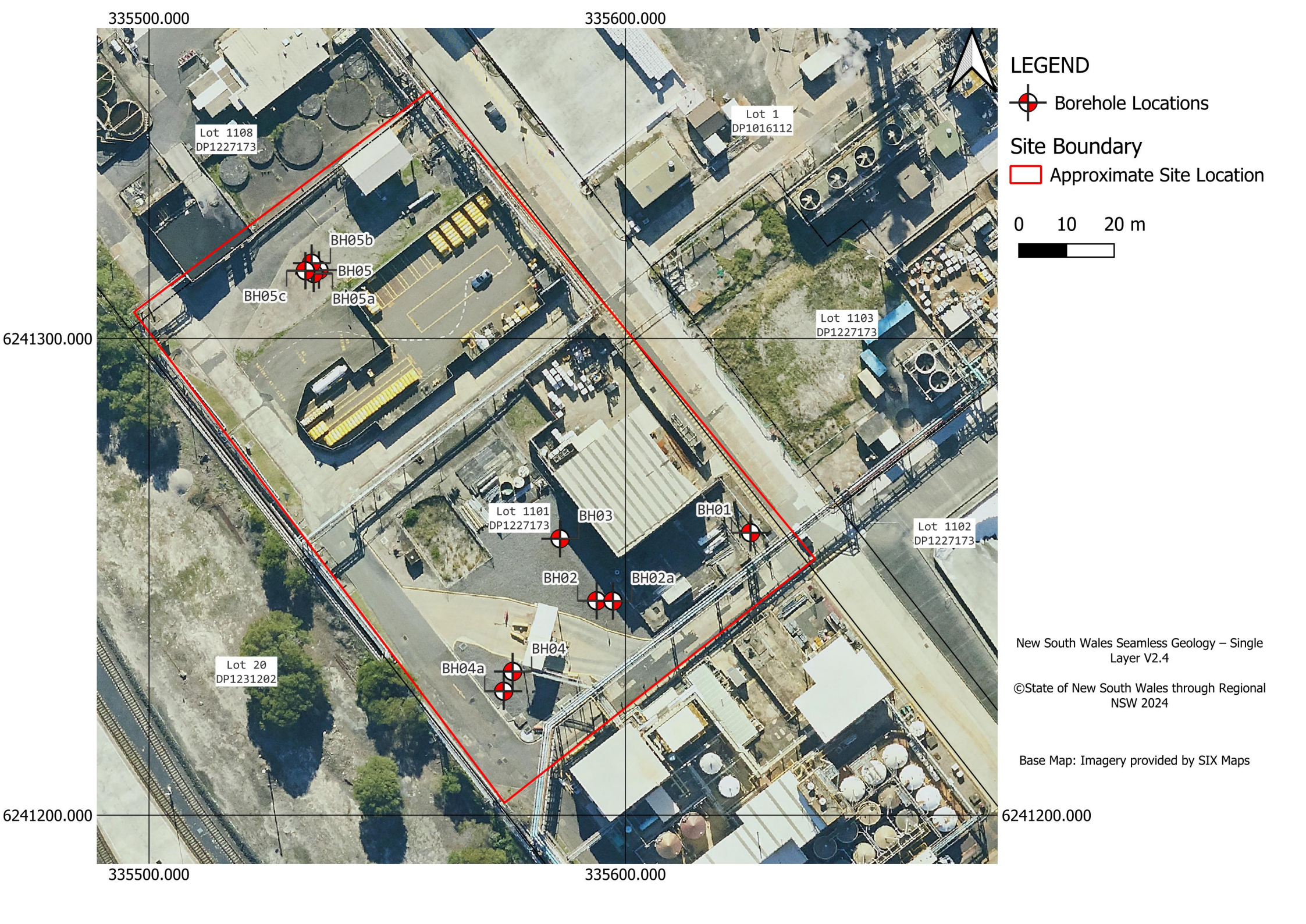
| | |
|---|---|
| fragmented | The core is comprised primarily of fragments of length less than 20mm, and mostly of width less than the core diameter |
| highly fractured | Core lengths are generally less than 20mm - 40mm with occasional fragments. |
| fractured | Core lengths are mainly 30mm - 100mm with occasional shorter and longer lengths |
| slightly fractured | Core lengths are generally 300mm - 1000mm with occasional longer sections and shorter sections of 100mm -- 300mm. |
| unbroken | The core does not contain any fracture. |

# - spacing of all types of natural fractures, but not artificial breaks, in cored bores.

The fracture spacing is shown where applicable and the Rock Quality Designation is given by: RQD (%) = sum of unbroken core pieces 100 mm or longer

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# Appendix B – Site Plan


335500.000
335600.000
6241300.000
6241200.000
Lot 1108
DP1227173
Lot 1
DP1016112
Lot 1103
DP1227173
Lot 1101
DP1227173
Lot 1102
DP1227173
Lot 20
DP1231202
BH05b
BH05
BH05c
BH05a
BH03
BH01
BH02
BH02a
BH04
BH04a
LEGEND
Borehole Locations
Site Boundary
Approximate Site Location
0
10
20 m
New South Wales Seamless Geology – Single Layer V2.4
©State of New South Wales through Regional NSW 2024
Base Map: Imagery provided by SIX Maps

MACQUARIE GEOTECH

# Appendix C – Borehole Logs

MACQUARIE GEOTECH

# EXPLORATORY HOLE - GEOTECHNICAL LOG

ID: **BH01**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE: **BH**

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: 1 of 1

DATA QUALITY: REVISION: PRODUCTION CODE: **2502241754** SUITABILITY CODE:

POSITION: E: **335626.00** N: **6241259.00** **(MGA2020-56)** RL: **12.00** (AHD) DESIGN ELEMENT:

FIELD WORK: DATE: **25/10/24** LOGGED BY: **KR**

HOLE CONSTRUCTION: PLANT: **GEO305** DIP/AZIMUTH: **°/°** OPERATED BY: **IB**

| METHOD | CASING | WATER OBS. | SAMPLE | DEPTH | INSITU TEST | ELEVATION | DEPTH | GRAPHIC LOG | INFERRED ORIGIN | GROUP SYMBOL | MATERIAL COMPOSITION | MOISTURE CONDITION | CONSIS. / REL. DENS. | ADDITIONAL OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD/T | | ▶ | D DIG.JAY | 0.15 | | 12.0 | 0.0 | | NA | NA | 0.00 CONCRETE; aggregate up to 20mm | NA | NA | |
| | | | SPT SET.LIB B TAM.REM | 0.50 | SPT: 5,5,5 N=10 | | | | | | 0.13 SAND trace gravel, trace silt; grey pale orange yellow; SAND is fine to coarse grained; gravel is fine to medium grained, sub-angular to angular | | | |
| | | | | 0.95 | | | | | | | | | | |
| | | | B WAY.JOY | 1.00 | | 11.0 | 1.0 | | ALV and AEO | SP | | M | L | |
| | | | | 1.50 | | | | | | | | | | |
| | | | SPT JOB.ASH B PAD.SHE | 1.95 | SPT: 4,5,4 N=9 | 10.0 | 2.0 | | | | | | | |
| | | | D SAM.SUP | 2.20 | | | | | | | 2.20 SAND trace silt; pale-dark grey; SAND is fine to medium grained | | | |
| | | | SPT ELM.SUB B WIN.JET | 2.50 | SPT: 1,3,3 N=6 | | | | | | | | | |
| | | | | 2.95 | | 9.0 | 3.0 | | ALV and AEO | SP | | M | L | |
| | | | | 3.50 | | | | | | | | | | |
| | | | SPT RUM.ART B PAL.COT | 3.70 | SPT: 3,5,6 N=11 | | | | | | 3.63 SAND trace silt; dark brown orange; SAND is fine to medium grained | | | |
| | | | | 3.95 | | 8.0 | 4.0 | | ALV and AEO | SP | | M | MD | |
| | | | | 4.50 | | | | | | | | | | |
| | | | SPT DOG.DAN B OWE.PAP | 4.60 | SPT: 2,6,8 N=14 | | | | | | 4.60 SAND trace silt; pale grey; SAND is fine to medium grained | | | |
| | | | | 4.95 | | 7.0 | 5.0 | | ALV and AEO | SP | | M-W | MD | |
| | | | | 5.50 | | | | | | | | | | |
| | | | SPT THE.BOW B HAM.ASP | 5.95 | SPT: 2,7,9 N=16 | | | | | | | | | |
| | | | | 6.00 | | 6.0 | 6.0 | | | | Terminated at 6.00 m. Criteria Satisfied. | | | |
| | | | | | | 5.0 | 7.0 | | | | | | | |

VERSION CONTROL
HOLE ID: BH01
PRODUCTION CODE: 2502241754
PAGE ID: BH01{GDMS[LOG]_001}

Remarks:

MACQUARIE GEOTECH

# EXPLORATORY HOLE - SAMPLE PHOTOS

ID: **BH01**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE:

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: **1** of **1**

MACQUARIE GEOTECH

# EXPLORATORY HOLE - MISCELLANEOUS PHOTOS ID: BH01

PROJECT NAME: Matraville Chlorine Liquefaction Plant
PROJECT LOCATION:
CLIENT: KBR

HOLE TYPE:
MacGeo PROJECT: G24469
PAGE: 1 of 4




BH01_0.00-0.13




BH01_0.5-0.95

VERSION CONTROL
HOLE ID: BH01
PRODUCTION CODE: 2502241806
PAGE ID: BH01{GDMS[MPH]_001}




BH01_1.5-1.95




BH01_2.5-2.95




BH01_3.5-3.95

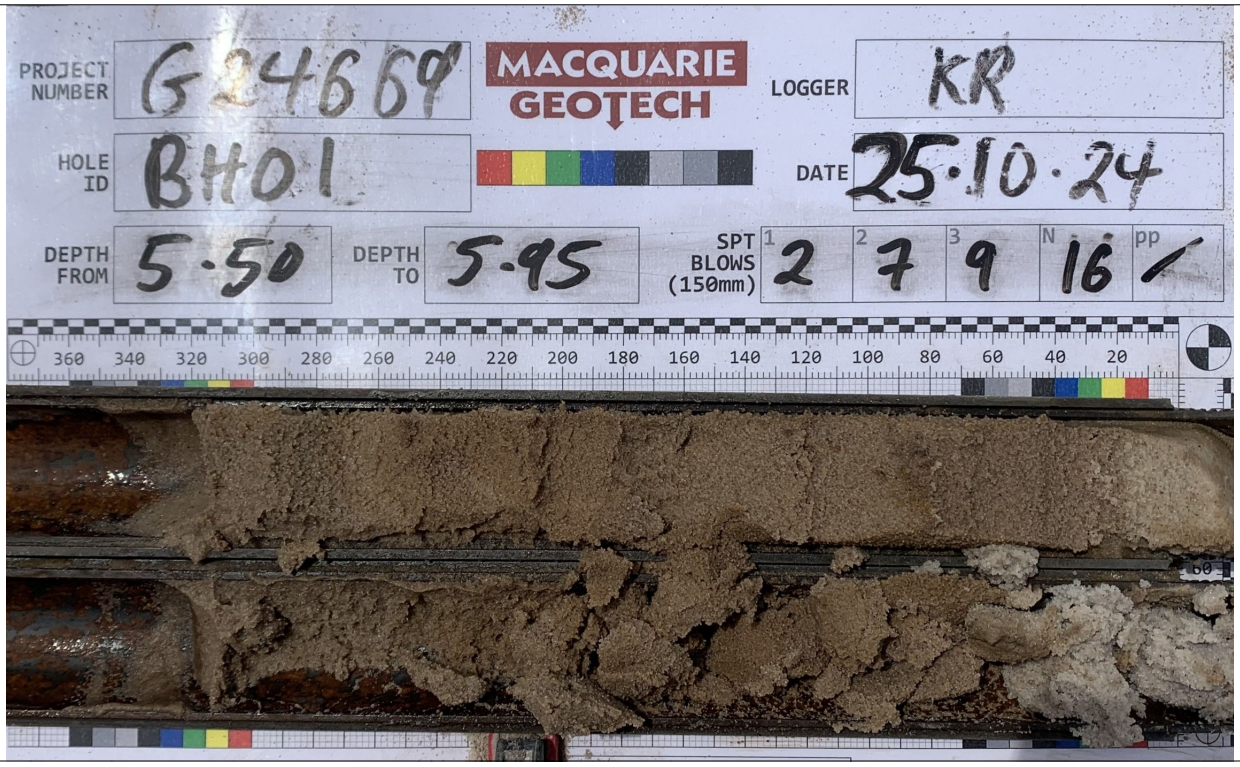



BH01_4.5-4.95

# EXPLORATORY HOLE - MISCELLANEOUS PHOTOS ID: BH01

PROJECT NAME: Matraville Chlorine Liquefaction Plant
PROJECT LOCATION:
CLIENT: KBR

HOLE TYPE:
MacGeo PROJECT: G24469


BH01_5.5-5.95

MACQUARIE GEOTECH

# EXPLORATORY HOLE - GEOTECHNICAL LOG

ID: **BH02**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE: **BH**

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: **1** of **1**

DATA QUALITY: REVISION: PRODUCTION CODE: **2502241754** SUITABILITY CODE:

POSITION: E: **335593.00** N: **6241244.00** **(MGA2020-56)** RL: **11.00** (AHD) DESIGN ELEMENT:

FIELD WORK: DATE: **24/10/24** LOGGED BY: **KR**

HOLE CONSTRUCTION: PLANT: **GEO305** DIP/AZIMUTH: **°/°** OPERATED BY: **IB**

| METHOD / CASING | WATER OBS. | SAMPLE | DEPTH | INSITU TEST | ELEVATION / DEPTH | GRAPHIC LOG | INFERRED ORIGIN | GROUP SYMBOL | MATERIAL COMPOSITION | MOISTURE CONDITION | CONSIS. / REL. DENS. | DCP / VDEP | ADDITIONAL OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD/T | ▼ | SPT FAY.OIL; B LED.CAP | 0.10 – 0.95 | SPT: 4,20,12 N=32 | 11.0 / 0.0 – 10.1 / 1.0 | | FIL | NA | 0.00 FILL/GRAVEL with sand; grey; GRAVEL is fine to coarse, sub-rounded to sub-angular; sand is fine to coarse grained<br>0.10 FILL/SAND with gravel, trace silt; grey-brown; SAND is fine coarse grained; gravel is fine to coarse, sub-angular to angular | NA | NA | 1, 3, 3, 4, 6, 10, 14, 11, 14, 10, 10, 11, 13, 13, 15 | |
| | | SPT ORE.TOY; B RAP.NEW | 1.50 – 1.95 | SPT: 5,10,11 N=21 | 9.0 / 2.0 | | ALV and AEO | SP | 1.50 SAND trace silt; pale grey; SAND is fine to medium grained | M | MD | | |
| | | SPT LAG.MAS; B SIS.CAN; B BAY.DIM | 2.50 – 3.00 | SPT: 5,7,9 N=16 | 8.0 / 3.0 | | | | | | | | |
| | | SPT TAR.SAE; B WAX.MET | 3.50 – 3.95 | SPT: 2,1,0 N=1 | 7.0 / 4.0 | | ALV and AEO | SC-SM | 3.75 SAND with silt, trace gravel; black dark brown; SAND is fine to coarse grained; silt is medium plasticity ; gravel is fine to medium | M-W | VL | | |
| | | SPT COS.NIP; D EGG.OLD | 4.00 – 4.45 | SPT: 1,1,0 N=1 | | | | | | | | | |
| | | B MAC.PIC | 4.50 – 5.00 | | 6.0 / 5.0 | | ALV and AEO | SP-SM | 4.50 Silty SAND; pale grey; SAND is medium to coarse grained | W | MD | | |
| | | SPT FIX.PAT | 5.00 – 5.45 | SPT: 5,9,12 N=21 | | | | | | | | | |
| | | | | | 5.0 / 6.0 | | | | Terminated at 6.00 m.<br>Criteria Satisfied. | | | | |
| | | | | | 4.0 / 7.0 | | | | | | | | |

Remarks:

MACQUARIE GEOTECH

# EXPLORATORY HOLE - SAMPLE PHOTOS

ID: **BH02**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE:

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: **1** of **1**

VERSION CONTROL

HOLE ID: BH02

PRODUCTION CODE: 2502241754

PAGE ID: BH02{GDMS[SMP]_001}

MACQUARIE GEOTECH

# EXPLORATORY HOLE - GEOTECHNICAL LOG

ID: **BH02a**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE: **BH**

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: **1** of **1**

DATA QUALITY: REVISION: PRODUCTION CODE: **2502241754** SUITABILITY CODE:

POSITION: E: **335597.00** N: **6241244.00** **(MGA2020-56)** RL: **11.00** (AHD) DESIGN ELEMENT:

FIELD WORK: DATE: **25/10/24** LOGGED BY: **KR**

HOLE CONSTRUCTION: PLANT: **GEO305** DIP/AZIMUTH: **°/°** OPERATED BY: **IB**

| METHOD | CASING | WATER OBS. | SAMPLE | DEPTH | INSITU TEST | ELEVATION / DEPTH | GRAPHIC LOG | INFERRED ORIGIN | GROUP SYMBOL | MATERIAL COMPOSITION | MOISTURE CONDITION | CONSIS. / REL. DENS. | ADDITIONAL OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD/T | | Free groundwater not observed | B SAC.SAY | 0.10 | | 11.0 / 0.0 | | FIL | NA | 0.00 FILL/GRAVEL; grey; fine to coarse, sub-rounded to sub-angular | NA | NA | |
| | | | | | | | | | | 0.10 FILL/Gravelly SAND; grey; SAND is fine to coarse grained; Gravel is fine to medium grained, sub-angular to angular | | | |
| | | | | | | 10.1 / 1.0 | | FIL | NA | | NA | NA | |
| | | | B ANY.FOG | 1.20 | | | | ALV and AEO | SP | 1.20 SAND with silt; grey pale grey; SAND is fine to medium grained | D | | |
| | | | | 1.70 | | 9.0 / 2.0 | | | | Terminated at 1.70 m. Criteria Satisfied, Bulk Auger samples collected. | | | |
| | | | | | | 8.0 / 3.0 | | | | | | | |
| | | | | | | 7.0 / 4.0 | | | | | | | |
| | | | | | | 6.0 / 5.0 | | | | | | | |
| | | | | | | 5.0 / 6.0 | | | | | | | |
| | | | | | | 4.0 / 7.0 | | | | | | | |

VERSION CONTROL
HOLE ID: BH02a
PRODUCTION CODE: 2502241754
PAGE ID: BH02a(GDMS[LOG]_001)

Remarks:

MACQUARIE GEOTECH

# EXPLORATORY HOLE - SAMPLE PHOTOS

ID: **BH02a**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE:

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: **1** of **1**

VERSION CONTROL
HOLE ID: BH02a
PRODUCTION CODE: 2502241754
PAGE ID: BH02a{GDMS[SMP]_001}

# EXPLORATORY HOLE - MISCELLANEOUS PHOTOS ID: BH02

PROJECT NAME: Matraville Chlorine Liquefaction Plant
PROJECT LOCATION:
CLIENT: KBR

HOLE TYPE:
MacGeo PROJECT: G24469





BH02_0.5-0.95




BH02_1.5-1.95




BH02_2.5-2.95




BH02_3.5-3.95

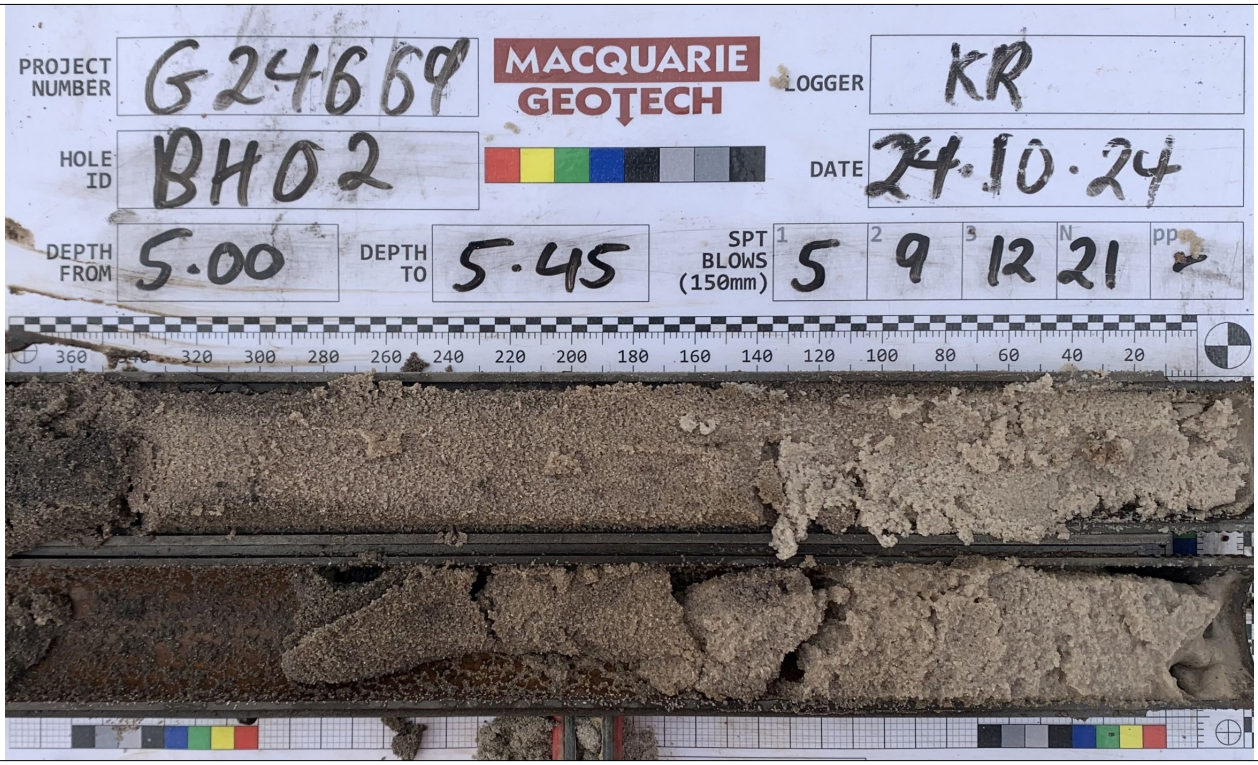
# EXPLORATORY HOLE - MISCELLANEOUS PHOTOS ID: BH02

PROJECT NAME: Matraville Chlorine Liquefaction Plant
PROJECT LOCATION:
CLIENT: KBR

HOLE TYPE:
MacGeo PROJECT: G24469
PAGE: 3 of 3




BH02_4-4.45




BH02_5-5.45

VERSION CONTROL
HOLE ID: BH02
PRODUCTION CODE: 2502241807
PAGE ID: BH02{GDMS[MPH]_003}

MACQUARIE GEOTECH

# EXPLORATORY HOLE - GEOTECHNICAL LOG

ID: **BH03**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

PROJECT LOCATION:

CLIENT: **KBR**

HOLE TYPE: **BH**

MacGeo PROJECT: **G24469**

PAGE: 1 of **1**

DATA QUALITY: REVISION: PRODUCTION CODE: **2502241754** SUITABILITY CODE:

POSITION: E: **335586.00** N: **6241257.00** **(MGA2020-56)** RL: **11.00** (AHD) DESIGN ELEMENT:

FIELD WORK: DATE: **24/10/24** LOGGED BY: **KR**

HOLE CONSTRUCTION: PLANT: **GEO305** DIP/AZIMUTH: **°/°** OPERATED BY: **IB**

| METHOD / CASING | WATER OBS. | SAMPLE | DEPTH | INSITU TEST | ELEVATION / DEPTH | GRAPHIC LOG | INFERRED ORIGIN | GROUP SYMBOL | MATERIAL COMPOSITION | MOISTURE CONDITION | CONSIS. / REL. DENS. | DCP (5 10 15 20) / VDEP (2 4 6 8) | ADDITIONAL OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD/T | ▶ | B OAK.FED | 0.10 | | 11.0 / 0.0 | | FIL | NA | 0.00 FILL/GRAVEL with sand; grey; GRAVEL is fine to coarse, sub-angular to angular; sand is fine to coarse grained | | | 1 | |
| | | SPT COW.RAT | 0.50 0.57 0.58 | SPT: 30/75 mm N=R | | | FIL | NA | 0.10 FILL/Sandy GRAVEL trace clay; grey-dark grey; GRAVEL is fine to coarse, sub-angular to angular; Sand is fine to coarse grained | | | 11 5 7 10 9 | |
| | | | | | | | | | 0.57 FILL/CONCRETE; grey; aggregate up to 15mm | NA | NA | 6 13 | |
| | | | | | 10.1 / 1.0 | | FIL | NA | | | | 25 | |
| | | SPT COX.TOT | 1.50 | SPT: 1,1,1 N=2 | | | | | 1.40 SAND with silt; pale grey mottled yellow-orange; SAND is fine to medium grained | | VL | | |
| | | B OLE.OFT | 1.95 | | 9.0 / 2.0 | | | | | | | | |
| | | SPT WOW.TEN | 2.50 | SPT: 4,5,5 N=10 | | | ALV and AEO | SP | *2.50-2.95: trace pockets of dark brown silt* | M | L | | |
| | | B INN.LAG | 2.95 | | 8.0 / 3.0 | | | | | | | | |
| | | SPT FAY.SIS | 3.50 | SPT: 4,4,3 N=7 | | | | | *3.50-3.95: trace pockets of black and dark brown silt* | | | | |
| | ▶ | | 3.90 | | | | | | | | | | |
| | | D SIP.SIS | 3.95 | | 7.0 / 4.0 | | ALV and AEO | OL | 3.90 Clayey SAND; black dark brown; SAND is fine to coarse grained; Clay is medium plasticity | W | MD | | |
| | | SPT PEP.OWN | 4.50 4.60 | SPT: 1,5,9 N=14 | | | | | 4.60 SAND with silt; grey-brown; SAND is fine to medium grained | | | | |
| | | B JAR.GIG | 4.95 5.00 | SPT: 1,4,6 N=10 | 6.0 / 5.0 | | ALV and AEO | SP | | W | L-MD | | |
| | | SPT APE.HUH | 5.45 5.50 | | | | | | | | | | |
| | | D EMU.PUB | 5.95 | | | | | | | | | | |
| | | | 6.00 | | 5.0 / 6.0 | | | | Terminated at 6.00 m. Criteria Satisfied. | | | | |
| | | | | | 4.0 / 7.0 | | | | | | | | |

VERSION CONTROL
HOLE ID: BH03
PRODUCTION CODE: 2502241754
PAGE ID: BH03{GDMS[LOG]_001}

Remarks:

MACQUARIE GEOTECH

# EXPLORATORY HOLE - SAMPLE PHOTOS

ID: **BH03**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE:

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

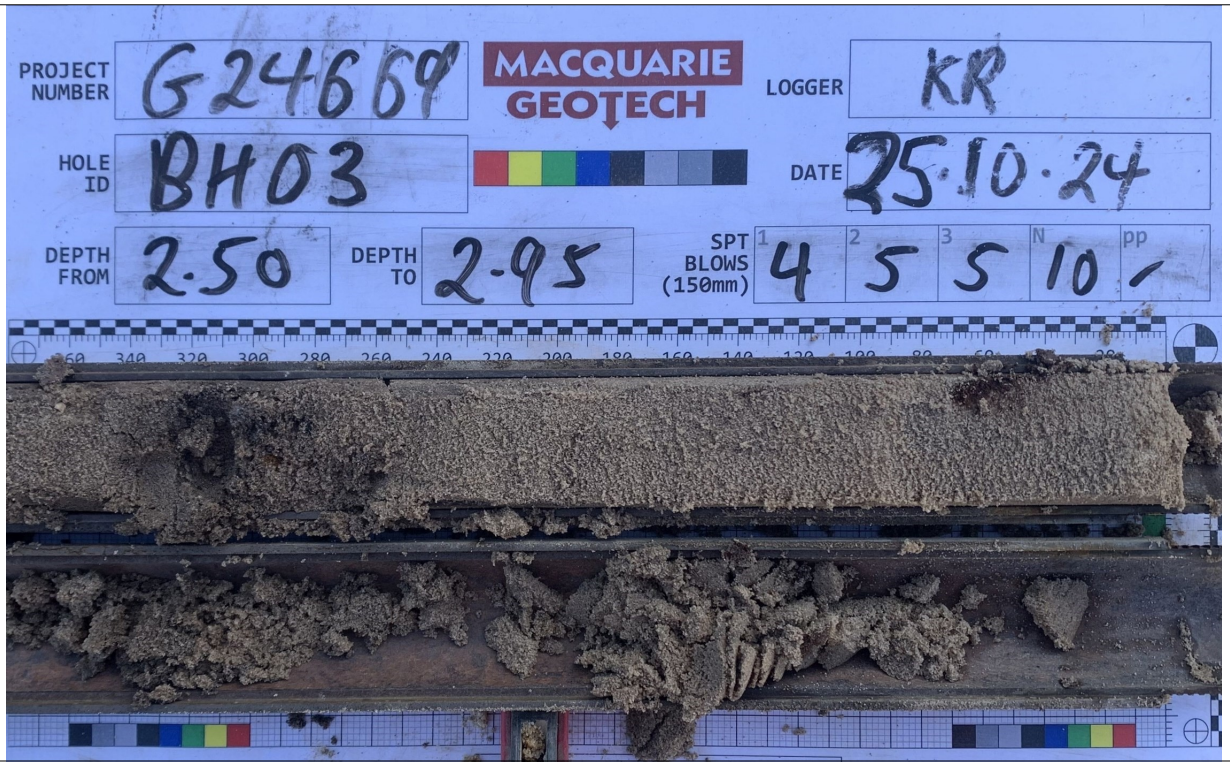
PAGE: **1** of **1**



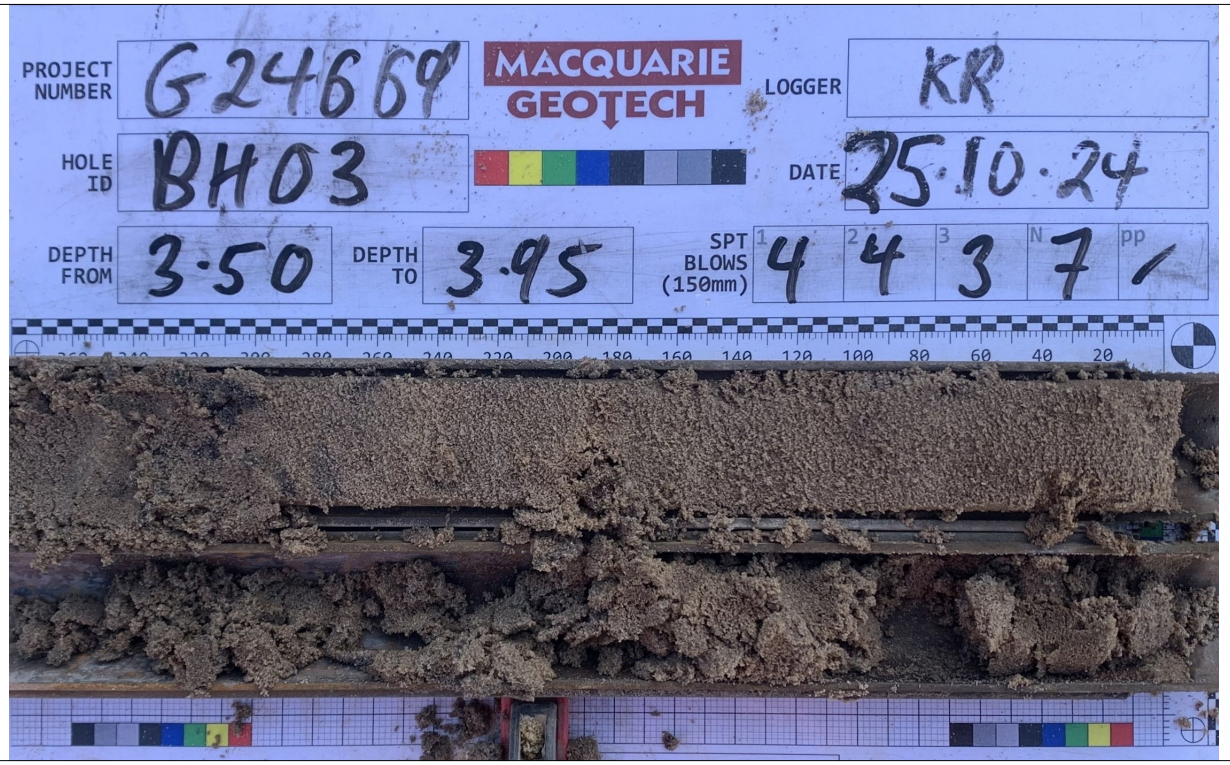

BH03_0.5-0.57




BH03_1.5-1.95




BH03_2.5-2.95




BH03_3.5-3.95

MACQUARIE GEOTECH

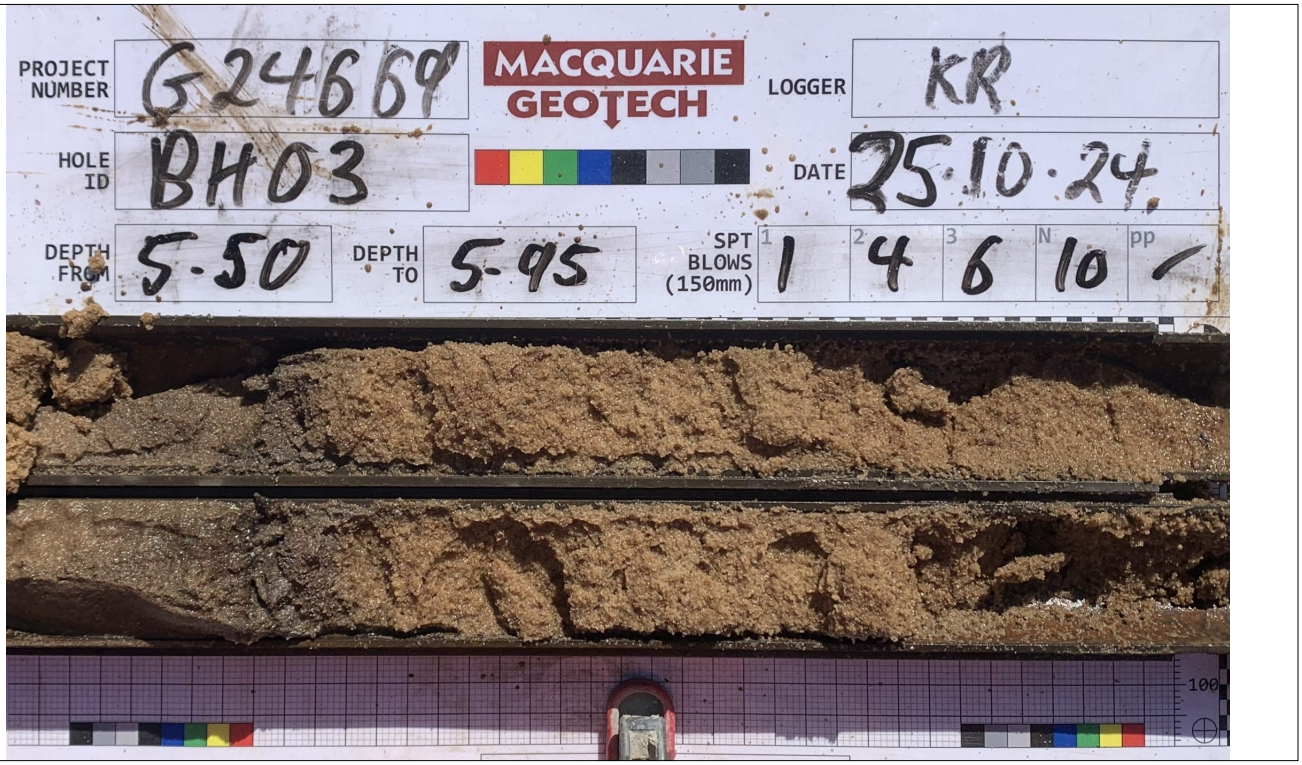
# EXPLORATORY HOLE - MISCELLANEOUS PHOTOS ID: BH03

PROJECT NAME: Matraville Chlorine Liquefaction Plant
PROJECT LOCATION:
CLIENT: KBR

HOLE TYPE:
MacGeo PROJECT: G24469
PAGE: 3 of 3




BH03_4.5-4.95




BH03_5.5-5.95

VERSION CONTROL
HOLE ID: BH03
PRODUCTION CODE: 2502241807
PAGE ID: BH03{GDMS[MPH]_003}

# EXPLORATORY HOLE - GEOTECHNICAL LOG

ID: **BH04**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**
HOLE TYPE: **BH**
PROJECT LOCATION:
MacGeo PROJECT: **G24469**
CLIENT: **KBR**
PAGE: **1** of **1**

DATA QUALITY: REVISION: PRODUCTION CODE: **2502241754** SUITABILITY CODE:

POSITION: E: **335576.00** N: **6241229.00** **(MGA2020-56)** RL: **11.00** (AHD) DESIGN ELEMENT:

FIELD WORK: DATE: **24/10/24** LOGGED BY: **KR**

HOLE CONSTRUCTION: PLANT: **GEO305** DIP/AZIMUTH: **°/°** OPERATED BY: **IB**

| METHOD | CASING | WATER OBS. | SAMPLE | DEPTH | INSITU TEST | ELEVATION / DEPTH | GRAPHIC LOG | INFERRED ORIGIN | GROUP SYMBOL | MATERIAL COMPOSITION | MOISTURE CONDITION | CONSIS. / REL. DENS. | DCP / VDEP | ADDITIONAL OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD/T | 140 mm | Free groundwater not observed | D NEB.LES | 0.10 | | 11.0 / 0.0 | | FIL | NA | 0.00 FILL/GRAVEL with sand; grey-red; | | | 1 | 0.10m: 10mm thick plastic sheeting |
| | | | | | | | | | | 0.10 GRAVEL is fine coarse, angular; sand is fine to coarse grained FILL/SAND with gravel, trace silt; grey-brown black; SAND is fine to coarse grained; gravel is fine to coarse, sub-angular to angular | | | 4 | |
| | | | | | | | | | | | | | 4 | |
| | | | | 0.50 | | | | | | | | | 3 | |
| | | | SPT JAW.THY | | SPT: 5,5,11 N=16 | | | | | | | | 3 | |
| | | | | | | | | | | | | | 3 | |
| | | | | | | | | | | | | | 8 | |
| | | | D SOD.LAB | 0.95 | | | | | | | | | 4 | |
| | | | | 1.00 | | 10.01.0 | | FIL | NA | | NA | NA | 2 | |
| | | | | | | | | | | | | | 7 | |
| | | | | | | | | | | | | | 11 | |
| | | | | | | | | | | | | | 7 | |
| | | | B LIT.BAT | 1.40 | | | | ALV and AEO | SP | 1.40 SAND trace silt; pale grey; SAND is fine to medium grained | | | 10 | |
| | | | | | | | | | | Terminated at 1.41 m. Possible concrete obstruction . | | | 9 | |
| | | | | | | 9.02.0 | | | | | | | 8 | |
| | | | | | | 8.03.0 | | | | | | | | |
| | | | | | | 7.04.0 | | | | | | | | |
| | | | | | | 6.05.0 | | | | | | | | |
| | | | | | | 5.06.0 | | | | | | | | |
| | | | | | | 4.07.0 | | | | | | | | |

DCP 5 10 15 20 / 2 4 6 8 — VDEP

Remarks:

VERSION CONTROL
HOLE ID: BH04
PRODUCTION CODE: 2502241754
PAGE ID: BH04{GDMS[LOG]_001}

MACQUARIE GEOTECH

# EXPLORATORY HOLE - SAMPLE PHOTOS

ID: **BH04**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE:

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: **1** of **1**

MACQUARIE GEOTECH

# EXPLORATORY HOLE - GEOTECHNICAL LOG

ID: **BH04a**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE: **BH**

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: 1 of 1

DATA QUALITY: REVISION: PRODUCTION CODE: **2502241754** SUITABILITY CODE:

POSITION: E: **335574.00** N: **6241225.00** **(MGA2020-56)** RL: **10.00** (AHD) DESIGN ELEMENT:

FIELD WORK: DATE: **24/10/24** LOGGED BY: **KR**

HOLE CONSTRUCTION: PLANT: **GEO305** DIP/AZIMUTH: **°/°** OPERATED BY: **IB**

| METHOD / CASING | WATER OBS. | SAMPLE | DEPTH | INSITU TEST | ELEVATION / DEPTH | GRAPHIC LOG | INFERRED ORIGIN | GROUP SYMBOL | MATERIAL COMPOSITION | MOISTURE CONDITION | CONSIS. / REL. DENS. | ADDITIONAL OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD/T | ▶ | D JOG.RAM | 0.10 | | 10.0 / 0.0 | | FIL | NA | 0.00 FILL/GRAVEL with sand; grey; GRAVEL is fine to coarse, angular to sub-angular; sand is fine to coarse grained | NA | NA | |
| | | | 0.10 | | | | FIL | NA | FILL/SAND with gravel, with silt; grey brown; SAND is fine to coarse grained; gravel is fine to coarse, angular to subangular | NA | NA | |
| | | SPT OUR.GAG | 0.50 | SPT: 3,7,18 N=25 | | | | | | | | |
| | | | 0.95 | | | | | | | | | |
| | | | 1.00 | | 9.01.0 | | FIL | NA | 0.85 FILL/CONCRETE; grey red brown; aggregate up to 15mm; aggregate up to 15mm | NA | NA | |
| | | D SAC.KIN | 1.50 | | | | | | | | | |
| | | SPT PAP.AID | | SPT: 4,6,8 N=14 | | | | | 1.50 SAND trace silt, trace gravel; pale grey; SAND is fine to medium grained; gravel is fine | | | |
| | | B IGG.WET | 1.95 | | 8.02.0 | | ALV and AEO | SP | *2.50-2.95: trace pockets of black silt* | M | L-MD | |
| | | SPT WEE.WET | 2.50 | SPT: 3,4,6 N=10 | | | | | | | | |
| | | | 2.95 | | 7.03.0 | | | | | | | |
| | | D NAY.LEG | 3.00 | | | | | | | | | |
| | | SPT SAW.CAT | 3.50 | SPT: 4,5,6 N=11 | | | ALV and AEO | SP | 3.50 SAND trace silt; grey; SAND is fine to medium grained *3.50-3.95: trace gravel subangular fine to medium.* | M | MD | |
| | | | 3.95 | | 6.04.0 | | | | | | | |
| | | B PSI.DIS | 4.00 | | | | ALV | CI | 4.00 Sandy Silty CLAY; black; CLAY is medium plasticity; Sand is fine to medium grained; Hydrocarbon Odour | w<PL | S-F | |
| | | U HIS.CUB | 4.50 | | | | | | 4.50 Silty SAND; grey dark grey; SAND is fine to medium grained *4.90-5.00: oily sheen observed on the SPT sample.* | | | |
| | | | 4.90 | | | | | | | | | |
| | | SPT DOE.COS | 5.00 | SPT: 3,5,7 N=12 | 5.05.0 | | ALV and AEO | SM | | M-W | MD | |
| | | | 5.35 | | | | | | | | | |
| | | B PUT.NOW | | | | | | | | | | |
| | | | 6.00 | | 4.06.0 | | | | Terminated at 6.00 m. Criteria Satisfied. | | | |
| | | | | | 3.07.0 | | | | | | | |

VERSION CONTROL
HOLE ID: BH04a
PRODUCTION CODE: 2502241754
PAGE ID: BH04a{GDMS[LOG]_001}

Remarks:

MACQUARIE GEOTECH

# EXPLORATORY HOLE - SAMPLE PHOTOS

ID: **BH04a**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE:

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

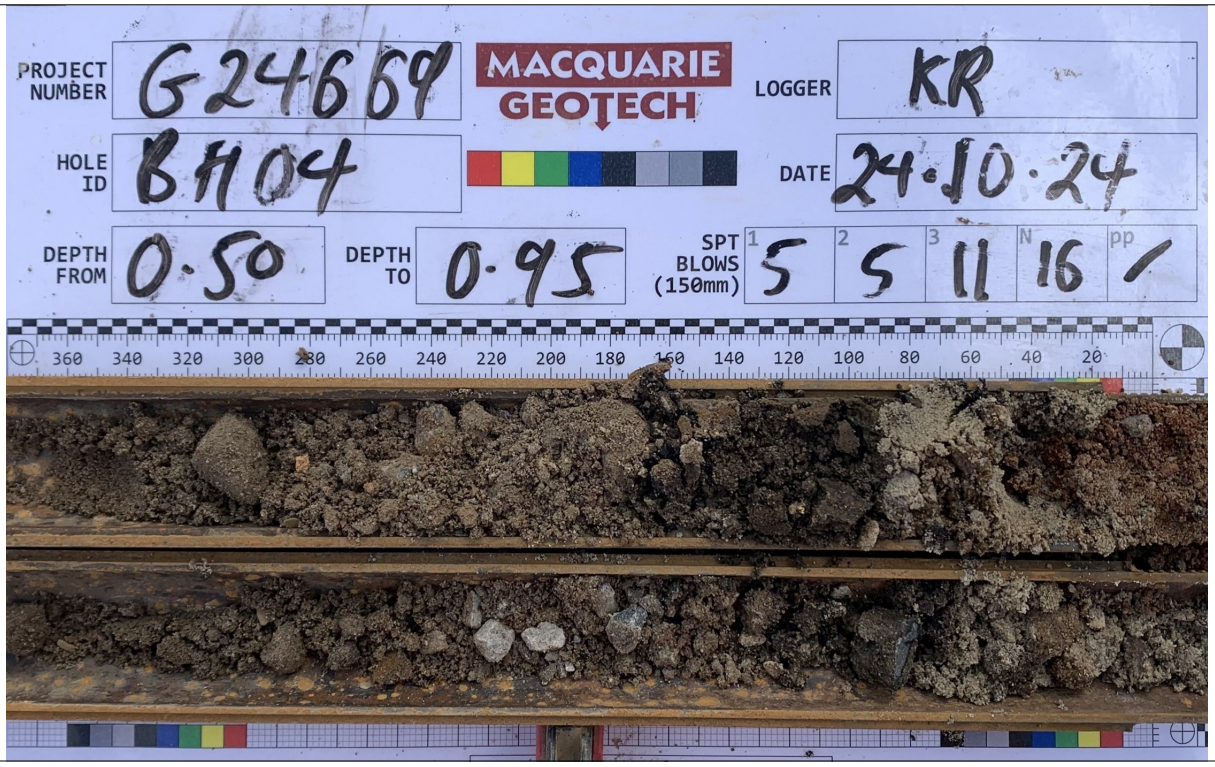
PAGE: **1** of **1**

VERSION CONTROL
HOLE ID: BH04a
PRODUCTION CODE: 2502241754
PAGE ID: BH04a{GDMS[SMP]_001}

# EXPLORATORY HOLE - MISCELLANEOUS PHOTOS ID: BH04

PROJECT NAME: Matraville Chlorine Liquefaction Plant
PROJECT LOCATION:
CLIENT: KBR

HOLE TYPE:
MacGeo PROJECT: G24469
PAGE: 1 of 1



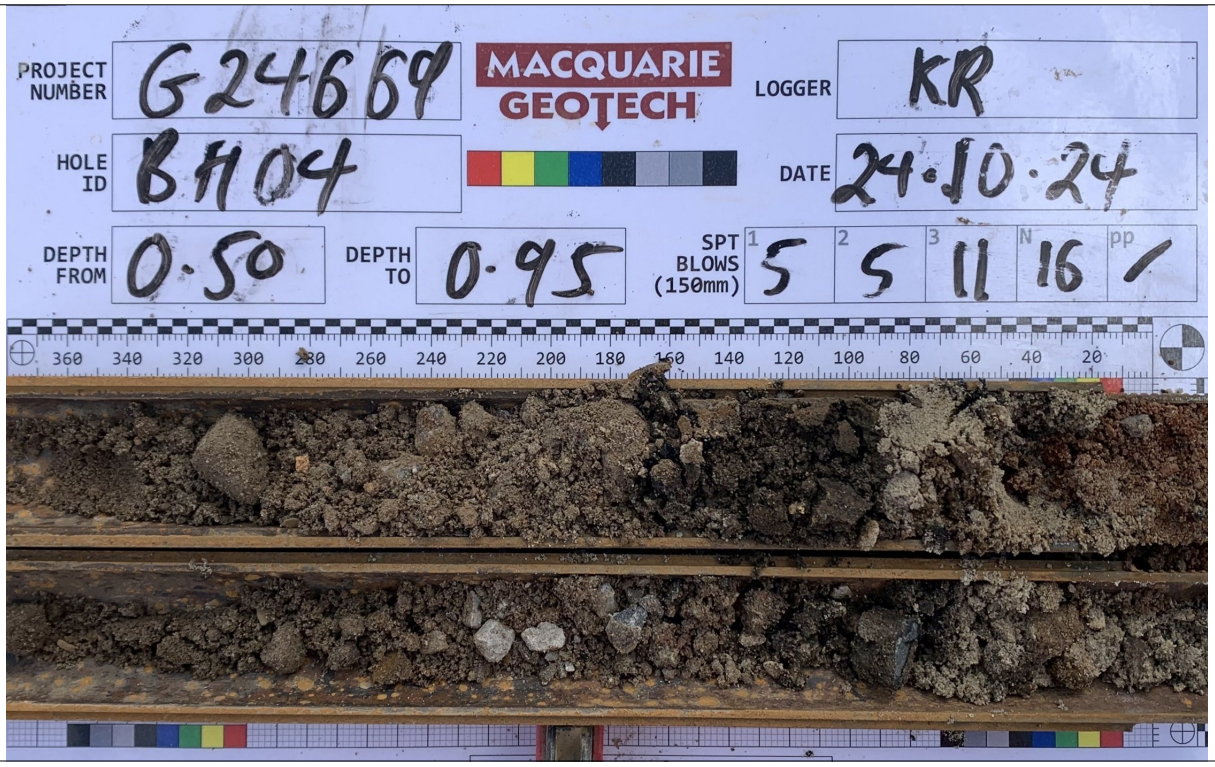

BH04_0.5-0.95

VERSION CONTROL
HOLE ID: BH04
PRODUCTION CODE: 2502241807
PAGE ID: BH04{GDMS[MPH]_001}

# EXPLORATORY HOLE - MISCELLANEOUS PHOTOS ID: BH04a

PROJECT NAME: Matraville Chlorine Liquefaction Plant
PROJECT LOCATION:
CLIENT: KBR

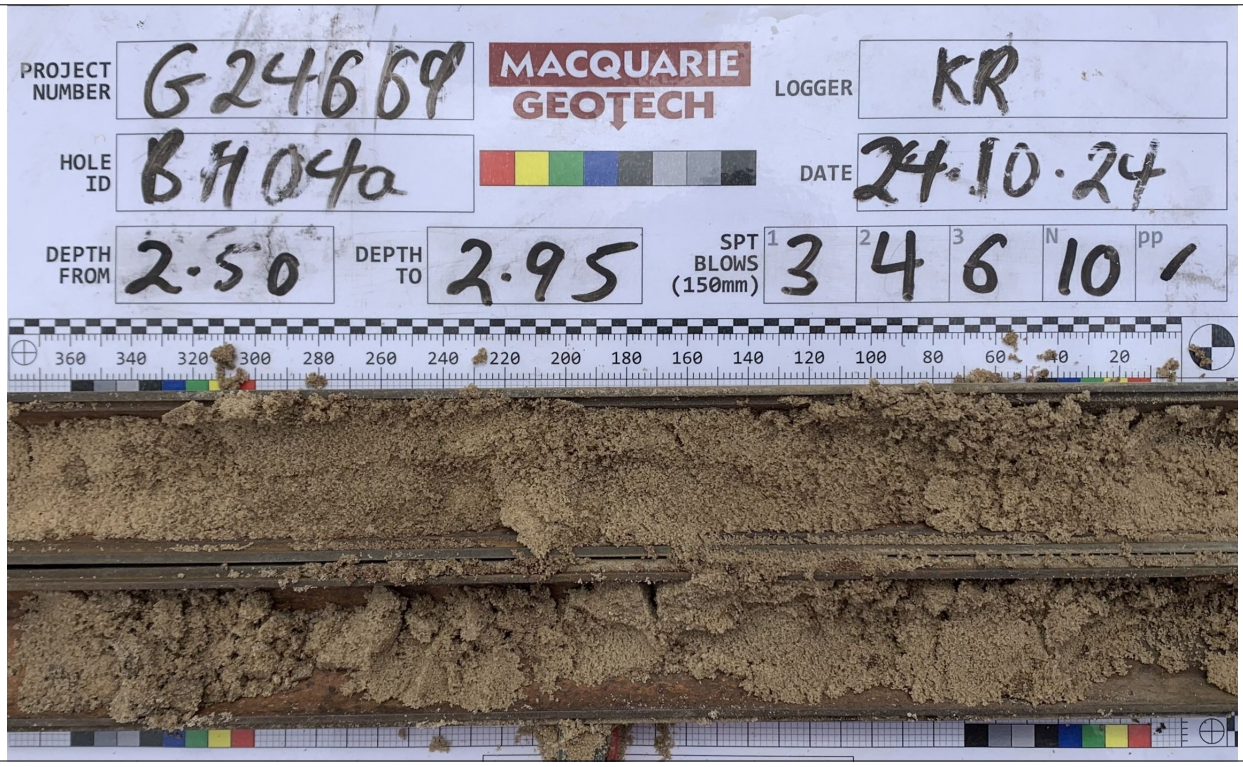
HOLE TYPE:
MacGeo PROJECT: G24469


BH04a_0.5-0.95




BH04a_1.5-1.95




BH04a_2.5-2.95

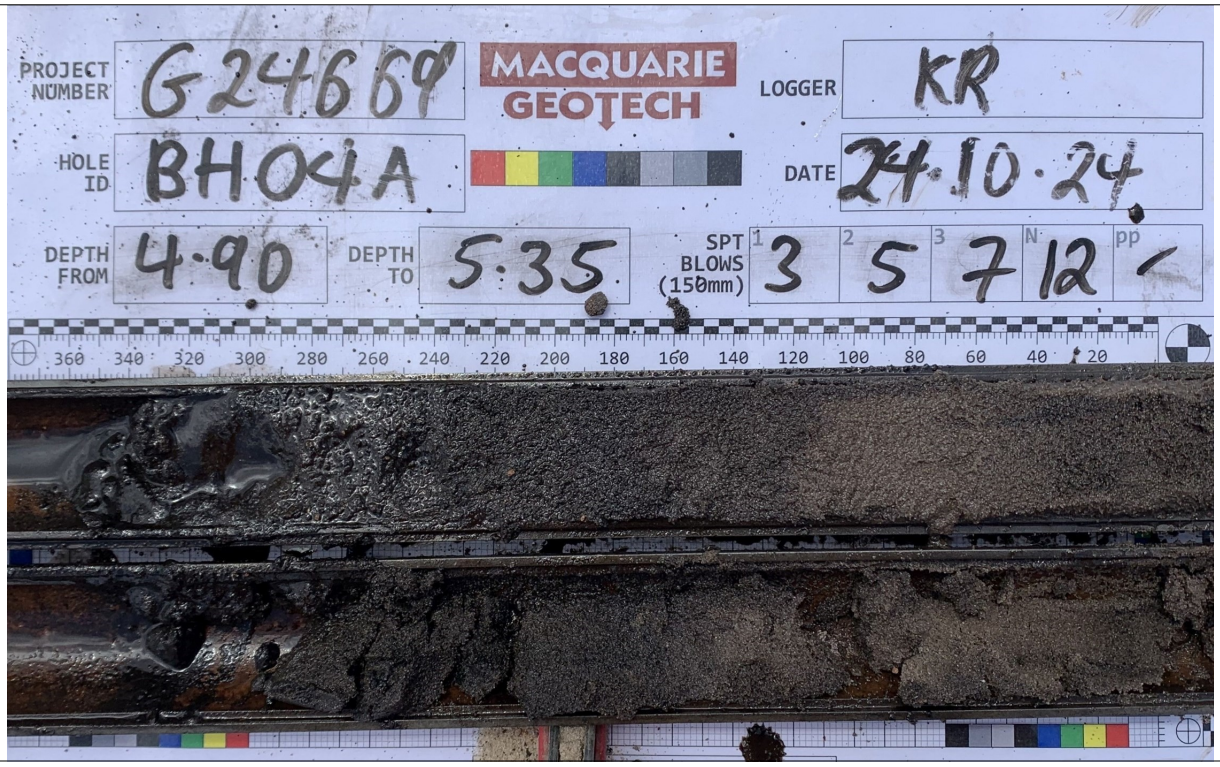



BH04a_3.5-3.95

# EXPLORATORY HOLE - MISCELLANEOUS PHOTOS ID: BH04a

PROJECT NAME: Matraville Chlorine Liquefaction Plant
PROJECT LOCATION:
CLIENT: KBR

HOLE TYPE:
MacGeo PROJECT: G24469


BH04a_4.9-5.35

VERSION CONTROL
HOLE ID: BH04a
PRODUCTION CODE: 2502241807
PAGE ID: BH04a{GDMS[MPH]_003}

MACQUARIE GEOTECH

# EXPLORATORY HOLE - GEOTECHNICAL LOG

ID: **BH05**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE: **BH**

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: **1** of **1**

DATA QUALITY: REVISION: PRODUCTION CODE: **2502241754** SUITABILITY CODE:

POSITION: E: **335535.00** N: **6241314.00** **(MGA2020-56)** RL: **9.00** (AHD) DESIGN ELEMENT:

FIELD WORK: DATE: **25/10/24** LOGGED BY: **KR**

HOLE CONSTRUCTION: PLANT: **GEO305** DIP/AZIMUTH: **°/°** OPERATED BY: **IB**

| METHOD | CASING | WATER OBS. | SAMPLE | DEPTH | INSITU TEST | ELEVATION / DEPTH | GRAPHIC LOG | INFERRED ORIGIN | GROUP SYMBOL | MATERIAL COMPOSITION | MOISTURE CONDITION | CONSIS. / REL. DENS. | DCP / VDEP | ADDITIONAL OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD/T | | Free groundwater not observed | | | | 9.0 0.0 | | FIL | NA | 0.00 FILL/Sandy GRAVEL with silt; grey; GRAVEL is fine to coarse, angular to sub-angular; Sand is fine to coarse grained. | NA | NA | 25 / 25 | |
| | | | | | | | | | | Terminated at 0.40 m. Concrete Obstruction. | | | | |
| | | | | | | 8.01.0 | | | | | | | | |
| | | | | | | 7.02.0 | | | | | | | | |
| | | | | | | 6.03.0 | | | | | | | | |
| | | | | | | 5.04.0 | | | | | | | | |
| | | | | | | 4.05.0 | | | | | | | | |
| | | | | | | 3.06.0 | | | | | | | | |
| | | | | | | 2.07.0 | | | | | | | | |

DCP 5 10 15 20

VDEP 2 4 6 8

VERSION CONTROL
HOLE ID: BH05
PRODUCTION CODE: 2502241754
PAGE ID: BH05{GDMS[LOG]_001}

Remarks:

MACQUARIE GEOTECH

# EXPLORATORY HOLE - SAMPLE PHOTOS

ID: **BH05**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE:

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: **1** of **1**

VERSION CONTROL
HOLE ID: BH05
PRODUCTION CODE: 2502241754
PAGE ID: BH05{GDMS[SMP]_001}

# EXPLORATORY HOLE - GEOTECHNICAL LOG

ID: **BH05a**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**
HOLE TYPE: **BH**
PROJECT LOCATION:
MacGeo PROJECT: **G24469**
CLIENT: **KBR**
PAGE: **1** of **1**

DATA QUALITY: REVISION: PRODUCTION CODE: **2502241754** SUITABILITY CODE:

POSITION: E: **335534.00** N: **6241313.00** **(MGA2020-56)** RL: **9.00** (AHD) DESIGN ELEMENT:

FIELD WORK: DATE: **25/10/24** LOGGED BY: **KR**

HOLE CONSTRUCTION: PLANT: **GEO305** DIP/AZIMUTH: **°/°** OPERATED BY: **IB**

| METHOD | CASING | WATER OBS. | SAMPLE | DEPTH | INSITU TEST | ELEVATION / DEPTH | GRAPHIC LOG | INFERRED ORIGIN | GROUP SYMBOL | MATERIAL COMPOSITION | MOISTURE CONDITION | CONSIS. / REL. DENS. | ADDITIONAL OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD/T | | Free groundwater not observed | | | | 9.0 0.0 | | FIL | NA | 0.00 FILL/Sandy GRAVEL with silt; grey; GRAVEL is fine to coarse, angular to sub-angular; Sand is fine to coarse grained | NA | NA | |
| | | | | | | | | | | Terminated at 0.40 m. Concrete Obstruction . | | | |
| | | | | | | 8.0 1.0 | | | | | | | |
| | | | | | | 7.0 2.0 | | | | | | | |
| | | | | | | 6.0 3.0 | | | | | | | |
| | | | | | | 5.0 4.0 | | | | | | | |
| | | | | | | 4.0 5.0 | | | | | | | |
| | | | | | | 3.0 6.0 | | | | | | | |
| | | | | | | 2.0 7.0 | | | | | | | |

Remarks:

VERSION CONTROL
HOLE ID: BH05a
PRODUCTION CODE: 2502241754
PAGE ID: BH05a{GDMS[LOG]_001}

MACQUARIE GEOTECH

# EXPLORATORY HOLE - SAMPLE PHOTOS

ID: **BH05a**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE:

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: **1** of **1**

VERSION CONTROL
HOLE ID: BH05a
PRODUCTION CODE: 2502241754
PAGE ID: BH05a{GDMS[SMP]_001}

MACQUARIE GEOTECH

# EXPLORATORY HOLE - GEOTECHNICAL LOG

ID: **BH05b**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE: **BH**

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: **1** of **1**

DATA QUALITY: REVISION: PRODUCTION CODE: **2502241754** SUITABILITY CODE:

POSITION: E: **335534.00** N: **6241315.00** **(MGA2020-56)** RL: **9.00** (AHD) DESIGN ELEMENT:

FIELD WORK: DATE: **25/10/24** LOGGED BY: **KR**

HOLE CONSTRUCTION: PLANT: **GEO305** DIP/AZIMUTH: **°/°** OPERATED BY: **IB**

| METHOD / CASING | WATER OBS. | SAMPLE | DEPTH | INSITU TEST | ELEVATION / DEPTH | GRAPHIC LOG | INFERRED ORIGIN | GROUP SYMBOL | MATERIAL COMPOSITION | MOISTURE CONDITION | CONSIS. / REL. DENS. | ADDITIONAL OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD/T | Free groundwater not observed | | 0.50<br>0.51 | SPT: 30/5 mm HB N=R | 9.0 0.0 | | FIL | | 0.00 FILL/Sandy GRAVEL; dark grey.; GRAVEL is fine to coarse, sub-angular to angular; Sand is fine to coarse grained.<br><br>Terminated at 0.51 m.<br>Concrete Obstruction . | NA | NA | |

8.01.0

7.02.0

6.03.0

5.04.0

4.05.0

3.06.0

2.07.0

VERSION CONTROL
HOLE ID: BH05b
PRODUCTION CODE: 2502241754
PAGE ID: BH05b{GDMS[LOG]_001}

Remarks:

MACQUARIE GEOTECH

# EXPLORATORY HOLE - SAMPLE PHOTOS

ID: **BH05b**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

HOLE TYPE:

PROJECT LOCATION:

MacGeo PROJECT: **G24469**

CLIENT: **KBR**

PAGE: **1** of **1**

VERSION CONTROL
HOLE ID: BH05b
PRODUCTION CODE: 2502241754
PAGE ID: BH05b{GDMS[SMP]_001}

MACQUARIE GEOTECH

# EXPLORATORY HOLE - GEOTECHNICAL LOG

ID: **BH05c**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**
HOLE TYPE: **BH**
PROJECT LOCATION:
MacGeo PROJECT: **G24469**
CLIENT: **KBR**
PAGE: **1** of **1**

DATA QUALITY: REVISION: PRODUCTION CODE: **2502241754** SUITABILITY CODE:

POSITION: E: **335532.00** N: **6241314.00** **(MGA2020-56)** RL: **9.00** (AHD) DESIGN ELEMENT:

FIELD WORK: DATE: **06/11/24** LOGGED BY: **KR**

HOLE CONSTRUCTION: PLANT: **Drill Techniques Truck Rig/ Concrete Coring** DIP/AZIMUTH: **°/°** OPERATED BY: **TK/GW**

| METHOD | CASING | WATER OBS. | SAMPLE | DEPTH | INSITU TEST | ELEVATION | DEPTH | GRAPHIC LOG | INFERRED ORIGIN | GROUP SYMBOL | MATERIAL COMPOSITION | MOISTURE CONDITION | CONSIS. / REL. DENS. | ADDITIONAL OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD/T | | | B WIS.RAN | 0.00 | | 9.0 | 0.0 | | FIL | NA | 0.00 FILL/Sandy GRAVEL trace silt; grey; | NA | NA | |
| | | | | 0.30 | | | | | FIL | NA | 0.10 GRAVEL is fine to coarse, angular to sub-angular; Sand is fine to coarse grained. | NA | NA | |
| DT | | | | | | | | | NA | NA | 0.30 FILL/Gravelly SAND trace clay; dark grey; SAND is fine to coarse grained; Gravel is angular to sub angular, fine to coarse grained. | NA | NA | |
| | | | | 0.70 | | | | | FIL | NA | 0.68 | NA | NA | |
| | | | SPT COL.PIN | 1.00 | SPT: 2,4,6 N=10 | | 8.01.0 | | | | 0.78 CONCRETE; grey; Aggregate up to 20mm *0.40: rebar (<5mm)* *0.60: rebar (<5mm)* FILL/SAND trace silt, trace gravel; grey; SAND is fine to medium grained; gravel is angular to sub angular fine to coarse grained | | | |
| | | | | 1.15 | | | | | | | | | | |
| | | | B AHA.ROT | | | | | | ALV and AEO | SP | SAND trace silt, trace gravel; grey; SAND is fine to medium grained; gravel is fine to medium; trace vegetation | D | MD | |
| | | | | 2.00 | | | 7.02.0 | | | | | | | |
| | | | SPT INN.SPY | | SPT: 4,6,8 N=14 | | | | | | *2.30-2.70: trace becoming with pockets of black silt* | | | |
| | | | B TOD.ORB | 2.45 | | | | | | | | | | |
| | | | | 2.70 | | | | | | | | | | |
| | | ▶ | B RIP.BAY | | | | | | | | | | | |
| | | | | 3.00 | | | 6.03.0 | | ALV and AEO | SC | 2.70 SAND with silt, trace gravel; black grey; SAND is fine to medium grained; gravel is fine to medium; Hydrocarbon odour | M-W | VL | |
| | | | SPT GET.LAM | | SPT: HW/150 mm, 1,0,2 N=2 | | | | | | | | | |
| | | | B LIB.DEN | 3.45 | | | | | | | | | | |
| | | | | 3.50 | | | | | | | | | | |
| | | | SPT SPY.JUG | | | | | | | | | | | |
| | | | | 3.95 | | | | | | | | | | |
| | | | | 4.00 | | | 5.04.0 | | ALV and AEO | SM | 3.70 Silty SAND; grey black; SAND is fine to medium grained; Hydrocarbon odour | W | L-MD | |
| | | | B VOW.BIS | | | | | | | | | | | |
| | | | | 5.00 | | | 4.05.0 | | ALV and AEO | SP | 5.00 SAND trace silt; grey; SAND is fine to coarse grained; trace lenses of black silt | W | MD-D | |
| | | | SPT BOB.BAT | | SPT: 6,14,26 N=40 | | | | | | | | | |
| | | | B TUB.SOY | 5.45 | | | | | | | | | | |
| | | | | 6.00 | | | 3.06.0 | | | | | | | |
| | | | SPT CUB.MEG | | SPT: 9,10,15 N=25 | | | | | | | | | |
| | | | | 6.45 | | | | | | | Terminated at 6.45 m. Criteria Satisfied. | | | |
| | | | | | | | 2.07.0 | | | | | | | |

VERSION CONTROL
HOLE ID: BH05c
PRODUCTION CODE: 2502241754
PAGE ID: BH05c{GDMS[LOG]_001}

Remarks:

# EXPLORATORY HOLE - SAMPLE PHOTOS

ID: **BH05c**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

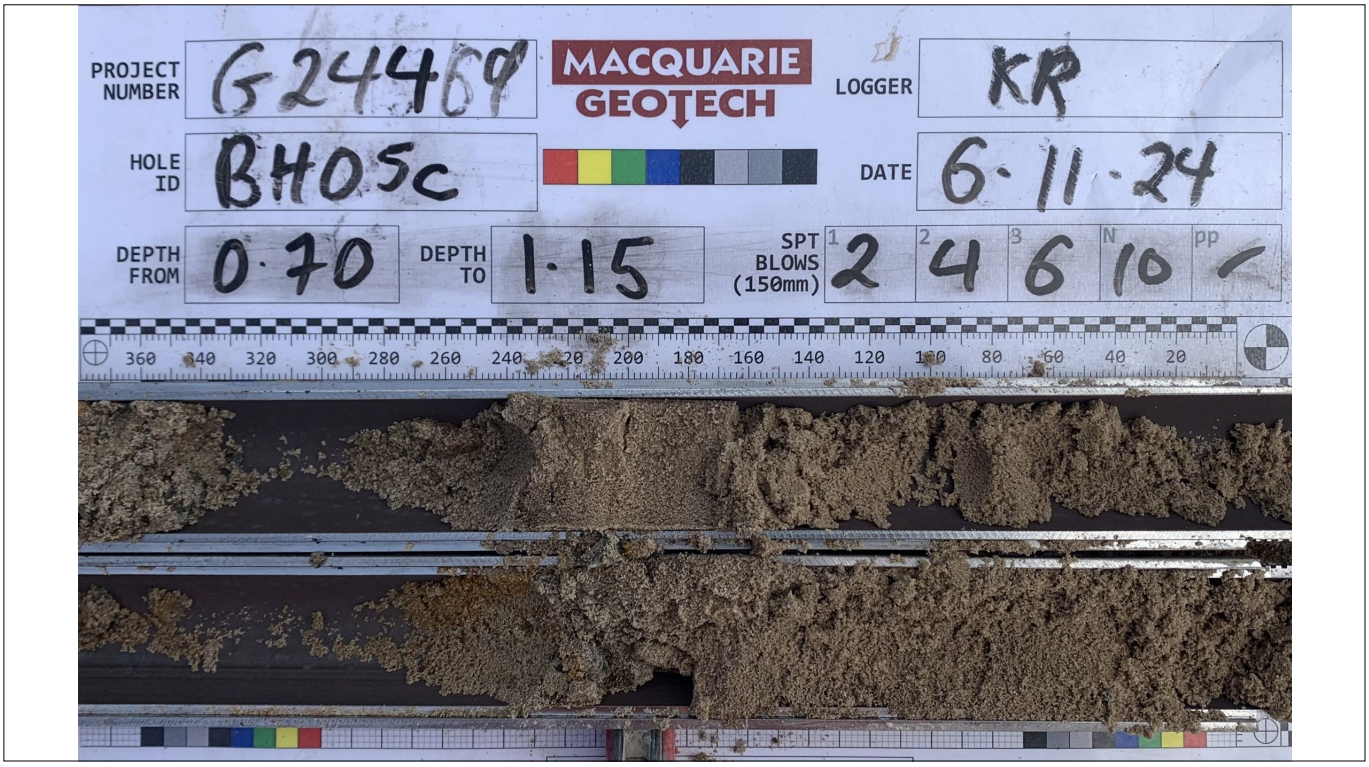
PROJECT LOCATION:

CLIENT: **KBR**

HOLE TYPE:

MacGeo PROJECT: **G24469**

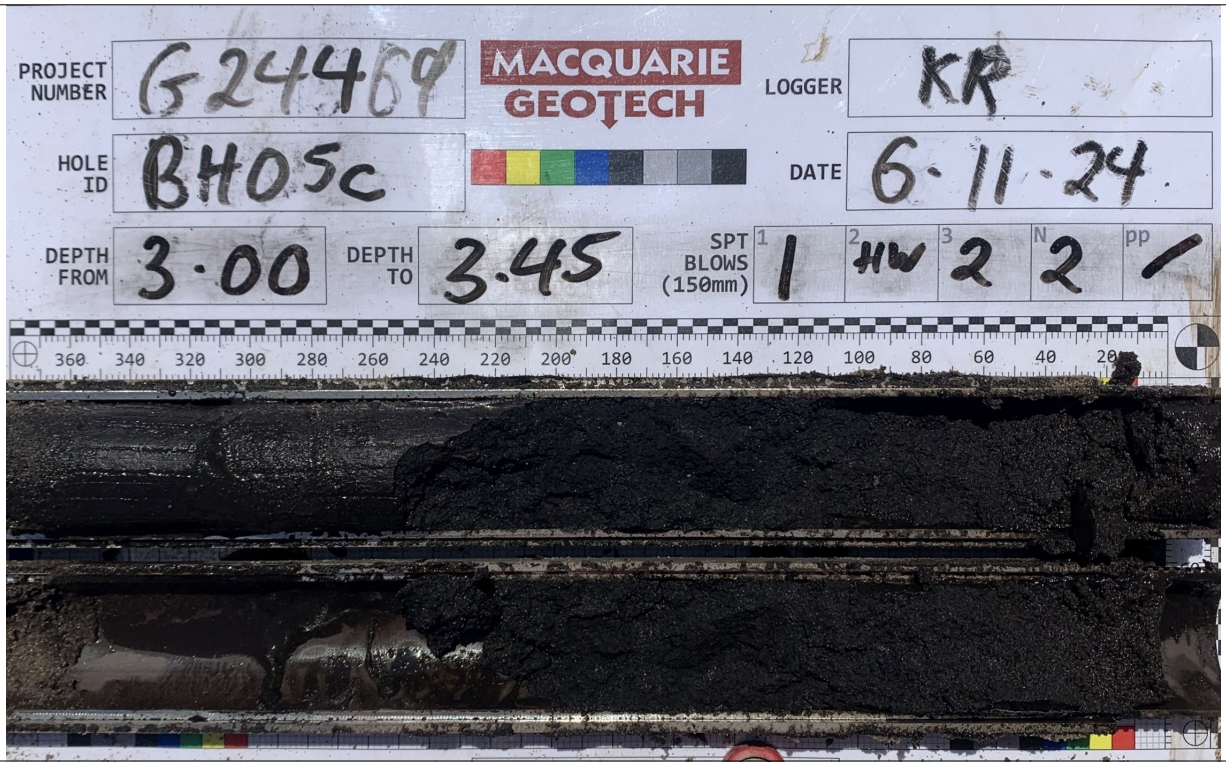




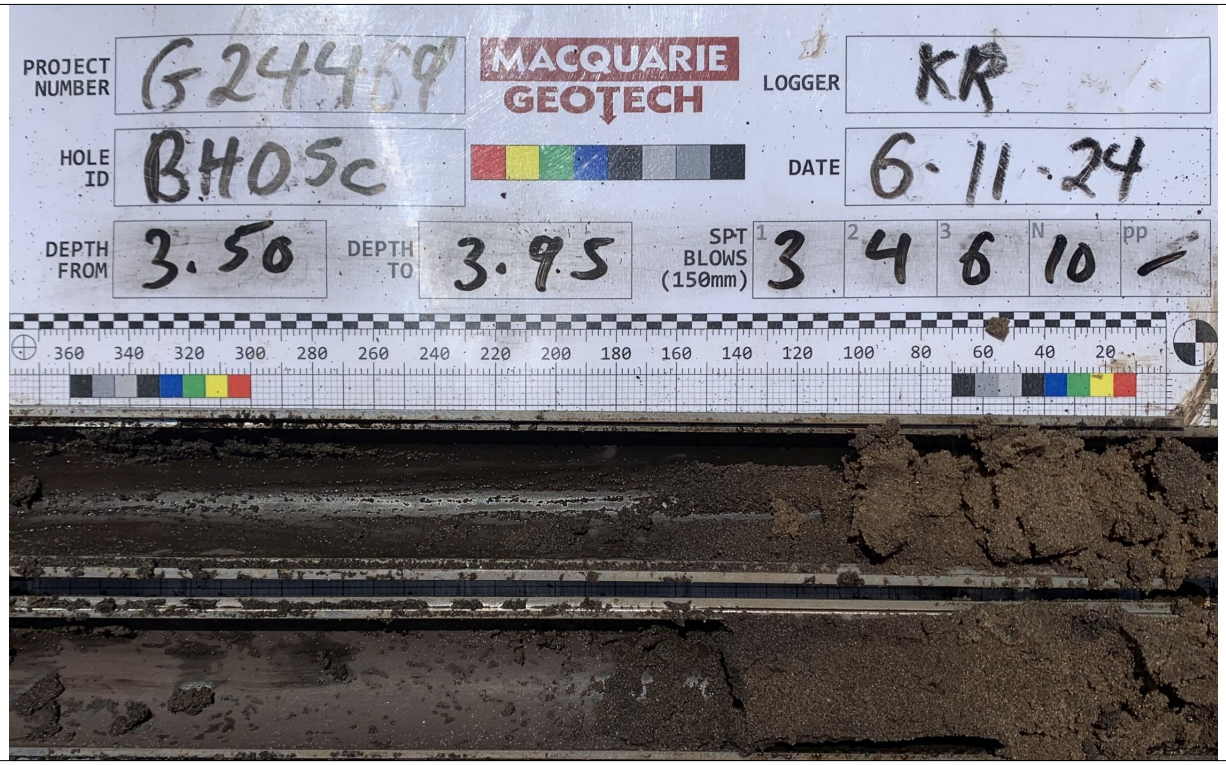

BH05c | 0.70-1.15 | Standard Penetration Test




BH05c | 2.00-2.45 | Standard Penetration Test




BH05c | 3.00-3.45 | Standard Penetration Test




BH05c | 3.50-3.95 | Standard Penetration Test

# EXPLORATORY HOLE - SAMPLE PHOTOS

ID: **BH05c**

PROJECT NAME: **Matraville Chlorine Liquefaction Plant**

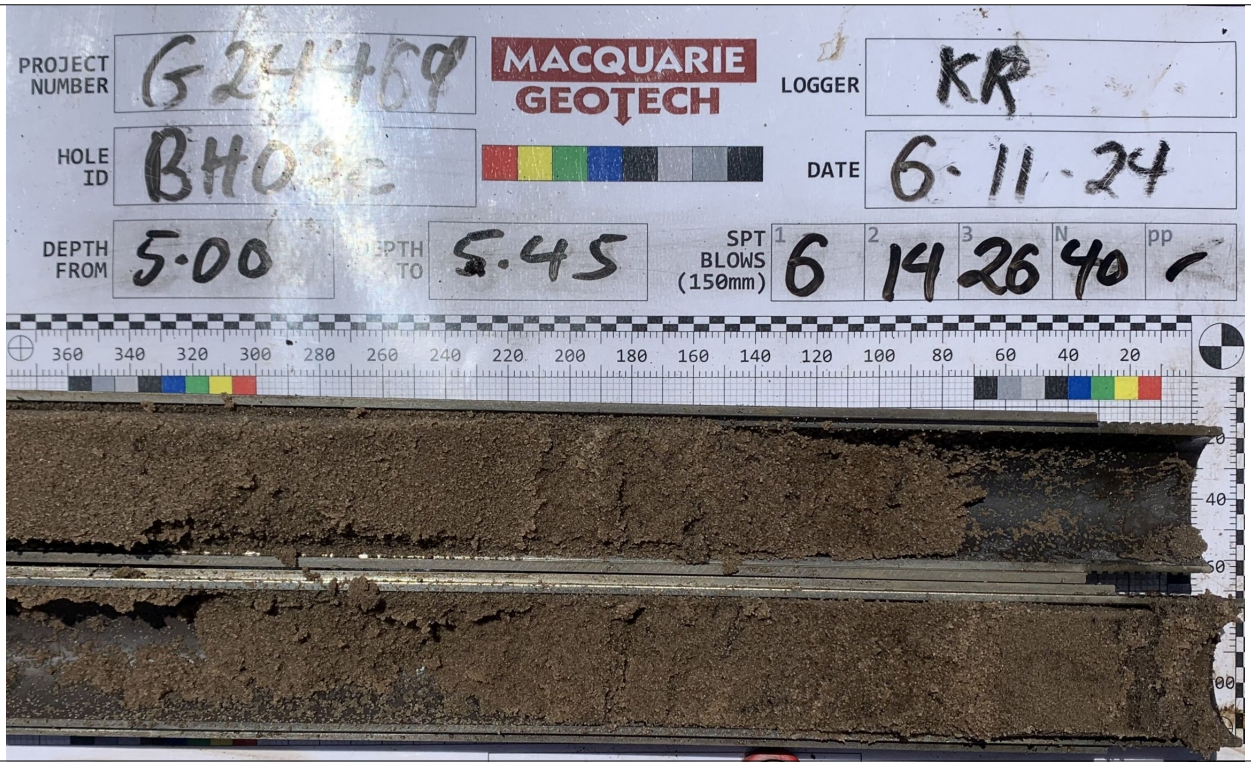
PROJECT LOCATION:

CLIENT: **KBR**

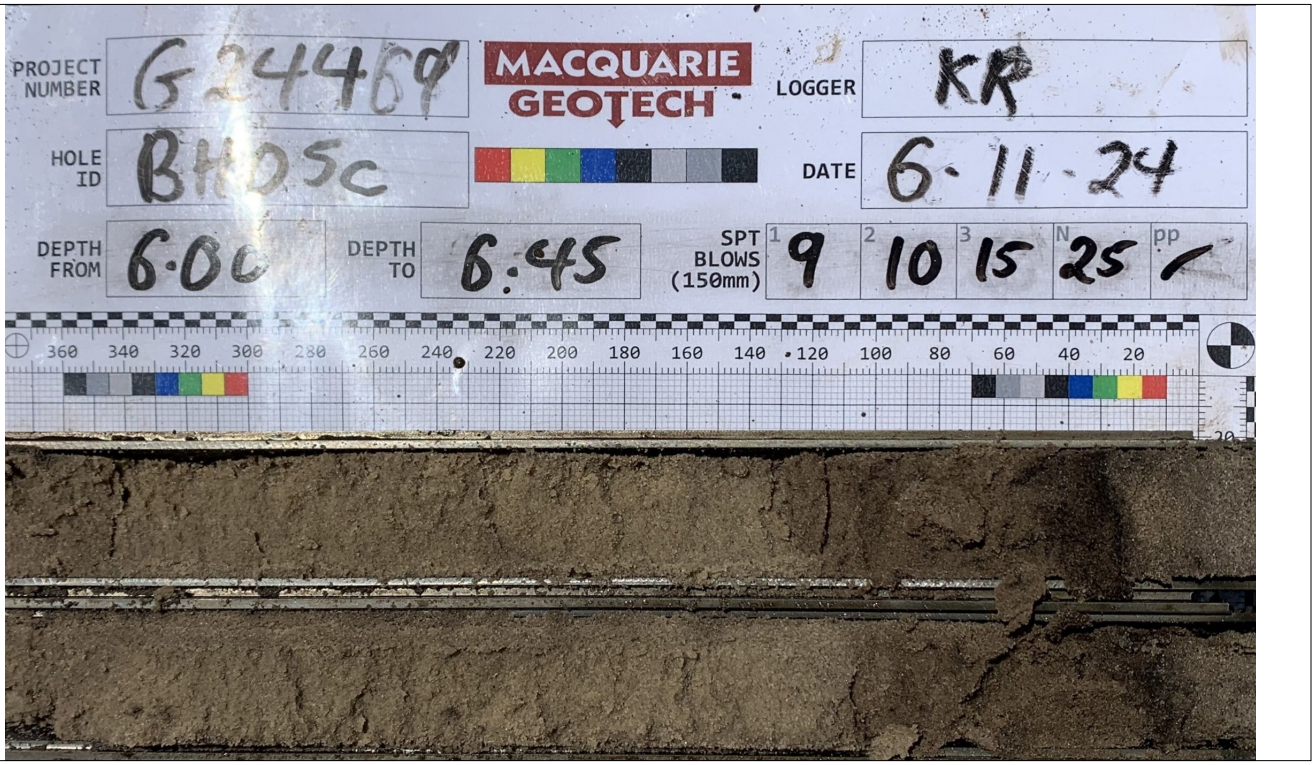
HOLE TYPE:

MacGeo PROJECT: **G24469**

PAGE: **3** of **3**




BH05c | 5.00-5.45 | Standard Penetration Test




BH05c | 6.00-6.45 | Standard Penetration Test

VERSION CONTROL
HOLE ID: BH05c
PRODUCTION CODE: 2502241754
PAGE ID: BH05c{GDMS[SMP]_003}

# Appendix D – Laboratoty Test Results

**Envirolab Services Pty Ltd**
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

# CERTIFICATE OF ANALYSIS 365939

## Client Details

| | |
|---|---|
| **Client** | Macquarie Geotech |
| **Attention** | Gavin Boyd, k routledge |
| **Address** | 3 Watt Dr, Bathurst, NSW, 2795 |

## Sample Details

| | |
|---|---|
| **Your Reference** | **G24469** |
| **Number of Samples** | 4 Soil |
| **Date samples received** | 08/11/2024 |
| **Date completed instructions received** | 08/11/2024 |

## Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

**Please refer to the last page of this report for any comments relating to the results.**

## Report Details

| | |
|---|---|
| **Date results requested by** | 15/11/2024 |
| **Date of Issue** | 15/11/2024 |

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**Results Approved By**
Diego Bigolin, Inorganics Supervisor

**Authorised By**
Nancy Zhang, Laboratory Manager

| Misc Inorg - Soil | | | | | |
|---|---|---|---|---|---|
| Our Reference | | 365939-1 | 365939-2 | 365939-3 | 365939-4 |
| Your Reference | UNITS | BH03 COX.TOT | BH04a JOG>RAM | BH05c COL.PIN | BH05c TOD.ORB |
| Depth | | 1.50-0.95 | 0.10-0.50 | 0.70-1.15 | 2.70-3.00 |
| Date Sampled | | 24/10/2024 | 24/10/2024 | 06/11/2024 | 06/11/2024 |
| Type of sample | | Soil | Soil | Soil | Soil |
| Date prepared | - | 13/11/2024 | 13/11/2024 | 13/11/2024 | 12/11/2024 |
| Date analysed | - | 13/11/2024 | 13/11/2024 | 13/11/2024 | 12/11/2024 |
| pH 1:5 soil:water | pH Units | 9.0 | 8.7 | 8.4 | [NA] |
| Electrical Conductivity 1:5 soil:water | µS/cm | 76 | 86 | 190 | [NA] |
| Chloride, Cl 1:5 soil:water | mg/kg | 20 | <10 | 210 | [NA] |
| Sulphate, SO4 1:5 soil:water | mg/kg | 10 | 30 | 20 | [NA] |
| Total Organic Matter in soil/solids | mg/kg | [NA] | [NA] | [NA] | 36,000 |

| Method ID | Methodology Summary |
|---|---|
| **Inorg-001** | pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times. |
| **Inorg-002** | Conductivity and Salinity - measured using a conductivity cell. |
| **Inorg-081** | Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis.<br>Alternatively determined by colourimetry/turbidity using Discrete Analyser. |
| **INORG-137** | Total Carbon Nitrogen Sulfur by high temperature catalytic combustion with IR detection. |

| QUALITY CONTROL: Misc Inorg - Soil | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-1 | 365939-2 |
| Date prepared | - | | | 12/11/2024 | 1 | 13/11/2024 | 13/11/2024 | | 12/11/2024 | 12/11/2024 |
| Date analysed | - | | | 12/11/2024 | 1 | 13/11/2024 | 13/11/2024 | | 12/11/2024 | 12/11/2024 |
| pH 1:5 soil:water | pH Units | | Inorg-001 | [NT] | 1 | 9.0 | 9.2 | 2 | 100 | [NT] |
| Electrical Conductivity 1:5 soil:water | µS/cm | 1 | Inorg-002 | <1 | 1 | 76 | 66 | 14 | 97 | [NT] |
| Chloride, Cl 1:5 soil:water | mg/kg | 10 | Inorg-081 | <10 | 1 | 20 | 20 | 0 | 108 | 104 |
| Sulphate, SO4 1:5 soil:water | mg/kg | 10 | Inorg-081 | <10 | 1 | 10 | 20 | 67 | 110 | 114 |
| Total Organic Matter in soil/solids | mg/kg | 1000 | INORG-137 | <1000 | [NT] | [NT] | [NT] | [NT] | 90 | [NT] |

## Result Definitions

| | |
|---|---|
| **NT** | Not tested |
| **NA** | Test not required |
| **INS** | Insufficient sample for this test |
| **PQL** | Practical Quantitation Limit |
| **<** | Less than |
| **>** | Greater than |
| **RPD** | Relative Percent Difference |
| **LCS** | Laboratory Control Sample |
| **NS** | Not specified |
| **NEPM** | National Environmental Protection Measure |
| **NR** | Not Reported |

## Quality Control Definitions

| | |
|---|---|
| **Blank** | This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples. |
| **Duplicate** | This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable. |
| **Matrix Spike** | A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist. |
| **LCS (Laboratory Control Sample)** | This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample. |
| **Surrogate Spike** | Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples. |

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

## Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

## Report Comments

MISC_INORG_DRY: pH/EC
Samples 1 amd 2 were out of the recommended holding time for this analysis.

**Envirolab Services Pty Ltd**
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customerservice@envirolab.com.au
www.envirolab.com.au

# CERTIFICATE OF ANALYSIS 366170

## Client Details

| | |
|---|---|
| **Client** | Macquarie Geotech |
| **Attention** | Gavin Boyd |
| **Address** | 3 Watt Dr, Bathurst, NSW, 2795 |

## Sample Details

| | |
|---|---|
| **Your Reference** | **G24469** |
| **Number of Samples** | 1 Soil |
| **Date samples received** | 12/11/2024 |
| **Date completed instructions received** | 12/11/2024 |

## Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

**Please refer to the last page of this report for any comments relating to the results.**

## Report Details

| | |
|---|---|
| **Date results requested by** | 19/11/2024 |
| **Date of Issue** | 15/11/2024 |

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**Results Approved By**
Nick Sarlamis, Assistant Operation Manager

**Authorised By**
Nancy Zhang, Laboratory Manager

| Soil Aggressivity | | |
|---|---|---|
| Our Reference | | 366170-1 |
| Your Reference | UNITS | BH01 DIG.JAY |
| Depth | | 0.15-0.50 |
| Date Sampled | | 25/10/2024 |
| Type of sample | | Soil |
| Date prepared | - | 14/11/2024 |
| Date analysed | - | 14/11/2024 |
| pH 1:5 soil:water | pH Units | 8.2 |
| Electrical Conductivity 1:5 soil:water | µS/cm | 45 |
| Chloride, Cl 1:5 soil:water | mg/kg | <10 |
| Sulphate, SO4 1:5 soil:water | mg/kg | 21 |

| Method ID | Methodology Summary |
|---|---|
| **Inorg-001** | pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times. |
| **Inorg-002** | Conductivity and Salinity - measured using a conductivity cell. |
| **Inorg-081** | Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis.<br>Alternatively determined by colourimetry/turbidity using Discrete Analyser. |

| QUALITY CONTROL: Soil Aggressivity | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-1 | [NT] |
| Date prepared | - | | | 13/11/2024 | [NT] | [NT] | [NT] | [NT] | 13/11/2024 | [NT] |
| Date analysed | - | | | 13/11/2024 | [NT] | [NT] | [NT] | [NT] | 13/11/2024 | [NT] |
| pH 1:5 soil:water | pH Units | | Inorg-001 | [NT] | [NT] | [NT] | [NT] | [NT] | 100 | [NT] |
| Electrical Conductivity 1:5 soil:water | µS/cm | 1 | Inorg-002 | <1 | [NT] | [NT] | [NT] | [NT] | 98 | [NT] |
| Chloride, Cl 1:5 soil:water | mg/kg | 10 | Inorg-081 | <10 | [NT] | [NT] | [NT] | [NT] | 108 | [NT] |
| Sulphate, SO4 1:5 soil:water | mg/kg | 10 | Inorg-081 | <10 | [NT] | [NT] | [NT] | [NT] | 111 | [NT] |

## Result Definitions

| | |
|---|---|
| **NT** | Not tested |
| **NA** | Test not required |
| **INS** | Insufficient sample for this test |
| **PQL** | Practical Quantitation Limit |
| **<** | Less than |
| **>** | Greater than |
| **RPD** | Relative Percent Difference |
| **LCS** | Laboratory Control Sample |
| **NS** | Not specified |
| **NEPM** | National Environmental Protection Measure |
| **NR** | Not Reported |

## Quality Control Definitions

| | |
|---|---|
| **Blank** | This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples. |
| **Duplicate** | This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable. |
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| **LCS (Laboratory Control Sample)** | This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample. |
| **Surrogate Spike** | Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples. |

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

## Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

## Report Comments

pH analysed outside holding time.

# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | TAM.REM BH01 0.50-1.00 + WAY.JOY BH01 1.00-1.50m + PAD.SHE BH01 1.50-2.20m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT, 2609 | **Sample Description** | Silty SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101423-DS |
| **Job No** | S24581-1 | **Lab No** | S101423 |

| | | | |
|---|---|---|---|
| **Test Procedure** | AS1289 6.2.2 Soil strength and consolidation tests - Determination of the shear strength of a soil - Direct shear test using a shear box | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 20/11/2024 |

| **Test Details** | | | | | | |
|---|---|---|---|---|---|---|
| Remoulding Details | 100% Standard Compaction @ 100% Optimum Moisture Content | | | | | |
| Size of Shear Box (mm) | 100mm Square | | | | | |
| **Test Parameter** | **Stage 1** | **Stage 2** | **Stage 3** | **Stage 4** | **Stage 5** | **Stage 6** |
| Specimen Dimensions (mm) | 99.98 x 100.03 | 99.98 x 100.03 | 99.98 x 100.03 | - | - | - |
| Rate of Strain (mm/min) | 0.05 | 0.05 | 0.05 | - | - | - |
| Placement Moisture Content (%) | 14.3 | 14.3 | 14.3 | - | - | - |
| Placement Wet Density ($t/m^3$) | 1.90 | 1.90 | 1.90 | - | - | - |
| Placement Dry Density ($t/m^3$) | 1.66 | 1.66 | 1.66 | - | - | - |
| **Peak Values** | | | | | | |
| Normal Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Shear Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Normal Stress at Peak Shear Stress (kPa) | 50.0 | 100.0 | 200.0 | - | - | - |
| Peak Shear Stress (kPa) | 27.6 | 74.8 | 129.6 | - | - | - |
| Normal Stress at Ultimate Shear Stress (kPa) | 50.0 | 100.0 | 200.0 | - | - | - |
| Shear Stress at Ultimate Shear Stress (kPa) | 27.8 | 75.9 | 129.9 | - | - | - |
| **Residual Values** | | | | | | |
| Normal Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Shear Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Normal Stress at Peak Shear Stress (kPa) | - | - | - | - | - | - |
| Peak Shear Stress (kPa) | - | - | - | - | - | - |
| Normal Stress at Ultimate Shear Stress (kPa) | - | - | - | - | - | - |
| Shear Stress at Ultimate Shear Stress (kPa) | - | - | - | - | - | - |

| **Failure Envelopes** | | | |
|---|---|---|---|
| | | **Peak Values** | **Residual Values** |
| **At Displacement** | Friction Angle (°) | - | - |
| | Cohesion (kPa) | - | - |
| | Correlation | - | - |
| **Peak Shear Stress** | Friction Angle (°) | **33.5** | - |
| | Cohesion (kPa) | **0.2** | - |
| | Correlation | **0.9892** | - |
| **Ultimate Shear Stress** | Friction Angle (°) | **33.4** | - |
| | Cohesion (kPa) | **0.8** | - |
| | Correlation | **0.9878** | - |

**Notes**

Accredited for compliance with ISO/IEC 17025 - Testing.

**NATA Accredited Laboratory Number: 14874**

Authorised Signatory: Chris Lloyd

Date: 22/11/2024

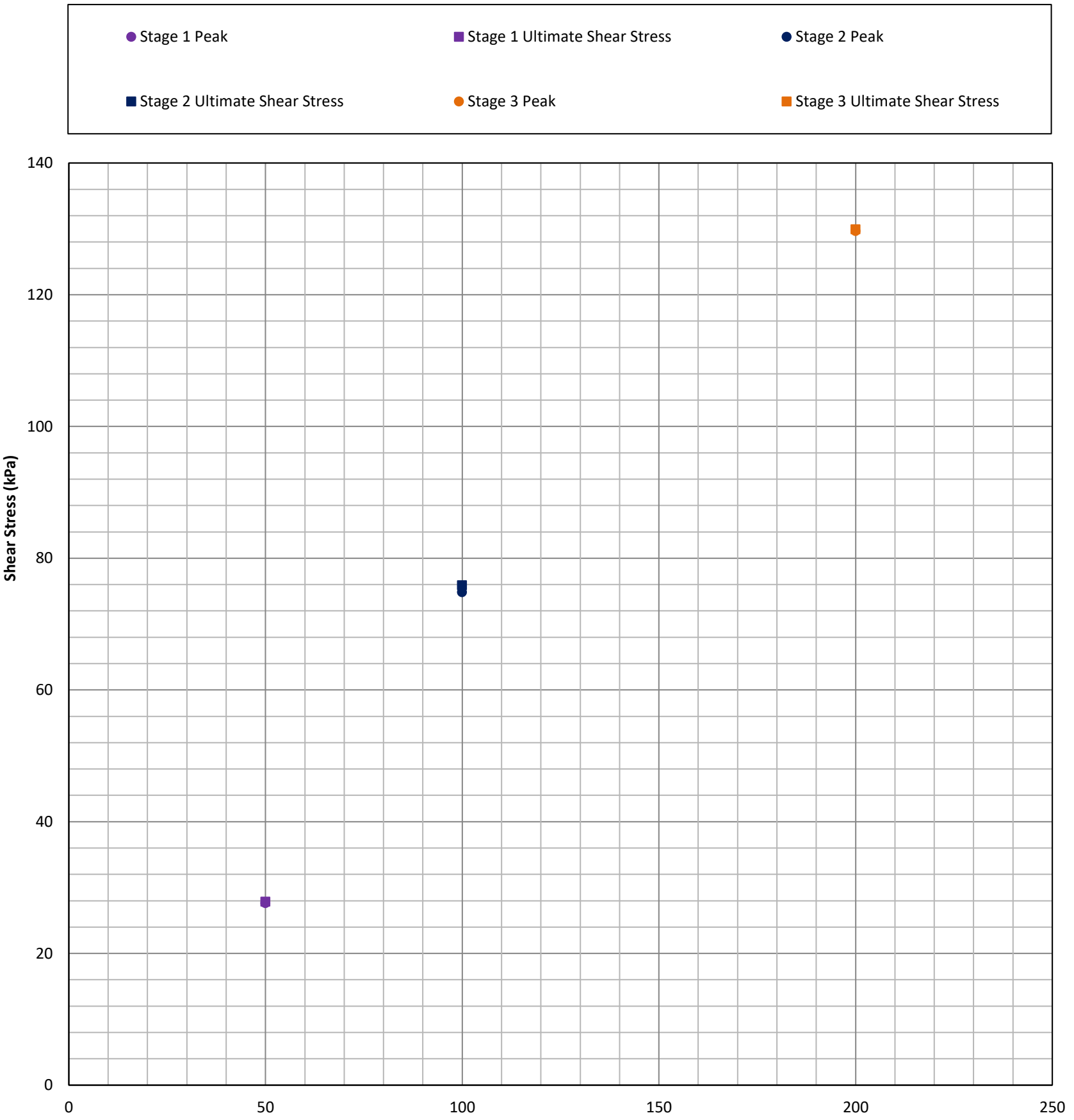
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Results relate only to the samples tested.

Macquarie Geotechnical
14 Carter St
Lidcombe NSW 2141

# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Report No** | S101423-DS |

## Peak Shear Stress / Normal Stress




Accredited for compliance with ISO/IEC 17025 - Testing.

Authorised Signatory:

Date: 22/11/2024

**NATA Accredited Laboratory Number: 14874**

Chris Lloyd

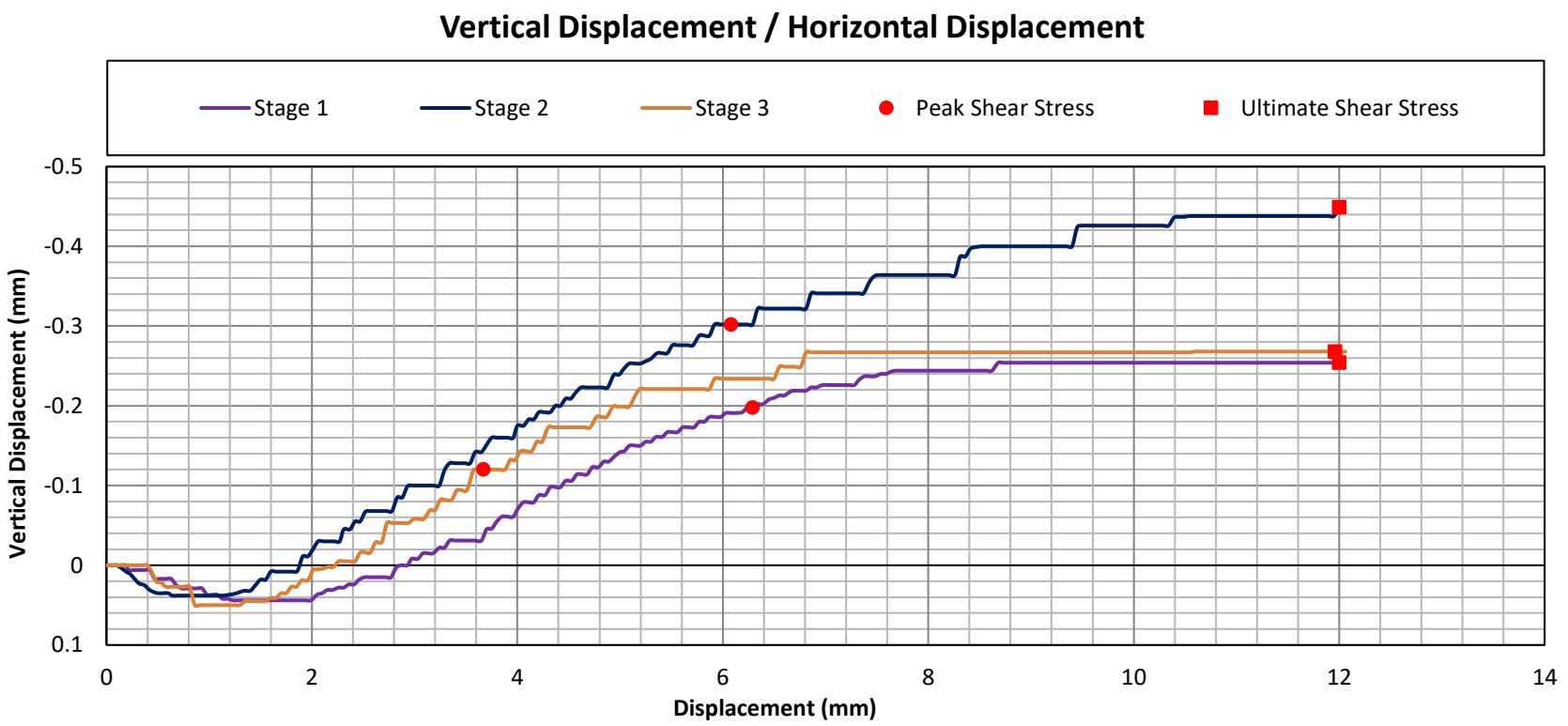

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Lidcombe NSW 2141

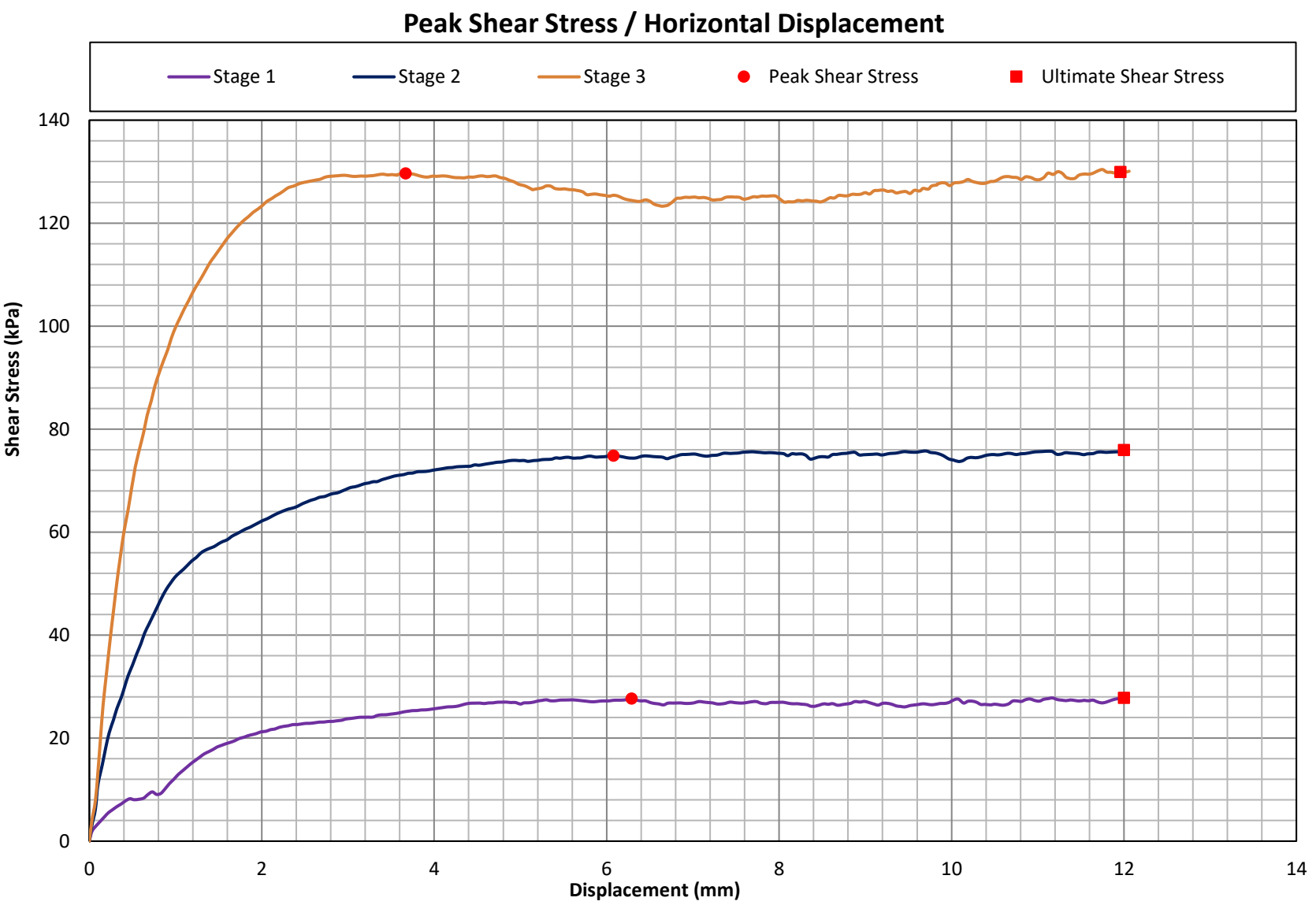


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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Report No** | S101423-DS |




Accredited for compliance with ISO/IEC 17025 - Testing.

Authorised Signatory:

Date: 22/11/2024

**NATA Accredited Laboratory Number: 14874**

Chris Lloyd


Macquarie Geotechnical
14 Carter St
Lidcombe NSW 2141



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Results relate only to the samples tested.

# MOISTURE CONTENT TEST REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Job #** | S24581-1 |
| **Address** | Level 4, 11 Lancaster Place, Majura Park, ACT, 2609 | **Report #** | S101423-MC |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | | |

**Test Procedure**

- ☑ AS 1289 2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method).
- ☐ AS4133 1.1.1 Determination of the moisture content of rock - Oven drying method (standard method)
- ☐ RMS T120 Moisture content of road construction materials (Standard method)
- ☐ RMS T262 Determination of moisture content of aggregates (Standard method)

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 14/11/2024

| Sample # | Source | Sample Description | Moisture Content % |
|---|---|---|---|
| S101423 | TAM.REM BH01 0.50-1.00 + WAY.JOY BH01 1.00-1.50m + PAD.SHE BH01 1.50-2.20m | SAND | **4.3** |
| S101424 | OWE.PAP BH01 4.60-5.50m | SAND | **9.6** |
| S101427 | WAX.MET BH02 3.75-4.00m + EGG.OLD BH02 4.00-4.50m | SAND with Silt, trace of Gravel | **17.7** |
| S101431 | PSI.DIS BH04a 4.00-4.50m | SAND with Clay, trace of Gravel | **29.6** |
| S101435 | TOD.ORB BH05c 2.00-2.70m | SAND trace of Silt and Gravel | **14.0** |
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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory:

Jacob Lloyd

2/12/2024

Date:

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# DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | TAM.REM BH01 0.50-1.00 + WAY.JOY BH01 1.00-1.50m + PAD.SHE BH01 1.50-2.20m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT, 2609 | **Sample Description** | SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101423-MDD |
| **Job No** | S24581-1 | **Sample No** | S101423 |

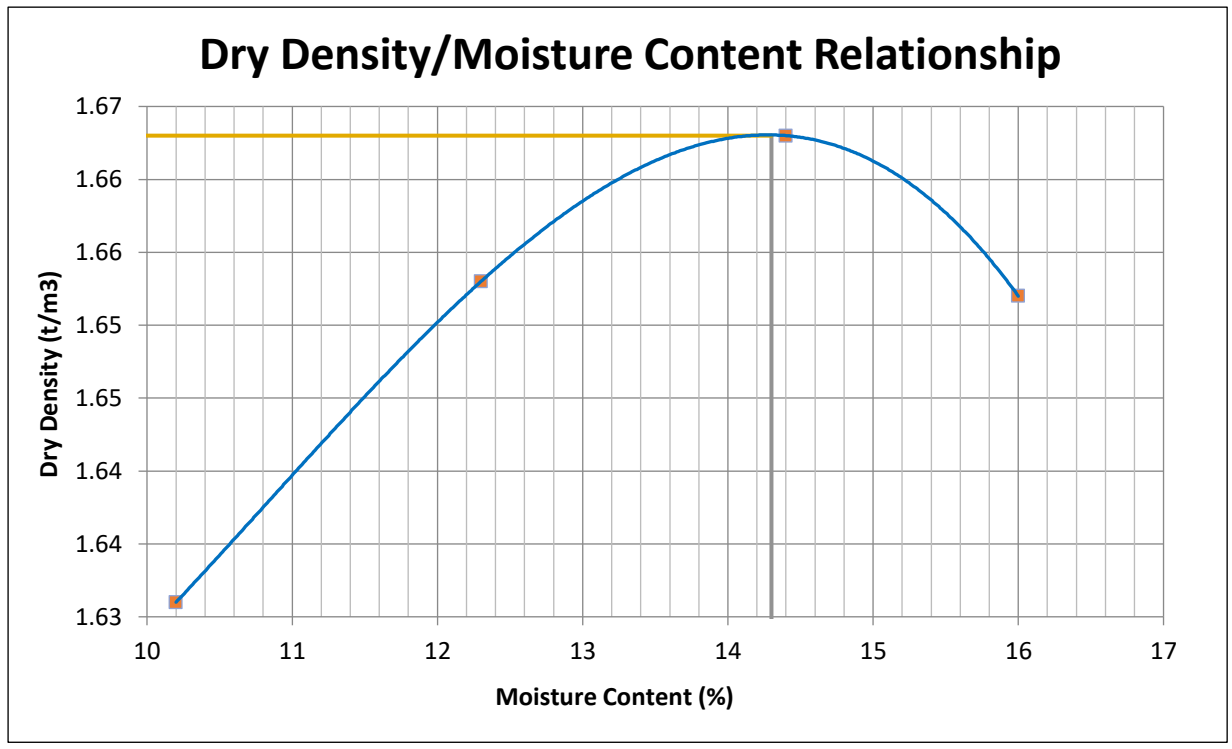
**Test Procedure**

☑ AS1289.5.1.1 Dry Density / Moisture Content Relationship - Standard Compaction

☑ AS1289.2.1.1 Moisture Content - Oven Drying Method (Standard Method)

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 15/11/2024




| | |
|---|---|
| **Maximum Dry Density (t/m$^3$)** | 1.66 |
| **Optimum Moisture Content (%)** | 14.3 |
| **Oversize Retained on 19mm sieve (%)** | 0 |
| **Oversize Retained on 37.5mm sieve (%)** | 0 |
| **Curing Time** | 2 hrs |
| **Liquid Limit Determination** | Technician Assessment |

**Notes**

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Authorised Signatory:

Chris Lloyd

22/11/2024

Date:

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# SOIL PARTICLE DENSITY REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | TAM.REM BH01 0.50-1.00 + WAY.JOY BH01 1.00-1.50m + PAD.SHE BH01 1.50-2.20m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report #** | S101423-SPD |
| **Job #** | S24581-1 | **Lab #** | S101423 |

| | | | |
|---|---|---|---|
| **Test Procedure** | ☑ AS1289 3.5.1 (2006) Soil classification tests - Determination of the soil particle density of a soil - Standard method | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 21/11/2024 |

| | |
|---|---|
| Average Apparent Particle Density:<br>Fraction Retained 2.36mm (g/cm$^3$) | * |
| Average Apparent Particle Density:<br>Fraction Passing 2.36mm (g/cm$^3$) | **2.63** |
| Soil Particle Density:<br>Total Soil Sample (g/cm$^3$) | * |

** Value unable to be determined due to limited amount of sample.*

**Notes**

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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | OWE.PAP BH01 4.60-5.50m + HAM. ASP BH01 5.50-6.00m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT. 2609 | **Sample Description** | Silty SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101425-DS |
| **Job No** | S24581-1 | **Lab No** | S101425 |

**Test Procedure** AS1289 6.2.2 Soil strength and consolidation tests - Determination of the shear strength of a soil - Direct shear test using a shear box

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 21/11/2024

| Test Details | | | | | | |
|---|---|---|---|---|---|---|
| Remoulding Details | 100% Standard Compaction @ 100% Optimum Moisture Content | | | | | |
| Size of Shear Box (mm) | 100mm Square | | | | | |
| **Test Parameter** | **Stage 1** | **Stage 2** | **Stage 3** | **Stage 4** | **Stage 5** | **Stage 6** |
| Specimen Dimensions (mm) | 99.98 x 100.03 | 99.98 x 100.03 | 99.98 x 100.03 | - | - | - |
| Rate of Strain (mm/min) | 0.05 | 0.05 | 0.05 | - | - | - |
| Placement Moisture Content (%) | 15.5 | 15.5 | 15.5 | - | - | - |
| Placement Wet Density (t/m$^3$) | 1.94 | 1.94 | 1.94 | - | - | - |
| Placement Dry Density (t/m$^3$) | 1.68 | 1.68 | 1.68 | - | - | - |
| **Peak Values** | | | | | | |
| Normal Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Shear Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Normal Stress at Peak Shear Stress (kPa) | 50.0 | 100.0 | 200.0 | - | - | - |
| Peak Shear Stress (kPa) | 28.9 | 74.9 | 116.2 | - | - | - |
| Normal Stress at Ultimate Shear Stress (kPa) | 50.0 | 100.0 | 200.0 | - | - | - |
| Shear Stress at Ultimate Shear Stress (kPa) | 28.1 | 72.1 | 127.3 | - | - | - |
| **Residual Values** | | | | | | |
| Normal Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Shear Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Normal Stress at Peak Shear Stress (kPa) | - | - | - | - | - | - |
| Peak Shear Stress (kPa) | - | - | - | - | - | - |
| Normal Stress at Ultimate Shear Stress (kPa) | - | - | - | - | - | - |
| Shear Stress at Ultimate Shear Stress (kPa) | - | - | - | - | - | - |

| Failure Envelopes | | | |
|---|---|---|---|
| | | **Peak Values** | **Residual Values** |
| **At Displacement** | Friction Angle (°) | **-** | **-** |
| | Cohesion (kPa) | **-** | **-** |
| | Correlation | **-** | **-** |
| **Peak Shear Stress** | Friction Angle (°) | **29.2** | **-** |
| | Cohesion (kPa) | **8.3** | **-** |
| | Correlation | **0.9757** | **-** |
| **Ultimate Shear Stress** | Friction Angle (°) | **32.9** | **-** |
| | Cohesion (kPa) | **0.5** | **-** |
| | Correlation | **0.9921** | **-** |

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Date: 22/11/2024

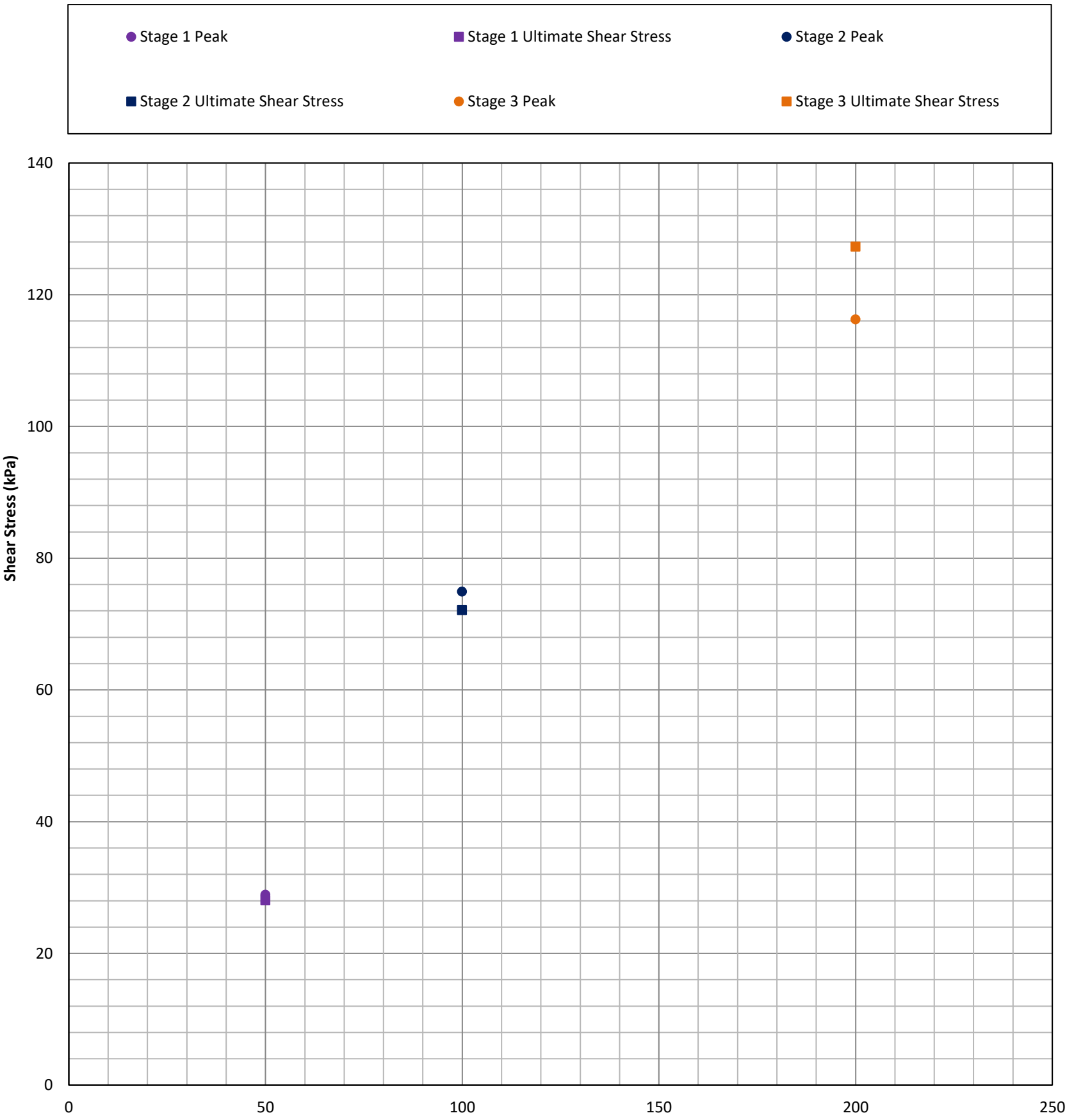
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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Report No** | S101425-DS |

## Peak Shear Stress / Normal Stress




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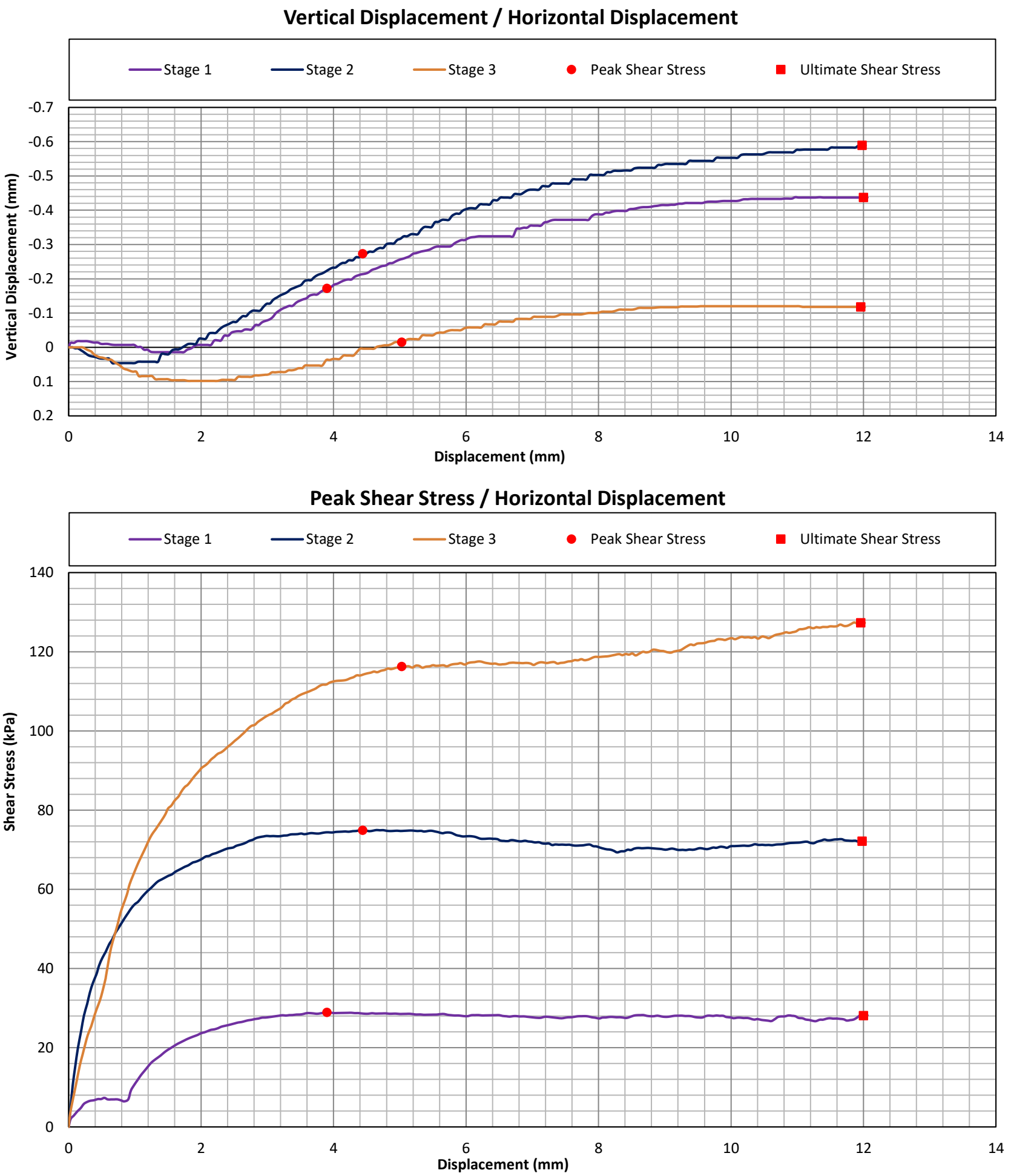

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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Report No** | S101425-DS |




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# DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | OWE.PAP BH01 4.60-5.50m + HAM. ASP BH01 5.50-6.00m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT, 2609 | **Sample Description** | SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101425-MDD |
| **Job No** | S24581-1 | **Sample No** | S101425 |

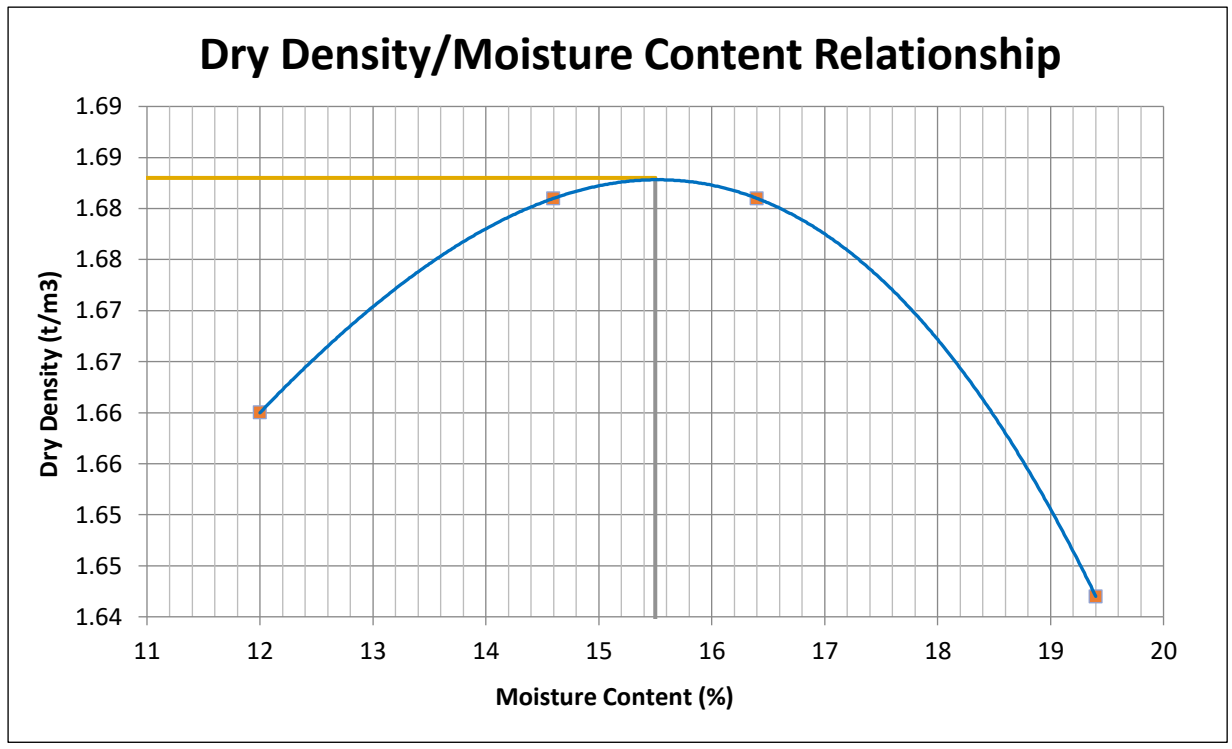
**Test Procedure**

☑ AS1289.5.1.1 Dry Density / Moisture Content Relationship - Standard Compaction

☑ AS1289.2.1.1 Moisture Content - Oven Drying Method (Standard Method)

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 15/11/2024




| | |
|---|---|
| **Maximum Dry Density (t/m$^3$)** | 1.68 |
| **Optimum Moisture Content (%)** | 15.5 |
| **Oversize Retained on 19mm sieve (%)** | 0 |
| **Oversize Retained on 37.5mm sieve (%)** | 0 |
| **Curing Time** | 5 hrs |
| **Liquid Limit Determination** | Technician Assessment |

**Notes**

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Authorised Signatory:

Chris Lloyd

22/11/2024

Date:

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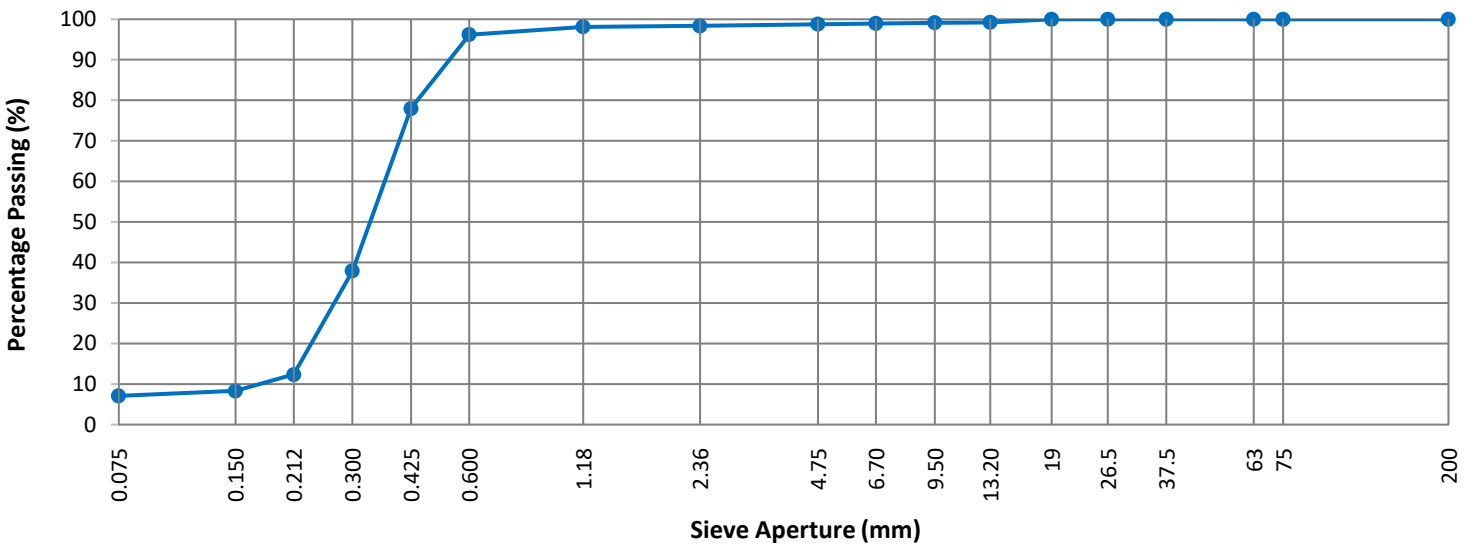
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# Particle Size Distribution Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | WAX.MET BH02 3.75-4.00m + EGG.OLD BH02 4.00-4.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND with Silt, trace of Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101427-PSD |
| **Job No** | S24581-1 | **Lab No** | S101427 |

| | | | |
|---|---|---|---|
| **Test Procedure** | AS 1289.3.6.1 Determination of the particle size distribution of a soil - Standard method of analysis by sieving | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 2/12/2024 |




| Sieve Aperture (mm) | Percentage Passing (%) |
|---|---|
| 200 | **100** |
| 75 | **100** |
| 63 | **100** |
| 37.5 | **100** |
| 26.5 | **100** |
| 19.0 | **100** |
| 13.2 | **99** |
| 9.50 | **99** |
| 6.70 | **99** |
| 4.75 | **99** |
| 2.36 | **98** |

| Sieve Aperture (mm) | Percentage Passing (%) |
|---|---|
| 1.18 | **98** |
| 0.600 | **96** |
| 0.425 | **78** |
| 0.300 | **38** |
| 0.212 | **12** |
| 0.150 | **8** |
| 0.075 | **7** |

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# SOIL PARTICLE DENSITY REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | WAX.MET BH02 3.75-4.00m + EGG.OLD BH02 4.00-4.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND with Silt, trace of Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report #** | S101427-SPD |
| **Job #** | S24581-1 | **Lab #** | S101427 |

| | | | |
|---|---|---|---|
| **Test Procedure** | ☑ AS1289 3.5.1 (2006) Soil classification tests - Determination of the soil particle density of a soil - Standard method | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 22/11/2024 |

| | |
|---|---|
| Average Apparent Particle Density:<br>Fraction Retained 2.36mm (g/cm$^3$) | * |
| Average Apparent Particle Density:<br>Fraction Passing 2.36mm (g/cm$^3$) | **2.58** |
| Soil Particle Density:<br>Total Soil Sample (g/cm$^3$) | * |

** Value unable to be determined due to limited amount of sample.*

**Notes**

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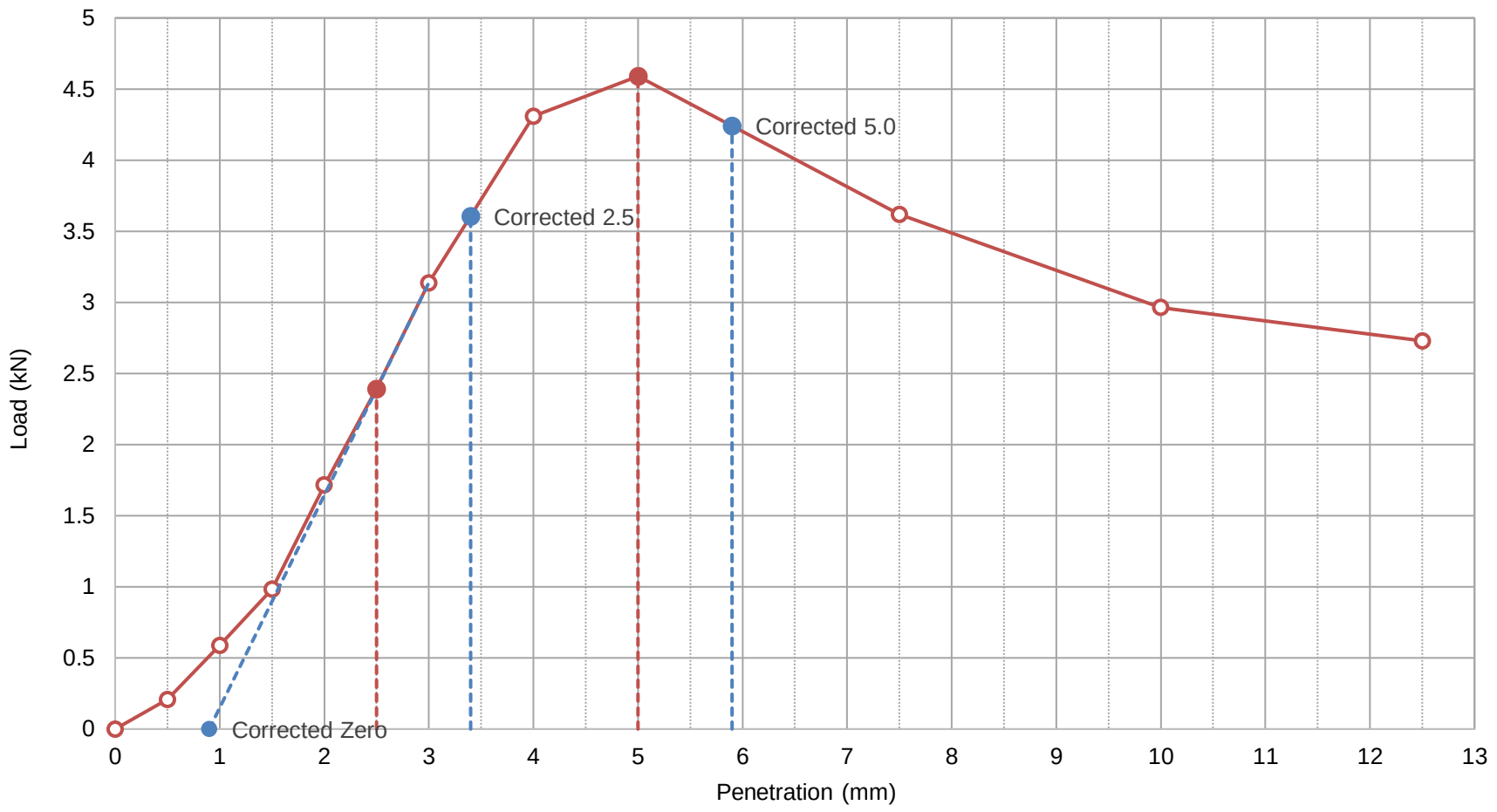
# CALIFORNIA BEARING RATIO REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | SAC.SAY BH02a 0.10-1.20m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No.** | S101428-CBR |
| **Job No.** | S24581-1 | **Sample No.** | S101428 |

| | | | |
|---|---|---|---|
| **Test Procedure** | ☑ AS 1289.6.1.1 | ☐ RMS T117 | California Bearing Ratio |
| | ☑ AS 1289.5.1.1 | ☐ RMS T111 | Dry Density / Moisture Content Relationship - Standard Compaction |
| | ☐ AS 1289.5.2.1 | ☐ RMS T112 | Dry Density / Moisture Content Relationship - Modified Compaction |
| | ☑ AS 1289.2.1.1 | ☐ RMS T120 | Moisture Content - Oven Drying Method (Standard Method) |

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 19/11/2024




| Preparation & Specification | |
|---|---|
| Retained on 19.0mm Sieve (%) | 5 |
| Method of Establishing Plasticity Level | Technician Assessment |
| Sample Curing Time (hrs) | 2 hrs |
| Compaction Hammer Used | Standard |
| Surcharge Mass Applied (kg) | 4.5 |
| Period of Soaking (Days) | 4 |
| Maximum Dry Density - MDD (t/m³) | 1.68 |
| Optimum Moisture Content - OMC (%) | 14.0 |

| Density & Moisture | Achieved | Target |
|---|---|---|
| Lab Moisture Ratio - LMR (%) | 100.5 | 100.0 |
| Lab Density Ratio - LDR (%) | 100.0 | 100.0 |
| Dry Density - At Compaction (t/m³) | 1.68 | 1.68 |
| Dry Density - After Soaking (t/m³) | 1.68 | |
| Specimen Swell (%) | 0.0 | |
| Moisture Content - At Compaction (%) | 14.1 | |
| Moisture Content - Top 30mm (%) | 14.4 | |
| Moisture Content - Remainder (%) | 14.2 | |

**Material CBR Value (%): 25 at a penetration of 2.5 mm**

**Notes**

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Authorised Signatory:

Chris Lloyd Date: 21/11/2024

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# DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | SAC.SAY BH02a 0.10-1.20m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT, 2609 | **Sample Description** | SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101428-MDD |
| **Job No** | S24581-1 | **Sample No** | S101428 |

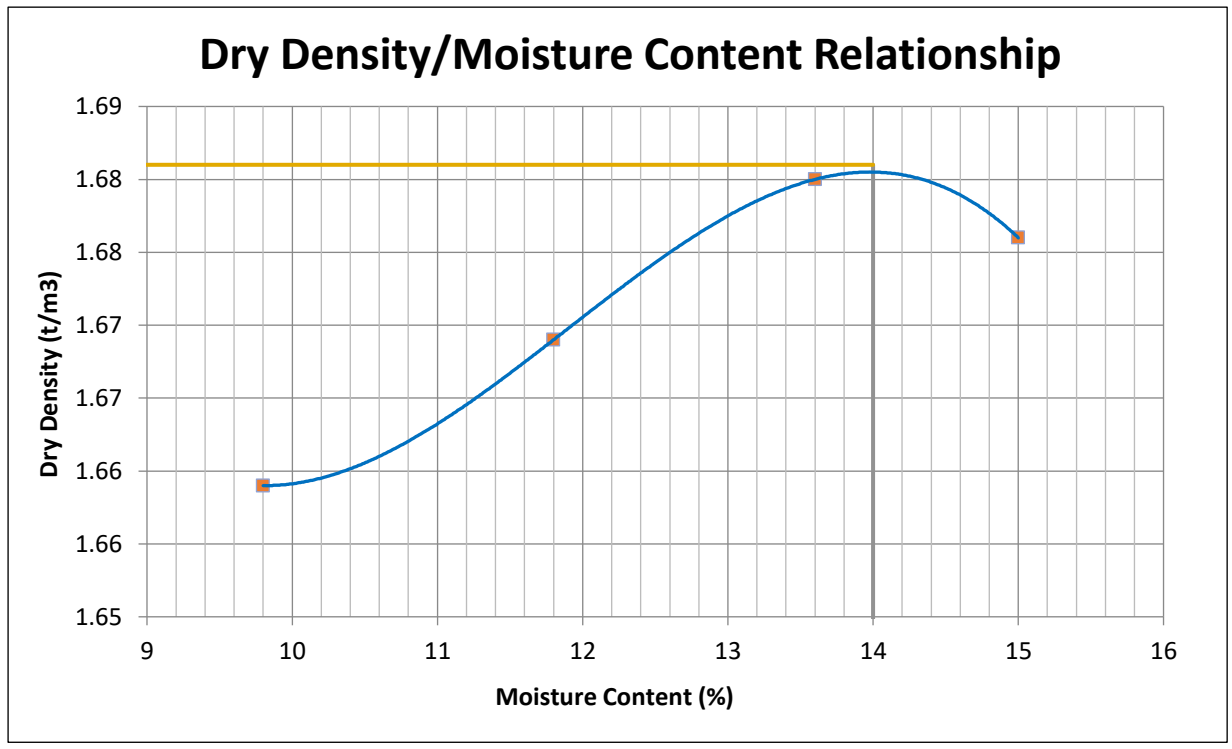
**Test Procedure**

☑ AS1289.5.1.1 Dry Density / Moisture Content Relationship - Standard Compaction

☑ AS1289.2.1.1 Moisture Content - Oven Drying Method (Standard Method)

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 14/11/2024




| | |
|---|---|
| **Maximum Dry Density (t/m$^3$)** | 1.68 |
| **Optimum Moisture Content (%)** | 14.0 |
| **Oversize Retained on 19mm sieve (%)** | 5 |
| **Oversize Retained on 37.5mm sieve (%)** | 1 |
| **Curing Time** | 2 hrs |
| **Liquid Limit Determination** | Technician Assessment |

**Notes**

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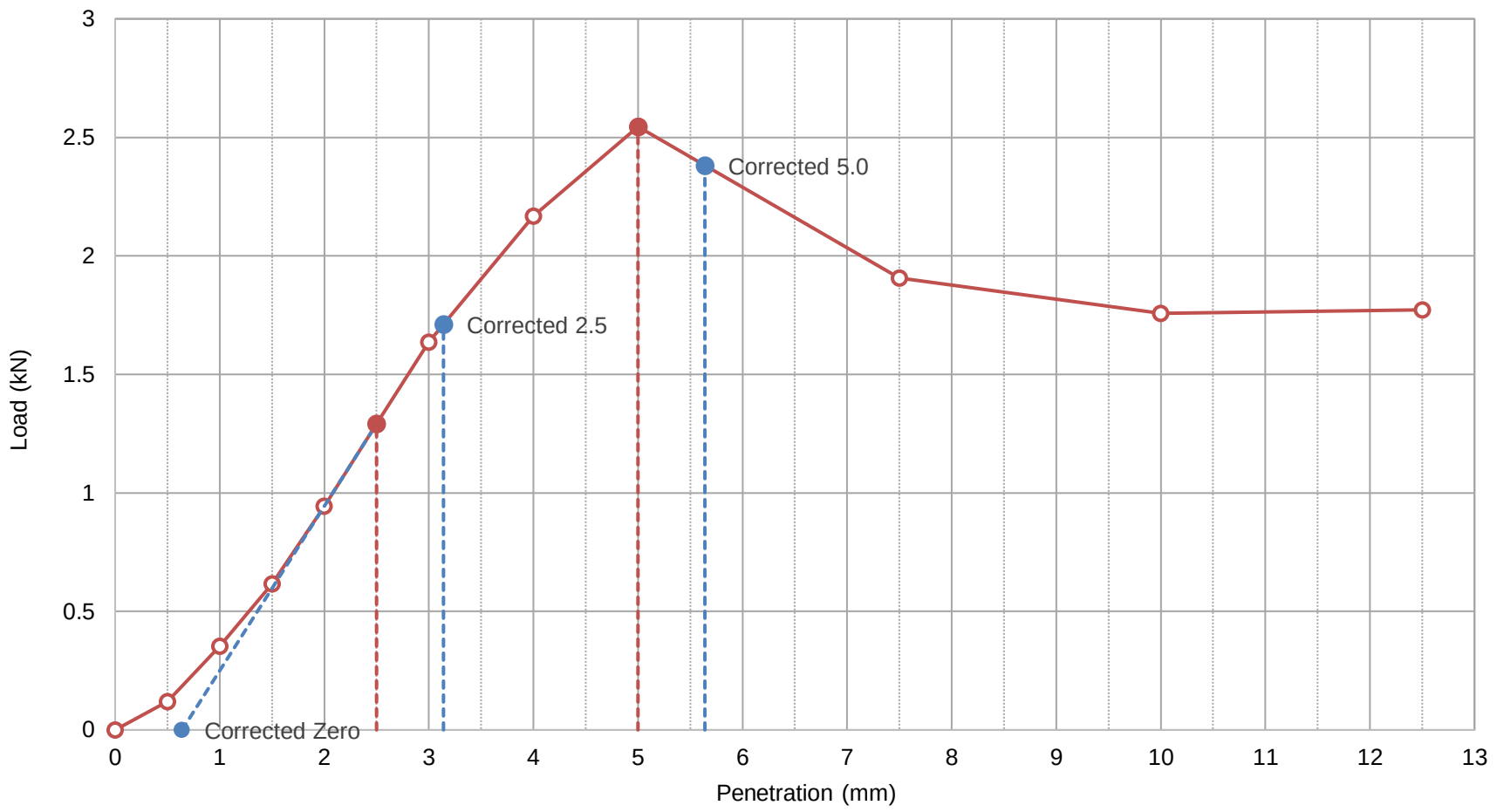
# CALIFORNIA BEARING RATIO REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | ANY.FOG BH02a 1.20-1.70m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | Gravelly SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No.** | S101429-CBR |
| **Job No.** | S24581-1 | **Sample No.** | S101429 |

| | | | |
|---|---|---|---|
| **Test Procedure** | ☑ AS 1289.6.1.1 | ☐ RMS T117 | California Bearing Ratio |
| | ☑ AS 1289.5.1.1 | ☐ RMS T111 | Dry Density / Moisture Content Relationship - Standard Compaction |
| | ☐ AS 1289.5.2.1 | ☐ RMS T112 | Dry Density / Moisture Content Relationship - Modified Compaction |
| | ☑ AS 1289.2.1.1 | ☐ RMS T120 | Moisture Content - Oven Drying Method (Standard Method) |

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 19/11/2024




| Preparation & Specification | |
|---|---|
| Retained on 19.0mm Sieve (%) | 1 |
| Method of Establishing Plasticity Level | Technician Assessment |
| Sample Curing Time (hrs) | 2 hrs |
| Compaction Hammer Used | Standard |
| Surcharge Mass Applied (kg) | 4.5 |
| Period of Soaking (Days) | 4 |
| Maximum Dry Density - MDD (t/m³) | 1.66 |
| Optimum Moisture Content - OMC (%) | 13.3 |

| Density & Moisture | Achieved | Target |
|---|---|---|
| Lab Moisture Ratio - LMR (%) | 100.0 | 100.0 |
| Lab Density Ratio - LDR (%) | 100.0 | 100.0 |
| Dry Density - At Compaction (t/m³) | 1.66 | 1.66 |
| Dry Density - After Soaking (t/m³) | 1.66 | |
| Specimen Swell (%) | -0.1 | |
| Moisture Content - At Compaction (%) | 13.3 | |
| Moisture Content - Top 30mm (%) | 17.1 | |
| Moisture Content - Remainder (%) | 16.1 | |

**Material CBR Value (%): 13 at a penetration of 2.5 mm**

**Notes**

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Authorised Signatory:

Chris Lloyd Date: 21/11/2024

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# DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | ANY.FOG BH02a 1.20-1.70m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT, 2609 | **Sample Description** | Gravelly SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101429-MDD |
| **Job No** | S24581-1 | **Sample No** | S101429 |

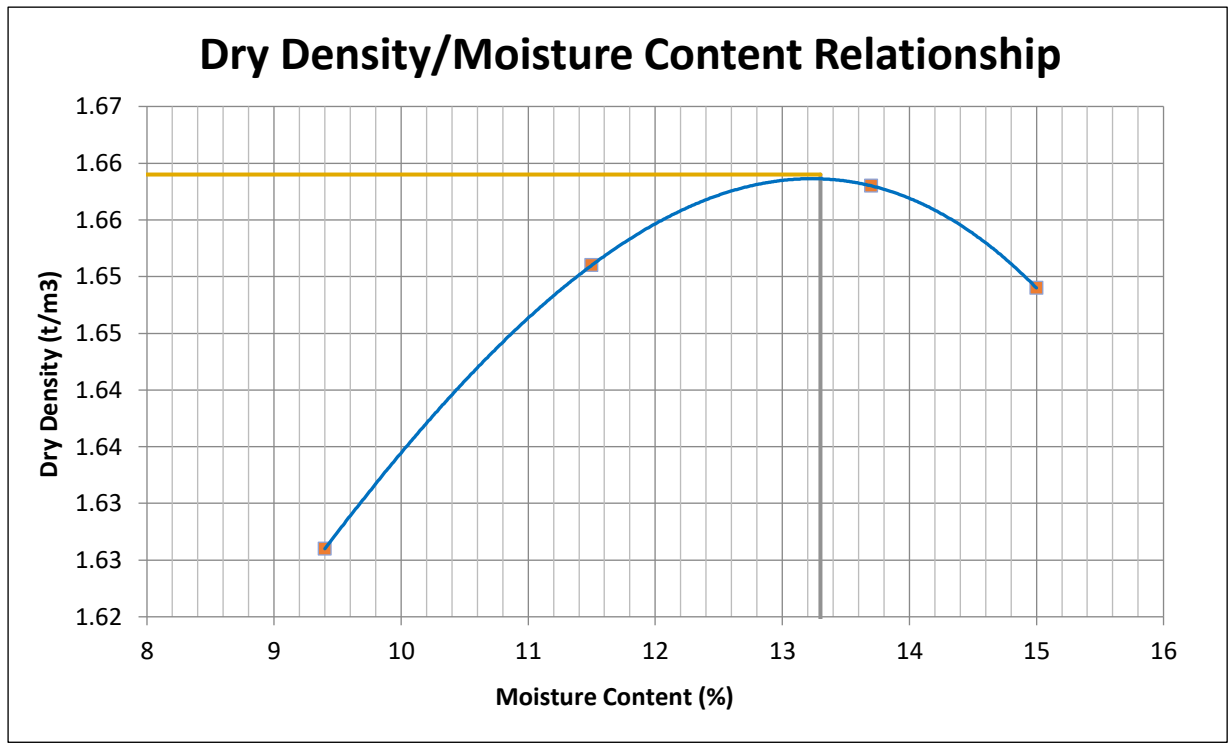
**Test Procedure**

☑ AS1289.5.1.1 Dry Density / Moisture Content Relationship - Standard Compaction

☑ AS1289.2.1.1 Moisture Content - Oven Drying Method (Standard Method)

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 14/11/2024




| | |
|---|---|
| **Maximum Dry Density (t/m$^3$)** | 1.66 |
| **Optimum Moisture Content (%)** | 13.3 |
| **Oversize Retained on 19mm sieve (%)** | 1 |
| **Oversize Retained on 37.5mm sieve (%)** | 0 |
| **Curing Time** | 2 hrs |
| **Liquid Limit Determination** | Technician Assessment |

**Notes**

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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory:

Jacob Lloyd

15/11/2024

Date:

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# SOIL CLASSIFICATION REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | PSI.DIS BH04a 4.00-4.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND with Clay, trace of Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No.** | S101431-PI |
| **Job No.** | S24581-1 | **Lab No.** | S101431 |

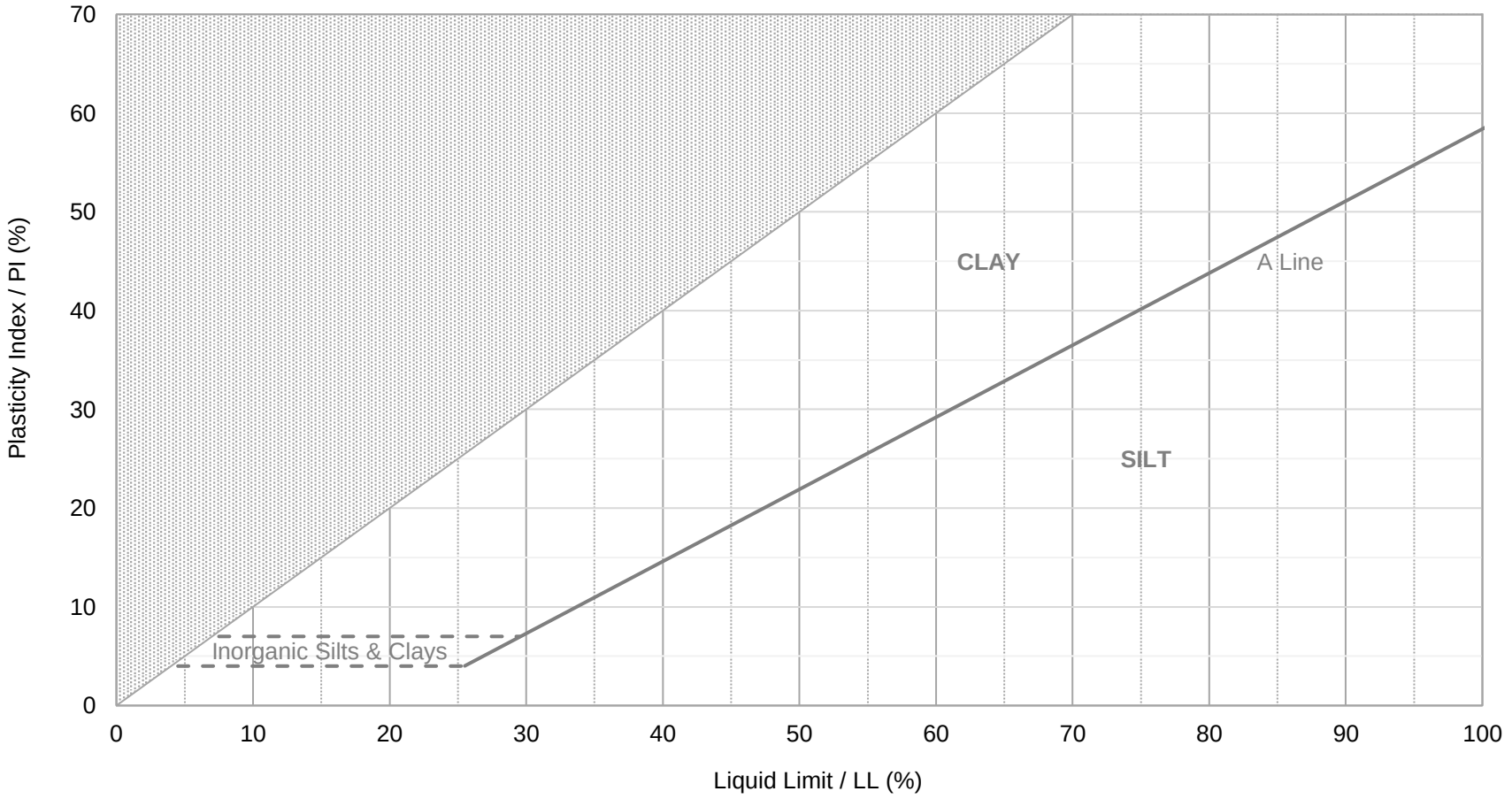
**Test Procedure**

| | | |
|---|---|---|
| ☑ | AS1289 3.1.1 | Liquid Limit - Four point Casagrande method |
| ☐ | AS1289 3.1.2 | Liquid Limit - One point Casagrande method |
| ☑ | AS1289 3.2.1 | Plastic Limit - Standard method |
| ☑ | AS1289 3.3.1 | Calculation of the Plasticity Index |
| ☑ | AS1289 3.4.1 | Linear Shrinkage - Standard method |

| | | | |
|---|---|---|---|
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 28/11/2024 |

## Plasticity Chart for Classification of Fine-Grained Soils

AS 1726:2017 Clause 6.1.6 (Figure 5)




**Preparation**

| | |
|---|---|
| Method of Preparation | **Dry Sieved** |
| History of the Sample | **Air Dried** |

**Results**

| | |
|---|---|
| Liquid Limit / LL (%) | **Unobtainable** |
| Plastic Limit (%) | **Unobtainable** |
| Plasticity Index / PI (%) | **Non-Plastic** |
| Linear Shrinkage (%) | **Unobtainable** |
| Condition upon Drying | **N/A** |

**Notes**

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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory:

Jacob Lloyd

2/12/2024

Date:

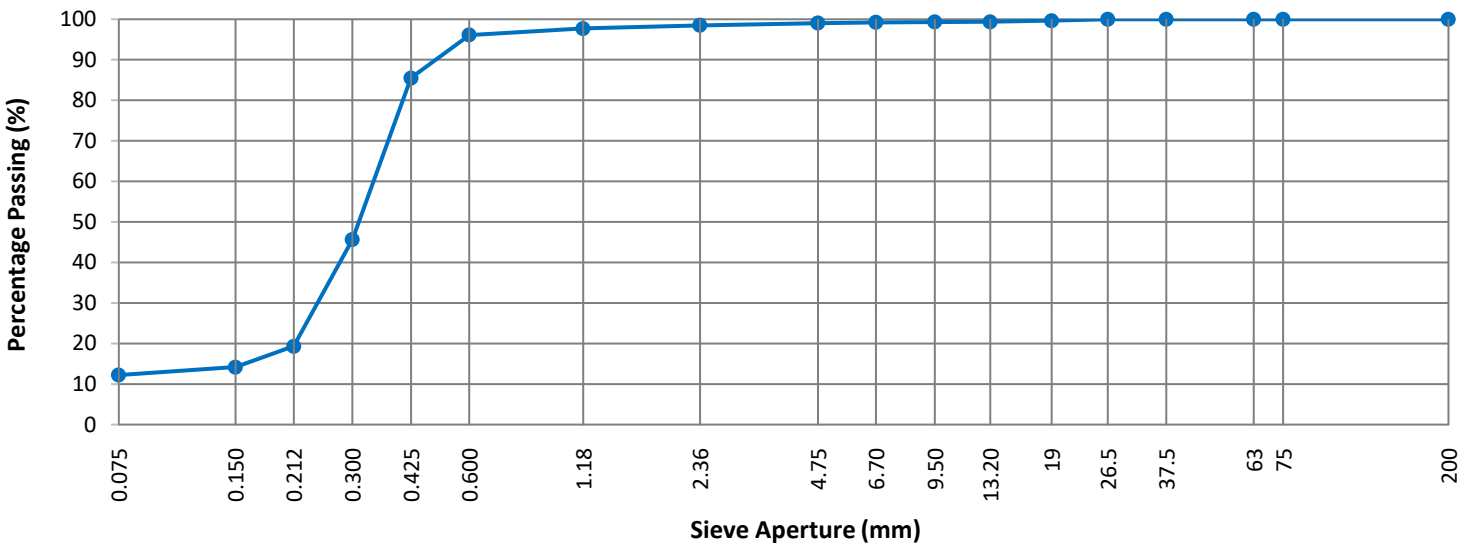
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# Particle Size Distribution Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | PSI.DIS BH04a 4.00-4.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND with Clay, trace of Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101431-PSD |
| **Job No** | S24581-1 | **Lab No** | S101431 |

| | | | |
|---|---|---|---|
| **Test Procedure** | AS 1289.3.6.1 Determination of the particle size distribution of a soil - Standard method of analysis by sieving | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 2/12/2024 |




| Sieve Aperture (mm) | Percentage Passing (%) |
|---|---|
| 200 | **100** |
| 75 | **100** |
| 63 | **100** |
| 37.5 | **100** |
| 26.5 | **100** |
| 19.0 | **100** |
| 13.2 | **99** |
| 9.50 | **99** |
| 6.70 | **99** |
| 4.75 | **99** |
| 2.36 | **99** |

| Sieve Aperture (mm) | Percentage Passing (%) |
|---|---|
| 1.18 | **98** |
| 0.600 | **96** |
| 0.425 | **86** |
| 0.300 | **46** |
| 0.212 | **19** |
| 0.150 | **14** |
| 0.075 | **12** |

**Notes**

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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory: Date:

2/12/2024

Jacob Lloyd

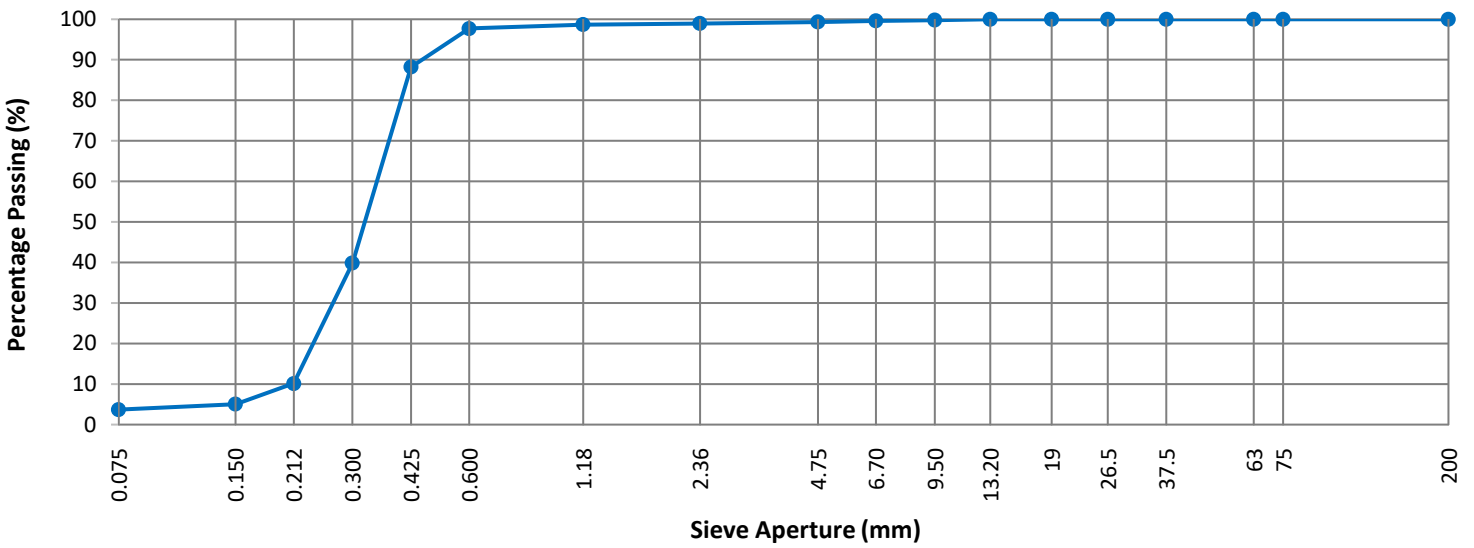
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# Particle Size Distribution Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | IGG.WET BH04a 1.50-2.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND trace of Silt and Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101432-PSD |
| **Job No** | S24581-1 | **Lab No** | S101432 |

| | | | |
|---|---|---|---|
| **Test Procedure** | AS 1289.3.6.1 Determination of the particle size distribution of a soil - Standard method of analysis by sieving | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 2/12/2024 |




| Sieve Aperture (mm) | Percentage Passing (%) |
|---|---|
| 200 | **100** |
| 75 | **100** |
| 63 | **100** |
| 37.5 | **100** |
| 26.5 | **100** |
| 19.0 | **100** |
| 13.2 | **100** |
| 9.50 | **100** |
| 6.70 | **100** |
| 4.75 | **99** |
| 2.36 | **99** |

| Sieve Aperture (mm) | Percentage Passing (%) |
|---|---|
| 1.18 | **99** |
| 0.600 | **98** |
| 0.425 | **88** |
| 0.300 | **40** |
| 0.212 | **10** |
| 0.150 | **5** |
| 0.075 | **4** |

**Notes**

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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory: Jacob Lloyd

Date: 2/12/2024

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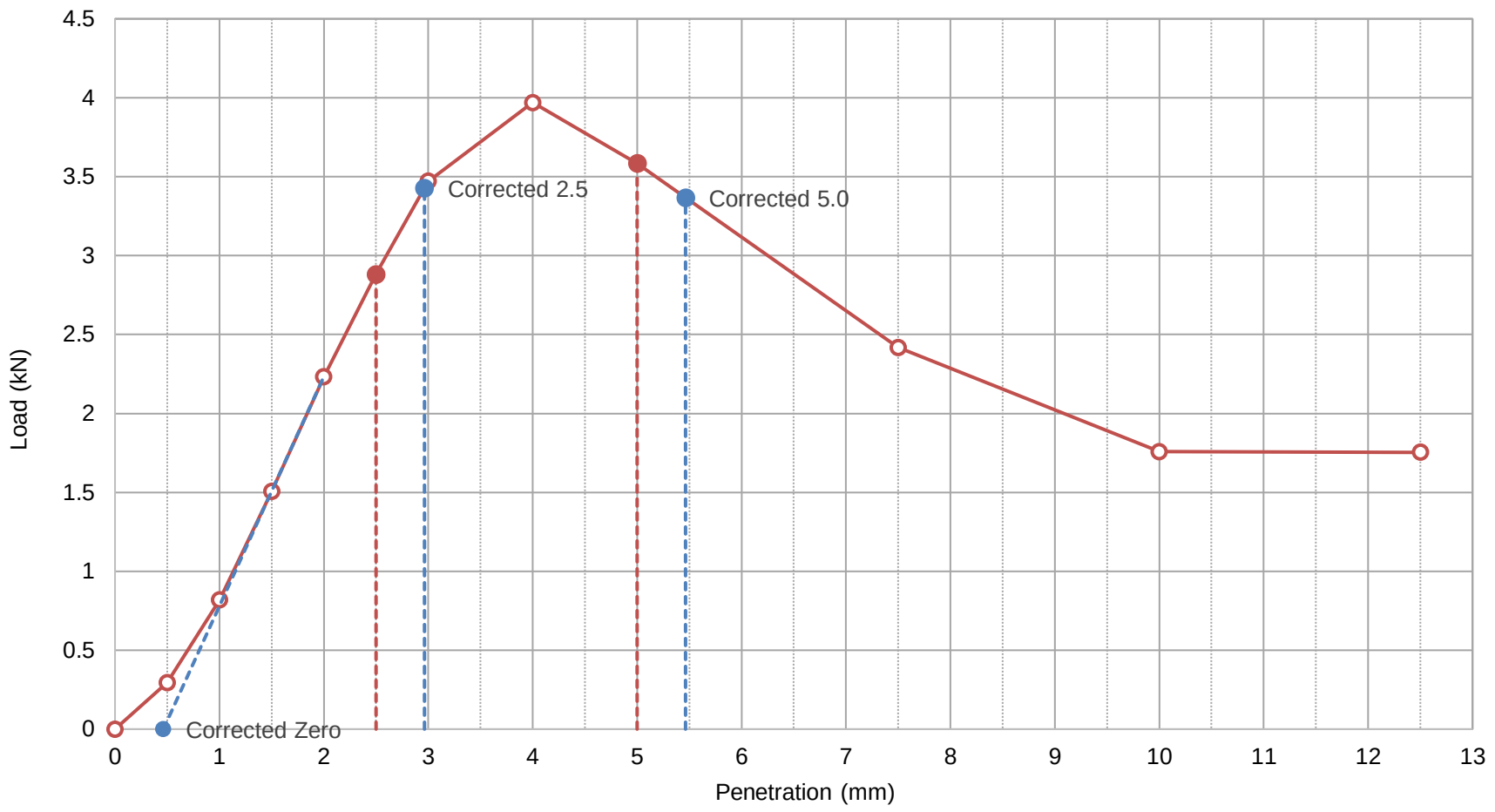
# CALIFORNIA BEARING RATIO REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | AHA.ROT BH05c 1.00-2.00m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No.** | S101433-CBR |
| **Job No.** | S24581-1 | **Sample No.** | S101433 |

| | | | |
|---|---|---|---|
| **Test Procedure** | ☑ AS 1289.6.1.1 | ☐ RMS T117 | California Bearing Ratio |
| | ☑ AS 1289.5.1.1 | ☐ RMS T111 | Dry Density / Moisture Content Relationship - Standard Compaction |
| | ☐ AS 1289.5.2.1 | ☐ RMS T112 | Dry Density / Moisture Content Relationship - Modified Compaction |
| | ☑ AS 1289.2.1.1 | ☐ RMS T120 | Moisture Content - Oven Drying Method (Standard Method) |

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 19/11/2024




| Preparation & Specification | |
|---|---|
| Retained on 19.0mm Sieve (%) | 0 |
| Method of Establishing Plasticity Level | Technician Assessment |
| Sample Curing Time (hrs) | 2 hrs |
| Compaction Hammer Used | Standard |
| Surcharge Mass Applied (kg) | 4.5 |
| Period of Soaking (Days) | 4 |
| Maximum Dry Density - MDD (t/m³) | 1.71 |
| Optimum Moisture Content - OMC (%) | 12.9 |

| Density & Moisture | Achieved | Target |
|---|---|---|
| Lab Moisture Ratio - LMR (%) | 99.5 | 100.0 |
| Lab Density Ratio - LDR (%) | 100.0 | 100.0 |
| Dry Density - At Compaction (t/m³) | 1.71 | 1.71 |
| Dry Density - After Soaking (t/m³) | 1.71 | |
| Specimen Swell (%) | 0.0 | |
| Moisture Content - At Compaction (%) | 12.8 | |
| Moisture Content - Top 30mm (%) | 14.8 | |
| Moisture Content - Remainder (%) | 14.7 | |

**Material CBR Value (%): 25 at a penetration of 2.5 mm**

**Notes**

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Authorised Signatory:

Chris Lloyd Date: 21/11/2024

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# DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | AHA.ROT BH05c 1.00-2.00m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT, 2609 | **Sample Description** | SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101433-MDD |
| **Job No** | S24581-1 | **Sample No** | S101433 |

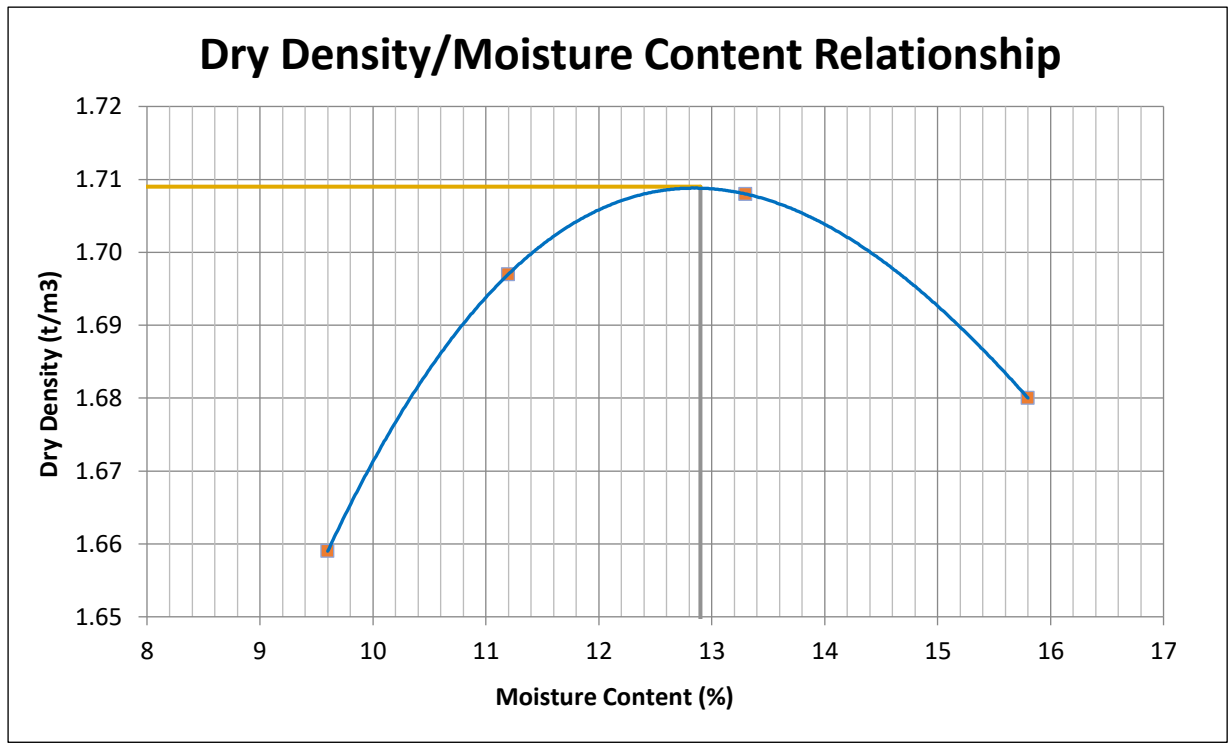
**Test Procedure**

☑ AS1289.5.1.1 Dry Density / Moisture Content Relationship - Standard Compaction

☑ AS1289.2.1.1 Moisture Content - Oven Drying Method (Standard Method)

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 14/11/2024




| | |
|---|---|
| **Maximum Dry Density (t/m$^3$)** | 1.71 |
| **Optimum Moisture Content (%)** | 12.9 |
| **Oversize Retained on 19mm sieve (%)** | 0 |
| **Oversize Retained on 37.5mm sieve (%)** | 0 |
| **Curing Time** | 2 hrs |
| **Liquid Limit Determination** | Technician Assessment |

**Notes**

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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory:

Jacob Lloyd

15/11/2024

Date:

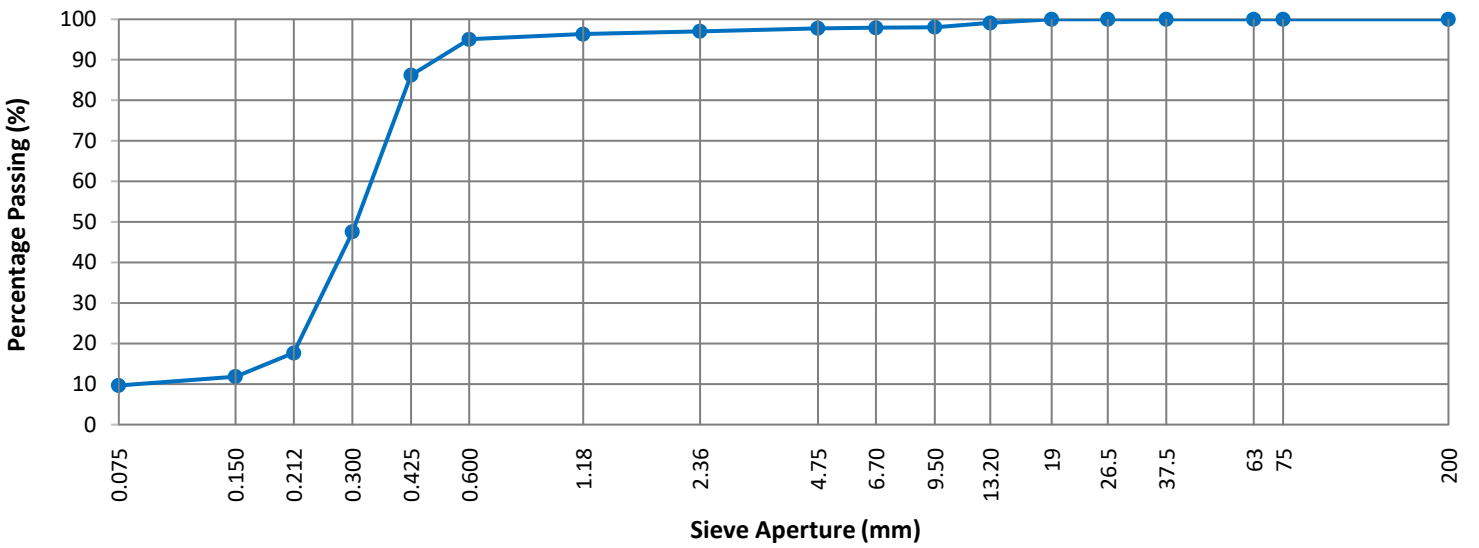
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# Particle Size Distribution Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | LIB.DEN BH05c 3.00-3.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND with Silt, trace of Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101434-PSD |
| **Job No** | S24581-1 | **Lab No** | S101434 |

| | | | |
|---|---|---|---|
| **Test Procedure** | AS 1289.3.6.1 Determination of the particle size distribution of a soil - Standard method of analysis by sieving | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 2/12/2024 |




| Sieve Aperture (mm) | Percentage Passing (%) |
|---|---|
| 200 | **100** |
| 75 | **100** |
| 63 | **100** |
| 37.5 | **100** |
| 26.5 | **100** |
| 19.0 | **100** |
| 13.2 | **99** |
| 9.50 | **98** |
| 6.70 | **98** |
| 4.75 | **98** |
| 2.36 | **97** |

| Sieve Aperture (mm) | Percentage Passing (%) |
|---|---|
| 1.18 | **96** |
| 0.600 | **95** |
| 0.425 | **86** |
| 0.300 | **48** |
| 0.212 | **18** |
| 0.150 | **12** |
| 0.075 | **10** |

**Notes**

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Authorised Signatory: Jacob Lloyd

Date: 2/12/2024

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# SOIL PARTICLE DENSITY REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | LIB.DEN BH05c 3.00-3.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND with Silt, trace of Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report #** | S101434-SPD |
| **Job #** | S24581-1 | **Lab #** | S101434 |

| | | | |
|---|---|---|---|
| **Test Procedure** | ☑ AS1289 3.5.1 (2006) Soil classification tests - Determination of the soil particle density of a soil - Standard method | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 21/11/2024 |

| | |
|---|---|
| Average Apparent Particle Density:<br>Fraction Retained 2.36mm (g/cm$^3$) | * |
| Average Apparent Particle Density:<br>Fraction Passing 2.36mm (g/cm$^3$) | **2.47** |
| Soil Particle Density:<br>Total Soil Sample (g/cm$^3$) | * |

** Value unable to be determined due to limited amount of sample.*

**Notes**

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**NATA Accredited Laboratory Number: 14874**

Jacob Lloyd

2/12/2024

Date:

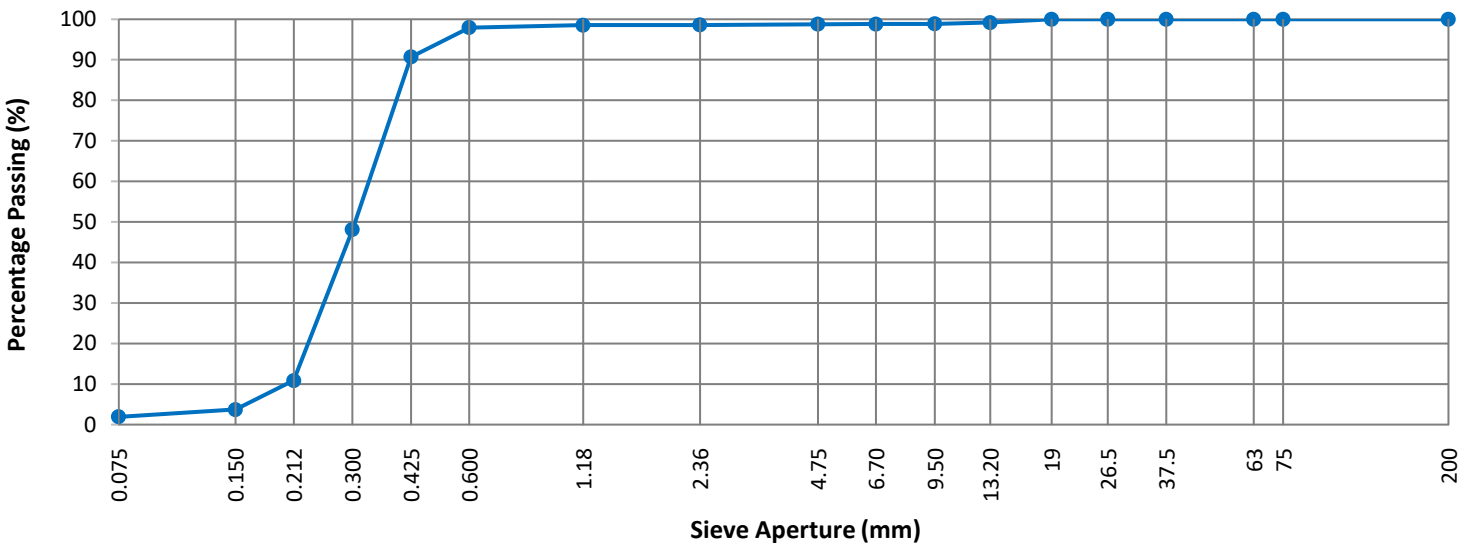
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# Particle Size Distribution Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | TOD.ORB BH05c 2.00-2.70m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND trace of Silt and Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101435-PSD |
| **Job No** | S24581-1 | **Lab No** | S101435 |

| | | | |
|---|---|---|---|
| **Test Procedure** | AS 1289.3.6.1 Determination of the particle size distribution of a soil - Standard method of analysis by sieving | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 2/12/2024 |




| Sieve Aperture (mm) | Percentage Passing (%) |
|---|---|
| 200 | **100** |
| 75 | **100** |
| 63 | **100** |
| 37.5 | **100** |
| 26.5 | **100** |
| 19.0 | **100** |
| 13.2 | **99** |
| 9.50 | **99** |
| 6.70 | **99** |
| 4.75 | **99** |
| 2.36 | **99** |

| Sieve Aperture (mm) | Percentage Passing (%) |
|---|---|
| 1.18 | **99** |
| 0.600 | **98** |
| 0.425 | **91** |
| 0.300 | **48** |
| 0.212 | **11** |
| 0.150 | **4** |
| 0.075 | **2** |

**Notes**

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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory: Date:

2/12/2024

Jacob Lloyd

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# SOIL PARTICLE DENSITY REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | TOD.ORB BH05c 2.00-2.70m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT 2609 | **Sample Description** | SAND trace of Silt and Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report #** | S101435-SPD |
| **Job #** | S24581-1 | **Lab #** | S101435 |

| | | | |
|---|---|---|---|
| **Test Procedure** | ☑ AS1289 3.5.1 (2006) Soil classification tests - Determination of the soil particle density of a soil - Standard method | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 25/11/2024 |

| | |
|---|---|
| Average Apparent Particle Density:<br>Fraction Retained 2.36mm (g/cm$^3$) | * |
| Average Apparent Particle Density:<br>Fraction Passing 2.36mm (g/cm$^3$) | **2.64** |
| Soil Particle Density:<br>Total Soil Sample (g/cm$^3$) | * |

** Value unable to be determined due to limited amount of sample.*

**Notes**

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**NATA Accredited Laboratory Number: 14874**

Jacob Lloyd

2/12/2024

Date:

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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | SIS.CAN BH02 2.50-3.00m + BAY.DIM BH02 3.00-3.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT, 2609 | **Sample Description** | SAND trace of Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101426-DS |
| **Job No** | S24581-1 | **Lab No** | S101426 |

| | | | |
|---|---|---|---|
| **Test Procedure** | AS1289 6.2.2 Soil strength and consolidation tests - Determination of the shear strength of a soil - Direct shear test using a shear box | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 16/11/2024 |

| **Test Details** | | | | | | |
|---|---|---|---|---|---|---|
| Remoulding Details | 100% Standard Compaction @ 100% Optimum Moisture Content | | | | | |
| Size of Shear Box (mm) | 100mm Square | | | | | |
| **Test Parameter** | **Stage 1** | **Stage 2** | **Stage 3** | **Stage 4** | **Stage 5** | **Stage 6** |
| Specimen Dimensions (mm) | 99.98 x 100.03 | 99.98 x 100.03 | 99.98 x 100.03 | - | - | - |
| Rate of Strain (mm/min) | 0.05 | 0.05 | 0.05 | - | - | - |
| Placement Moisture Content (%) | 14.5 | 14.5 | 14.5 | - | - | - |
| Placement Wet Density (t/m$^3$) | 1.94 | 1.94 | 1.94 | - | - | - |
| Placement Dry Density (t/m$^3$) | 1.69 | 1.69 | 1.69 | - | - | - |
| **Peak Values** | | | | | | |
| Normal Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Shear Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Normal Stress at Peak Shear Stress (kPa) | 50.0 | 100.0 | 200.0 | - | - | - |
| Peak Shear Stress (kPa) | 32.1 | 71.1 | 129.7 | - | - | - |
| Normal Stress at Ultimate Shear Stress (kPa) | 50.0 | 100.0 | 200.0 | - | - | - |
| Shear Stress at Ultimate Shear Stress (kPa) | 31.2 | 71.7 | 133.0 | - | - | - |
| **Residual Values** | | | | | | |
| Normal Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Shear Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Normal Stress at Peak Shear Stress (kPa) | - | - | - | - | - | - |
| Peak Shear Stress (kPa) | - | - | - | - | - | - |
| Normal Stress at Ultimate Shear Stress (kPa) | - | - | - | - | - | - |
| Shear Stress at Ultimate Shear Stress (kPa) | - | - | - | - | - | - |

| **Failure Envelopes** | | | |
|---|---|---|---|
| | | **Peak Values** | **Residual Values** |
| **At Displacement** | Friction Angle (°) | - | - |
| | Cohesion (kPa) | - | - |
| | Correlation | - | - |
| **Peak Shear Stress** | Friction Angle (°) | **32.7** | - |
| | Cohesion (kPa) | **2.8** | - |
| | Correlation | **0.9972** | - |
| **Ultimate Shear Stress** | Friction Angle (°) | **33.8** | - |
| | Cohesion (kPa) | **0.6** | - |
| | Correlation | **0.9974** | - |

**Notes**

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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory: Chris Lloyd

Date: 19/11/2024

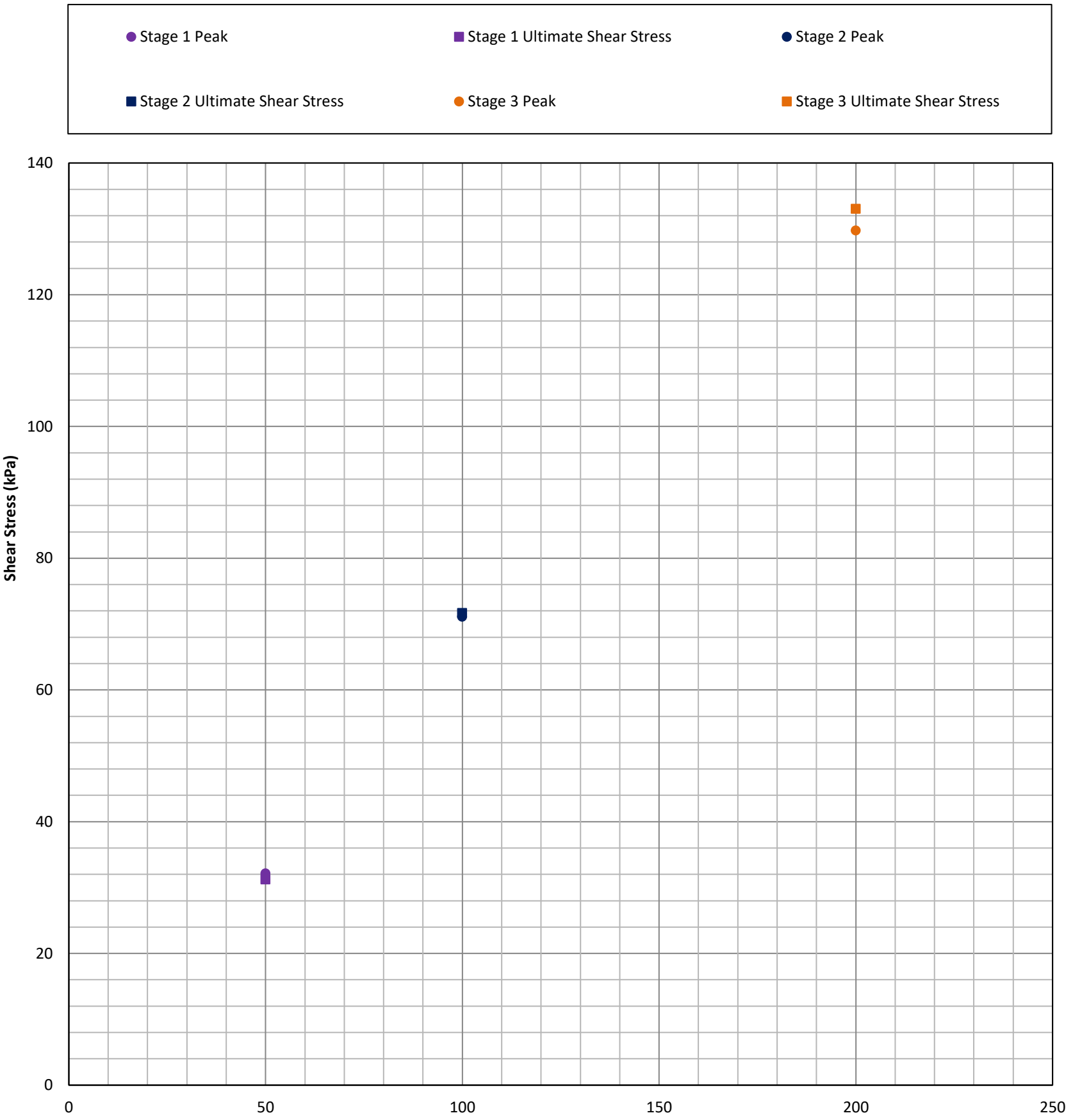
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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Report No** | S101426-DS |

## Peak Shear Stress / Normal Stress




Accredited for compliance with ISO/IEC 17025 - Testing.

Authorised Signatory:

Date: 19/11/2024

**NATA Accredited Laboratory Number: 14874**

Chris Lloyd

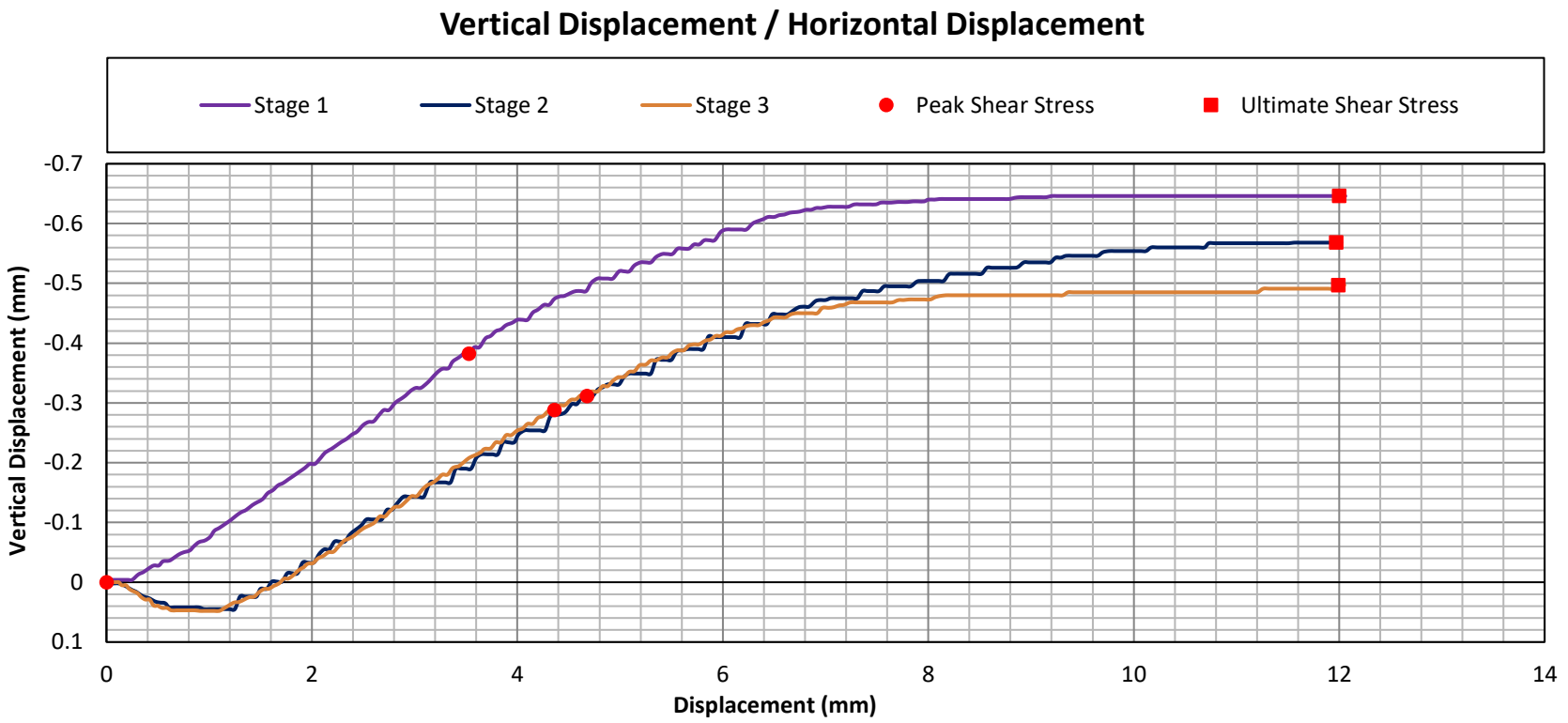

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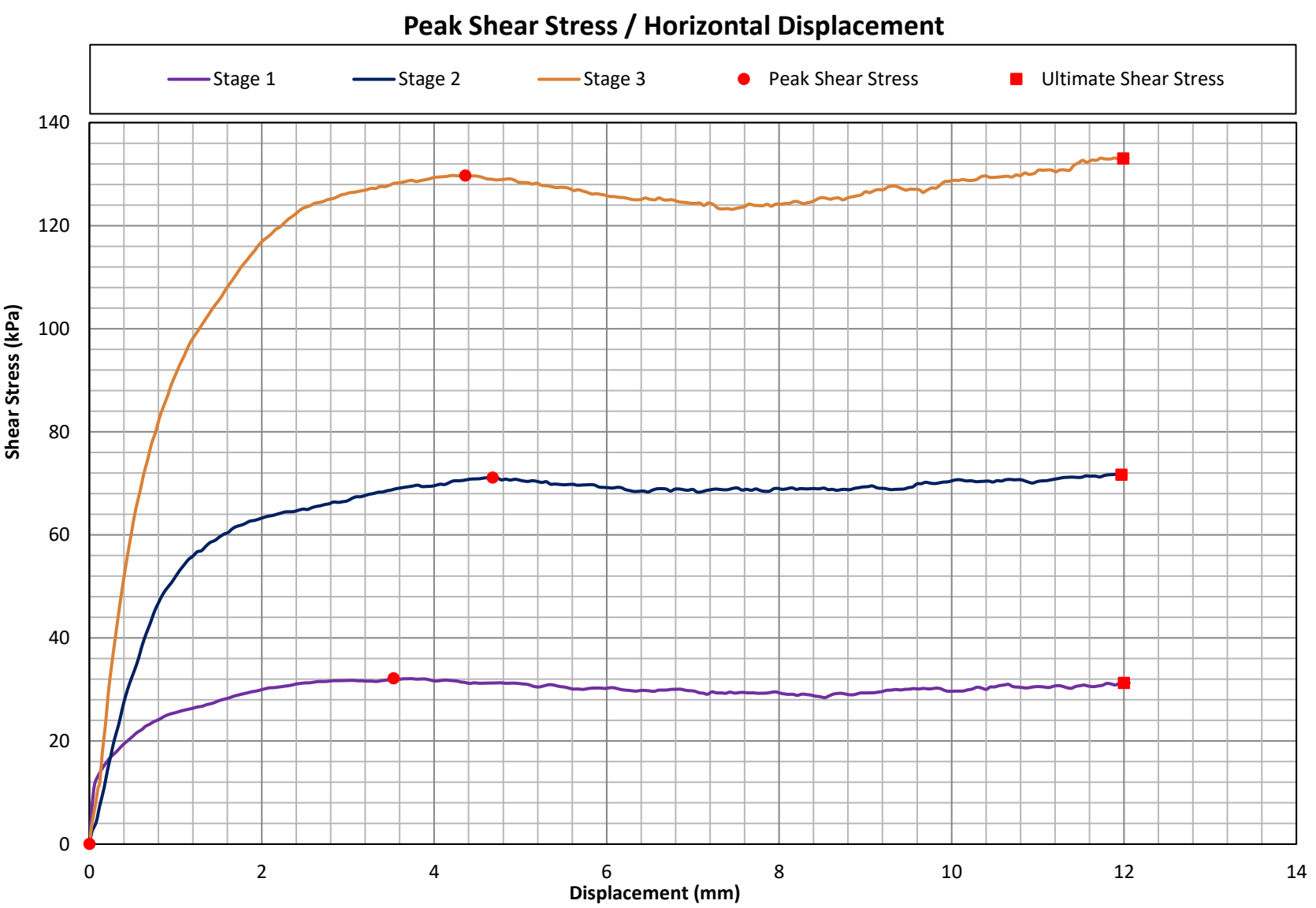


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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Report No** | S101426-DS |




Accredited for compliance with ISO/IEC 17025 - Testing.

Authorised Signatory:

Date: 19/11/2024

Chris Lloyd

**NATA Accredited Laboratory Number: 14874**


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# DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | SIS.CAN BH02 2.50-3.00m + BAY.DIM BH02 3.00-3.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT, 2609 | **Sample Description** | SAND trace of Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101426-MDD |
| **Job No** | S24581-1 | **Sample No** | S101426 |

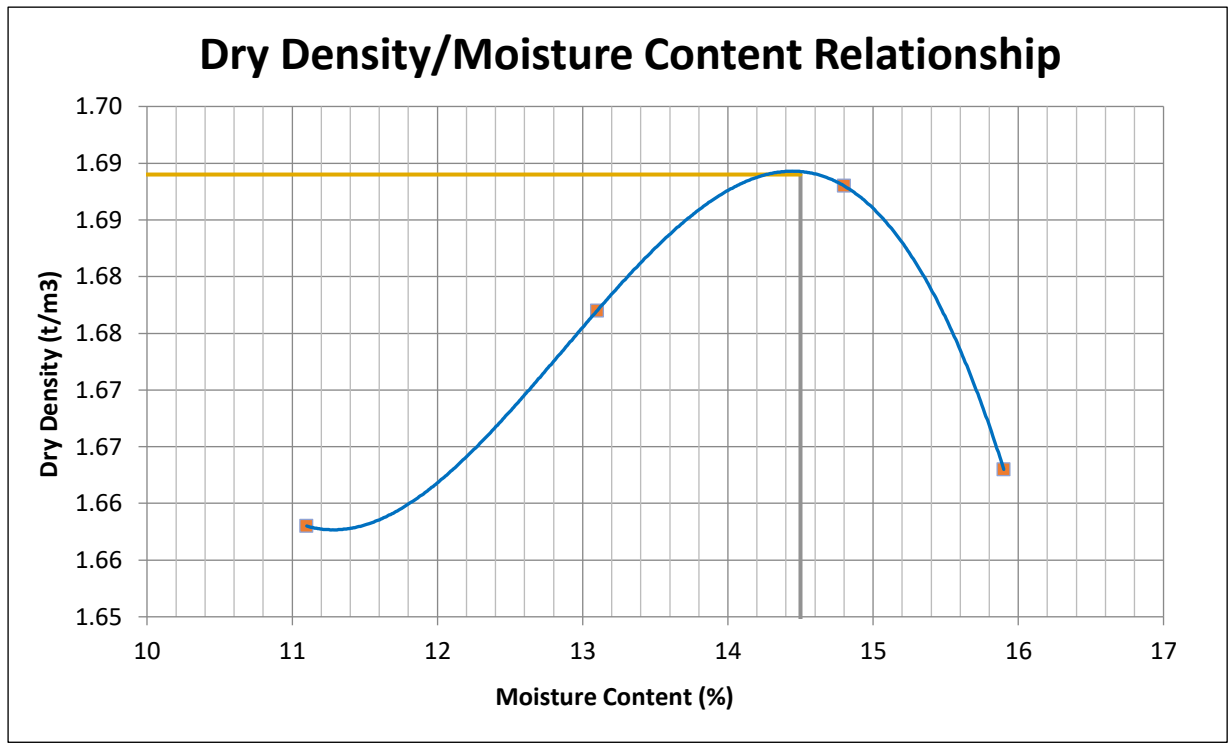
**Test Procedure**

☑ AS1289.5.1.1 Dry Density / Moisture Content Relationship - Standard Compaction

☑ AS1289.2.1.1 Moisture Content - Oven Drying Method (Standard Method)

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 14/11/2024




| | |
|---|---|
| **Maximum Dry Density (t/m$^3$)** | 1.69 |
| **Optimum Moisture Content (%)** | 14.5 |
| **Oversize Retained on 19mm sieve (%)** | 2 |
| **Oversize Retained on 37.5mm sieve (%)** | 1 |
| **Curing Time** | 2 hrs |
| **Liquid Limit Determination** | Technician Assessment |

**Notes**

Accredited for compliance with ISO/IEC 17025 - Testing.

**NATA Accredited Laboratory Number: 14874**

Authorised Signatory:

Jacob Lloyd

15/11/2024

Date:

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14 Carter St
Lidcombe NSW 2141

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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | OLE.OFT BH03 1.50-2.50 + INN.LAG BH03 2.50-3.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT, 2609 | **Sample Description** | Silty SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101430-SB |
| **Job No** | S24581-1 | **Lab No** | S101430 |

| | | | |
|---|---|---|---|
| **Test Procedure** | AS1289 6.2.2 Soil strength and consolidation tests - Determination of the shear strength of a soil - Direct shear test using a shear box | | |
| **Sampling** | Sampled by Client - results apply to the sample as received | **Date Sampled** | 24-25/10/2024 |
| **Preparation** | Prepared in accordance with the test method | **Date Tested** | 18/11/2024 |

| **Test Details** | | | | | | |
|---|---|---|---|---|---|---|
| Remoulding Details | 100% Standard Compaction @ 100% Optimum Moisture Content | | | | | |
| Size of Shear Box (mm) | 100mm Square | | | | | |
| **Test Parameter** | **Stage 1** | **Stage 2** | **Stage 3** | **Stage 4** | **Stage 5** | **Stage 6** |
| Specimen Dimensions (mm) | 99.98 x 100.03 | 99.98 x 100.03 | 99.98 x 100.03 | - | - | - |
| Rate of Strain (mm/min) | 0.05 | 0.05 | 0.05 | - | - | - |
| Placement Moisture Content (%) | 14.1 | 14.1 | 14.1 | - | - | - |
| Placement Wet Density (t/m$^3$) | 1.89 | 1.89 | 1.89 | - | - | - |
| Placement Dry Density (t/m$^3$) | 1.66 | 1.66 | 1.66 | - | - | - |
| **Peak Values** | | | | | | |
| Normal Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Shear Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Normal Stress at Peak Shear Stress (kPa) | 50.0 | 100.0 | 200.0 | - | - | - |
| Peak Shear Stress (kPa) | 31.1 | 69.4 | 125.8 | - | - | - |
| Normal Stress at Ultimate Shear Stress (kPa) | 50.0 | 100.0 | 200.0 | - | - | - |
| Shear Stress at Ultimate Shear Stress (kPa) | 29.9 | 66.9 | 125.0 | - | - | - |
| **Residual Values** | | | | | | |
| Normal Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Shear Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Normal Stress at Peak Shear Stress (kPa) | - | - | - | - | - | - |
| Peak Shear Stress (kPa) | - | - | - | - | - | - |
| Normal Stress at Ultimate Shear Stress (kPa) | - | - | - | - | - | - |
| Shear Stress at Ultimate Shear Stress (kPa) | - | - | - | - | - | - |

| **Failure Envelopes** | | | |
|---|---|---|---|
| | | **Peak Values** | **Residual Values** |
| **At Displacement** | Friction Angle (°) | **-** | **-** |
| | Cohesion (kPa) | **-** | **-** |
| | Correlation | **-** | **-** |
| **Peak Shear Stress** | Friction Angle (°) | **31.9** | **-** |
| | Cohesion (kPa) | **2.9** | **-** |
| | Correlation | **0.9968** | **-** |
| **Ultimate Shear Stress** | Friction Angle (°) | **32.1** | **-** |
| | Cohesion (kPa) | **0.8** | **-** |
| | Correlation | **0.9980** | **-** |

**Notes**

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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory: Chris Lloyd

Date: 19/11/2024

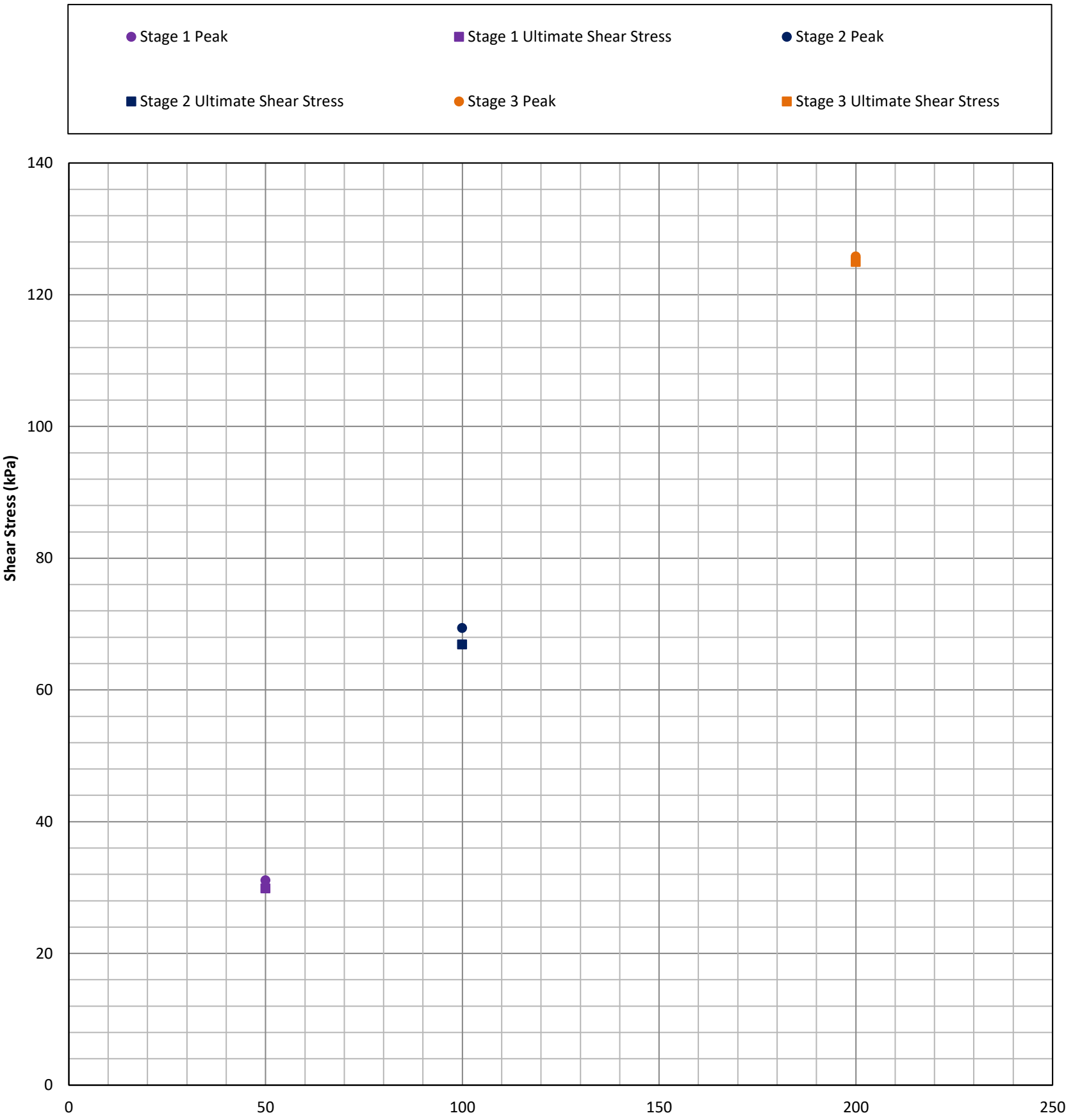
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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Report No** | S101430-SB |

## Peak Shear Stress / Normal Stress




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Authorised Signatory:

Date: 19/11/2024

**NATA Accredited Laboratory Number: 14874**

Chris Lloyd

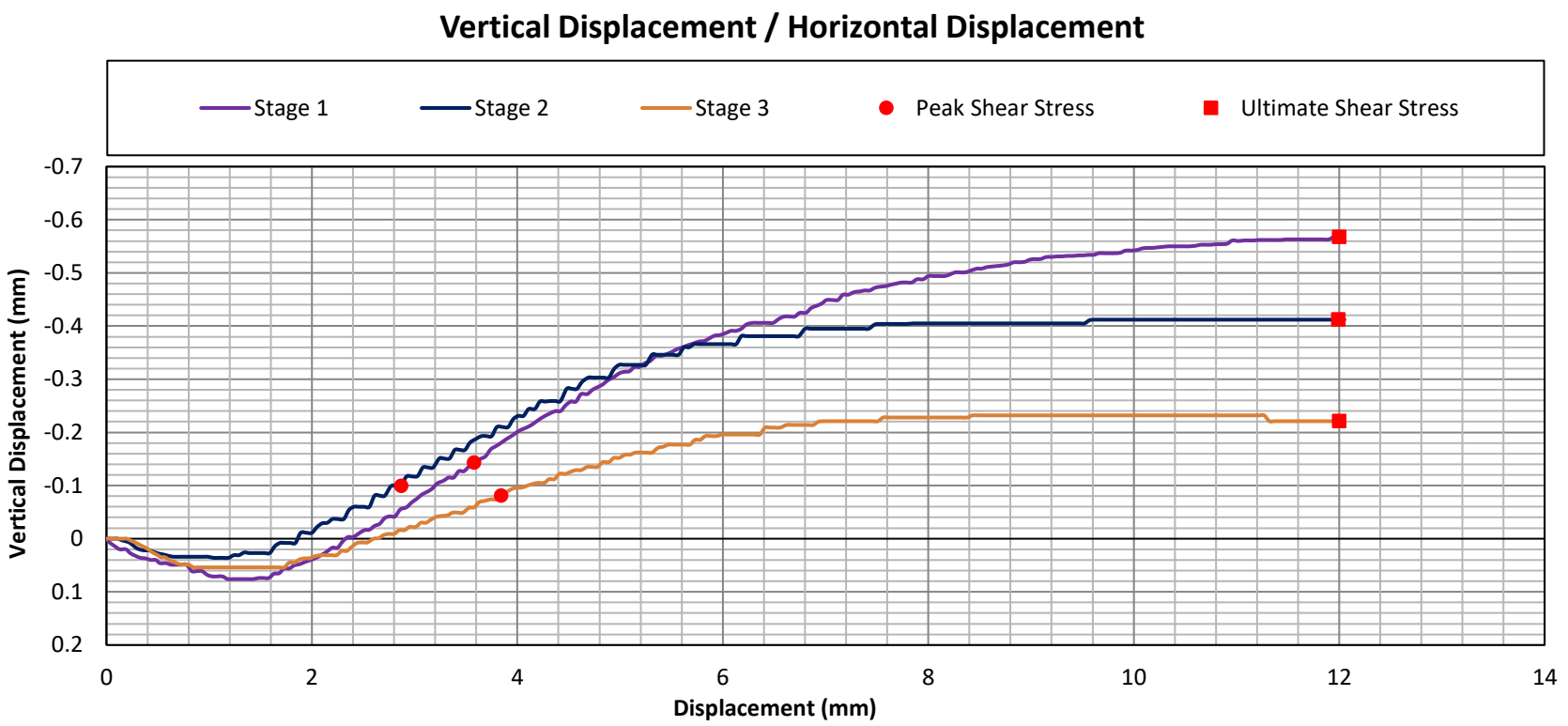

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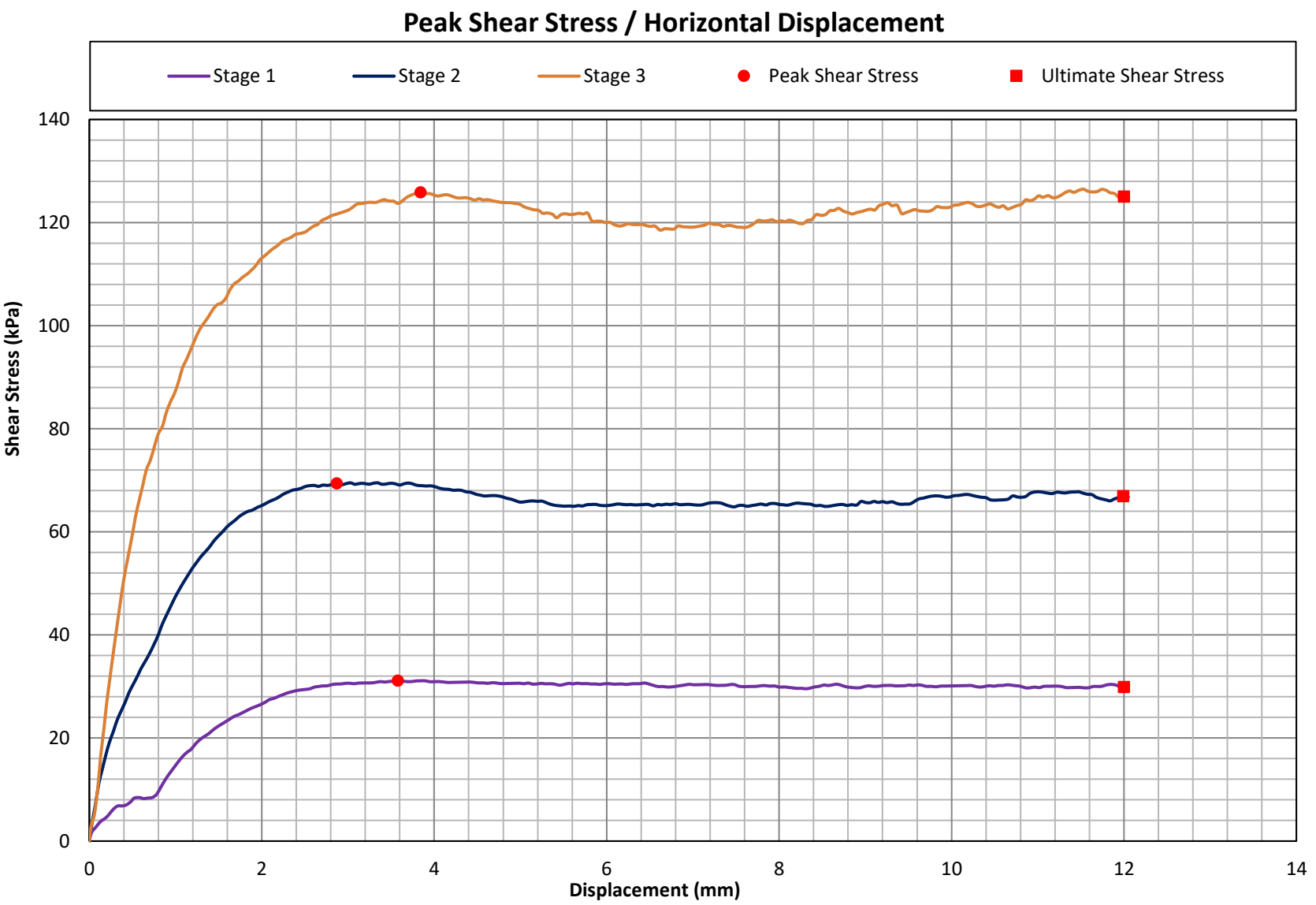


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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Report No** | S101430-SB |




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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory: Chris Lloyd

Date: 19/11/2024


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# DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | OLE.OFT BH03 1.50-2.50 + INN.LAG BH03 2.50-3.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT, 2609 | **Sample Description** | SAND |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101430-MDD |
| **Job No** | S24581-1 | **Sample No** | S101430 |

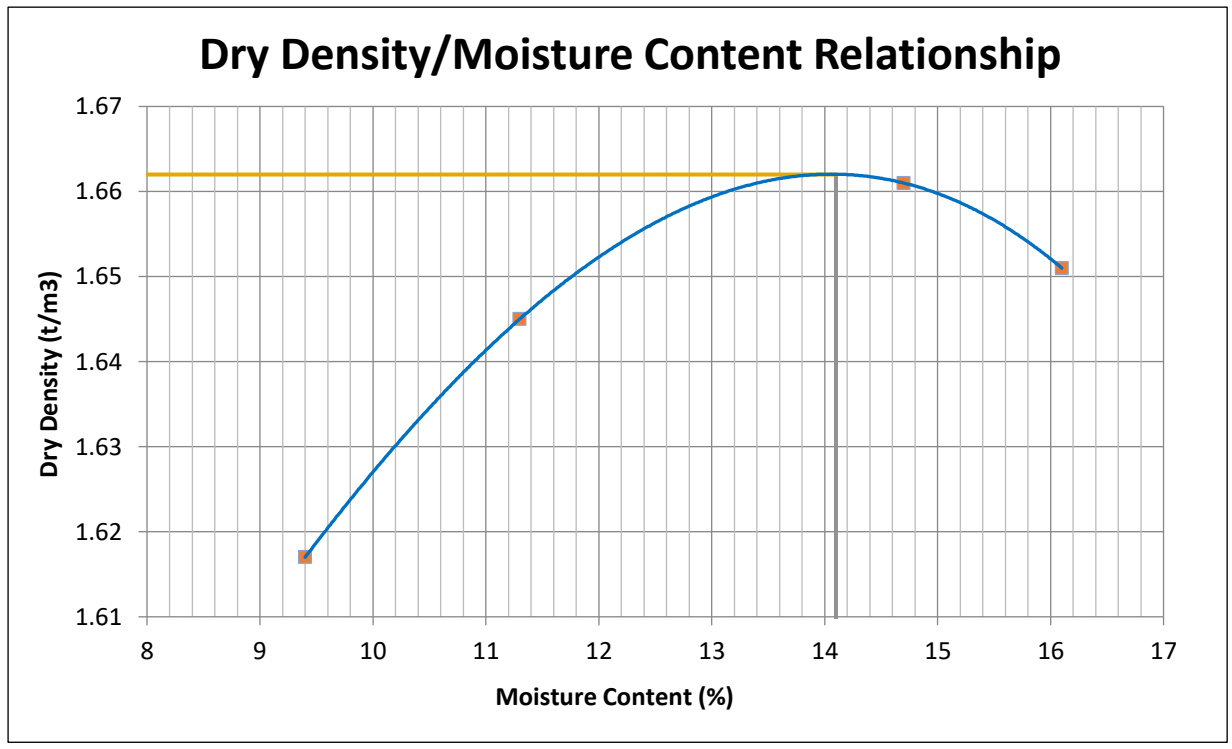
**Test Procedure**

☑ AS1289.5.1.1 Dry Density / Moisture Content Relationship - Standard Compaction

☑ AS1289.2.1.1 Moisture Content - Oven Drying Method (Standard Method)

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 14/11/2024




| | |
|---|---|
| **Maximum Dry Density (t/m$^3$)** | 1.66 |
| **Optimum Moisture Content (%)** | 14.1 |
| **Oversize Retained on 19mm sieve (%)** | 0 |
| **Oversize Retained on 37.5mm sieve (%)** | 0 |
| **Curing Time** | 2 hrs |
| **Liquid Limit Determination** | Technician Assessment |

**Notes**

Accredited for compliance with ISO/IEC 17025 - Testing.

**NATA Accredited Laboratory Number: 14874**

Authorised Signatory:

Jacob Lloyd

15/11/2024

Date:

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Lidcombe NSW 2141

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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Source** | LIB.DEN BH05c 3.00-3.50m |
| **Address** | Level 4, 11 Lancaster Place,<br>Majura Park,<br>ACT, 2609 | **Sample Description** | SAND with Silt, trace of Gravel |
| **Project** | G24469 - Matraville Chlorine Liquefaction Plant | **Report No** | S101434-SB |
| **Job No** | S24581-1 | **Lab No** | S101434 |

**Test Procedure** AS1289 6.2.2 Soil strength and consolidation tests - Determination of the shear strength of a soil - Direct shear test using a shear box

**Sampling** Sampled by Client - results apply to the sample as received **Date Sampled** 24-25/10/2024

**Preparation** Prepared in accordance with the test method **Date Tested** 2/12/2024

| Test Details | | | | | | |
|---|---|---|---|---|---|---|
| Remoulding Details | 100% Standard Compaction @ 100% Optimum Moisture Content | | | | | |
| Size of Shear Box (mm) | 100mm Square | | | | | |
| **Test Parameter** | **Stage 1** | **Stage 2** | **Stage 3** | **Stage 4** | **Stage 5** | **Stage 6** |
| Specimen Dimensions (mm) | 99.98 x 100.03 | 99.98 x 100.03 | 99.98 x 100.03 | - | - | - |
| Rate of Strain (mm/min) | 0.02 | 0.02 | 0.02 | - | - | - |
| Placement Moisture Content (%) | 22.3 | 22.3 | 22.3 | - | - | - |
| Placement Wet Density ($t/m^3$) | 2.08 | 2.08 | 2.08 | - | - | - |
| Placement Dry Density ($t/m^3$) | 1.70 | 1.70 | 1.70 | - | - | - |
| **Peak Values** | | | | | | |
| Normal Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Shear Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Normal Stress at Peak Shear Stress (kPa) | 50.0 | 100.0 | 200.0 | - | - | - |
| Peak Shear Stress (kPa) | 40.7 | 80.3 | 155.2 | - | - | - |
| Normal Stress at Ultimate Stress (kPa) | 50.0 | 100.0 | 200.0 | - | - | - |
| Shear Stress at Ultimate Stress (kPa) | 36.9 | 72.4 | 151.2 | - | - | - |
| **Residual Values** | | | | | | |
| Normal Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Shear Stress at Nominated Displacement (kPa) | - | - | - | - | - | - |
| Normal Stress at Peak Shear Stress (kPa) | - | - | - | - | - | - |
| Peak Shear Stress (kPa) | - | - | - | - | - | - |
| Normal Stress at Ultimate Stress (kPa) | - | - | - | - | - | - |
| Shear Stress at Ultimate Stress (kPa) | - | - | - | - | - | - |

| Failure Envelopes | | | |
|---|---|---|---|
| | | **Peak Values** | **Residual Values** |
| **At Displacement** | Friction Angle (°) | **-** | **-** |
| | Cohesion (kPa) | **-** | **-** |
| | Correlation | **-** | **-** |
| **Peak Shear Stress** | Friction Angle (°) | **37.3** | **-** |
| | Cohesion (kPa) | **3.2** | **-** |
| | Correlation | **0.9999** | **-** |
| **At Ultimate Stress** | Friction Angle (°) | **37.4** | **-** |
| | Cohesion (kPa) | **0.0** | **-** |
| | Correlation | **0.9997** | **-** |

**Notes**

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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory: Chris Lloyd

Date: 5/12/2024

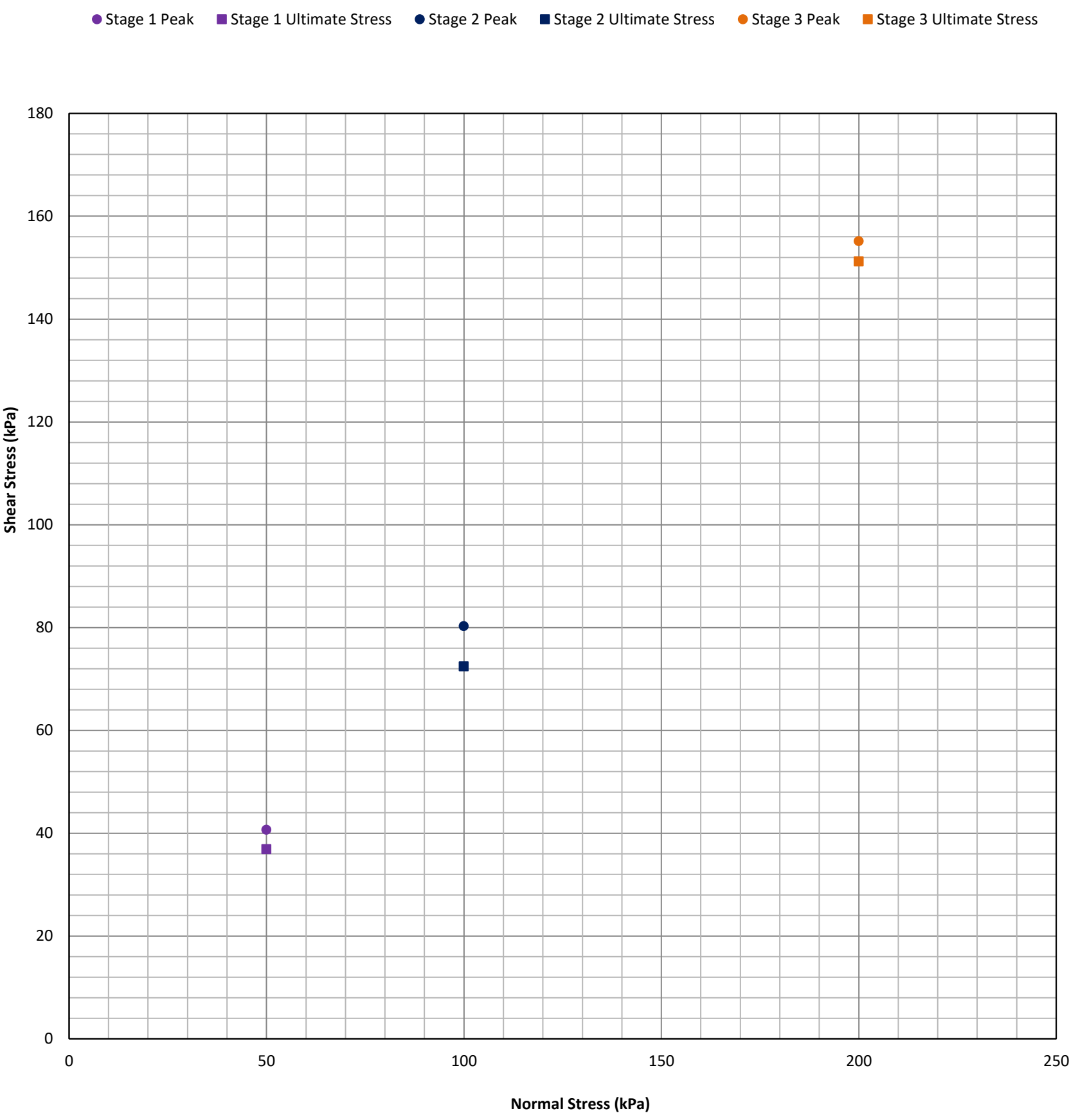
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# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Report No** | S101434-SB |

## Peak Shear Stress / Normal Stress




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**NATA Accredited Laboratory Number: 14874**

Authorised Signatory:

Date: 5/12/2024

Chris Lloyd

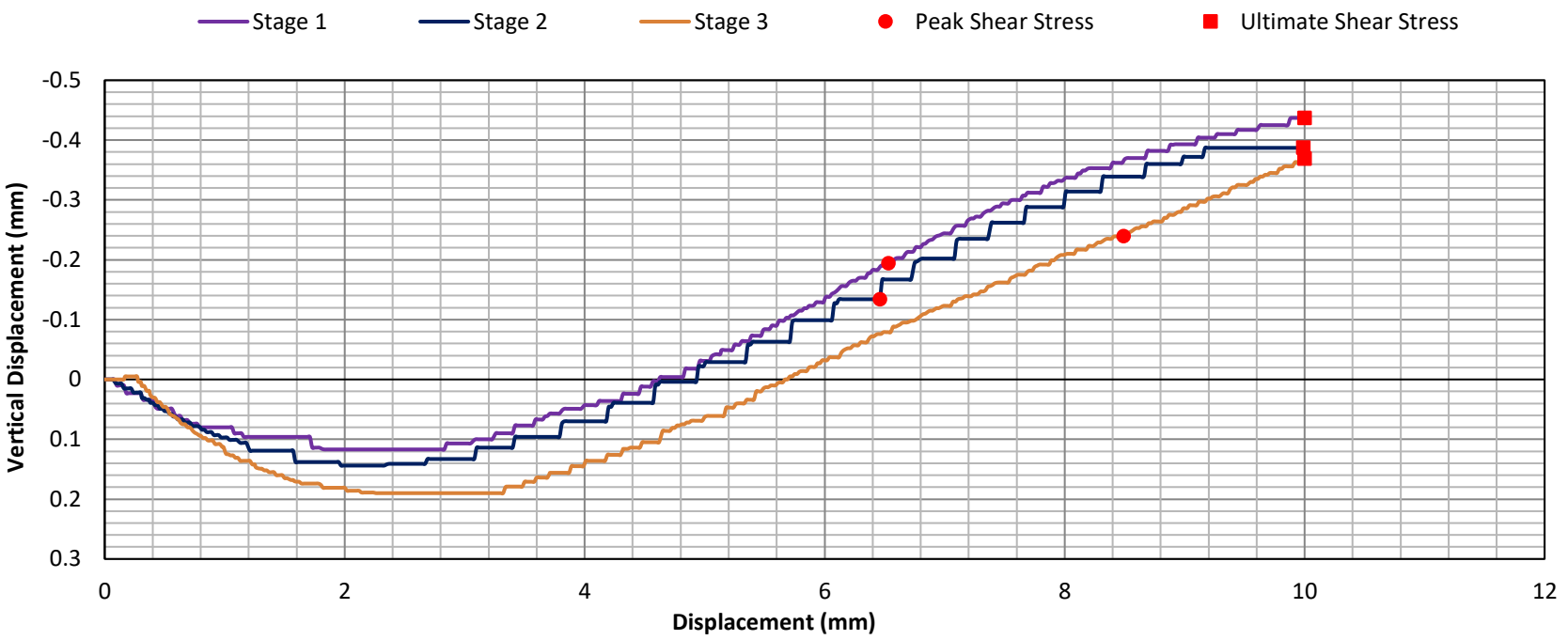
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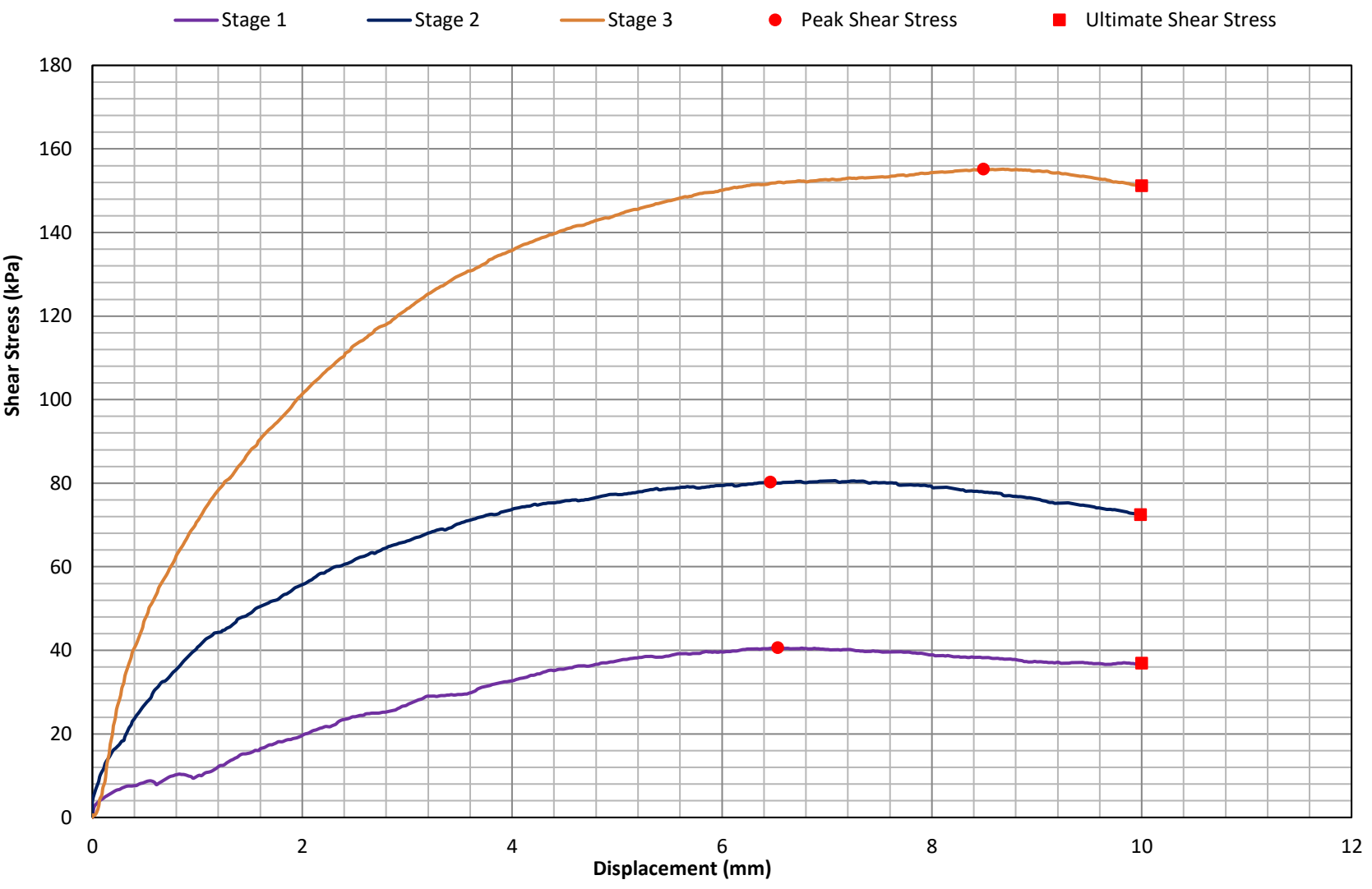
# Shear Strength by Direct Shear Report

| | | | |
|---|---|---|---|
| **Client** | KBR | **Report No** | S101434-SB |

## Vertical Displacement / Horizontal Displacement




## Peak Shear Stress / Horizontal Displacement




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Authorised Signatory:

Date: 5/12/2024

Chris Lloyd

**NATA Accredited Laboratory Number: 14874**


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# APPENDIX D

## CONSULTATION AND RESPONSES

**29 October 2025**

Dear neighbour,

**Notice : Modification to Steam Generation Boiler for the IXOM Chlorine Plant**

Recently IXOM notified you of an application to the Department of Planning, Housing and Infrastructure (DPHI) to upgrade to the Chlorine Plant at 16-20 Beauchamp Road, Matraville NSW. This involves the proposed addition of a Chlorine Liquefaction facility.

I am now notifying you about an additional change involving the replacement of a temporary diesel-fired boiler with a new permanent low-emission gas-fired boiler to generate steam for the existing Chlorine Plant. This change also needs to be approved by the DPHI.

Over the page is:

- More information about what is being proposed
- A map showing the location of the new proposed Steam Boiler House.
- Information about the environmental assessment and initial findings.

To learn more about the IXOM site and the recent modification application you can visit:

- the IXOM website https://www.ixom.com/locations/botany
- the NSW Government DPHI website: https://www.planningportal.nsw.gov.au/major-projects/projects/mod-6-chlorine-liquefaction-plant

Should you have questions or comments about this current modification application for the steam generation boiler please:

- email chlorineliquefactionproject@ixom.com
- phone 1800 194 718

We value our relationships with our immediate neighbours and welcome you to speak with us about this proposal at any time.

Yours sincerely,

RBrittliff

**Robert Brittliff**
**Head of Manufacturing, IXOM Chlorine Plant**

1 Nicholson St,
East Melbourne VIC 3002
Ph: +61 3 9906 3000
**www.ixom.com**

**About IXOM and Chlorine -** IXOM currently produces chlorine at this plant, which is used to manufacture several chlorine-based products used in water treatment and industrial applications. Importantly, chlorine is the main product used to disinfect water, making it safe to drink. IXOM has safely produced, stored and transported chlorine around Australia for over 100 years. The Australian water industry needs large quantities of chlorine to ensure the health and safety of the public and the environment.

**What is being proposed**

Until recently, the Chlorine Plant sourced steam from the Qenos Pty Ltd (Qenos) site utilities plant in the Botany Industrial Park. Qenos entered into voluntary administration in April 2024. The supply of steam ceased and IXOM installed a temporary 3 megawatt (MW) diesel-fired boiler.

IXOM are proposing to install a 6MW natural gas boiler to permanently replace the approximately 100MW of coal/natural gas fired boilers that was accessed from the Qenos site utilities plant.

The new boiler will be housed in an open-sided shelter adjacent to existing site infrastructure within the IXOM site. The boiler uses the existing gas connection points, pipelines and structural elements to provide a reliable long-term supply of steam for the Chlorine Plant.

This change is subject to review and audit by NSW Government including Environment Protection Authority and the Safe Work Major Hazard Facility Unit. Environmental assessment by DPHI includes the operational impacts for this and the potential addition of the chlorine liquification plant. Impacts including air emissions, noise, safety and risks, and resource use are being considered. Impacts are expected to be low and unlikely to increase the risk of the site.

**Location map: Steam Boiler House - IXOM Chlorine Plant, 16-20 Beauchamp Road, Matraville**




1 Nicholson St,
East Melbourne VIC 3002
Ph: +61 3 9906 3000
**www.ixom.com**

17 October 2025

Attention: NSW Environment Protection Authority

IXOM gas-fired boiler and associated boiler room –
State Significant Development modification

PO Box 1563
Warriewood
NSW 2102

ABN 45 162
835 083

via email: info@environment.nsw.gov.au
NSW Environment Protection Authority
6 Parramatta Square, 10 Darcy Street
Parramatta
NSW 2124

Dear Development Team

**IXOM gas-fired boiler and associated roofed shelter – Modification to State Significant Development**

# Introduction

Element Environment Pty Ltd (Element) is writing on behalf of IXOM Operations Pty Ltd (IXOM). IXOM has engaged Element to prepare the report for the modification of a State significant development (SSD) consent under Section 4.55(1A) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the installation of a gas-fired boiler, including an open-sided roofed shelter (boiler house), ancillary equipment, and extensions to existing pipework (the modification) to provide a reliable long-term steam supply at IXOM's Botany Chlor-alkali Plant (CAP) at 16-20 Beauchamp Road, Banksmeadow NSW 2019 (the site).

The CAP operates under consent DA35/98 (the consent), granted by the Minister for Urban Affairs and Planning in 1998. Since the original approval, the development has undergone five modifications:

- 2006 – Construction of sodium hypochlorite manufacturing facilities (Part 4 modification).
- 2006 – Demolition of the old CAP (Part 4 modification).
- 2009 – Relocation of sodium hypochlorite manufacturing facilities (Part 4 modification).
- 2012 – Replacement of two 1.1 ML steel caustic tanks and demolition of two disused tanks (Part 3A modification).
- 2018 – Construction of a repackaging facility (Part 3A modification).

A sixth modification is currently underway to gain approval for the construction and operation of a chlorine liquefaction plant (CLP). The CLP will be housed within a new containment building in the southwestern portion of Block L, with the sodium hypochlorite loading bay relocated to Block Q (see Figure 3).

Element recently submitted a scoping letter to the NSW Department of Planning, Housing and Infrastructure (DPHI). The modification will be submitted under Section 4.55(1A). Please note that DPHI has not issued Secretary's Environmental Assessment Requirements (SEARs) for the modification, given its minimal environmental impact.

The modification report will be prepared in accordance with the State Significant Guidelines – Preparing a Modification Report (DPE, 2022) and will address the specific information requirements outlined in Section 100(1) of the EP&A Regulation. IXOM and Element welcome feedback from the NSW Environment Protection Authority on the proposed modification.

This letter provides an overview of the proposal and the key environmental matters for EPAs consideration.

**About IXOM**

IXOM operates the following lots in the Botany Industrial Park (BIP) at 16-20 Beauchamp Road, Banksmeadow NSW 2019 (see Figure 1 and Figure 2):

- Lot 1101 DP 1227173
- Lot 1102 DP 1227173
- Lot 1103 DP 1227173
- Lot 1104 DP 1227173
- Lot 1115 DP 1227173

The site is privately owned by Orica and leased by IXOM. IXOM also utilise the Orica-owned administration building on Lot 1105 DP 1227173.

The site is in Banksmeadow, an industrial suburb over 8 kilometres (km) south of Sydney Central Business District (CBD). It covers approximately 67,500 square meters ($m^2$), including private internal two-way roads that it shares with other users of the BIP.

The site is in the Bayside Council local government area (LGA) and is zoned IN1 General Industrial under Chapter 5 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP) (Figure 1).

Existing approved site infrastructure and the proposed boiler location is illustrated in Figure 3:

- Administration building.
- Brine treatment and electrolysers.
- Chlorine drying and compression plant
- Hydrogen compression plant
- Caustic evaporation plant
- Caustic tanker loading bays.
- Caustic soda product tanks.
- Chlorine container storage (Block Q)
- Control room.
- Cooling water towers.
- Ferric Chloride Product Plant, product tanks and tanker loading bay.
- Hydrochloric acid (HCl) Product Plant, product tanks and tanker loading bay.
- Old Chlorine container filling facilities (decommissioned 2001).
- Repackaging facility.
- Salt storage pile.
- Sodium Hypochlorite Product Plant and product tanks
- Sodium hypochlorite loading bay (Block L).
- Workshop.
- Proposed boiler location.

The site is bordered by a rail corridor to the west, Beauchamp Road to the south, Denison Street to the east and other users of the BIP to the north, including Orica and until recently, Indorama Ventures Oxides Australia Pty Ltd (Indorama) and Qenos. Following recent public announcements, Qenos and Indorama major hazard facilities have ceased operations in the BIP.

The closest residents are in Hillsdale, near the east of the BIP, on the eastern side of Denison Street. Banksmeadow is bordered by the residential suburbs of Hillsdale and Matraville to the east, Botany and Pagewood to the west, Daceyville to the north and the industrial suburb of Port Botany to the south.

The site is accessed via the following State roads (see Figure 2):

- From the south – Botany Road, Beauchamp Road and Denison Street.
- From the north – M1 Motorway, Wentworth Avenue and Denison Street.

**The modification**

Until recently, the CAP sourced steam from the site utilities plant operated by Qenos Pty Ltd (Qenos) within the Botany Industrial Park (BIP). Following Qenos entering voluntary administration in April 2024, the supply of 1.1 MPa steam ceased. To maintain operations, IXOM submitted a licence variation application to the NSW Environment Protection Authority (EPA) on 3 December 2024 under environment protection licence (EPL) 20547, seeking approval to install and operate a temporary diesel-fired boiler. The EPA approved the variation and issued a notice of licence variation on 13 January 2025 (Notice number 1645497).

The licence, issued under the Protection of the Environment Operations Act 1997, includes provisions for chemical production, chemical storage, and waste processing and storage. The temporary boiler installation was incorporated into the regulatory framework of the licence, confirming its compliance with EPA requirements.

IXOM now seeks a more permanent on-site solution and proposes to modify the consent under Section 4.55(1A) of the NSW EP&A Act. The modification would allow installation of a gas-fired boiler, including a boiler house, ancillary equipment, and extensions to existing pipework to provide a reliable long-term steam supply for the CAP. The works would involve:

- IXOM to gain access to the existing Qenos-owned natural gas metering compound and ethylene and pygas pipelines.
- Construction of a 10 m x 10 m x 8.6 m open-sided roofed boiler house.
- Installation of the gas boiler and associated equipment, with the boiler stack extending approximately 12 m high (about 4 m above the roof of the boiler house).
- Access and downgrading arrangements for the Qenos-owned meter set as per IXOM's requirements.
- Extension of the existing steam header and other utility pipelines by approximately 30 m from the existing CAP plant to connect with the new boiler.
- Decommissioning and removal of the temporary diesel-fired boiler, licensed under EPL 20547, including safe disconnection of utilities, environmental clearance, waste classification and disposal, and notification to relevant authorities (NSW EPA, SafeWork NSW).

The proposal involves minimal environmental impact and does not alter the nature or scale of the approved development. The works will be confined to the existing operational footprint, utilise existing infrastructure, and involve only minor aboveground construction. The new boiler house and stack are consistent with the site's industrial character and will not significantly affect visual amenity. The modification ensures continued operational safety and steam supply without changing the approved land use or development intensity.

The site is licensed under Environment Protection Licence (EPL) 20547. A licence variation will be required to reflect the removal of the existing temporary diesel-fired boiler and the commissioning and operation of the proposed gas-fired boiler. It is noted that the operation of the gas-fired boiler does not constitute a scheduled activity under Schedule 1 of the NSW *Protection of the Environment Operations Act 1997* (POEO Act).

Figure 1.1
**Regional context**

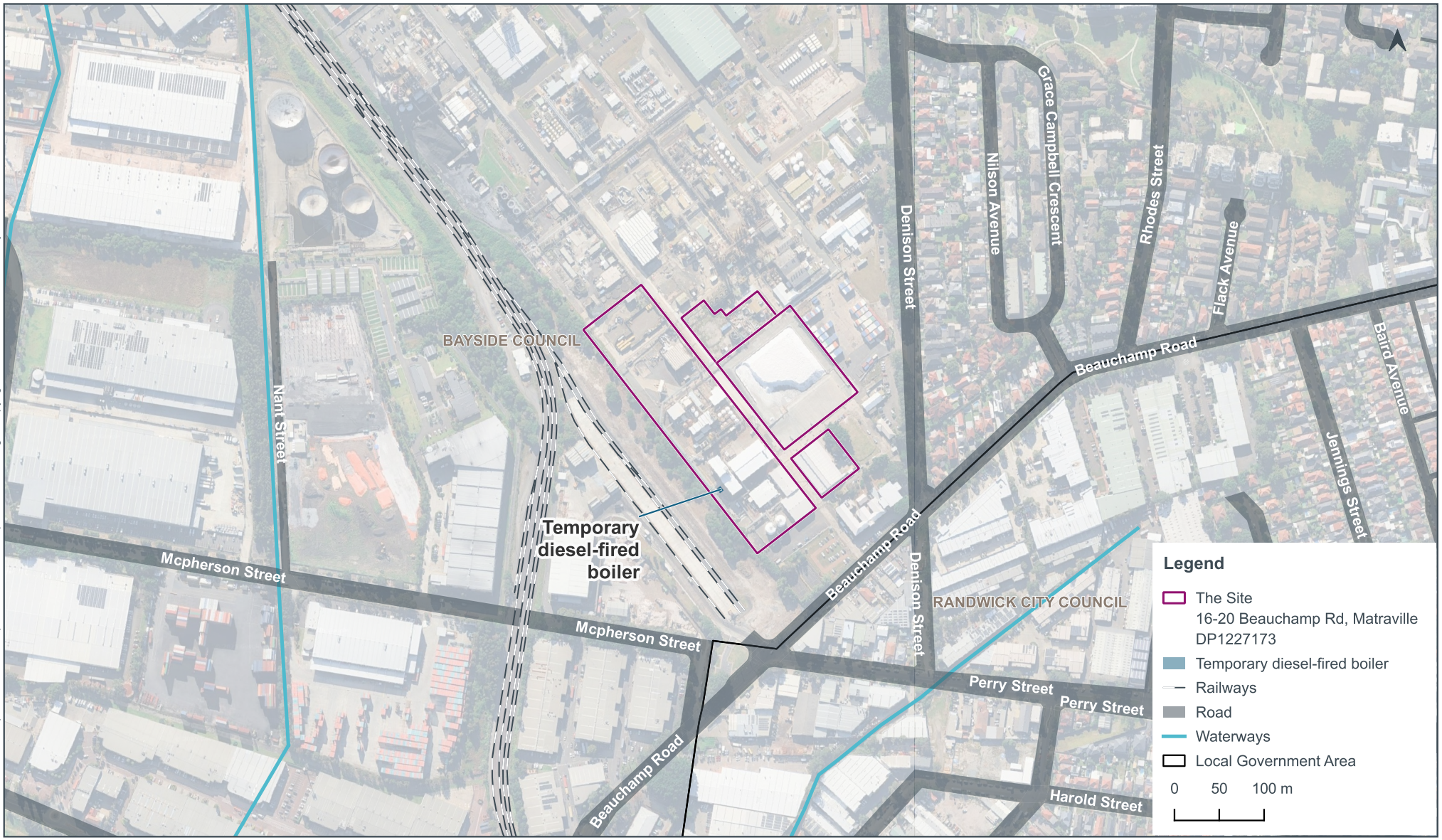





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Figure 1.2
**Local context**

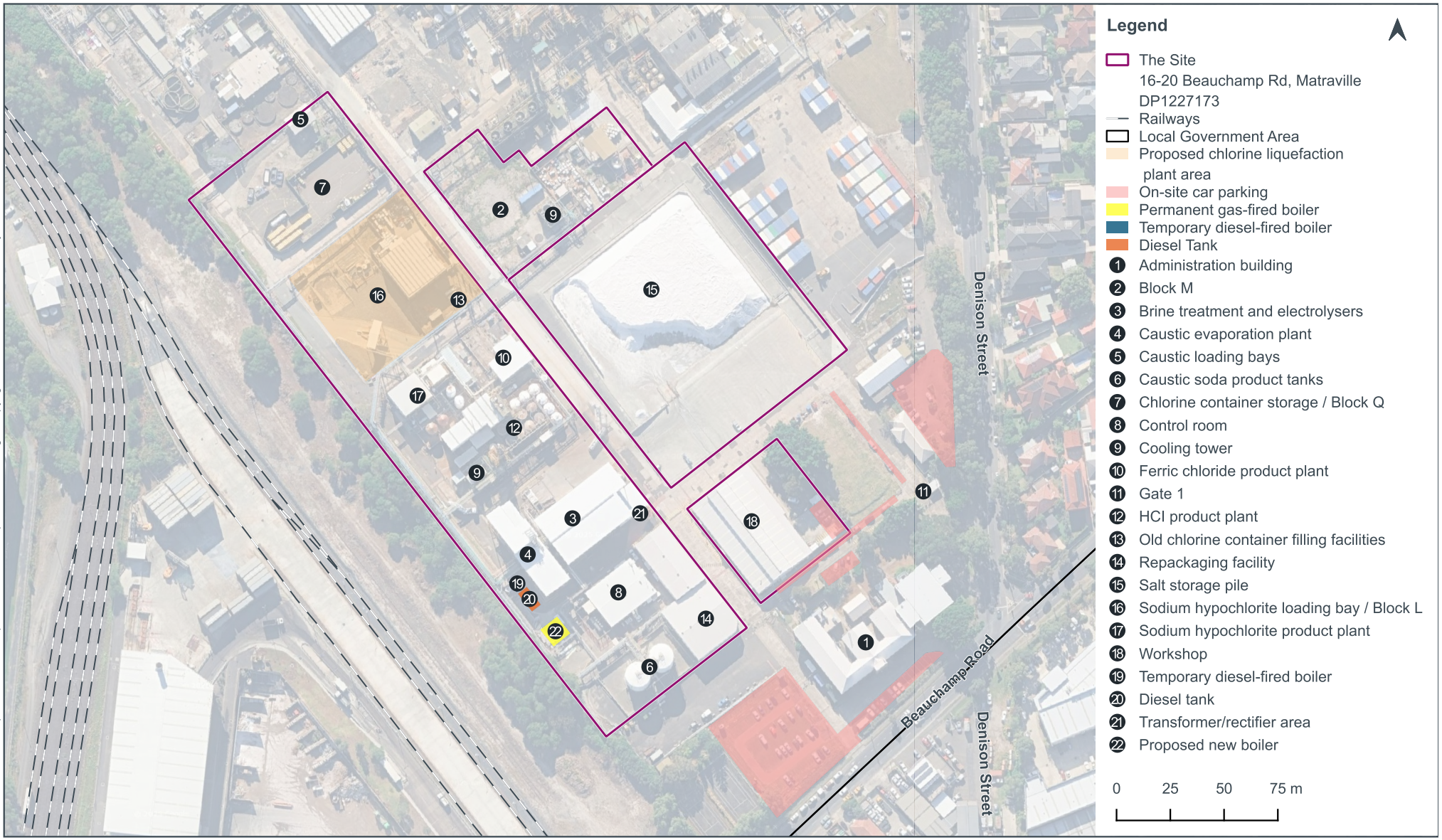
Chlor-Alkali Plant (CAP) Gas-fired boiler
Modification Report




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Figure 3.1
**Site layout**

Chlor-Alkali Plant (CAP) Gas-fired boiler
Modification Report




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## Key environmental matters

As required by Section 4.55(3) of the EP&A Act, in determining an application for modification of a development consent, the consent authority is to take into account those matters listed under section 4.15(1) of the EP&A Act as they are relevant to the proposed modification.

Section 4.15(1)(b) of the EP&A Act requires the consent authority to consider the following when granting approval of a development application: *The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality.*

A modification report will be prepared to consider the likely impacts of the proposed modification, including environmental impacts on both the natural and built environments, and social and economic impacts on the locality, in accordance with Section 4.15(1)(b) of the EP&A Act.

Element used the DPHI scoping worksheet to determine the environmental matters requiring detailed or standard assessment in the modification report and those that will not require further assessment.

Except for minor excavations for structural footings, all proposed works will be above ground, utilising existing concrete slabs, infrastructure, and pipelines. This avoids any significant subsurface disturbance and, therefore, minimises risks to soil, groundwater, and potential contamination.

The modification involves installing a new, energy-efficient, low-emission gas-fired boiler to generate steam for use in the operation of the CAP. As a state-of-the-art unit, its operational impacts, particularly in terms of air emissions, noise, and resource use, are expected to be low.

Given the limited scope, use of existing infrastructure, and the low-impact nature of the proposed boiler, the modification is considered to have minimal environmental impact. No detailed quantitative assessments were considered necessary by technical specialists for the following environmental aspects:

## Air quality impact matters

A qualitative assessment was carried out to assess the potential for air quality impacts from the modification, which includes the identification of potential air emission sources associated with the modification, a review of the proposed air quality control measures, an assessment of the existing air quality levels in the vicinity of the site and local dispersion conditions.

**Potential air emission sources**

The primary source of potential air emissions from the modification would arise from the use of the gas-fired boiler. There is not expected to be any significant emissions of dust during the construction of the new boiler house, as the Colourbond-clad shed is to be installed over an existing concrete slab, except for minor excavations for structural footings.

**Air control measures**

The proposed gas-fired boiler is expected to produce minimal air emissions, primarily carbon dioxide, water vapour, and small amounts of nitrogen oxides (NOx) and carbon monoxide (CO), with negligible particulate matter and sulphur oxides due to the use of natural gas. Emissions will be effectively dispersed via a vertical stack 4 m above roof level.

Operational controls to manage emissions include:

- Use of a certified low-NOx burner (with flue-gas recirculation if needed),
- Proper commissioning and tuning to avoid rich firing,

- Maintaining clean air intakes and filters for efficient combustion,
- Routine inspections and maintenance per manufacturer guidelines,
- Installation of an uncapped vertical stack with sufficient exit velocity, positioned to prevent re-entrainment.

Under the Protection of the Environment Operations (Clean Air) Regulation 2022, the proposed boiler's exhaust emissions are expected to meet the general standards of concentration for scheduled premises. Expected nitrogen oxide (NOx) levels are less than half the allowable concentration for $NO_2$. Since natural gas combustion produces negligible particulates, meeting criteria for solid particles and smoke is straightforward.

Emissions will be released via a rooftop stack to enhance dispersion. With the use of a low-NOx burner, proper commissioning, and regular maintenance, no significant off-site impacts on air quality or odour are anticipated.

In summary, given the nature of the air emission sources, the air emission controls, the receiving environment, and prevailing winds, it is unlikely that the operation of the modification would create any air quality issues at this location.

## Key noise impact matters

An acoustic review was conducted to assess the potential noise impacts of the proposed modification, including construction and operational noise associated with the new gas-fired boiler.

The assessment has been undertaken in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017; and
- NSW Department of Environment and Climate Change (DECCW) – NSW Interim Construction Noise Guideline (ICNG), July 2009.

**Operational Noise**

The proposed modification would involve the replacement of a temporary 3MW diesel-fired boiler, with a new permanent gas-fired boiler. The new boiler will be housed in an open-sided shelter situated adjacent to the existing site infrastructure. The boiler will make use of existing gas connection points, pipelines and structural elements. There would be no change to the nature, scale, or intensity of the approved development, and there would be no change to on-site or off-site vehicle movements.

The proposed new boiler would be a low NOx, high-efficiency Natural Gas Weishaupt model WM-G50/1-A ZM-NR (integral fan) 6 MW Boiler, with an unattenuated sound pressure level (SPL) of 85 dBA at 1m, equivalent to a sound power level (SWL) of 93 dBA.

Section 6.1 of the NPI indicates that where a development involves a discrete process, the criteria for the new/modified components may be set at 10dBA or more below the existing requirements. The rationale for this guidance is based on simple decibel addition. Where two noise sources with a difference of 10dBA or more are added together (logarithmic sum), there would be no net increase in the total noise generated. Hence, as the SWL for the new gas-fired boiler is more than 10dBA below the existing fleet SWL for the site, the project is not expected to result in an increase in noise emissions from the site.

**Construction Noise**

Construction activities (including concrete cutting for boiler house footings) were modelled using worst-case scenarios. Predicted noise levels at the nearest residential receiver (52 Denison Street) are up to 52 dBA LAeq(15min), which is below the operational noise limits for daytime periods.

All audible construction works will occur within standard hours (Monday–Friday 7:00 am–6:00 pm, Saturday 8:00 am–1:00 pm), as required by Condition L5.1 of the EPL. Construction will be progressive over more than three weeks, with noise managed through appropriate scheduling, equipment maintenance and standard noise mitigation measures.

The modification will not result in any change to onsite or offsite vehicle movements. Therefore, road traffic noise impacts are considered negligible.

## Safety and Risk

The gas-fired boiler will operate within the current industrial footprint and will be designed and installed in accordance with relevant Australian Standards, including AS1210 for pressure vessels. The use of natural gas will be managed via pipeline supply with no bulk on-site storage, significantly reducing risk. The modification is not expected to increase the site's overall risk profile, and existing safety protocols will be updated to reflect the new infrastructure. Hazard and operability studies (HAZOP) will be conducted to validate the design, facilitated by an IXOM-accredited specialist. All actions will be recorded and tracked in IXOMs environmental management system.

## Next steps

Element is currently preparing the modification report for submission to DPHI. Once complete, the report will be submitted to DPHI for consideration.

## Closing

As summarised above, IXOM and Element are seeking feedback from the EPA on the proposed development and invite the EPA to provide feedback on the key matters described above as well as any additional matters for consideration or questions regarding the proposal.

Kind Regards



Jacob Vickers

Senior Environmental Scientist

0481 203 334

jacob@elementenvironment.com.au

Outlook

## RE: PR457_IXOM Port Botany Chlor-Alkali Plant Boiler Modification_EPA consultation letter

**From** Nathan Eagar <nathan.eager@epa.nsw.gov.au>
**Date** Thu 12/4/2025 10:32 AM
**To** Tarryn Dale <Tarryn@elementenvironment.com.au>; Jacob Vickers <jacob@elementenvironment.com.au>; PR457 <PR457@elementenvironment.com.au>
**Cc** Amanda Mcdonald <Amanda.McDonald@epa.nsw.gov.au>; Rajesh Mottey <Rajesh.Mottey@epa.nsw.gov.au>; Steven Tan <Steven.Tan@epa.nsw.gov.au>

Good Morning Tarryn,

Thank you for your email and consultation letter prepared by Element Environmental regarding the proposal to construct and operate a new permanent gas-fired boiler and associated shelter (the Modification) at the Port Botany Chlor-Alkali Plant operated by Ixom Operations Pty Ltd (Ixom) at 16-20 Beauchamp Road, Matraville, NSW 2036 (the Premises).

The EPA notes that Ixom currently hold Environment Protection Licence 20547 (the Licence) for the Protection of the Environment Operation Act Schedule 1 activities Dangerous goods production, chemical storage, waste storage and non-thermal treatment of waste.

The EPA understands that a scoping letter has been provided to the NSW Department of Planning, Housing and Infrastructure (DPHI) providing information on the proposed planning pathway of the Modification, and that DPHI has not issued SEARs for the modification.

The EPA has reviewed the details of the proposed permanent gas-fired boiler as outlined in Element Environmental's letter. The EPA offer the following comments to the letter below:

- Based on the EPA's initial review of the Modification we have determined that a variation to the Licence may be required to:
  - Monitor air pollutants discharged from a 12m high stack servicing the proposed gas boiler, &
  - Undertake an assessment of the noise impacts of the modification on nearby residents and other sensitive receivers.
- Following commissioning of the proposed boiler further updates to the premises Pollution Incident Response Management Plan (PIRMP) and Environmental Management Plan will also be required to address potential incident risks associated with the operation of the gas-fired boiler.
- The proposed development area is within land declared by the EPA as Significantly Contaminated under the Contaminated Land Management Act (1997). Soil and groundwater contamination will need to be considered and addressed within the modification report and during development works.

The EPA will provide further comments on the development through the planning process once the modification has been submitted to DPHI.

Please contact me by reply email or on 02 9274 6191 if you have any questions about the details above.

Kind Regards,

Nathan

**Nathan Eagar**

Operations Officer
West Metro Operations
NSW Environment Protection Authority
**D** 02 9274 6191
Level 2, 6 Parramatta Square, 10 Darcy St, Parramatta, NSW 2150



www.epa.nsw.gov.au @NSW_EPA

The EPA acknowledges the Traditional Custodians of the land, waters and sky where we work.
As part of the world's oldest surviving cultures we pay our respect to Aboriginal Elders past and present.

I work on Dharug and Gadigal Country.

-



Report pollution and environmental incidents 131 555 or +61 2 9995 5555

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**From:** Tarryn Dale <Tarryn@elementenvironment.com.au>
**Sent:** Wednesday, 22 October 2025 2:30 PM
**To:** Nathan Eagar <nathan.eager@epa.nsw.gov.au>; Amanda Mcdonald <Amanda.McDonald@epa.nsw.gov.au>; Rajesh Mottey <Rajesh.Mottey@epa.nsw.gov.au>; INFOEnvironment Mailbox <info@environment.nsw.gov.au>
**Cc:** Jacob Vickers <jacob@elementenvironment.com.au>; PR457 <PR457@elementenvironment.com.au>
**Subject:** PR457_IXOM Port Botany Chlor-Alkali Plant Boiler Modification_EPA consultation letter

Good afternoon,

Element Environment Pty Ltd (Element) is writing on behalf of IXOM Operations Pty Ltd (IXOM). IXOM has engaged Element to prepare a report for the modification of a State significant development (SSD) consent under Section 4.55(1A) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the proposed installation of a new gas-fired boiler and associated shelter at the Port Botany Chlor-Alkali Plant at 16-20 Beauchamp Road, Matraville, NSW 2036 (the modification).

As part of the SSD process, and as required by the Department of Planning, Housing and Infrastructure (DPHI), we would like to request feedback on the attached consultation letter regarding the planning pathway and proposed environmental assessment approach.

If you would like to arrange a meeting or require any clarifications, please do not hesitate to contact us.

Kind regards,

**Tarryn Dale**
Environmental Consultant
Planning and Environment
0497 712 714 | Tarryn@elementenvironment.com.au
elementenvironment.com.au | Follow us on LinkedIn




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# APPENDIX E

## HAZARDS AND RISK STATEMENT

Sherpa Consulting Pty Ltd (ABN 40 110 961 898)
PO Box 1830
Chatswood NSW 2057
AUSTRALIA
Phone: 61 2 9412 4555
Web: www.sherpaconsulting.com.au

Sherpa Ref: 21838-LET-001 BOILER INSTALLATION IXOM FINAL
31 October 2025

Prepared for:
IXOM
Gerry Fitzpatrick
Senior Project Manager
16-20 Beauchamp Road, Matraville, NSW 2036

Dear Gerry

**RE: Land use planning risk implications, Boiler Installation IXOM Botany**

As requested, please find attached advice regarding the offsite risk implications of the proposed installation of a gas fired boiler in the southern area of IXOM's chlorine plant at the Botany Industrial Park (BIP), Lot 1101/DP1227173.

The attached letter provides a qualitative review of the potential risk implications.

In summary this project will not materially change the offsite risk profile from the existing IXOM Chloralkali plant (CAP) or proposed Chlorine Liquefaction Plant (CLP).

Best regards

Jenny Polich
Principal Engineer
Sherpa Consulting Pty Ltd
Ph +61 (0) 2 9412 4555
Mob +61 (0) 403 855 006

**PROPOSAL: Risk advice, Boiler Installation Ixom Botany**

**Background**:

IXOM is proposing to install a new natural gas-fired boiler at the existing Botany ChlorAlkali Plant (CAP) to replace the capacity previously being provided by Qenos Site Utilities. The boiler will be supplied by a re-purposed aboveground flammable gas line running along the site boundary as per Figure 1, and located in the southern part of the existing CAP close to the caustic soda area of the CAP as shown in Figure 2.

The IXOM CAP is required to periodically submit an updated Quantitative Risk Assessment (QRA) to Department of Planning, Housing, Infrastructure and Planning (DPHI) as part of existing conditions of consent, with individual fatality risk contours primarily due to chlorine as shown in Figure 3. (Reproduced from the 2025 CAP QRA most recently submitted and approved by DPHI). IXOM has also recently submitted a QRA covering a proposed chlorine liquefaction plant (CLP) to be located in Block L (northern part of layout in existing hypo loadout area) as shown in Figure 2. The QRAs are prepared for IXOM by Sherpa Consulting Pty Ltd (Sherpa).

DPHI has requested that IXOM include a statement in the boiler project modification submission confirming that the new boiler will not increase the overall risk profile of the IXOM site. IXOM has requested that Sherpa provide advice in relation to gas fired boiler risk implications for the QRA risk profiles.

**Scenarios**

As part of the modification, as a Major Hazard Facility (MHF) IXOM will need to update the site's Safety Case to:

- Identify any new or altered major incident (MI) hazards
- Demonstrate that existing and new control measures are sufficient
- Confirm that the Safety Management System remains adequate to manage these risks

Sherpa's advice does not cover the MHF update activities which would occur later in the project schedule. However the MIs associated with gas fired boilers are well understood with clear statutory codes and standards specifying well established control measures to minimise the likelihood of any of these scenarios.

The main concern from an offsite risk perspective is any scenarios that could escalate to cause a loss of containment of chlorine.

Table 1 summarises the potential scenarios associated with the proposed gas fired boiler and qualitatively assesses the potential risk implications.

**Risk implications**

As per Table 1, based on the qualitative analysis of the MI scenarios, the proposed gas fired boiler will not materially affect the offsite risk profile of the existing IXOM CAP or proposed CLP as the proposed boiler location and use of an existing flammable gas pipe route minimises the risk of escalation to chlorine inventories.

**Periodic risk assessment**

The gas supply lines that will be repurposed from existing BIP infrastructure are not currently included in the IXOM QRA (as they are not currently in use for the IXOM CAP) but similar operations were historically included in the cumulative BIP QRA. The flammable gas pipelines were not a dominant risk contributor as other larger flammable inventories / process equipment presented a higher risk in the western area of the BIP than the pipelines. As the process equipment (which is associated with Qenos) will be removed, the risk in this area will be lower than previously presented.

It is not currently clear how the overall risk profile from the BIP will be managed in the context of changes to BIP approval and consent conditions in light of the Qenos / Indorama shutdown and proposed BIP land sale. However the gas lines do not have an extensive risk profile and this could continue to be allowed for in either the IXOM or BIP QRAs (if this is retained) by modified condition of consent relating to risk as agreed with DPHI when any changes to the consent are resolved.

**Figure 1: Gas piping route (largely aboveground)**

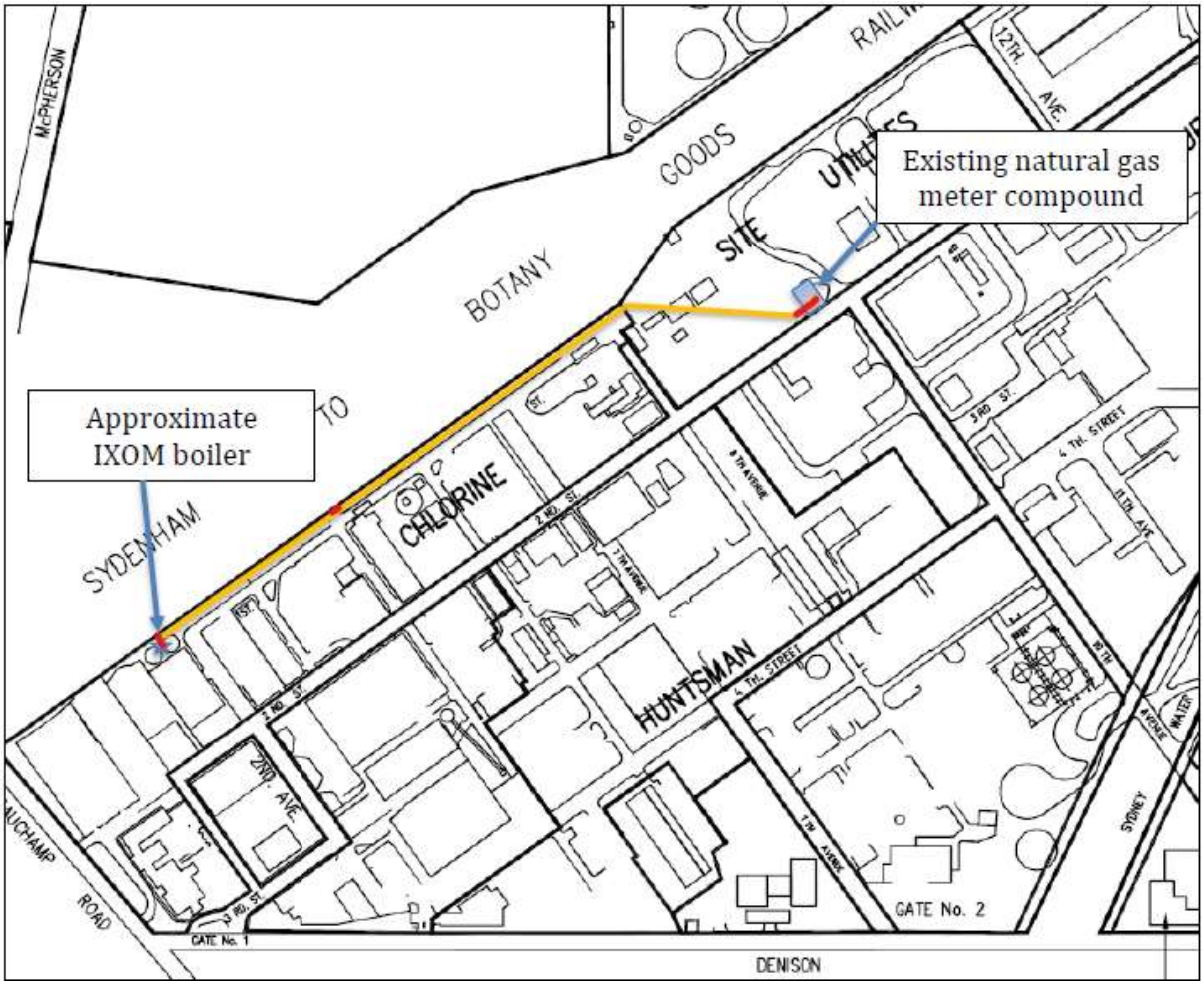


**Figure 2: CAP layout and proposed boiler location**

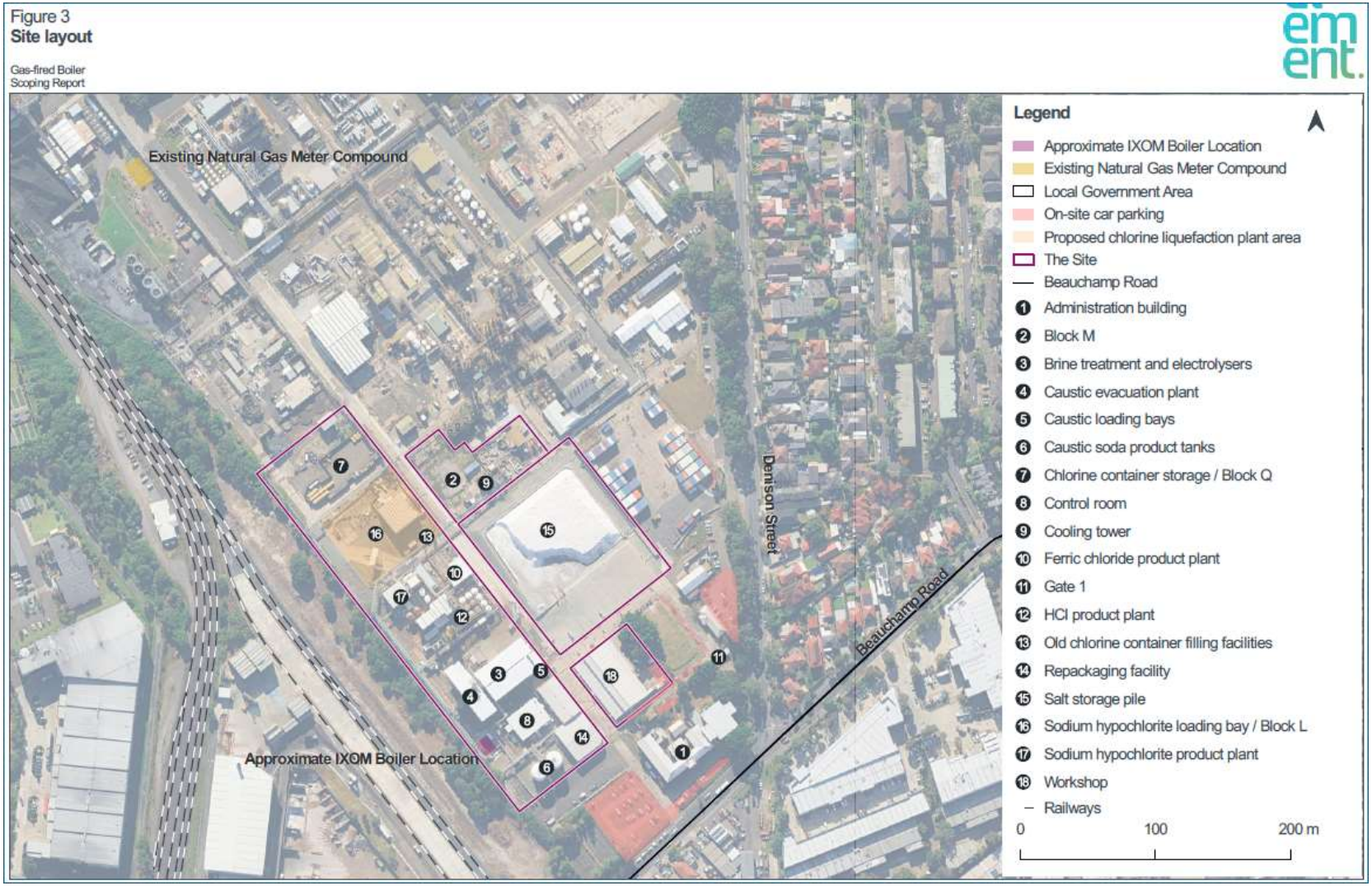


**Figure 3: CAP QRA 2025 risk contours (extract from CAP QRA 2025 doc ref 21972-RP-001 REVISION: 1 DATE: 22-Jul-2025)**

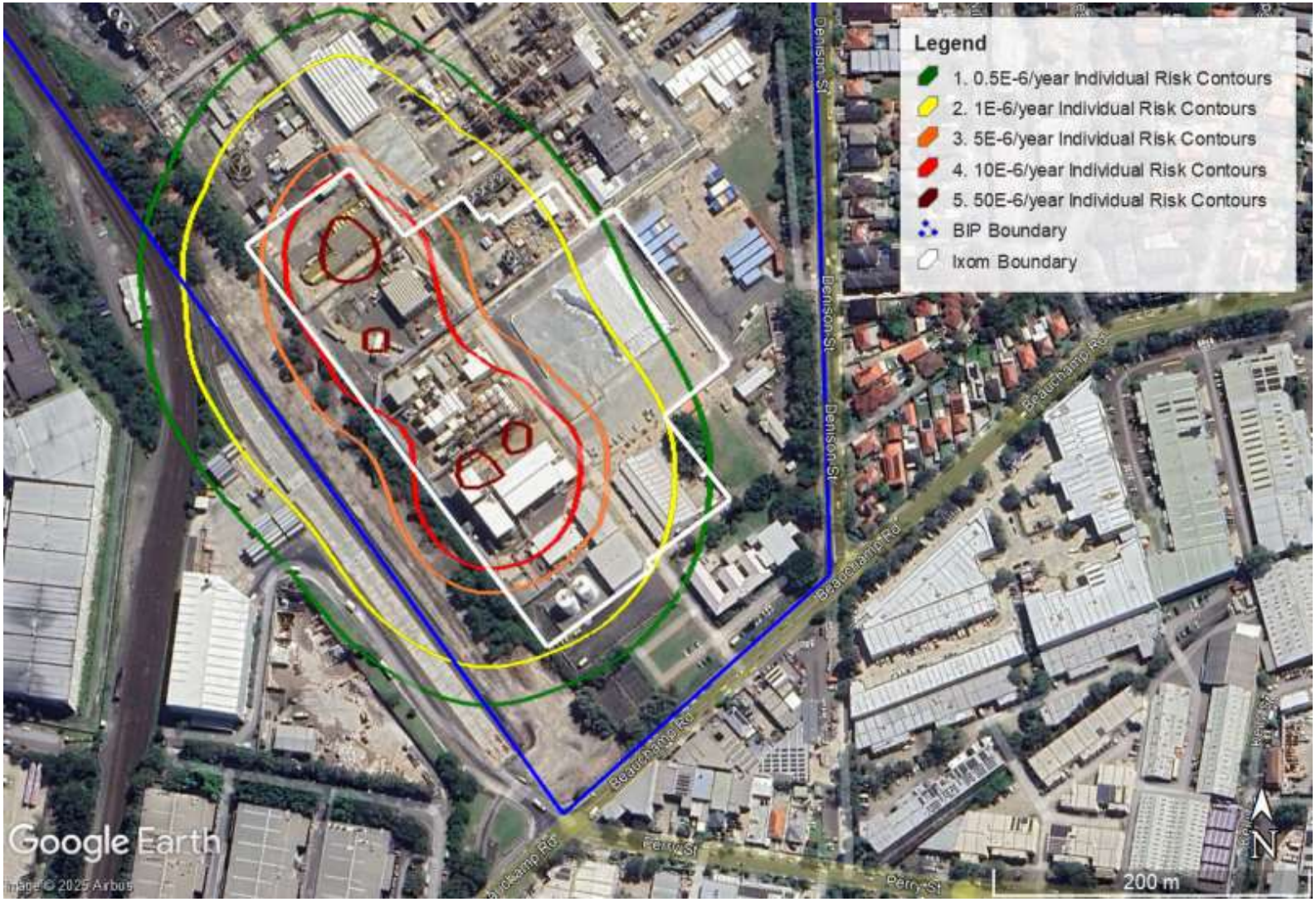


**Table 1: Boiler MI scenarios**

| Scenario | Comments – effect on IXOM risk (see Figure 2 for Locations) | Potential escalation to CAP | Potential escalation to CLP (Block L, Loc 16) | Effect on IXOM risk contours |
|---|---|---|---|---|
| Boiler explosion – internal explosion fired appliance | Frequency very low – numerous code required control measures for fired appliances to prevent internal explosions. Frequencies typically of the order of $1x10^{-6}$ per year, i.e. well below industrial land use risk criteria of $50x10^{-6}$ per year.<br>Some potential for damage to IXOM control room (Loc 8) or caustic plant area (Loc 4). | Minimal<br>No escalation to pressurised or liquid chlorine handling areas<br>Nearest chlorine is electrolyser (Loc 5), low pressure / vacuum gas no significant inventory chlorine, shielded by Loc 4 | None<br>Well separated in north part of IXOM land (Loc 16) | None |
| Boiler explosion – steam drum rupture | Frequency very low – numerous code required design measures for boilers to prevent overpressure / rupture. Frequencies typically of the order of $1x10^{-6}$ per year, i.e. well below industrial land use risk criteria of $50x10^{-6}$ per year<br>Some potential for damage to IXOM control room (Loc 8) or caustic plant area (Loc 4). | | | |

| Scenario | Comments – effect on IXOM risk (see Figure 2 for Locations) | Potential escalation to CAP | Potential escalation to CLP (Block L, Loc 16) | Effect on IXOM risk contours |
|---|---|---|---|---|
| Gas supply line – loss of containment and fire/ explosion | No change - existing flammable gas lines, not included in IXOM QRA.<br>Mechanical integrity will be confirmed and relevant inspection tasks put in place by IXOM<br>Risk dominated by existing chlorine line along western boundary | No change<br>Existing flammable gas lines. | None – CLP will be within building and separation distance to pipe corridor | None for IXOM QRA<br>Risk will be less than existing BIP QRA in western area of BIP site as these are dominated by other process equipment (formerly Qenos) which will be removed. |




# APPENDIX F

## ACOUSTIC REVIEW

PO Box 678
Kotara NSW 2289
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

3 October 2025

MAC232001-02LR1V1

Attention: Jacob Vickers
Element Environment Pty Ltd
PO Box 1563
Warriewood NSW 2102

Dear Jacob,

# Acoustic Review – New Gas-Fired Boiler

# Port Botany Chlor-Alkali Plant, 16 – 20 Beauchamp Road, Banksmeadow, NSW

## 1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) understands that Element Environment Pty Ltd (Element), on behalf of IXOM Operations Pty Ltd (IXOM), require an Acoustic Review (AR) to assess the potential noise emissions from the proposed modification to construct and operate a new gas-fired boiler at the Port Botany Chlor-Alkali Plant at 16 – 20 Beauchamp Road, Banksmeadow, NSW (the 'project').

The AR has been prepared to assess the potential change in noise levels associated with the modification and is provided to support the Modification Application for the project.

The assessment has been undertaken in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017; and
- NSW Department of Environment and Climate Change (DECCW) – NSW Interim Construction Noise Guideline (ICNG), July 2009.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

# 2 Project Description

## 2.1 Existing Development

IXOM operate the Port Botany Chlor-Alkali Plant (CAP) at 16 – 20 Beauchamp Road, Banksmeadow NSW (the site). The site is privately owned by Orica and leased by IXOM. The CAP operates under consent DA35/98 (the consent), granted by the Minister for Urban Affairs and Planning in 1998. Since the original approval, the development has undergone five modifications.

A sixth modification is currently underway to gain approval for the construction and operation of a chlorine liquefaction plant (CLP). The CLP will be housed within a new containment building in the southwestern portion of Block L, with the sodium hypochlorite loading bay relocated to Block Q. This modification is being pursued under Section 4.55(2) of the EP&A Act and is supported by a comprehensive modification report addressing Section 4.15 matters.

Until recently, the CAP sourced steam from the Qenos-operated site utilities plant within the Botany Industrial Park (BIP). Following Qenos entering voluntary administration in April 2024, the supply of 1.1MPa steam ceased. To maintain operations, IXOM installed a temporary diesel-fired boiler under agreement with the NSW EPA.

The site currently operates under Environment Projection Licence (EPL) No.20547.

## 2.2 Proposed Modification

IXOM now seeks a more permanent on-site solution and proposes to modify the consent under Section 4.55(1A) of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act). The modification would allow installation of a gas-fired boiler, including an open-sided roofed shelter (boiler house), ancillary equipment, and extensions to existing pipework to provide a reliable long-term steam supply for the CAP. The works would involve:

- IXOM to gain access to the existing Qenos-owned natural gas metering compound and ethylene and pygas pipelines.
- Construction of a 10m x 10m x 8.6m open-sided roofed boiler house.
- Installation of a gas boiler and associated equipment, with the boiler stack extending approximately 12m high (about 4m above the roof of the boiler house).
- Installation of a new natural gas meter set as per IXOM's requirements. (Qenos will manage the decommissioning of the existing gas meter set)
- Extension of the existing steam header and other utility pipelines by approximately 30m from the existing CAP plant to connect with the new boiler
- Decommissioning and removal of the temporary diesel-fired boiler, currently housed within a container and licensed under EPL No. 20547, including safe disconnection of utilities, environmental clearance, waste classification and disposal, and notification to relevant authorities (NSW EPA, SafeWork NSW).

Under the proposed modification there would be no changes to the existing development footprint, or operating hours. It is noted that the boiler would operate 24 hours per day, seven days per week, which is consistent with existing approvals.

# 3 Existing Noise Limits

## 3.1 Nearby Sensitive Receivers

The site is located within the BIP and is bordered by a rail corridor to the west, Beauchamp Road to the south, Denison Street to the east and other users of the BIP to the north. Land surrounding the site is predominantly IN1 – General Industrial or E4 – General Industrial.

The closest receivers are residences in Hillsdale, near the east of the BIP, on the eastern side of Denison Street. Receivers fronting Denison Street are zoned R2 – Low Density Residential, while receivers set back from Denison Street are predominantly R3 – Medium Density Residential. There is one residence located at 105 Beauchamp Road, Matraville, approximately 100m to the south of the site, however, this receiver is defined under the NPI as an "isolated residence within an industrial land zone" and is assessed as an industrial receiver.

It is noted that the residential receivers on Dennison Street represent the nearest and potentially most sensitive receivers. Hence, where compliance is demonstrated at the nearest residential receivers on Denison Street, it is considered that residential receivers, further afield in Matraville, and non-residential receivers, would also comply with the relevant noise limits.

## 3.2 Operational Noise Limits

Condition L4.2 of EPL No. 20547 provides the operational noise limits for the IXOM site, reproduced in **Table 1**.

**Table 1 Operational Noise Criteria from EPL #20547**

| Receiver Location | Day<br>dB $L_{Aeq(15min)}$ | Evening<br>dB $L_{Aeq(15min)}$ | Night<br>dB $L_{Aeq(15min)}$ |
|---|---|---|---|
| All privately owned residences | 65 | 55 | 50 |

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Furthermore, Condition L4.4 of EPL No. 20547 states that each existing BIP Plant shall ensure that new or replacement equipment is selected and/or installed so that no increase in noise emissions is thereby created when measured or computed at any point within one meter of the nearest boundary of any residence in the vicinity of the premises.

## 3.3 Construction Noise Limits

Condition L5.1 of EPL No. 20547 states that all activities likely to generate perceivable noise outside the boundaries of the lots on which the plant is located shall be restricted to the hours of 7am to 6pm Monday to Friday and 8am to 1pm Saturday, unless otherwise agreed to in writing by the EPA.

Construction activities that are not audible at the nearest affected receivers are permitted at any time.

It is noted that the EPL does not prescribe specific construction noise management levels (NMLs), hence, the operational noise criteria (refer to **Table 1**) has been adopted for the assessment of potential construction noise impacts on residential receivers.

# 4 Noise Assessment

## 4.1 Operational Noise Assessment

The proposed modification would involve the replacement of a temporary 3MW diesel-fired boiler, with a new permanent gas-fired boiler. The new boiler will be housed in an open sided shelter situated adjacent to existing site infrastructure. The boiler will make use of existing gas connection points, pipelines and structural elements. There would be no change to the nature, scale or intensity of the approved development, and there would be no change to onsite or offsite vehicle movements.

MAC understands that the proposed new boiler would be a low NOx high efficiency Natural Gas Weishaupt model WM-G50/1-A ZM-NR (integral fan) 6 MW Boiler, with an unattenuated sound pressure level (SPL) of 85dBA at 1m, equal to a sound power level (SWL) of 93dBA.

The noise emission levels for acoustically significant existing plant and equipment on the IXOM site, are summarised in **Table 2**. The fleet SWL for the existing plant and equipment was calculated to be 112dBA.

**Table 2 Significant Existing Equipment Sound Power Levels, dB $LA_{eq(15min)}$**

| Noise Source/Item | Sound Power Level (SWL), dBA | Source Height, m |
|---|---|---|
| Brine Treatment and Electrolysers | 105 | 5m |
| Caustic Evaporation Plant | 106 | 5m |
| HCL Product Plant | 99 | 5m |
| Sodium Hypochlorite Product Plant | 93 | 5m |
| Cooling Towers | 99 | 3m |
| Heavy Vehicles (low speed manoeuvring on site) | 103 | 1.5m |
| Excavator (20t or similar) | 105 | 2m |
| Front-end Loader (CAT930K or similar) | 104 | 2m |
| Chlorine Liquefaction Plant[1,2] | 90 | Emitting façade up to 8m |

Note 1: Measured at IXOM Laverton North Facility.

Note 2: SWL at building façade.

Section 6.1 of the NPI indicates that where a development involves a discrete process, the criteria for the new/modified components may be set at 10dBA or more below the existing requirements, The rationale for this guidance is based on simple decibel addition. Where two noise sources with a difference of 10dBA or more are added together (logarithmic sum), there would be no net increase in the total noise generated. Hence, as the SWL for the new gas-fired boiler is more than 10dBA below the existing fleet SWL for the site, the project is not expected to result in an increase in noise emissions from the site.

## 4.2 Construction Noise Assessment

The construction of the project would generally involve the erection of an open-sided shelter, the installation of the new gas-fired boiler, and extension of the existing steam header and other utility pipelines by approximately 30m from the existing CAP. The construction works would be progressive and are anticipated to occur over a period of greater than three weeks.

To assess the potential for construction noise impacts, one worst-case scenario was modelled for concrete cutting works to facilitate the footings of the new boiler shelter, to the potentially most affected residential receivers on Denison Street, using the iNoise environmental noise modelling software package. The SWL of 118dBA for concrete cutting was sourced from the Transport for NSW (TfNSW) Construction and Maintenance Noise Estimator Tool (CMNET). It is noted that the assessment assumed that the concrete saw would operate continuously for the duration of the assessment period (standard construction hours).

The results of the construction noise model (refer to **Figure 1**), demonstrate that noise levels during concrete cutting are expected to be up to 52dB $LA_{eq(15min)}$ at the nearest residential receivers on Denison Street (52 Denison Street). It is noted that the conditions of consent and EPL do not prescribe noise limits for construction activities, instead requiring that works that are audible at the boundary of the nearby sensitive receiver locations must be undertaken during standard construction hours only. Notwithstanding, a conservative assessment was undertaken to demonstrate that construction noise levels are expected be below the operational noise limits for the day period during concrete sawing activities.

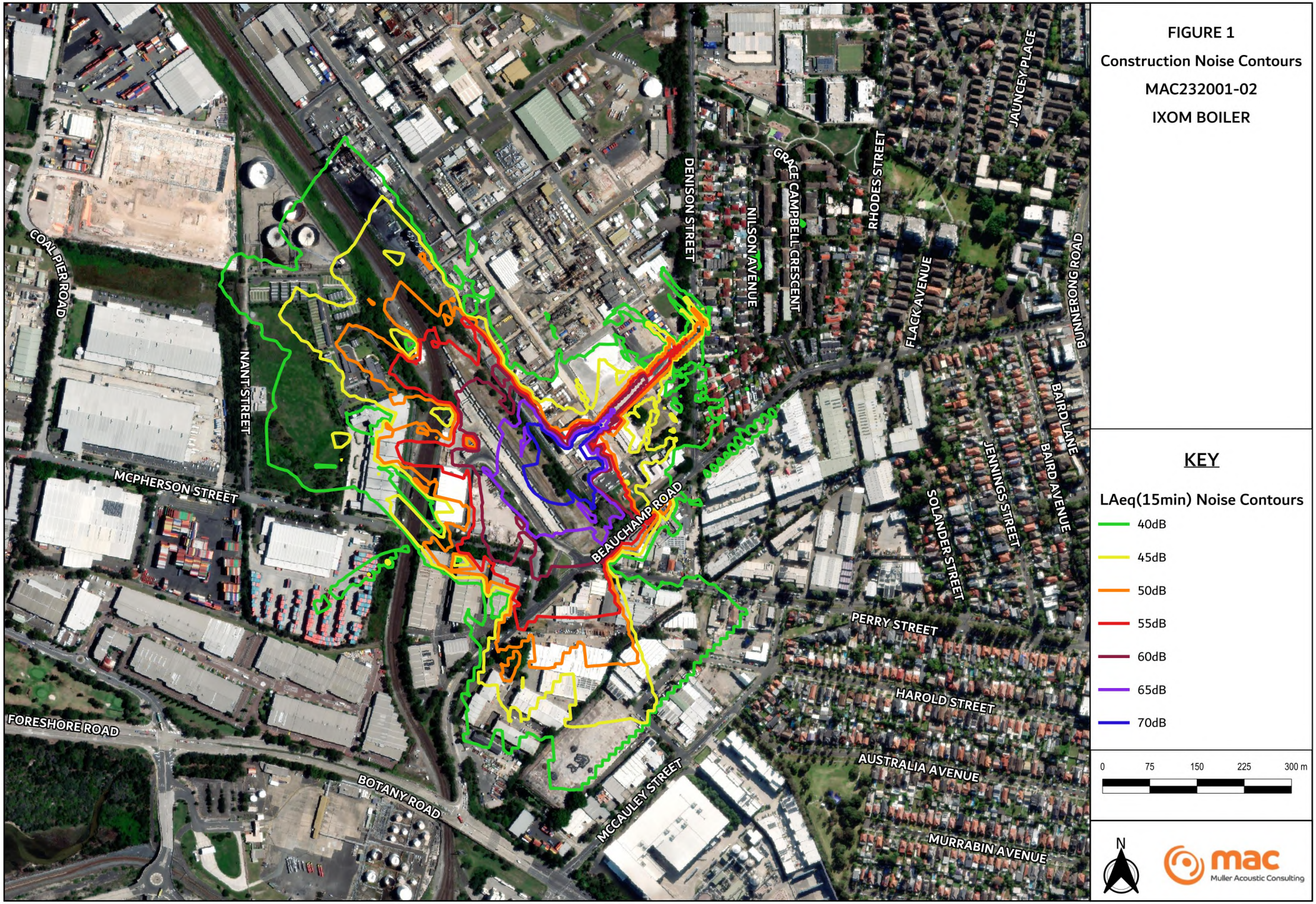



FIGURE 1

Construction Noise Contours

MAC232001-02

IXOM BOILER

KEY

LAeq(15min) Noise Contours

- 40dB
- 45dB
- 50dB
- 55dB
- 60dB
- 65dB
- 70dB

0 75 150 225 300 m

N

mac
Muller Acoustic Consulting

# 5 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed an Acoustic Review for the proposed modification to the operation of the Port Botany Chlor-Alkali Plant at 16 – 20 Beauchamp Road, Banksmeadow, NSW.

The Acoustic Review has considered the potential noise impacts of the proposed modification, including construction and operational noise associated with the new gas-fired boiler.

The operational noise assessment demonstrated that noise emissions from the gas-fired boiler are acoustically insignificant, compared with existing noise generating activities on site, and would not contribute to a net increase in noise levels at the nearby potentially sensitive receiver locations.

The consent (DA35/98) and Environment Protection Licence for the site do not prescribe noise limits for construction activities during standard construction hours. Notwithstanding, construction noise levels were conservatively assessed against the operational noise limits for the site, demonstrating that noise levels during concrete sawing works would comply with the operational noise limits during the day period.

Accordingly, the Acoustic Review supports the Modification Application for the project without the requirement for the implementation of ameliorative measures.

We trust the above information is satisfactory and if you have any further question regarding the assessment, please contact the undersigned.

Yours sincerely



**Dale Redwood**
Lead Acoustic Consultant
**BSc (Hons) | MAAS**
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Reviewed: Oliver Muller, Principal Acoustic Scientist, BSc (REM & HGeog) | MAAS

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# Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

**Table A1 Glossary of Acoustical Terms**

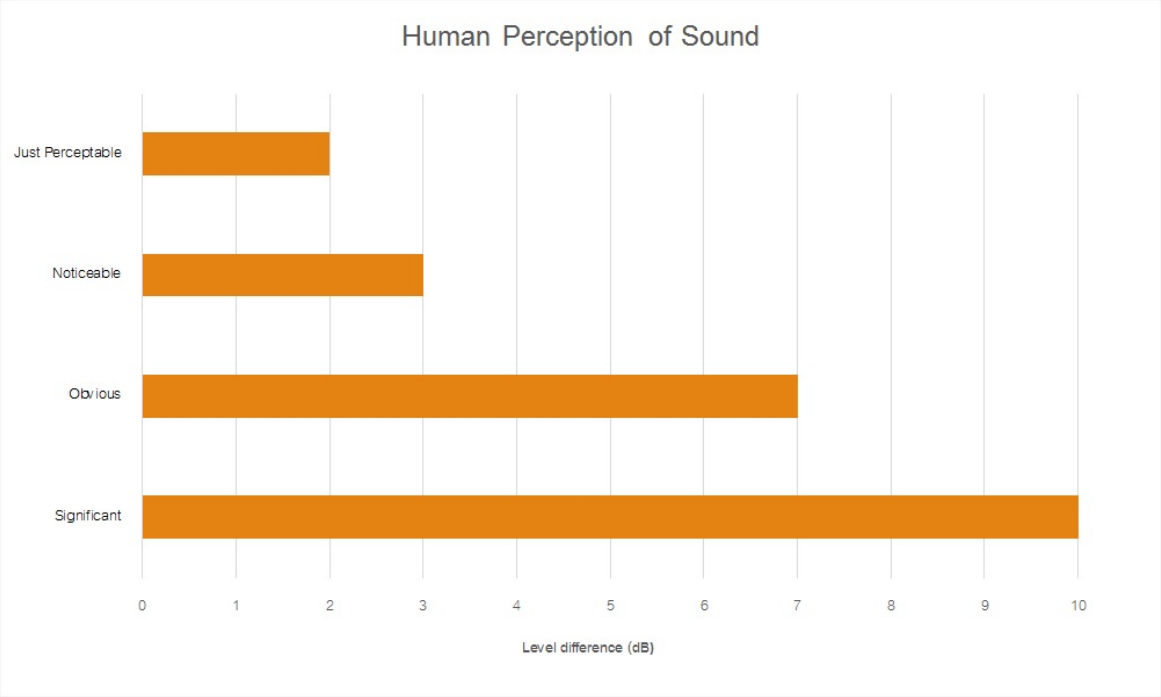
| Term | Description |
|---|---|
| 1/3 Octave | Single octave bands divided into three parts |
| Octave | A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit. |
| ABL | Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels. |
| Ambient Noise | The total noise associated with a given environment. Typically, a composite of sounds from all sources located both near and far where no particular sound is dominant. |
| A Weighting | A standard weighting of the audible frequencies designed to reflect the response of the human ear to sound. |
| Background Noise | The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is usually represented by the LA90 descriptor |
| dBA | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. |
| dB(Z), dB(L) | Decibels Z-weighted or decibels Linear (unweighted). |
| Extraneous Noise | Sound resulting from activities that are not typical of the area. |
| Hertz (Hz) | The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz. |
| LA10 | A sound level which is exceeded 10% of the time. |
| LA90 | Commonly referred to as the background noise, this is the level exceeded 90% of the time. |
| LAeq | Represents the average noise energy or equivalent sound pressure level over a given period. |
| LAmax | The maximum sound pressure level received at the microphone during a measuring interval. |
| Masking | The phenomenon of one sound interfering with the perception of another sound.<br>For example, the interference of traffic noise with use of a public telephone on a busy street. |
| RBL | The Rating Background Level (RBL) as defined in the NPI, is an overall single figure representing the background level for each assessment period over the whole monitoring period. The RBL, as defined is the median of ABL values over the whole monitoring period. |
| Sound power level (Lw or SWL) | This is a measure of the total power radiated by a source in the form of sound and is given by 10.log10 (W/Wo). Where W is the sound power in watts to the reference level of $10^{-12}$ watts. |
| Sound pressure level (Lp or SPL) | the level of sound pressure; as measured at a distance by a standard sound level meter. This differs from Lw in that it is the sound level at a receiver position as opposed to the sound 'intensity' of the source. |

Table A2 provides a list of common noise sources and their typical sound level.

**Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA**

| Source | Typical Sound Pressure Level |
|---|---|
| Threshold of pain | 140 |
| Jet engine | 130 |
| Hydraulic hammer | 120 |
| Chainsaw | 110 |
| Industrial workshop | 100 |
| Lawn-mower (operator position) | 90 |
| Heavy traffic (footpath) | 80 |
| Elevated speech | 70 |
| Typical conversation | 60 |
| Ambient suburban environment | 40 |
| Ambient rural environment | 30 |
| Bedroom (night with windows closed) | 20 |
| Threshold of hearing | 0 |

**Figure A1 – Human Perception of Sound**



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# APPENDIX G

## AIR QUALITY IMPACT ASSESSMENT

TODOROSKI AIR SCIENCES
Suite 2B, 14 Glen Street Eastwood, NSW 2122
Phone: 02 9874 2123
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ACN: 151 202 765 | ABN: 74 955 076 914

2 October 2025

Tarryn Dale
Environmental Consultant
Element Environment
Via email: Tarryn@elementenvironment.com.au

**RE: IXOM Botany Chlor-Alkali Plant – Boiler Modification Air Quality**

Dear Tarryn,
Todoroski Air Sciences has investigated the potential for air quality impacts to arise due to the proposed gas-fired boiler (the modification) to the IXOM Operations Pty Ltd (IXOM) Chlor-alkali Plant (CAP) at Banksmeadow, New South Wales (NSW) (hereafter referred to as the site). This letter report provides an overview of the modification, a review of the existing environmental conditions, a qualitative analysis of potential air quality impacts associated with the modification and discussion of proposed air quality mitigation and management measures.

**Overview**
IXOM Operations Pty Ltd (IXOM) operate the Port Botany Chlor-Alkali Plant (CAP) at 16-20 Beauchamp Road, Banksmeadow NSW 2019 (the site). The site is privately owned by Orica Limited (Orica) and leased by IXOM. The CAP operates under consent DA35/98 (the consent), granted by the Minister for Urban Affairs and Planning in 1998. Since the original approval, the development has undergone five modifications.

A sixth modification is currently underway to gain approval for the construction and operation of a chlorine liquefaction plant (CLP).

Until recently, the CAP sourced steam from the site utilities plant operated by Qenos Pty Ltd (Qenos) within the Botany Industrial Park (BIP). Following Qenos entering voluntary administration in April 2024, the supply of 1.1 MPa steam ceased. To maintain operations, IXOM submitted a licence variation application to the NSW Environment Protection Authority (EPA) on 3 December 2024 under Environment Protection Licence (EPL) 20547, seeking approval to install and operate a temporary diesel-fired boiler. The EPA approved the variation and issued a notice of licence variation on 13 January 2025 (Notice number 1645497).

IXOM now seeks a more permanent on-site solution and proposes to modify the consent under Section 4.55(1A) of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act). The modification would allow installation of a gas-fired boiler, including an open-sided roofed shelter (boiler house), ancillary equipment, and extensions to existing pipework to provide a reliable long-term steam supply for the CAP. The works would involve:

- IXOM to gain access to the existing Qenos-owned natural gas metering compound and ethylene and pygas pipelines.
- Construction of a 12 m x 12 m x 8.6 m open-sided roofed boiler house.
- Installation of the gas boiler and associated equipment, with the boiler stack extending approximately 12 m high (about 4 m above the roof of the boiler house).
- Installation of a new natural gas meter set as per IXOM's requirements.
- Extension of the existing steam header and other utility pipelines by approximately 30 m from the existing CAP plant to connect with the new boiler.

**Site setting**

The site is located in the Botany Industrial Park (BIP), at 16-20A Beauchamp Road, Banksmeadow, approximately 4.5 kilometres (km) southeast of Sydney Kingsford Smith Airport and approximately 1km south of Pagewood. Land use surrounding the site is comprised of various industrial and commercial operations as well as residential areas.

**Figure 1** presents the location of the modification and proposed boiler room, with reference to the nearest sensitive receptor locations. The figure shows nearest residential area is located approximately 200m to the east and southeast of the proposed boiler house, and the closest industrial receptors are situated approximately 110m to the east.




Figure 1: Site setting

**Existing environmental conditions**

Local climatic conditions

Long-term climatic data from the Bureau of Meteorology (BoM) weather station at Sydney Airport Aeronautical Meteorological Office (AMO) (Site No. 066037) were analysed to characterise the local climate in the proximity of the site. The Sydney Airport AMO weather station is located approximately 4.7km northwest of the site.

**Table 1** and **Figure 2** present a summary of data from the Sydney Airport AMO weather station collected over a 60 to 95 year period for the various meteorological parameters.

The data indicate that January is the hottest month with a mean maximum temperature of 26.7 degrees Celsius (ºC) and July is the coldest month with a mean minimum temperature of 7.4ºC.

Rainfall peaks during the first half of the year declines during the latter, with an annual average rainfall of 1096.5 millimetres (mm) over 96.3 days. The data indicate that June is the wettest month with an average rainfall of 124.1mm over 8.8 days and September is the driest month with an average rainfall of 59.8mm over 6.8 days.

Relative humidity exhibits little variability across the year. Mean 9am relative humidity ranges from 61% in October to 74% in June. Mean 3pm relative humidity levels range from 49% in August to 63% in February.

Wind speeds during the warmer months have a greater spread between the 9am and 3pm conditions compared to the cooler months. Mean 9am wind speeds range from 12.6 kilometres per hour (km/h) in May to 16.3km/h in October. Mean 3pm wind speeds range from 17.1km/h in May to 25.3km/h in November.

**Table 1 Monthly climate statistics summary – Sydney Airport AMO**

| Parameter | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Ann. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Temperature** | | | | | | | | | | | | | |
| Mean max. temp. (ºC) | 26.7 | 26.5 | 25.5 | 23.1 | 20.2 | 17.7 | 17.2 | 18.5 | 20.8 | 22.8 | 24.2 | 26.0 | 22.4 |
| Mean min. temp. (ºC) | 19.0 | 19.2 | 17.7 | 14.4 | 11.1 | 8.8 | 7.4 | 8.4 | 10.7 | 13.4 | 15.6 | 17.7 | 13.6 |
| **Rainfall** | | | | | | | | | | | | | |
| Rainfall (mm) | 94.7 | 117.6 | 122.9 | 107.8 | 97.3 | 124.1 | 71.8 | 74.8 | 59.8 | 71.3 | 81.0 | 73.0 | 1096.5 |
| No. of rain days (≥1mm) | 8.3 | 8.6 | 9.6 | 8.5 | 8.3 | 8.8 | 6.7 | 6.7 | 6.8 | 7.9 | 8.3 | 7.8 | 96.3 |
| **9am conditions** | | | | | | | | | | | | | |
| Mean temp. (ºC) | 22.4 | 22.3 | 21.1 | 18.2 | 14.6 | 11.9 | 10.8 | 12.5 | 15.7 | 18.4 | 19.9 | 21.6 | 17.4 |
| Mean R.H. (%) | 70 | 73 | 73 | 71 | 73 | 74 | 71 | 65 | 62 | 61 | 64 | 66 | 69 |
| Mean W.S. (km/h) | 14.4 | 13.8 | 12.9 | 12.9 | 12.6 | 13.4 | 13.3 | 14.4 | 15.5 | 16.3 | 16.0 | 14.8 | 14.2 |
| **3pm conditions** | | | | | | | | | | | | | |
| Mean temp. (ºC) | 24.8 | 24.8 | 23.9 | 21.7 | 19.0 | 16.6 | 16.1 | 17.2 | 19.0 | 20.7 | 22.1 | 23.9 | 20.8 |
| Mean R.H. (%) | 60 | 63 | 61 | 59 | 58 | 57 | 52 | 49 | 51 | 54 | 56 | 58 | 57 |
| Mean W.S. (km/h) | 24.1 | 23.0 | 21.0 | 19.3 | 17.1 | 17.8 | 18.2 | 20.8 | 23.1 | 24.6 | 25.3 | 25.2 | 21.6 |

Source: **Bureau of Meteorology, 2025**

R.H. – Relative Humidity, W.S. – wind speed

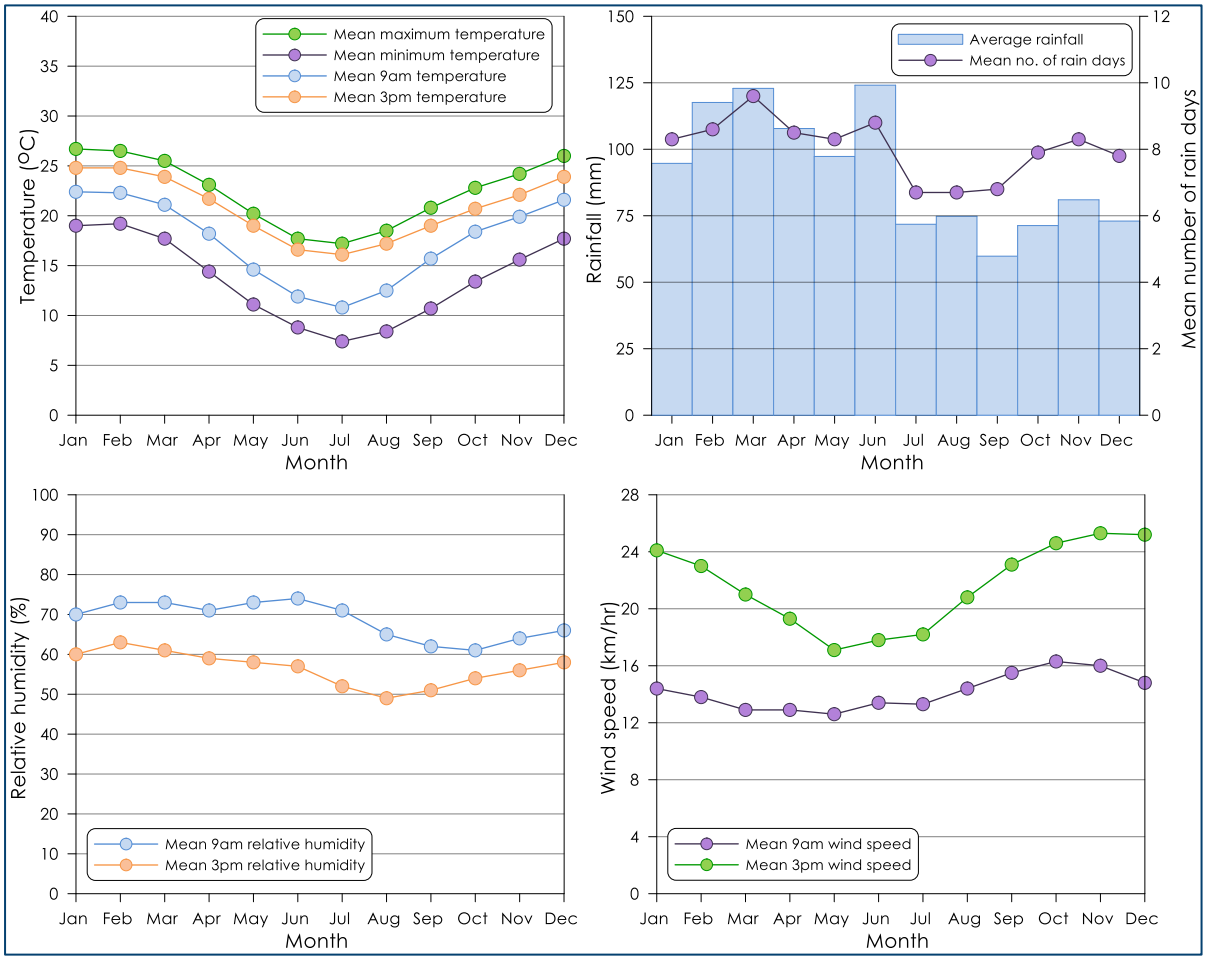



**Figure 2: Monthly climate statistics summary – Sydney Airport AMO**

Annual and seasonal windroses generated from data collected at the Sydney Airport AMO for the 2019 - 2023 period are presented in **Figure 3**.

Strong winds are generally experienced in the area due to its proximity to the coast. Winds from the northwest quadrant are typically weaker than winds from other directions. On an annual basis, the winds are varied with the highest portion originating from the northwest and south.

In summer, winds are typically from the northeast and southeast quadrants, with dominant winds from the northeast and south. The autumn distribution is similar to the annual distribution with a high portion of winds from the northwest. During winter, winds typically range from the southwest and northwest quadrants, with winds from the northwest most frequent. Spring has similar distribution to the annual distribution, however, indicates a slightly higher portion of north-northeast winds.

The surrounding topography features gentle slopes to the west and steep coastal elevation changes to the east. Although the steep slopes may allow for some katabatic winds, their development is unlikely overall to influence the site.




**Figure 3: Annual and seasonal windroses for Sydney Airport AMO (2020-2024)**

Local dispersion conditions

Annual and seasonal windroses for the Sydney Airport AMO are presented in **Figure 3**. Strong winds are generally experienced in the area with wind directions predominately coming from the northwest and south. Eastern winds are common in summer and western winds in winter, with varied winds from other directions in spring and autumn.

Potential air emissions from the modification will most likely be subject to similar wind patterns and be reasonably well distributed through the year. This means that it is unlikely for nearby residential receptors to remain downwind of the operations for extended periods of time and overall, the prevailing dispersion conditions should allow for air emissions from the modification to be reasonably well dispersed before reaching any residential receptors.

Existing air quality levels

The main sources of air pollutants in the area surrounding the site include emissions from other industries within the local industrial area, local anthropogenic activities (such as motor vehicle exhaust and domestic wood heaters) and nearby commercial activities.

Available data from the nearest air quality monitors operated by the NSW Department of Climate Change, the Environment, Energy and Water (DCCEEW) were used to characterise the existing background level for $NO_2$ and CO. The monitors are located at Randwick, Alexandria and Earlwood, approximately 3.1km northeast, 6km north-northwest and 9km northwest of the site respectively.

A summary of the available $NO_2$ monitoring data from 2020 to 2024 is presented in **Table 2**. Recorded daily maximum one hour average $NO_2$ concentrations are presented in **Figure 4**. A seasonal trend can be seen in the $NO_2$ monitoring data at all monitoring stations with higher levels occurring in the cooler months and lower levels warmer months.

A review of **Table 2** indicates that the annual average $NO_2$ concentrations recorded at Randwick, Alexandria and Earlwood were all below the criterion for the review period. The maximum one-hour average $NO_2$ concentrations were also all below the criteria of 8pphm for all years, typically reaching highs above 4pphm, just over half the criteria.

**Table 2: Summary of $NO_2$ levels from monitoring stations (pphm)**

| Year | Randwick | Alexandria | Earlwood | Criterion |
|---|---|---|---|---|
| | Annual average | | | |
| 2020 | 0.5 | - | 0.9 | **1.5** |
| 2021 | 0.5 | - | 0.9 | **1.5** |
| 2022 | 0.6 | 0.9 | 0.8 | **1.5** |
| 2023 | 0.7 | 1.1 | 0.9 | **1.5** |
| 2024 | 0.7 | 0.8 | 0.8 | **1.5** |
| **Year** | **Randwick** | **Alexandria** | **Earlwood** | **Criterion** |
| | Maximum 1-hour average | | | |
| 2020 | 3.7 | - | 4.0 | **8** |
| 2021 | 2.9 | 3.5 | 3.9 | **8** |
| 2022 | 3.2 | 4.2 | 3.3 | **8** |
| 2023 | 4.0 | 4.6 | 4.1 | **8** |
| 2024 | 4.1 | 4.1 | 3.8 | **8** |

- No data available

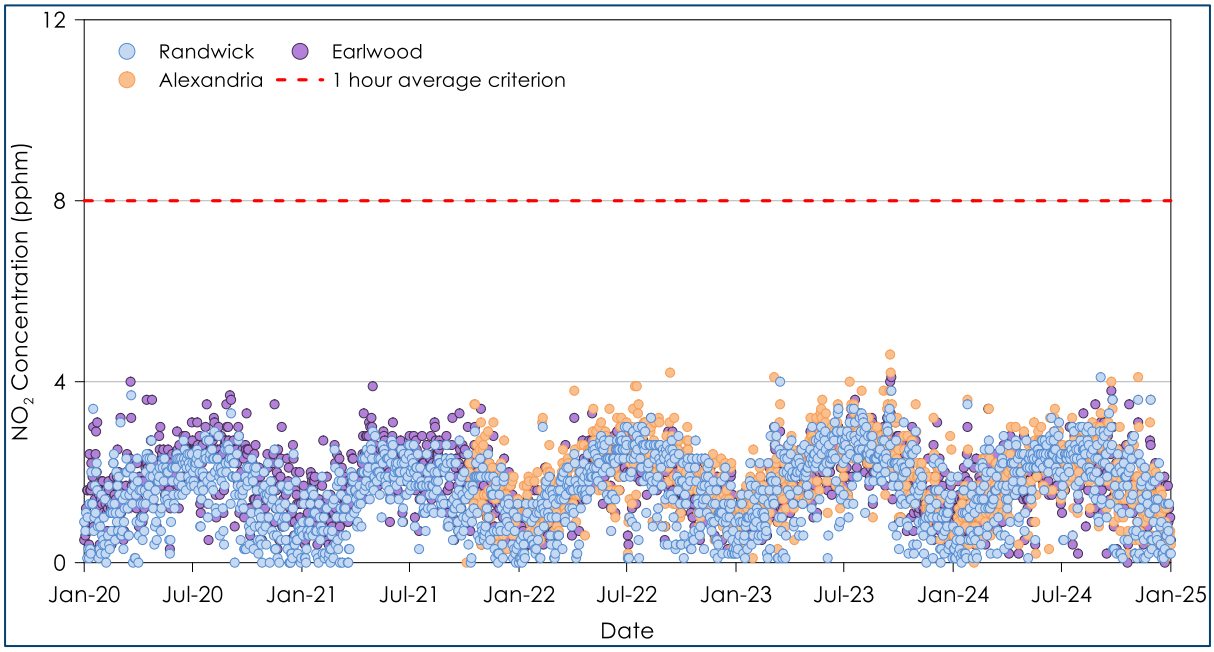



**Figure 4: Daily maximum 1-hour average $NO_2$ concentrations (pphm)**

A summary of the available CO monitoring data from 2020 to 2024 is presented in **Table 3**. Recorded daily maximum rolling eight hour average CO concentrations are presented in **Figure 5**. It is noted that only Alexandria records CO in the vicinity of the site, and commenced CO monitoring in the third quarter 2021. A seasonal trend can be seen in the CO monitoring data with higher levels occurring in the cooler months and lower levels warmer months.

A review of **Table 3** indicates that the CO concentrations recorded at Alexandria were all significantly lower than the criterion for the review period. The maximum levels are generally around 10% of the relevant criteria.

**Table 3: Summary of CO levels from monitoring stations (ppm)**

| Year | Alexandria<br>Maximum rolling 8-hour average | Criterion |
|---|---|---|
| 2020 | - | **9** |
| 2021 | 0.2 | **9** |
| 2022 | 1.0 | **9** |
| 2023 | 0.8 | **9** |
| 2024 | 1.2 | **9** |
| **Year** | **Alexandria**<br>**Maximum 1-hour average** | **Criterion** |
| 2020 | - | **25** |
| 2021 | 0.3 | **25** |
| 2022 | 1.3 | **25** |
| 2023 | 2.0 | **25** |
| 2024 | 1.5 | **25** |

- No data available

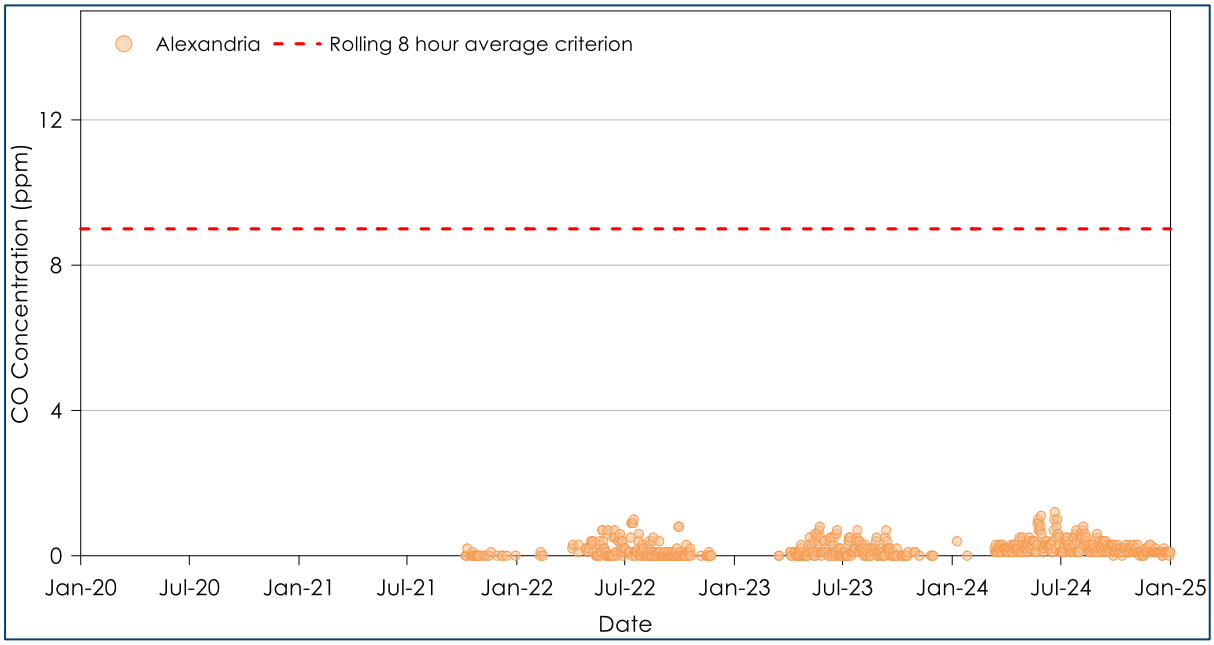



**Figure 5: Daily maximum rolling 8-hour average CO concentrations (ppm)**

The available background data collected from Randwick, Alexandria and Earlwood indicate $NO_2$ and CO concentrations are generally low and well below the applicable criteria. This is likely in part due to the location near to the coast which promotes dispersion and ventilation through moderate to strong coastal breezes.

**Assessment of potential air quality impacts**

To assess the potential for air quality impacts from the modification, a qualitative approach has been used which includes the identification of potential air emission sources associated with the modification, a review of the proposed air quality control measures, an assessment of the existing air quality levels in the vicinity of the site and local dispersion conditions.

A qualitative approach has been applied due to the nature of the activities from the modification having an inherently low potential for air quality impacts with consideration of appropriate air emissions controls.

Potential air emission sources

The primary source of potential air emissions from the modification would arise from the use of the gas-fired boiler. There is not expected to be any significant emissions of dust during the construction of the new boiler house, as the Colorbond-clad shed is to be installed over an existing concrete slab, with the exception of minor excavations for structural footings.

It is proposed to use a 6 megawatt (MW), low oxides of nitrogen (NOx), high efficiency Weishaupt model WM-G50/1-A ZM-NR (integral fan) burner natural gas fired boiler for the modification. The performance characteristics for the boiler stack and expected emissions are outlined in **Table 4**.

**Table 4: Boiler emissions and stack characteristics**

| Parameter | Value |
|---|---|
| **Stack Characteristics** | |
| Stack diameter | 0.55m |
| Stack Height | 4m taller than boiler house roof |
| Flow Rate | 3.48 $Am^3/s$ |
| Exit Velocity | 14.6m/s at 100% load |

| Parameter | Value |
|---|---|
| **Pollutants** | |
| CO | <50ppm dry volume @ 3% $O_2$ |
| NOx | <150mg/$Nm^3$ dry @ 3% $O_2$, 0°C & 1 atm |

As outlined in **Table 4**, the proposed modification would not add any additional notable particulate matter or chlorine emissions which are the primary existing pollutants for the site. The operation of the new gas-fired boiler would result in some carbon monoxide (CO) and NOx emissions which include nitrogen dioxide ($NO_2$).

Air control measures

The potential air emissions associated with the proposed gas-fired boiler are expected to be minimal and readily managed through good design and operation. Combustion of natural gas produces negligible particulate matter and sulphur oxides; the principal combustion products are carbon dioxide ($CO_2$), water vapour with small amounts of NOx and CO. The boiler is specified as a low-NOx unit and will discharge via a dedicated vertical stack to promote effective dispersion above roof level.

The operational controls will include, but are not limited to:

- Using a manufacturer certified low-NOx burner (flue-gas recirculation as applicable);
- Proper commissioning and tuning to maintain optimal excess oxygen, with burner controls set to prevent rich firing;
- Keeping combustion air intakes clear and filters clean to ensure a hot, well-oxygenated flame;
- Routine inspection, operational checks for visible emissions and maintenance per the manufacturer's recommendations; and,
- Installing a vertical, uncapped stack with adequate exit velocity, located above the roof line and away from air intakes/openings to avoid re-entrainment.

In accordance with the Protection of the Environment Operations (Clean Air) Regulation 2022, the exhaust gases from the boiler (see **Table 4**) will meet the general standards of concentration for scheduled premises (refer to **Table 5**). Maximum NOx concentrations from the boiler are expected less than half the standards of concentration for NOx (as $NO_2$). Given the negligible particulate generation from natural-gas combustion under normal operation, compliance with the solid particles and smoke criteria is readily achievable.

**Table 5: General standards of concentration for scheduled premises**

| Air impurity | Standards of Concentration |
|---|---|
| Nitrogen dioxide ($NO_2$) or nitric oxide (NO) or both nitrogen dioxide and nitric oxide, as $NO_2$ equivalent | 350mg/$m^3$ |
| Solid particles | 50mg/$m^3$ |
| Smoke | Ringlemann 1 or 20% Opacity |
| Carbon monoxide | N/A |

Emissions will be released via the rooftop stack to maximise initial dilution and dispersion in the ambient air. With the low-NOx burner, correct commissioning, and routine maintenance, off-site air quality and odour impacts are not expected.

Local air quality and dispersion conditions

As stated in the existing environmental conditions section above, the available background data indicate $NO_2$ and CO concentrations are generally low and well below the applicable criteria. With the prevailing wind conditions, potential air emissions from the modification will most likely be reasonably well distributed through the year. This means that it is unlikely for nearby residential receptors to remain downwind of the operations for extended periods of time and overall, the dispersion conditions should allow for air emissions from the modification to be reasonably well dispersed before reaching any residential receptors.

**Summary**

This report has assessed the potential for air impacts associated with the proposed gas-fired boiler modification to the IXOM CAP at Banksmeadow, NSW.

Given the nature of the air emission sources, the air emission controls, the receiving environment, and prevailing winds, it is unlikely that the operation of the modification would create any air quality issues at this location.

Please feel free to contact us if you would like to clarify any aspect of this report.

Yours faithfully,
Todoroski Air Sciences



Philip Henschke
CAQP

**References**

Bureau of Meteorology (2025)
Climate Averages Australia, Bureau of Meteorology website, accessed August 2025.
<http://www.bom.gov.au/climate/averages>




# APPENDIX H

## SOIL AND WATER MANAGEMENT PLAN

# New Steam Boiler
# Denison Street, Banksmeadow, NSW

## IXOM Operations Pty Ltd

## Soil and Water Management Plan

**JBS&G 71378 | 172,868 Rev A**

**17 December 2025**

**We acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community.**

We pay respect to Elders past and present and in the spirit of reconciliation, we commit to working together for our shared future.



**Caring for Country** The Journey of JBS&G
**Artist:** Patrick Caruso, Eastern Arrernte

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# Abbreviations

| Term | Definition |
|---|---|
| 1,1,1-TCA | 1,1,1-Trichloroethane |
| 1,1,2-TCA | 1,1,2-Trichloroethane |
| 1,2-DCA | 1,2-Dichloroethane |
| BGC | Botany Groundwater Cleanup |
| BIP | Botany Industrial Park |
| BTEX | Benzene, Toluene, Ethylbenzene, Xylene |
| CAP | ChlorAlkali Plant |
| CFM | Chloroform |
| CHC | Chlorinated Hydrocarbons |
| cis-1,2-DCE | Cis-1,2,-Dichloroethene |
| CLM Act | Contaminated Land Management Act 1997 |
| CSM | Conceptual Site Model |
| CTC | Carbon Tetrachloride |
| DCM | Dichloromethane |
| DNAPL | Dense Non-Aqueous Phase Liquid |
| EPA | Environment Protection Agency |
| EtO | Ethylene Oxide |
| eV | Electron Volt |
| FCAP | Former ChlorAlkali Plant |
| $f_{oc}$ | Fraction Of Organic Carbon |
| GRAMP | Groundwater Remediation And Management Plan |
| GTP | Groundwater Treatment Plant |
| Ha | Hectare |
| HCB | Hexachlorobenzene |
| HCBD | Hexachlorobutadiene |
| HCE | Hexachloroethane |
| HDPE | High Density Polyethylene |
| Hg | Mercury |
| LDPE | Low-Density Polyethylene |
| LLDPE | Linear Low-Density Polyethylene |
| mbgs | Metres Below Ground Level |
| MW | Mega Watt |
| NCUA | Notice Of Clean Up Action |
| OCP | Organochlorine Pesticides |
| OH&S | Occupational Health And Safety |
| PAH | Polycyclic Aromatic Hydrocarbons |
| PCB | Polychlorinated Biphenyls |
| PCE | Tetrachloroethene |

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| Term | Definition |
|---|---|
| PID | Photoionisation Device |
| POEO Act | Protection Of Environment Operations Act 1997 |
| PPE | Personal Protective Equipment |
| SEPP | State Environmental Planning Policy |
| SWMP | Soil And Water Management Plan |
| TCE | Trichloroethene |
| TEAL | Triethyl Aluminium |
| trans-1,2-DCE | Trans-1,2-Dichloroethene |
| TRH | Total Recoverable Hydrocarbons |
| VC | Vinyl Chloride |
| VENM | Virgin Excavated Natural Material |
| VMP | Voluntary Management Proposal |
| WHSP | Work Health And Safety Management Plan |

# 1. Introduction

JBS&G Australia Pty Ltd (JBS&G) was engaged by IXOM Operations Pty Ltd (IXOM, the "client") to prepare a Soil and Water Management Plan (SWMP) to address potential soil and groundwater contamination that may be encountered during the installation of a steam boiler within the south-western portion of the ChlorAlkali Plant (CAP) located at Denison Street, Banksmeadow, NSW (the "site"). The site comprises an approximate 0.15 Hectare (Ha) parcel of land, formally identified as part Lot 1101 in DP 1227173 and is shown on **Figure 1**.

The site is located within the Botany Industrial Park (BIP) and has a long history of chemical manufacturing, which began in 1944 with the production of chlorine, caustic soda, hydrochloric acid, sodium hypochlorite and ferric chloride from brine solution by ICI Australia (now Orica). The former ChlorAlkali Plant (FCAP) completed these manufacturing processes with mercury cells from 1944 until 2001 when it was replaced with a membrane cell process. There were four key areas associated with the FCAP that included; the Cell Block (Block G), Chlorine Liquefaction and Chlorine Storage Area (Black L), Hydrogen and Brine Treatment Area (Block M) and Caustic Soda Filtration and Storage (Black A). The site falls within Block A (refer to **Figure 2** and **Figure 3**) which has been subjected to previous investigations and remediation works (to the east of the site footprint) as documented in SA (2013)[1].

Historically, steam was produced by coal-powered boilers operated by Qenos within BIP, however, since Qenos' voluntary administration in April 2024, the supply of steam to the CAP ceased and a temporary three Mega watt (MW) diesel-fired boiler had been installed to maintain plant operations. For long term operations, it is understood that the client proposed to install a natural gas-fired boiler, boiler house and ancillary services south-west of the existing CAP control room. The boiler is expected to be built on top of existing grade, underneath an angled roof where minor excavations (up to a depth of 0.5 m) may occur as part of construction works.

Whilst remedial works have occurred nearby to the site to address mercury impacts (refer to **Section 3.1**), there is potential for residual soil and groundwater impacts at the site that will need to be considered and appropriately managed during construction works. Whilst direct exposure to contaminated soils and groundwater is considered unlikely, based on the scope of construction works, a SWMP has been prepared to control key environmental risks associated with the proposed works.

The SWMP outlines procedures to manage risks associated with potential soil and water impacts at the site during construction, ensuring compliance with relevant regulatory guidelines and minimising emissions as far as practicable. The SWMP should be implemented in conjunction with other site management plans and acts as a supplement to those plans.

## 1.1 Objectives

The objective of this soil and water management plan is to document the procedures and standards to be followed in order to mitigate any potential risks to human health and the environment during the construction of the new Boiler within the CAP in BIP.

[1] *Site Audit,* Blocks A and M, Former ChlorAlkali Plant, Botany Industrial Park, C. M. Jewell & Associates Pty Ltd, 19 December 2013 (SA 2013).

## 1.2 Previous Assessments

A range of previous assessments have historically been completed within surrounding BIP land. As such, background information as applicable to the site is limited to resources that are publicly available listed following:

- Former ChlorAlkali Plant, Human Health and Environmental Risk Assessment – 2013, Environmental Risk Sciences Pty Ltd, 20 June 2013 (EnRisks 2013).
- Site Audit, Blocks A and M, Former ChlorAlkali Plant, Botany Industrial Park, C. M. Jewell & Associates Pty Ltd, 19 December 2013 (SA 2013).
- Conceptual Site Model Orica Botany, 2022, Orica Australia Pty Ltd (Orica 2022).
- Detailed Site Investigation, New Chlorine Liquefaction Plant, JBS&G Australia Pty Ltd, 21 November 2024 (JBS&G 2024).
- Remedial Action Plan, New Chlorine Liquefaction Plant, JBS&G Australia Pty Ltd, 25 January 2025 (JBS&G 2025).

## 1.3 Proposed Construction Works

As noted above, the client is proposing to establish a new boiler, boiler house and ancillary equipment at the site. The boiler and relevant components are proposed to be installed on top of an existing sealed concrete area. An angled roof with whirly birds held up by stilts will be roofed over the boiler and its associated equipment. Above ground steel reinforced concrete plinths are expected to raise up the boiler house columns, steam boiler, boiler feed tank stand, vent stack and feedwater pumps.

Excavations (if any) are expected to be minor (maximum depth of 0.5 m) with slab reinstatement post-excavation to maintain sealed grounds. The design plans are provided in **Appendix A**.

## 1.4 Responsibilities

The Principal Contractor (PC) appointed to the project will be substantially responsible for the implementation of this SWMP. It is noted that where the specific procedures are technical or complex in nature, a specialist consultant or sub-contractor will fulfil the requirements of the procedure or advise the appropriate implementation of the procedure.

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# 2. Site Condition and Surrounding Environment

## 2.1 Site Identification

The site location is shown on **Figure 1** and the site extent / layout and proposed boiler location are shown on **Figure 2**. The extent of the site is summarised in **Table 2.1** following.

**Table 2.1: Site Identification**

| Site Feature | Description |
|---|---|
| Address | Denison Street Banksmeadow |
| Lot and DP | Part Lot 1101 in DP 1227173 |
| Approximate Site Area | 150 $m^2$ |
| Zoning | Industrial |
| Local Government Area | Bayside City Council |
| Approximate Coordinates (GDA94-MGA56) | 335667.70 E; 6241100.26 N (centre of main portion) |

## 2.2 Surrounding Land-Uses

Adjacent uses of potential significance are summarised in **Table 2.2** following.

**Table 2-2: Adjoining Land Uses**

| Identification | Location | Description |
|---|---|---|
| Orica Australia | Surrounding site | Orica owns the land immediately surrounding the site within BIP. Facilities that are located nearby or adjacent to the site include:<br>• Groundwater Treatment Plant (GTP) - located 200 m to the north of the main portion of site. Used for the processing and treatment of contaminated groundwater recovered as part of large-scale groundwater extraction/remediation (Botany Groundwater Cleanup (BGC) Project) |
| Indorama Ventures Oxides Australia Pty Ltd | North of site (approximately 300 m from main portion) | This property has a long history of chemical manufacturing, which began in 1942 with the production of carbon bisulphide by ICI Australia. Throughout the 1940s and 1950s, additional chemical plants were commissioned, including a rubber chemical plant, an herbicide plant, a formaldehyde plant, and an acetylene wet generation plant (refer to Figure 2a). These chemical manufacturing plants were decommissioned in the 1960s, after which the property was used to manufacture surfactants.<br>The property was acquired from Orica (formerly ICI) by Huntsman in 1998 and then by Indorama in 2019. Until recently, ethylene oxide (EtO) and its derivatives, including glycols, glycol ethers, and non-ionic surfactants, were manufactured at the site using primary raw materials supplied by the Olefines plant operated by Qenos, located to the north of the site within the BIP.<br>Indorama has recently ceased operations and is currently decommissioning the manufacturing facility. |

| Identification | Location | Description |
|---|---|---|
| Former Qenos Facility | North and North-west of Site | The former Qenos manufacturing facility is also located within BIP, with key features that are located nearby to the site include:<br>• Alkathene - Until recently this area was used for the production of low-density polyethylene (LDPE) products from ethylene (produced at Olefines II). The area contains the Alkathene plant (high- and low-pressure reactors, compressors, cooling towers, product extrusion machines, and a number of electrical substations), workshops, offices, bulk liquid (petroleum based) storage areas, product silos and warehouses<br>• Alkatuff - Until recently this area was used for production of linear low-density polyethylene (LLDPE) products from ethylene (Olefines II), hexene, nitrogen, hydrogen and TEAL (triethyl aluminium). The area also produced high density polyethylene (HDPE). The area comprises the Alkatuff plant, workshops, offices, additive store, catalyst store, hexene bulk storage tank, cooling towers, laboratory and two electrical substations<br>• Site Utilities - The site utilities area includes steam generation, demineralisation of water, effluent treatment, cooling towers, and instrument air plant. Coal unloading and storage bay adjacent to the steam plant. By-product boiler ash hoppers and loading bay. Site Utilities have ceased operations in early 2025. |
| Southlands | West | Southlands is located to the west of the site beyond the extent of the site. The area has been remediated and divested by Orica. A range of contaminants were present inclusive of chlorinated hydrocarbons and asbestos. |
| Sydenham to Botany goods railway line | West | Operational freight rail line adjacent to southwestern boundary of BIP. |
| Residential Properties on Denison Street | East | To the east of the site (beyond the Orica owned land) is Denison Street. A variety of residential dwellings are located beyond. |

## 2.3 Geology

Previous soil investigations from surrounding BIP land, reported that the geology of the area comprises of Botany Sands, a sequence of predominantly unconsolidated to semi-consolidated permeable sands. These sands are interspersed with lenses and layers of peat, peaty sands, silts, and clay, which become more prevalent in the lower part of the sequence. The sand layer varies in thickness across BIP from less than 20 m to over 80 m and is underlain by the Hawkesbury Sandstone, a rock formation with significantly lower permeability compared to the overlying Botany Sands.

Borehole logs from previous soil investigations within the site or surrounding FCAP land were not provided by the site owner for review herein. However, EnRisks (2013) provides a description of the soils encountered across Block L during previous investigations as follows:

- Fill ranged in depths from 0 to 1.0 m and comprised of grey and brown sands that were medium to coarse grained with 20-50 mm gravels; and

- Natural soils were reported to underly the fill materials (to 17 m as consistent with maximum depth of investigations in this area) and comprised of grey/brown to white sands that are medium to coarse grained.

The site geology is largely consistent with that described across the broader BIP area in Orica (2022). Orica (2022) further reports that the fraction of organic carbon ($f_{oc}$) in soils across BIP range from low in sandy materials (<1%) to high in peat (4-20%) and occasionally in sands with a "brown" coloration (up to 22%) which influence contaminant mobility.

## 2.4 Hydrogeology

Historical groundwater levels as collected in proximity of the site within BIP land have confirmed that the regional groundwater flow direction in the vicinity of the site is south-westerly towards Botany Bay (Orica 2022). The presence of three hydraulic containment lines at: the southwestern boundary of BIP; south (down-gradient) of the Nant Street Tank Farm, adjacent to McPherson Street; and further south on Foreshore Road, immediately prior to Botany Bay, induces groundwater flow towards the three containment lines and results in the hydraulic containment of groundwater flowing from the BIP. Shallow groundwater within BIP is generally characterised as slightly acidic with low salinity (<1000 µS/cm).

In the area of the site, SA (2013) reports that the inferred groundwater flow direction is to the south-west consistent with the above.

## 2.5 Meteorology

A review of climatic data for the nearest Bureau of Meteorology monitoring location (Sydney Airport AMO) indicates the Site is located within the following meteorological setting:

- Average maximum temperatures range from 17.2°C in July to 26.7°C in January;
- Average minimum temperatures range from 7.4°C in July to 19.1°C in February;
- The average annual rainfall is approximately 1093.4 mm with rainfall greater than 1 mm occurring on an average of 96 days per year; and
- Monthly rainfall varies from 59.8 mm in September to 124.7 mm in March, with the wettest periods on average occurring between the months of January to June.

## 2.6 EPA Regulation

### 2.6.1 Botany Groundwater Cleanup

The BIP site has a long industrial history (since the early 1940s) and was formerly owned and operated by ICI Australia Ltd (ICI). Historical operations at BIP have resulted in soil and groundwater contamination on and adjacent to the site which have resulted in a range of environmental regulatory actions being applied to the site.

The NSW EPA issued Orica with Notice of Clean Up Action (NCUA) No. 1030236 on 26 September 2003, under the *Protection of the Environment Operations Act 1997* (POEO Act) which applied to the BIP, inclusive of the site subject of this assessment. The NSW EPA also declared on 9 February 2005 (No. 21074) the land to be a remediation site under the *Contaminated Land Management Act 1997* (CLM Act), with subsequent notices repealing the declaration on portions of the land surrounding BIP as they have been remediated and developed.

Following effective completion of the principal NCUA actions, and consultation with the community and Orica, the NSW EPA determined that the project would be best managed by a Voluntary Management Proposal (VMP) under the CLM Act 1997. An initial VMP was approved on 5 November 2010 (Approval No. 20101714),

which was subsequently revised on 13 August 2015 (Approval No. 20151711) and 29 April 2020 (Approval No. 20201704). The VMP is the current regulatory tool requiring effective operation of the BGC.

The VMP applies to a range of constituents inclusive of volatile chlorinated hydrocarbons (CHC) (carbon tetrachloride (CTC), dichloromethane (DCM), chloroform (CFM), chloromethane, 1,1,1,2-tetrachloroethane, 1,1,1-trichloroethane (1,1,1-TCA), 1,1,2-trichloroethane (1,1,2-TCA), 1,1,2,2-tetrachloroethane, 1,2-dichloroethane (1,2-DCA), chloroethane, cis-1,2-dichloroethene (cis-1,2-DCE), tetrachloroethene (PCE), trans-1,2-dichloroethene (trans-1,2-DCE), trichloroethene (TCE) and vinyl chloride (VC)) and semi-volatile chlorinated hydrocarbons (1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, 1,3,5-trichlorobenzene, 1,2,4,5-tetrachlorobenzene, pentachlorobenzene, hexachlorobenzene (HCB), hexachlorobutadiene (HCBD), hexachlorocyclopentadiene, hexachloroethane (HCE) and hexachloropropery lene)

The BGC Project addresses BIP-related chlorinated hydrocarbon contamination issues. The overall remediation strategy, as required by various regulatory mechanisms discussed briefly above, has been a risk-based approach to:

- Protect human health and environmental receptors via hydraulic containment of the CHC plumes and source areas and administrative measures;
- Monitor the nature and extent of contamination to identify potential exposure pathways that require management; and
- Investigate potential technologies to remediate chlorinated hydrocarbon source zones and plumes (though periodic reviews and independent workshops with international experts have not identified practicable remediation alternatives).

A revised Groundwater Remediation and Management Plan (GRAMP) (Orica, 2020) was submitted as an attachment to the VMP; it outlines surface water and groundwater monitoring requirements.

Botany Groundwater Cleanup

Orica's approach for remediation of BIP-related contamination, as per the requirements of the NCUA and its subsequent variation notices, currently comprises:

- Containment of dissolved phase chlorinated hydrocarbon plumes on- and off-site to ensure risks to human health and the environment remain acceptable;
- Continual optimisation of operation of the hydraulic containment lines and GTP for protection of critical human health and environmental exposures and for gradual cleanup of contamination in areas;
- Improvements to the hydraulic containment system and GTP to further reduce impacts on Springvale Drain and Penrhyn Estuary/Botany Bay; and
- Ongoing review of developments in remediation technologies and experience for dense non-aqueous phase liquid (DNAPL), soil and groundwater phase CHCs, and their practical application to the BGC Project.

Containment of dissolved phase chlorinated hydrocarbon plumes on- and off-site achieved by:

- Groundwater extraction (with ex situ treatment) from the Botany Sands aquifer along the southwestern boundary of BIP (1st and 2nd Streets), the southern boundary of former Orica Southlands along McPherson Street and along Foreshore Road;
- Groundwater extracted is pumped to a purpose-built groundwater treatment plant (GTP) located on the Orica owned portion of BIP; and
- Performance monitoring at the GTP and of water levels and water quality within the aquifer is ongoing.

This system is often collectively referred to as the 'GTP system' or 'hydraulic containment system'. The effectiveness of hydraulic containment is reviewed on a quarterly (and biannually since 2017) basis as part of compliance monitoring under the GTP monitoring program. A range of remedial options have been considered to address DNAPL impacted areas though none have been found to be effective or appropriate for full scale implementation.

### 2.6.2 FCAP Remediation

The Site Audits (SA 2013 and 2014) provide a detailed history of the remediation of mercury impacts at the FCAP with associated NSW EPA regulatory requirements as summarised below.

**Operational History (1942–2002):**

- Orica, previously ICI Australia, operated a chemical manufacturing plant at the BIP since 1942.
- The FCAP used elemental mercury in its electrolytic process from 1944 until 2002, when it transitioned to membrane technology.
- The FCAP's above-ground structures were demolished between 2004 and 2007.

**Contamination Identified (2005–2009):**

- On February 9, 2005, the NSW EPA declared the BIP and surrounding land a Remediation Site (Notice No. 21074) under the Contaminated Land Management Act 1997 (CLM Act).
- Investigations (2006–2009) revealed elemental and inorganic mercury in soil and groundwater beneath and downgradient of the FCAP.
- On July 10, 2009, the EPA confirmed the contamination warranted regulation under the CLM Act. Orica committed to remediation through a VMP.

**Voluntary Management Proposal (2011):**

- Orica submitted a VMP on April 11, 2011, focusing on remediation of Blocks M and G of the former CAP. It is noted that no potential mercury contamination issues were identified as part of environmental investigations on Block L.
- Initial remediation efforts began in May 2011 with soil excavation and on-site soil washing being trialled on Block G. However, the process did not meet remediation objectives, leading Orica to suspend works in August 2011.

**Management Order Issued (2012):**

- On January 6, 2012, the EPA revoked the VMP and issued Management Order No. 20111406, requiring a new remediation framework.
- Golder Associates prepared a Remedial Options Appraisal Report (April 2012) recommending capping and containment of mercury impacted soils on Block G and excavation and off-site disposal for mercury "hotspots" in Blocks A and M.

**Completion of Remediation for Blocks A and M (2013)**

- Excavation and off-site disposal of mercury-impacted soils to the extent practicable was completed in accordance with the RAP on Blocks A and M. Further detail of the remedial works completed in proximity of the site are provided in **Section 3.1**.

**Completion of Soil Source Removal Works for Block G (2013)**

- A new Management Order (20131406) set objectives for implementing the RAP on Block G, requiring excavation and off-site disposal of mercury impacts in shallow soils on Block G. These remedial works were completed to the extent practicable between September and November 2013.

**Construction of cut-off wall and installation of Capping System (2015-2016)**

- Residual mercury impacted soils on Block G were managed through a cap and contain system, that included the construction a slurry-wall extending to bedrock, around the whole of Block G.

**Ongoing Maintenance Order (2017)**

- At the completion of remediation works in accordance with the MO (20131406), the NSW EPA issued an Ongoing Maintenance Order (20172802) in accordance with Section 28 of the CLM Act. The order requires:

*a) Maintain the ground surface of Blocks A and M in accordance with the Orica Former ChlorAlkali Plant Remediation Project, Blocks A & M Long Term Site Environmental Management Plan, 20 December 2013;*

*b) Maintain the encapsulation cell on Block G of the Botany Industrial Park in accordance with the Orica Australia Pty Ltd, Block G Long-Term Site Environmental Management Plan, 31 January 2017;*

*c) Monitor the mercury vapours within Block G in accordance with Orica Australia Pty Ltd, Block G Air Monitoring Plan, 31 January 2017.*

*d) Monitor the groundwater levels and chemistry within and adjacent to Block G in accordance with the Golder Associates, Former ChlorAlkali Plant, Botany Industrial Park, Post-Remediation Groundwater Monitoring, 31 January 2017;*

*e) Report to the EPA as soon as practicable any incident that may adversely affect the integrity of the encapsulation structure on Block G, the surface of Blocks A or M or cause migration of contaminants to the environment; and*

*f) Submit to the EPA annually, due by 31 March each year, a written report of compliance with this Notice detailing any instances of non-compliance, and potential changes to the long-term management plans, including the monitoring programs and the results of any vapour and water quality monitoring.*

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# 3. Conceptual Site Model

## 3.1 Remediation Works within Block A

Remediation works to address mercury impacts occurred to the east of the site as shown on **Figure 2** and documented within SA (2013). It was reported that all excavated materials from Block A were transported to the Temporary Environmental Control Area (TECA) at Block G, where they were stabilised prior to off-site disposal at a licensed facility. No excavated materials were designated for reuse in the reinstatement of the Block A excavation.

The excavation in Block A reached depths varying from approximately 0.85 to 1.15 metres below ground level. A total of twenty wall samples and four base samples were collected for validation. Total mercury concentrations in soil were below the adopted risk-based criteria (RBC) of 200 mg/kg in all samples except for two locations. Sample GAVS115, collected from residual fill material adhered to the face of an exposed concrete footing, returned 3,440 mg/kg, while GAVS116, from natural sands beneath the same footing, returned 298 mg/kg. Visible mercury was observed on the surface of the concrete footing and within sample GAVS115. This area of impact is understood to align directly beneath the former manway of the caustic tank previously located to the north of the excavation, consistent with anecdotal reports of wastewater discharges from tank cleaning operations.

To address the impacted materials to the extent practicable, the surface of the concrete footing was cleaned using a steel brush, removing the majority of mercury-affected material. Approximately 200 mm of soil was then hand-excavated from beneath the footing. Further excavation was not considered practicable due to the risk of releasing elevated mercury vapours and the unknown extent of the footing.

As the impacted materials represented by samples GAVS115 and GAVS116 were effectively removed through these actions, the results were excluded from the final soil validation and characterisation dataset. No further characterisation samples could be collected at this location. However, it was noted that the northern side of the excavation, that there is potential for mercury impacted materials to remain beneath a footing and that there is potential for elemental mercury within the concrete structure.

## 3.2 Potential Sources of Contamination and Associated Contaminants of Concern

There are no available sampling and analytical data within the site footprint available for review. However, based on information provided in historical reports (listed in **Section 1.2**) in nearby land, a summary of the potential sources of contamination that may be present at the site along with the affected media are presented in **Table 3.1.**

**Table 3.1: Known and Potential Sources of Contamination and Affected Media**

| Potential Source of Contamination (Areas of Environmental Concern) | Contaminants of Potential Concern | Potentially Affected Media |
|---|---|---|
| **AEC1.** Site Wide<br>Imported and/or reworked fill materials used to create site levels (comprising material of unknown character and/or origin).<br>Demolition of former site structures resulting in shallow soils impacted with hazardous materials (lead, asbestos). | Heavy metals (primarily mercury (Hg)) polycyclic aromatic hydrocarbons (PAHs), total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylenes (BTEX), organochlorine pesticides (OCPs), chlorinated hydrocarbons (CHCs), polychlorinated biphenyls (PCBs), asbestos and pH | Soil<br>Groundwater<br>Soil Vapour |
| **AEC2.** Former chemical manufacturing activities surrounding site. | Heavy metals (primarily Hg), TRH, BTEX, per- and polyfluoroalkyl substances (PFAS), CHCs | Soil<br>Groundwater<br>Soil Vapour |

A summary of the future site receptors as well as potential exposure pathways at the site is presented in **Table 3.2**.

**Table 3.2: Conceptual Site Model**

| Receptor | Location | Media | Potential Exposure Pathways | Commentary |
|---|---|---|---|---|
| **On-site Receptors** | | | | |
| Future Industrial Workers (i.e. operators of the Boiler) | Whole of site | Soil / Groundwater | Direct contact<br>Inhalation (vapours) | This exposure pathway is not complete given that the surface will be covered in hardstand (thereby precluding direct contact exposures to soils). Moreover, inhalation of volatile impacts (as vapours) will be mitigated given that there are no enclosed spaces (thereby reducing ventilation) proposed within the new Boiler |
| Construction worker or intrusive maintenance worker (short duration) | Construction areas/excavations | Soils | Inhalation (vapours, gases and particulates/fibres) | Potentially complete, as a result of potential chlorinated hydrocarbon, mercury and asbestos impacts in site soils. |
| | | Groundwater | Inhalation (vapours and particulates/fibres)<br>Oral (infiltrating seepage water)<br>Dermal (infiltrating seepage water) | Given the scope of construction works (where excavations are expected to be < 0.5 m in depth), these exposure pathways are not complete noting that groundwater depths are anticipated at > 2 m. |

# 4. Management Plan

## 4.1 Description of Construction Works

It is understood that detailed construction methodologies for the new boiler are currently still in development. However, the construction of the boiler and boiler house area are expected to be built on existing grade and raised by steel-reinforced concrete plinths. Should the construction works not result in the disturbance of underlying soils, then the management procedures as outlined in the following sections will largely not apply.

However, where disturbance of soils is required, it has been assumed that it will be relatively shallow (i.e. < 0.5 m) and require to address risks to human health (i.e. workers completing the construction works by review of **Table 3.2**) and environment. The procedures to address each of these aspects is outlined in the Sections following.

## 4.2 Pre-Construction Soil Assessment

If soils are to be disturbed during construction works, a soil assessment should be undertaken within the proposed disturbance footprint prior to commencement of those works. This will better inform the soil management procedures outlined in this report.

It is recommended that the assessment be conducted by an appropriately qualified environmental consultant, with soils characterised for the full suite of contaminants of potential concern (COPCs, as listed in **Table 3.1**) to the anticipated depth of disturbance associated with the construction activities.

## 4.3 WH&S Aspects

### 4.3.1 Work Health and Safety Plan

Following the soil assessment (Section 4.2), a Work Health and Safety Management Plan (WHSP) shall be prepared by the contractor prior to commencement of construction works (that involve excavation works). The objectives of the WHSP are:

- To apply standard procedures that minimises risks to site workers resulting from the works;
- To ensure all employees are provided with appropriate training, equipment and support to consistently perform their duties in a safe manner; and
- To have procedures to protect other site workers and the general public.

These objectives will be achieved by:

- Assignment of responsibilities;
- An evaluation of hazards;
- Establishment of personal protection standards, mandatory safety practices and procedures;
- Monitoring of potential hazards and implementation of corrective measures; and
- Provision for contingencies that may arise while operations are being conducted at the site.

The WHSP will require to be sufficiently detailed to address the particular site hazards as associated with under/above ground services, contact with contaminated soil (hydrocarbon/mercury) including potential vapour inhalation, and heat stress particularly in respect of PPE.

#### 4.3.1.1 Asbestos

Should the soil assessment (**Section 4.2**) confirm that site soils are impacted with asbestos, then appropriate procedures will be required to be implement. All asbestos works will require to be undertaken with the relevant requirements of *How to Manage and Control Asbestos in the Workplace Code of Practice*, July 2020, Safe Work Australia (SWA 2020). The works will require to be undertaken by a SafeWork Class A / B Accredited Asbestos Removal Contractor. During works that are inclusive of the disturbance of surface soils on the site, perimeter asbestos in air monitoring is recommended to be conducted at the applicable remedial works area boundary. Air monitoring will be conducted on a daily basis at relevant locations whilst disturbance of asbestos contaminated areas takes place. Air monitoring will be conducted during any ground disturbance activities within the site to verify that implementation of appropriate control measures has been successful at managing the risk of air borne fibre generation. Air monitoring will be undertaken in accordance with the requirements of the *National Occupational Health and Safety Commission (NOHSC) Asbestos Code of Practice and Guidance Notes*, in particular the Guidance note for the estimation of airborne asbestos dust [NOHSC 3002:2005].

## 4.4 Environmental Procedures

A formal list of procedures is provided to the SWMP based on an assessment of potential environmental emissions from site works that require the disturbance of soils. Environmental procedures have been considered in reference to requirements for management of contaminated sites as advised to *Botany Bay Development Control Plans 2013 (Amendment 5)*.

**Table 4.1: Review of Potential Environmental Impacts**

| Activity | Potential Emission | Management Procedure |
|---|---|---|
| Excavation of soil | Dust generation<br>Sediment migration<br>Release of asbestos fibres<br>Contamination of heavy equipment<br>Odour generation | Dust and airborne hazard control<br>Aquatic and riparian ecosystem protection<br>Boundary monitoring<br>Emergency response procedures<br>Appropriate handling of contaminated soil (water cart, dust monitoring)<br>Reinstatement of excavation / Cut and fill works<br>Sediment control<br>Decontamination of heavy equipment<br>Odour Control |
| Off-Site Disposal of Soils / Wastes<br><br>On-Site Material Importation | Noise generation<br>Dust generation<br>Sediment migration<br>Traffic impacts<br>Contamination of roadways | Dust and airborne hazard control<br>Emergency response procedures<br>Boundary monitoring<br>Traffic management<br>Appropriate handling of contaminated soil (water cart, dust monitoring)<br>Sediment control<br>Decontamination of heavy equipment<br>Sweeping truck tyres prior to exiting |
| Delivery of building materials / removal of wastes | Noise generation<br>Traffic impacts | Noise control<br>Traffic management |

The environmental monitoring and management procedures required to be implemented during the construction activities are listed in **Table 4.2** below and provided in **Appendix B**.

**Table 4.2: List of SWMP Procedures**

| SWMP Procedure | Description |
|---|---|
| SWMP01 | Dust and Airborne Hazard Control |
| SWMP02 | Handling of Contaminated Soil |
| SWMP03 | Reinstatement of Excavation |
| SWMP04 | Sediment / Leachate Control |
| SWMP05 | Visual Impact |
| SWMP06 | Emergency Response |
| SWMP07 | Traffic Management |
| SWMP08 | Decontamination of Heavy Equipment |
| SWMP09 | Training |
| SWMP10 | Non-compliance with SWMP |
| SWMP11 | Incident Reporting |
| SWMP12 | Record Keeping |
| SWMP13 | SWMP Review |

## 4.5 Regulatory Requirements

Future activities on site will be required to be completed in accordance with several sections of environmental and occupational health and safety legislation and associated regulations. The primary Acts, Regulations and Guidelines are listed below with a brief summary of their applicability. Please note that this list is not intended to be a comprehensive listing of acts and regulations. The proponent and contractors are required to satisfy themselves that all applicable permits, licences and legislation have been obtained and their conditions satisfied.

### 4.5.1 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is the key piece of environment protection legislation administered by the EPA.

### 4.5.2 Water Management Act 2000

No dewatering is anticipated with the construction works. Therefore a dewatering licence will not be required for the works to proceed.

If rainwater accumulates at the site and requires removal from the site, any discharge is required to be in accordance with the POEO Act. Where deemed suitable, collected / accumulated runoff may be discharged to the site surface to allow for re-infiltration to the subsurface (i.e. not discharged from the site).

If any water is required to be discharged from site to sewer, approval from the asset owner (Sydney Water/Council) will be required. Sydney Water's and/or Bayside Council's approval conditions will require to be upheld by the Principal Contractor and demonstration thereof.

### 4.5.3 Waste Classification Guidelines

All wastes generated and proposed to be disposed off-site shall be assessed, classified and managed in accordance with EPA (2014). Further discussion of waste management has been included as **Section 4.6**.

### 4.5.4 Protection of the Environment Operations (Waste) Regulation 2014

The POEO (Waste) Regulation makes requirements relating to non-licensed waste activities and waste transporting. The proposed works on the site will not be required to be licensed. Section 48 of the Regulation

requires that wastes are stored in an environmentally safe manner. It is also stipulated that vehicles used to transport waste must be appropriately licensed and covered when loaded with impacted materials. For transport activities this regulation also details additional tracking requirements for vehicles carrying Special (asbestos) waste if material is fill-based soils are required to be removed from the site (presumed to contain asbestos following waste classification activities).

Provision is provided in the Regulation and EPA (2014) guidelines for the NSW EPA to approve the immobilisation of contaminants in waste (if required with unexpected finds) and regulation of other waste classification such as virgin excavated natural material (VENM).

### 4.5.5 Work Health and Safety Act 2011

The overarching Act for NSW setting law relating to employee health and safety and employer responsibilities.

### 4.5.6 Work Health and Safety Regulation 2017

Sets regulations and details the duties for employers to achieve required employee health and safety performance. Of potential relevance to the site and works controlled by the SWMP, the Regulation contains a range of provisions to control works on asbestos affected sites.

## 4.6 Waste Management

In the event of soil disturbance resulting in the generation of surplus spoil during the construction works, specific provisions should be undertaken to ensure the appropriate management of these wastes as per below:

- Soils to be assessed and characterised by a qualified Environmental Consultant to facilitate waste classification reporting requirements in accordance with *Waste Classification Guidelines*, 2014, NSW EPA (EPA 2014) EPA Waste Classification Guidelines;
- Statements regarding materials being disposed via appropriately licenced facility or re-used under an order or exemption; and
- Requirements for recording waste disposal dockets or other waste documentation for any disposed waste.

# 5. Conclusion

This soil and water management plan outlines the procedures and standards to be followed in order to mitigate any potential risks to human health and the environment during the construction of the new Boiler within the Chlor-Alkali Plant in BIP.

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# 6. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties. The report has been prepared specifically for the client for the purposes of the commission, and no warranties, express or implied, are offered to any third parties and no liability will be accepted for use or interpretation of this report by any third party.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose. This report should not be amended in any way without prior approval by JBS&G, or reproduced other than in full including all attachments as originally provided to the client by JBS&G.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements or agreed scope of work.

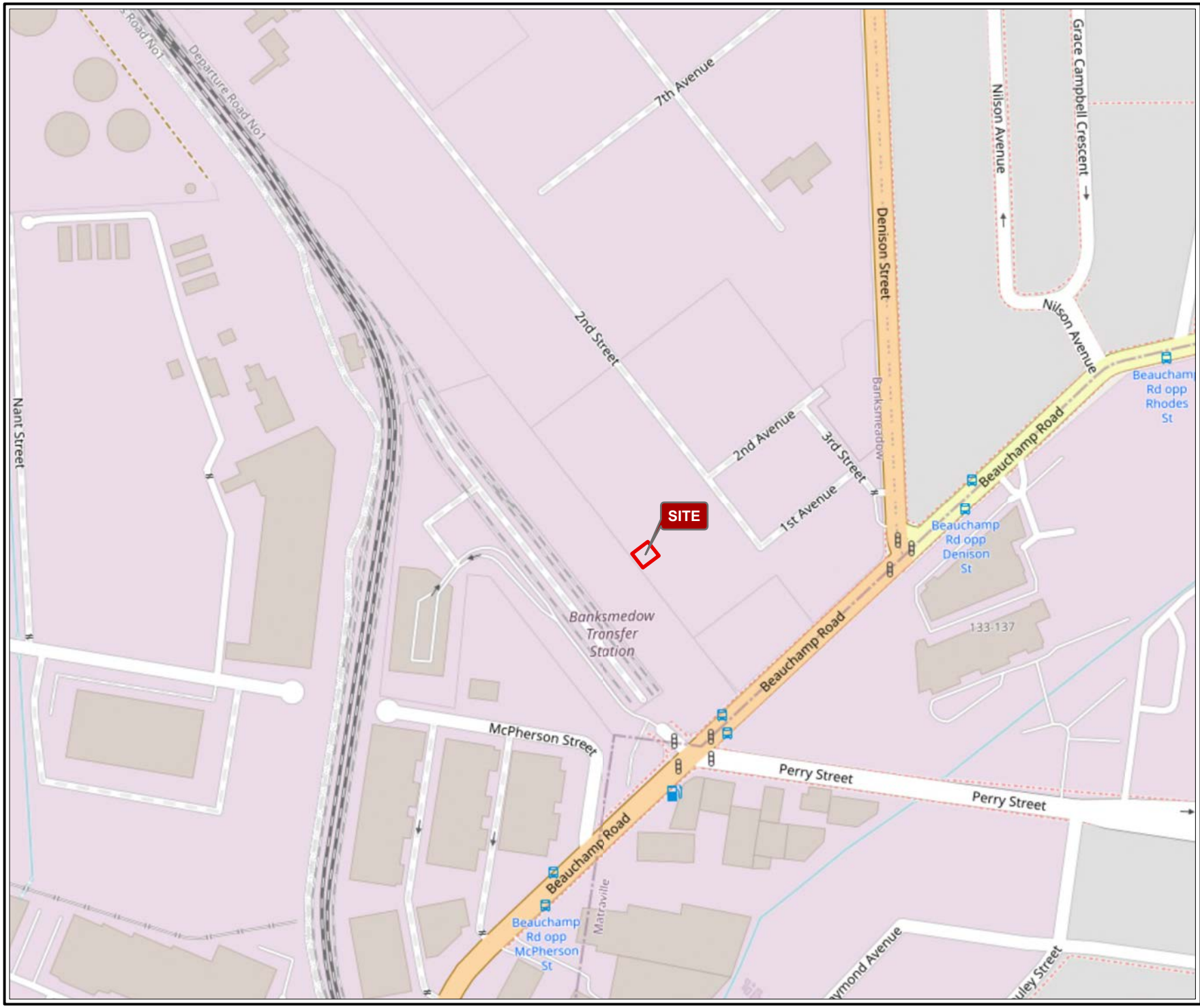
Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

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# Site Figures




Legend

Approximate Site Boundary

JBS&G

Job No: 71378

Client: IXOM

Version: R01 Rev A | Date 17/12/2025

Drawn By: IA | Checked By: LC

Scale 1:4,194

0 40 80

metres

Coord. Sys. GDA 1994 MGA Zone 56

**Banksmeadow**
**NSW**

**SITE LOCATION**

**FIGURE 1**

File Name: 71378_BotanyPlantBoilerModification_R01_RevA

Reference: © OpenStreetMap (and) contributors, CC-BY-SA




Legend

- Approximate Site Boundary
- NSW Cadastre
- Historical Remediation Area in Block A

JBS&G

Job No: 71378

Client: IXOM

| Version: R01 Rev A | Date 17/12/2025 |
|---|---|
| Drawn By: IA | Checked By: LC |

Scale 1:705

0 6.5 13

metres

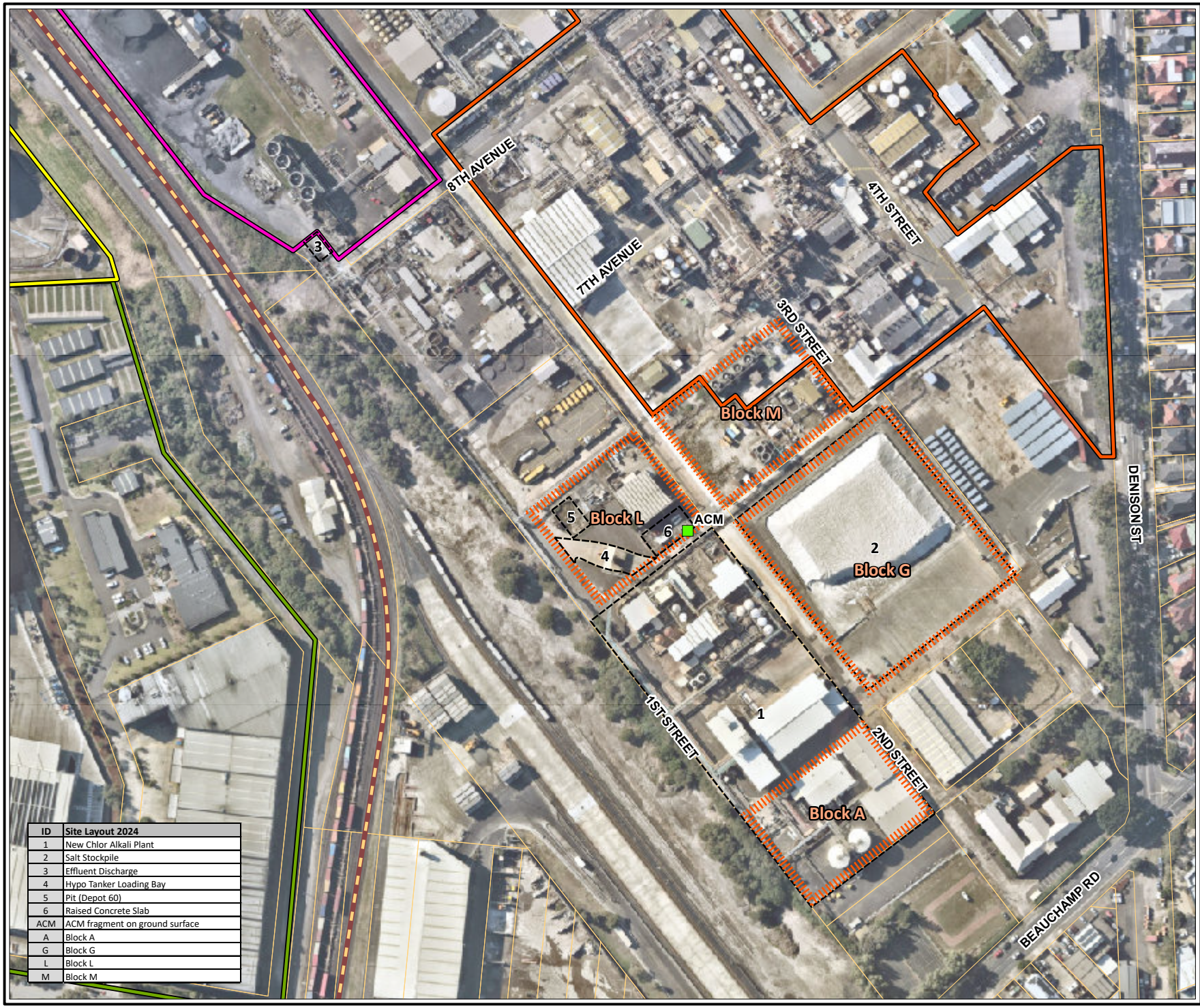
Coord. Sys. GDA2020 MGA Zone 56

**Banksmeadow**
**NSW**

**SITE LAYOUT**

**FIGURE 2**

File Name: 71378_BotanyPlantBoilerModification_R01_RevA
Reference: Nearmap - www.nearmap.com (Capture Date: 2025/12/03)




| ID | Site Layout 2024 |
|---|---|
| 1 | New Chlor Alkali Plant |
| 2 | Salt Stockpile |
| 3 | Effluent Discharge |
| 4 | Hypo Tanker Loading Bay |
| 5 | Pit (Depot 60) |
| 6 | Raised Concrete Slab |
| ACM | ACM fragment on ground surface |
| A | Block A |
| G | Block G |
| L | Block L |
| M | Block M |

Legend

- NSW Cadastre
- Site Features
- Site Layout 2024
- Site Layout - Blocks A, G, L, M
- ACM Fragment
- Nant Street Tank Farm
- Site Utilities
- Southlands
- Surfactants Plant
- Sydney to Botany Goods Railway Line

JBS&G

Job No: 71378

Client: IXOM

Version: R01 Rev A | Date 17/12/2025

Drawn By: RF | Checked By: CB

Scale 1:2,750

0 25 50

metres

Coord. Sys. GDA2020 MGA Zone 56

**Banksmeadow**
**Botany, NSW**

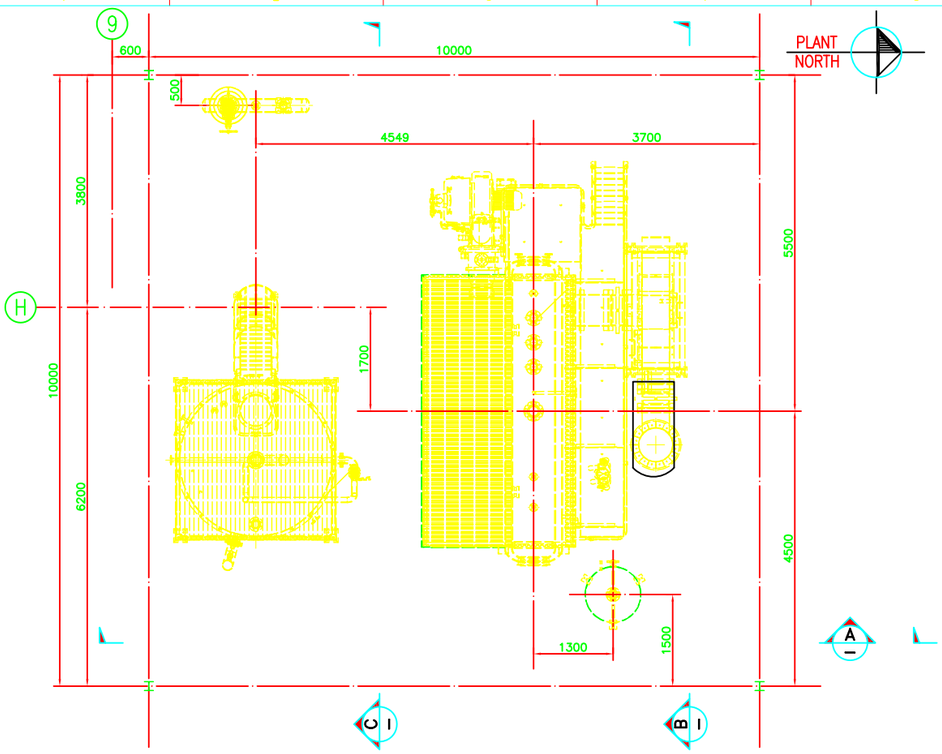
**SURROUNDING LAND-USE**

**FIGURE 3**

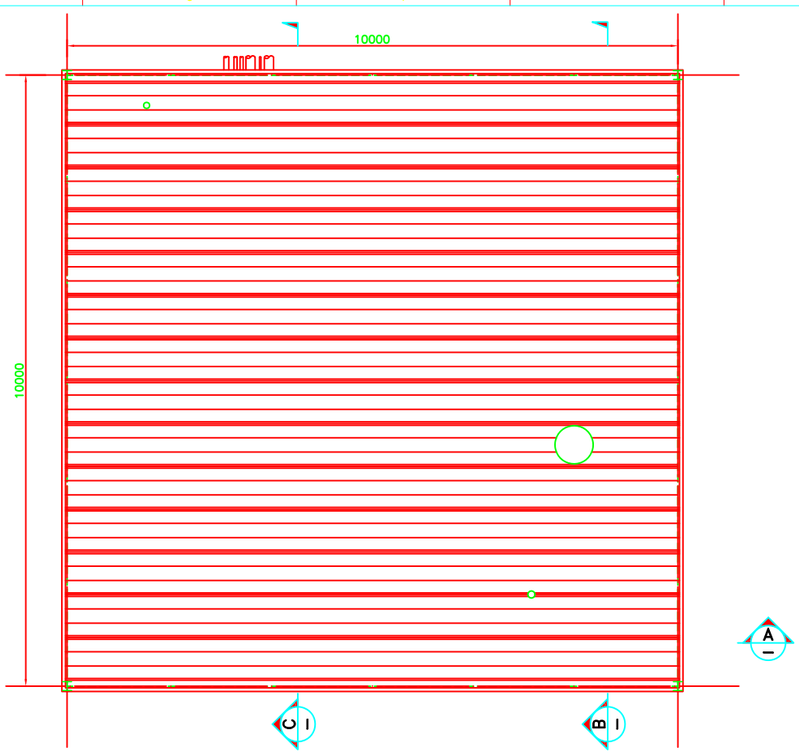
File Name: 67817_BIP_DSI_R02_RevA
Reference: Nearmap - www.nearmap.com (Capture Date: 20240921)

# Appendix A Construction Plans

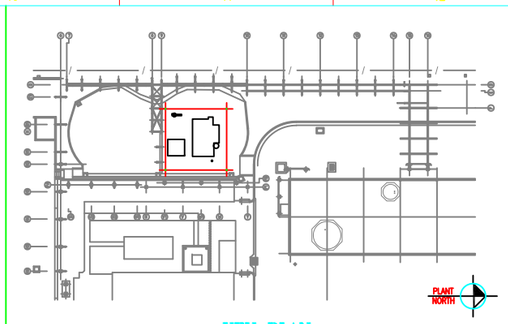
©JBS&G Australia Pty Ltd



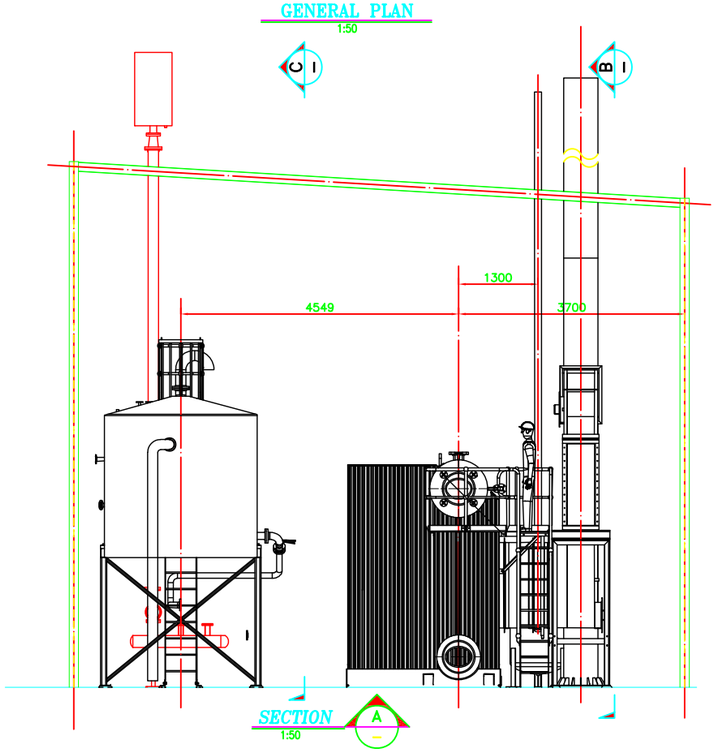

GENERAL PLAN
1:50



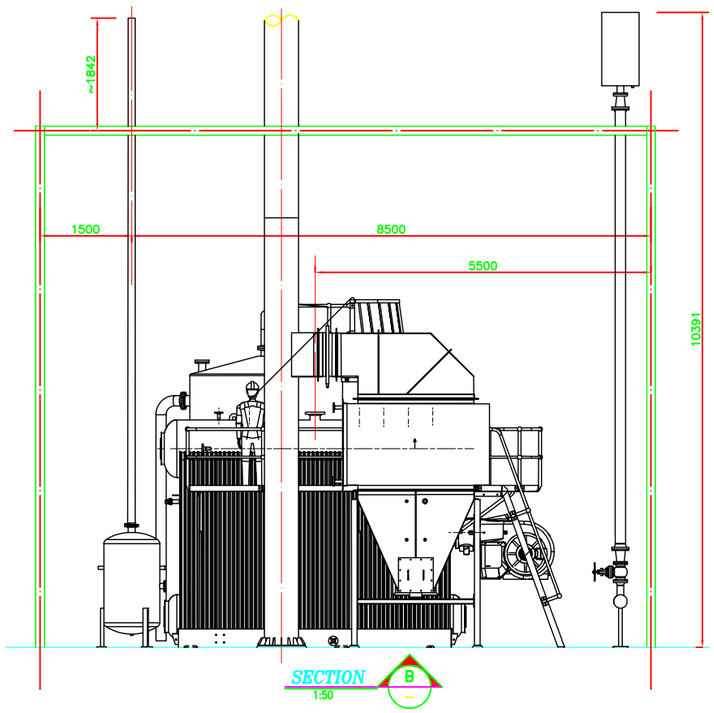

ROOF PLAN
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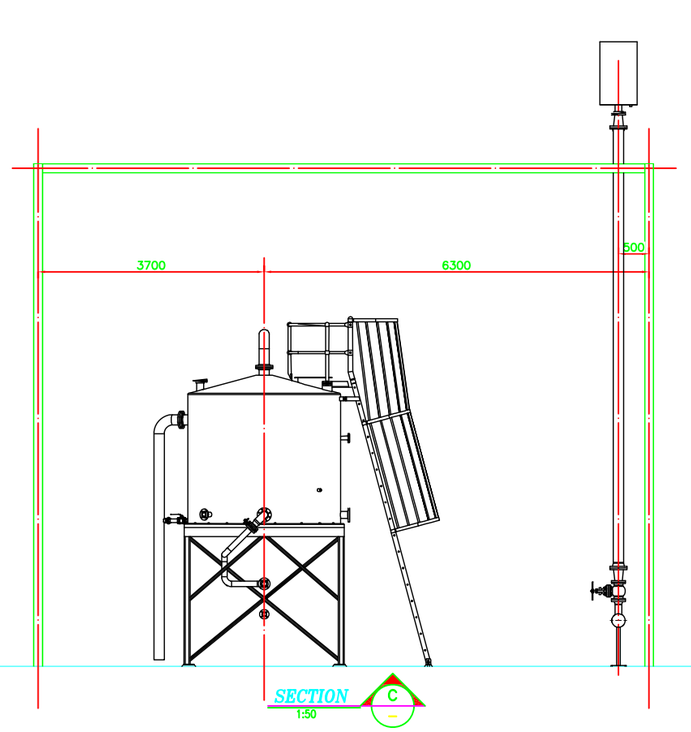

KEY PLAN




SECTION A
1:50




SECTION B
1:50




SECTION C
1:50

| REV | REVISIONS | DRAWN | CHECKED | AUTHORISED | DATE | REFERENCE DRAWINGS | DRG.No. |
|---|---|---|---|---|---|---|---|
| B | ISSUED FOR CLIENT REVIEW BASED ON UPDATED BOILER HOUSE ARRANGEMENT | S.KH. | A.N. | G.F. | 107/10/2025 | | |
| A | ISSUED FOR INFORMATION | S.KH. | A.N. | G.F. | 10/09/2025 | | |

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DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE

ALCM Asset LifeCycle Management Solutions

STATUS: PRELIMINARY

| INTER-DISCIPLINARY REVIEW | REV | DATE |
|---|---|---|
| PROCESS – | – | – – |
| MECHANICAL – | – | – – |
| CIVIL – | – | – – |
| ELECTRICAL – | – | – – |
| CONTROL – | – | – – |
| PROJECT – | – | – – |
| CONSTRUCTION – | – | – – |

CLIENT/VENDOR Dwg No.

| | | | |
|---|---|---|---|
| DRAWN: S.KH. | DATE 10/09/2025 | CLIENT | IXOM |
| DESIGNED: S.KH. | DATE 10/09/2025 | SITE | BOTANY |
| CHECKED: A.N. | DATE 10/09/2025 | PLANT | CHLORINE |
| PASSED: G.F. | DATE – | SCALE | 1:50 |
| AUTHORISED: – – | DATE – | | |

IXOM

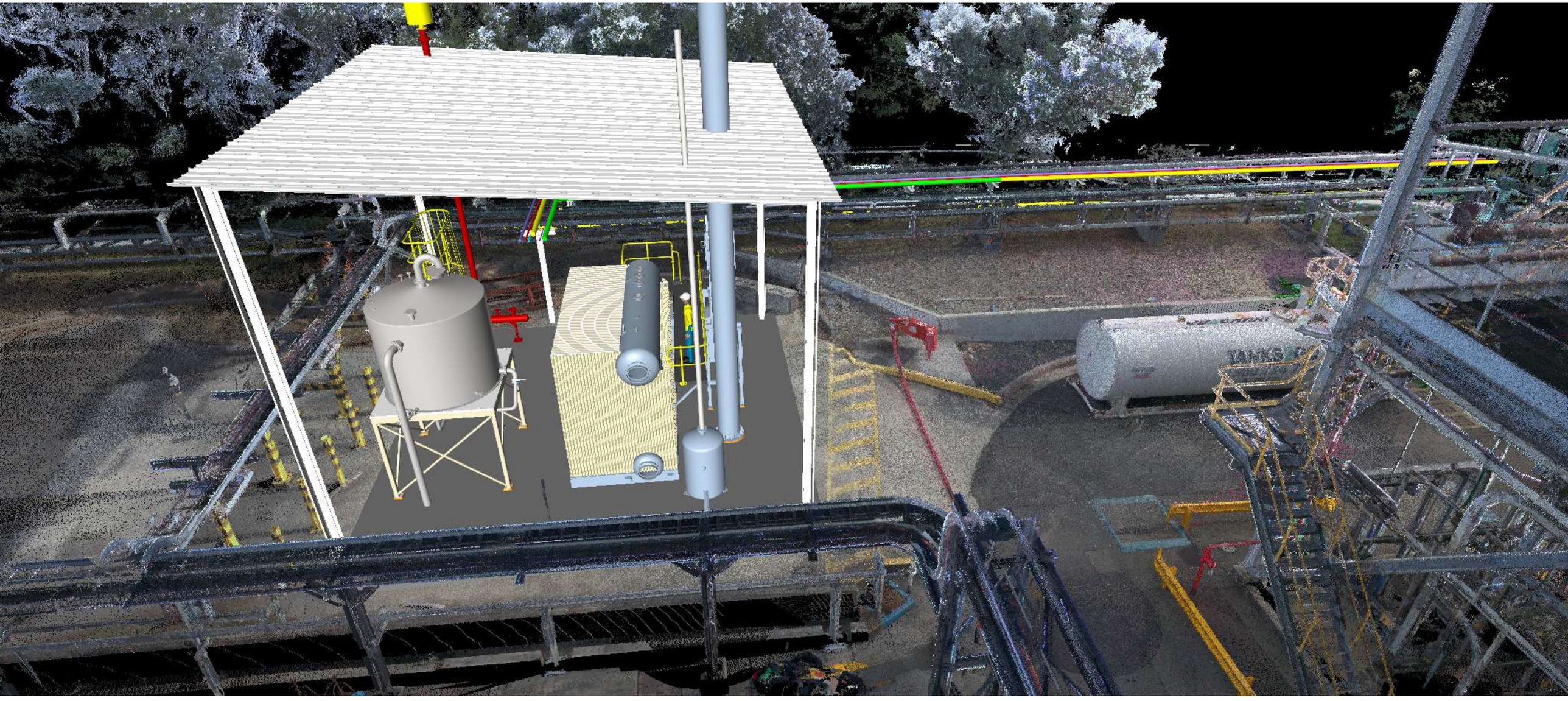
Botany Australia

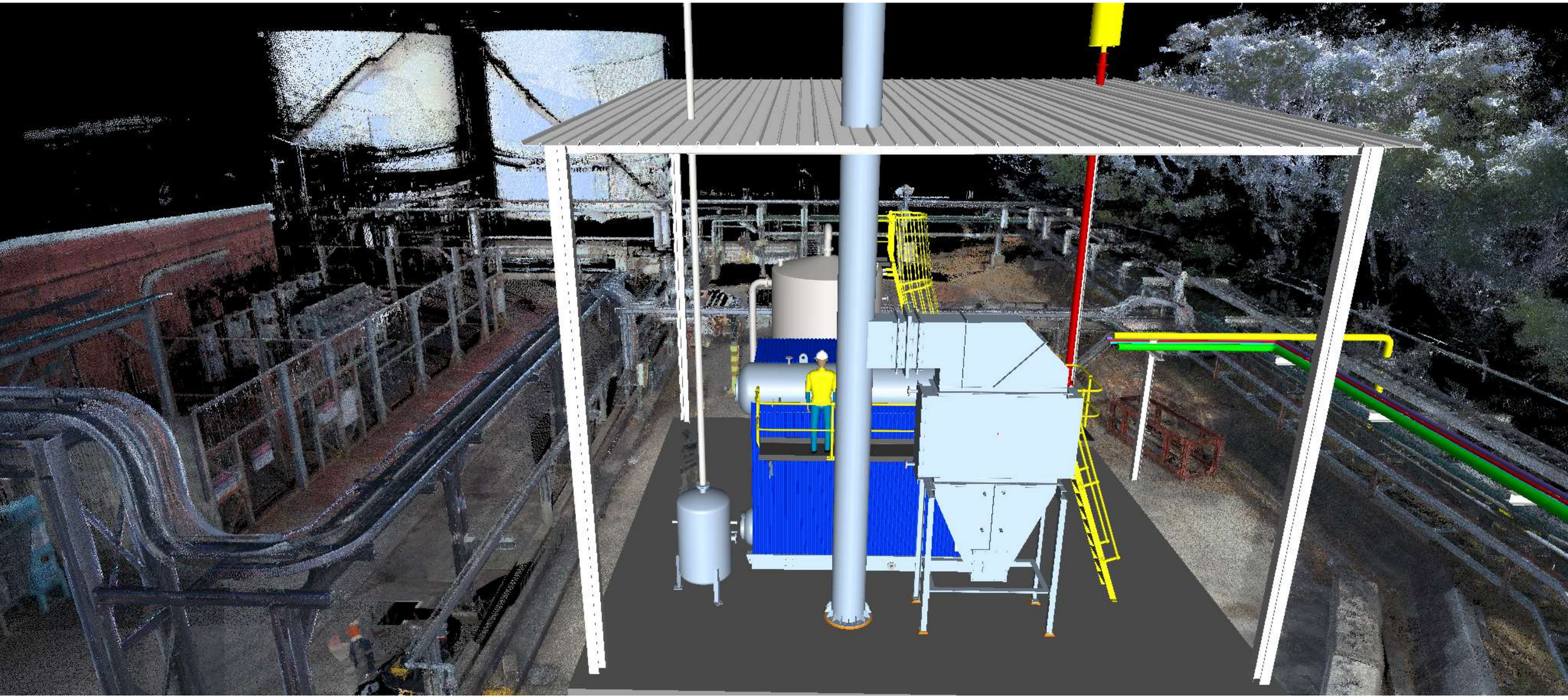
IXOM OPERATION PTY LTD

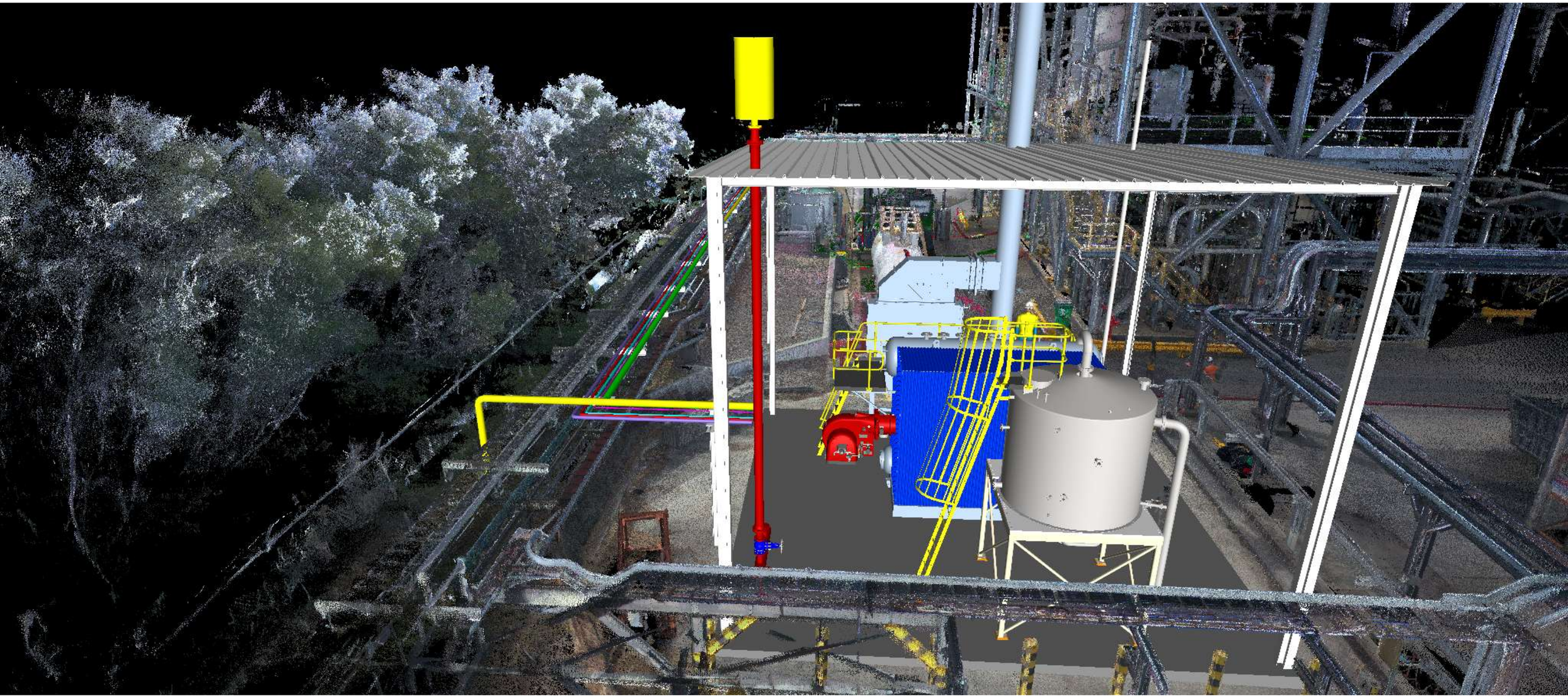
BOTANY BOILER HOUSE PROJECT

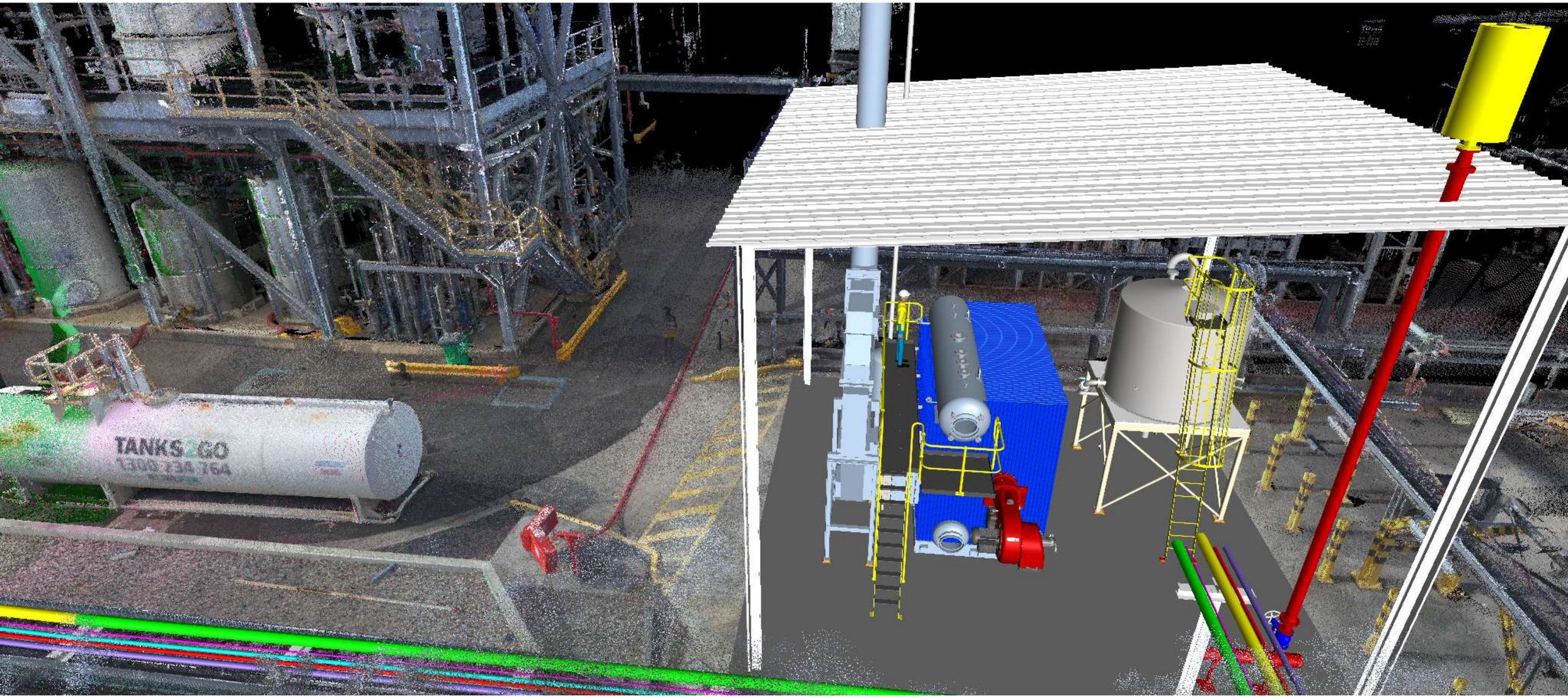
BOILER HOUSE PLAN & SECTIONS

| SHEET SIZE | DRAWING No. | REV |
|---|---|---|
| A1 | B201-10-01-0002 | B |








TANKS2GO

# Appendix B Environmental Procedures

| Dust and Airborne Hazard Control | SWMP01 |
|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**) |
| Frequency: | Continuous |
| Objective: | To minimise dust emissions from earthworks and construction works |

**Procedure**

All operations on site are to be conducted so that concentrations of dust and other hazardous substances satisfy those stipulated in NSW EPA published and endorsed guidelines. These guidelines include:

- NEPC (1998) 'National Environment Protection Measure for Ambient Air Quality' and
- Environmental criteria provided to NSW DEC (August 2005) 'Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales'.

Notwithstanding the applicability of the published and endorsed guidance from the NSW EPA as nominated above, during any future ground disturbance works which may include exposure of potentially impacted material, emissions require to be minimised to the extent that no visible airborne dust is present at the works area boundaries. Controls for each potential dust generating activity that will occur during the site construction shall be implemented:

- During ground disturbance works, all care must be taken to minimise the areas of exposed soil;
- Where visible dust is observed during excavation works, a fine water spray will be utilised to control the dust;
- Dust/shade cloth will be installed on all temporary construction fencing at the extent of the works area to minimise the potential for transport of dust beyond the works area boundaries; and
- Dust controls must be implemented around subsequent stockpiled soils. Any dust controls (i.e. mist spray, stockpile covers) will require regular inspection and maintenance to ensure effective operation until stockpiled material is returned to the excavations or removed from site.

Re-surfacing of reinstated excavations will be undertaken as soon as practically possible to minimise the volume of materials stockpiled.

Stockpiling

In the event that stockpiling of excavated material is necessary during works, the following should be implemented:

- Minimisation of stockpile heights and batters to reduce exposed faces;
- Minimising stockpiles with high proportion of fines at the stockpile surface;
- Stockpiles to be placed nearest to the settlement pond where discharge will be controlled from surrounding environment;
- No stockpiles to be placed on footpaths or nature strips;
- Stockpiles will be covered with an impervious barrier where there are unfavourable weather conditions, or risk of significant uncontrolled dust emissions / leachate runoff; and
- Consideration of regular dampening stockpiles with a fine water spray or covering with appropriate geotextile material during unfavourable weather conditions.

Trucks

Where excavated material is subject to off-site disposal, all loads will be covered on the completion of loading and prior to vehicle movement off site. Truck movements will be kept to a minimum and trucks will be required to use sealed (paved) surfaces whenever possible to minimise dust generation. To minimise the potential dust emissions to occur due to truck movements in and out of the site, the following shall be implemented:

- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable);
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit; and
- Access gates to be located at least 10m from adjoining properties/ receptors where possible.

Monitoring

Air monitoring shall further require to be undertaken during all works that have a potential to generate air emissions to

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ensure the appropriateness of the controls. The monitoring is intended to be used as a tool to instruct the level of air quality controls that are required to be applied to the site works. The following monitoring works shall be required to be undertaken:

- Daily on-site and off-site inspections to monitor dust. This should include regular dust soiling checks of surfaces such as street furniture, cars and windows in proximity of the site;
- Undertake real-time monitoring by use of a portable real-time aerosol monitor that uses a laser photometer to measure mass concentration of airborne particles (or equivalent) to determine site attributable levels of particulates (assessed as PM10) at representative locations on the site boundary. A works criterion of 50 $\mu g/m^3$ shall be adopted for the assessment of emissions as assessed at the site boundary (minimum one minute averaging time). Undertake assessment of results and identify any requirements for increased dust / air emission controls to works on the basis of potential exceedances;
- Undertake real time monitoring by the use of a photo-ionisation detector (PID) as provided with an 11.7 eV lamp at the site boundary to determine the potential for unacceptable vapour releases during site works where hydrocarbon impacted soils are being excavated / handled / stockpiled etc. Assessment of PID levels to an action criterion of five ppm (averaged over at least one minutes) as a basis to identify any requirements for increased vapour emission controls to works; and
- Record all inspection and monitoring results and make available to relevant authorities.

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| Handling of Contaminated Soils | | SWMP02 |
|---|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**) | |
| Frequency: | As required for excavations in potential asbestos affected soils | |
| Objective: | To minimise exposure of human and ecological receptors to impacted environmental media | |

**Procedure**

If asbestos is identified, the Asbestos Management Plan (if one is already available for the site) will be consulted. This may involve

- Removal works to be undertaken by a suitable qualified removalist;
- Notification to SafeWork five days before removal commences, and notification to neighbouring properties;
- Appropriate use of signage around the site (affected areas, stockpiled areas);
- If asbestos waste is to be disposed, appropriate waste classification and material tracking will be required; and
- If soil with ACM remains onsite, appropriate provisions will be included in an AMP to control future site access to soil.

The Responsible Person shall provide minimum advise to any persons who may be working in asbestos areas:

- Notification to ground disturbance contractors of affected areas and of requirements in the AMP;
- Workers will have correct PPE (i.e. P2 respirators, gloves, disposable coveralls, overboot covers); and
- Implementation of dust, noise, air and sediment control / monitoring procedures (as necessary).

All workers must have undertaken Occupational Health and Induction Training as defined in Part 8.2 of the *Work Health and Safety Regulation 2011.* Minimum PPE should be worn, and appropriate Safe Work Method Statements (or other required health and safety documentation) should be made available, reviewed and signed prior to works commencing.

In addition to stockpiling requirements outlined in SWMP01, the following additional requirements are included:

Requirements during other general handling of potentially contaminated environmental media

- Where materials are disposed to landfill, an appropriate waste classification will first be undertaken and all documents retained by the Responsible Person; and
- An unexpected finds protocol is available and will guide all stages of site works (**Appendix C**).

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| Reinstatement of Excavation | | SWMP03 |
|---|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**) | |
| Frequency: | As required for reinstatement of the site prior to occupation | |
| Objective: | To minimise exposure of human and ecological receptors to impacted environmental media | |

**Procedure**

It is noted that, in addition to site contamination management requirements, the Responsible Person may require implementation of procedures to ensure the suitable compaction of backfilled areas.

No waste will be received at the site and only virgin excavated natural material (VENM), excavated natural material (ENM) or materials covered by an NSW EPA exemption is to be imported to the site for use in reinstatement activities.

Reinstatement of excavations will be undertaken in accordance with:

- Imported VENM or suitable material will be placed above backfilled soils to form the finished site surface;
- Appropriate dust controls will be undertaken during backfilling (i.e. via water cart);
- No excavations will extend within proximity to regional groundwater. No preferential pathways will be formed during excavation works; and
- Excavations will be dewatered if required (though not anticipated), and the liquid disposed appropriately with all documentation or discharged into the site settlement pond established for on-site treatment.

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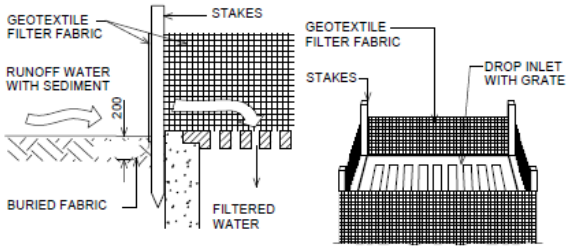
| Sediment / Leachate Control | | SWMP04 |
|---|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**) | |
| Frequency: | Disturbance of soils or storage of exposed soils | |
| Objective: | To control potential sediment generation and migration to nearby receptors | |

**Procedure**

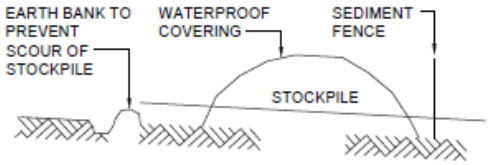
Equipment

The following general equipment may be required to allow construction of sediment control devices: gravel filter socks, sediment fencing, stakes / star pickets; and/or plastic or other impervious materials to cover stockpiles.

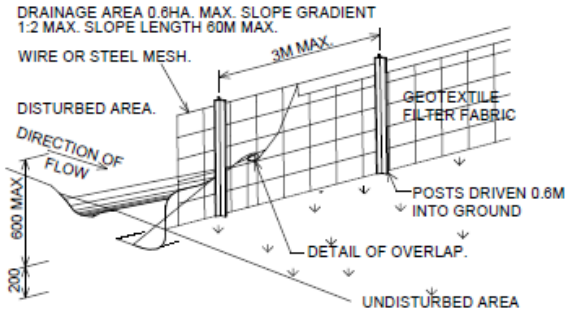
Indicative sediment controls, sediment fences and stockpile controls:




SEDIMENT TRAP TO STORMWATER SUMP
NTS
(WHERE APPLICABLE)




BUILDING MATERIAL STOCKPILES
NTS




SEDIMENT FENCE
NTS

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| Visual Impacts | | SWMP05 |
|---|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**) | |
| Frequency: | Continuous | |
| Objective: | To minimise visual impacts of works to surrounding areas | |

**Procedure**

Visual impacts of the works shall be minimised where possible:

- Covering of stockpiles with impervious barrier (as required) and ensuring stockpiles are of a suitable size/height;
- Use of neutral or natural colour plastics (i.e. green / black / beige) for covering stockpiles of soils (if required during works); and
- Selection of natural colours (i.e. green or brown) for site amenity structures.

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| Emergency Response | | SWMP06 |
|---|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**). Environmental consultant as available to project. | |
| Frequency: | Where uncontrolled releases of potential environmental pollutants occur | |
| Objective: | To minimise environmental impacts of all incidents on site | |

**Procedure**

Environmental incidents on the site which would require potential emergency response would relate to a spill of hazardous liquid or material or release of asbestos fibres without controls.

For spills on land, the following shall be undertaken:

- Identify source of spill and stop when / if safe to do so;
- Identify area of spill and clear area of all personnel;
- Notify council (within 24 hour), and environmental consultant of spill;
- Construct earthen bunding using earth moving equipment available on site to contain spill;
- Environmental consultant to coordinate the pumping of liquid waste out of the containment structure and appropriate lawful disposal;
- If solid waste, environmental consultant will coordinate the excavation and removal of the hazardous material to a secure area; and
- Assess soils in vicinity of environmental incident for contamination and conduct remediation works where contamination has occurred.

For spills in proximity of the stormwater outlets from the site, the following shall be undertaken:

- Identify source of spill and stop when / if safe to do so;
- Identify circumference of spill and clear area of all personnel (where onshore area present);
- Notify Council and environmental consultant of spill with 24 hours;
- Environmental consultant to instruct containment of area of spill in water by placement of temporary absorbent beams (available on site) to create 'coffer dam' around stormwater outlet to prevent discharge of spilt material;
- Environmental consultant to coordinate a liquid waste tanker to be bought onto site and pump directly from water contained within the impacted area until visual evidence of spill removed; and
- Subject to validation results, remove coffer dam.

All emergency responses should be followed up with Incident Reporting and Review procedures (see subsequent sections).

Emergency contact details will be made available to all workers, displayed clearly in the site office, form part of daily induction and toolbox talks, and be available in project health and safety documentation.

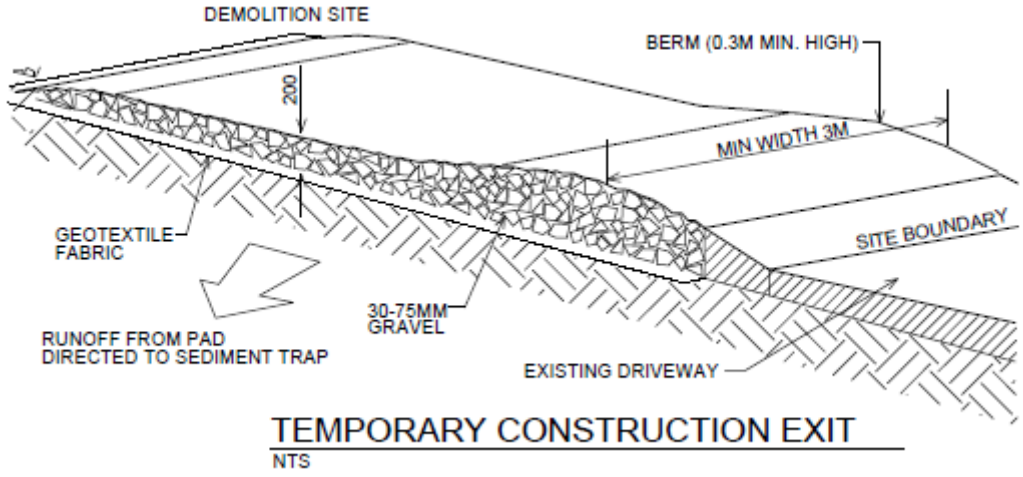
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| Traffic Management | | SWMP07 |
|---|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**) | |
| Frequency: | Heavy vehicle movements as generated by site works | |
| Objective: | To minimise impacts on local road network | |

**Procedure**

Heavy vehicle entry to and from site to occur via the single front entry path. Existing site pavement will be maintained to allow easy vehicle access to all required parts of the site. Further, sediment will be removed from trucks prior to exiting the site, and integrity checks will be undertaken along the access road daily.

Where this is a potential for sediment / site materials to be tracked in and out of the site (by pavement removal, requirement of traffic to move in unpaved areas etc) then a temporary construction exit will be constructed. An indicative plan for a temporary construction exit is provided below.




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| Decontamination of Heavy Equipment | | SWMP08 |
|---|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**) | |
| Frequency: | As required and subject to daily inspections | |
| Objective: | To ensure that contamination does not leave the site, and minimise cross-contamination | |

**Procedure**

Heavy earthmoving equipment will potentially come in contact with contaminated soils (including asbestos) while engaged on the site. Prior to heavy equipment moving off site, or conducting operations in validated areas (i.e. non contaminated areas) of the site, decontamination will be required to be undertaken.

- Heavy equipment decontamination shall include use of the following equipment
- Rinse solutions selected to remove contaminants and contaminated wash solutions;
- Pressurised sprayers for washing and rinsing, particularly hard to reach areas;
- Long handled brushes, rods and shovels for dislodging contaminants and contaminated soil caught in tyres and the undersides of vehicles and equipment;
- Containers to hold contaminants and contaminated soils removed from tyres and the undersides of vehicles and equipment;
- Wash and rinse buckets for use in decontamination of operator areas inside vehicles and equipment; and
- Containers for storage and disposal of contaminated wash and rinse solutions, damaged or heavily contaminated parts, and equipment to be discarded.

Subsequent to heavy equipment being decontaminated for transport off site, or use on validated areas of the site, it shall be inspected by the Responsible Person's Health and Safety Representative provided to the site works. Heavy equipment shall be moved out of the Decontaminated Area subject to authorisation of the Health and Safety Representative that decontamination is complete.

Decontamination shall be appropriate for the extent of potential contact with contaminated materials on the site. It is noted that tippers engaged on the site only to be loaded with contaminated materials will have sufficiently less potential contamination than earthmoving machinery used to excavate or stockpile contaminated materials, and decontamination need not be as comprehensive as described. Further vehicles accessing the site during the building works, subsequent to the completion of excavation works are unlikely to contact impacted soils / materials.

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| Training | SWMP09 |
|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**) |
| Frequency: | As required |
| Objective: | Suitably trained personnel will be available to implement the requirements of the SWMP |

**Procedure**

The Responsible Person, or nominated responsible party, shall ensure that any personnel engaged in the implementation of nominated tasks for which the Responsible Person is responsible within the EMP have been provided with adequate training to manage the site contamination conditions which may be encountered during site ground disturbance activities

Asbestos contaminated soil necessitating management are required to be undertaken in accordance with *How to Manage and Control Asbestos in the Workplace: Code of Practice 2016*, Safe Work Australia.

The Responsible Person shall maintain records of personnel engaged in the nominated tasks and their relevant training/qualifications for the period of three years in accordance with **SWMP09**.

| Non-Compliances with SWMP | SWMP10 |
|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**) |
| Frequency: | As required |
| Objective: | To ensure the SWMP is implemented as intended. |

**Procedure**

Non-compliances with the intent and procedures of the SWMP may occur during the implementation of the SWMP. Such non-compliances may include events such as failure to maintain the integrity of permanently paved areas.

Where a non-compliance is identified by a responsible organisation, they shall inform the affected organisations of the non-compliance in writing. Where a non-compliance with the SWMP is identified by another organisation (in the activities of an alternate organisation), then they shall have the responsibility of informing the non-complying party in writing of the non-compliance. The non-complying party will be required to rectify the non-conformity as soon as possible, as per the requirements of the relevant procedure(s) where non-compliance has occurred.

The non-compliance shall be detailed as per the requirements of **SWMP11** Incident Reporting to record the incident and to inform relevant follow up / review actions.

Detail of the action taken to rectify the non-compliance shall be provided to each of the affected organisations in writing. Where a non-compliance cannot be rectified, then the SWMP will require to be reviewed as per the requirements of **SWMP12** EMP Review.

| Incident Reporting | SWMP11 |
|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**) |
| Frequency: | As required in response to environmental incidents and/or non-compliance with SWMP |
| Objective: | To ensure the EMP is implemented as intended. |

**Procedure**

The head contractor shall facilitate the completion of environmental incident forms for any environmental incident that occurs on the site. The responsible person, as nominated by the head contractor, shall review all incident forms. The relevant council shall be notified of any incidents requiring emergency response within 24 hours of that incident.

The environmental incident form is provided as **Form 11-1**.

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| Incident Reporting | Form 11-1 |
|---|---|

## INCIDENT DESCRIPTION

Section 1 to be completed by the person reporting the incident.
INCIDENT CLASS (tick as appropriate)
Fatal ◯ Medical Treatment Case ◯ Near Miss ◯
Lost Time Injury ◯ First Aid ◯ Property Incident ◯
Restricted Work Case ◯ Occupational Illness ◯ Environmental Incident ◯
Date of Incident: _____ Time of Incident: _____
Name of Employee(s) involved / affected: _____
Location: _____
Nature of Incident: _____
(including description of situation prior to incident, actual incident and actions taken for immediate response / treatment of the incident)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

FURTHER INFORMATION REQUIRED FOR INCIDENT DETAILS
Where applicable attach Police/Statutory Authority Reports, Medical Certificates, Witness Statements, Photos etc
PERSON REPORTING INCIDENT (if not nominated above)
Name: _____ Incident report date: _____
Employment / Job Role: _____ Signature: _____
INJURIES (where applicable):
Name: _____ Occupation and company: _____
Injury (kind and severity): _____
Treatment (ie How?: first aid, hospital, sent home, other): _____
WITNESSES

| Name | Area/Company | Contact Details |
|---|---|---|
| _____ | _____ | |
| _____ | _____ | |
| _____ | _____ | |

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INCIDENT EVALUATION

Section 2 to be completed by the Head contractor and relevant personnel concerned with the incident.
Cause(s) and Contributing Factor(s):
List those factors that caused / contributed to the incident. Controls which could be used:
Consider: Hierarchy of Controls (elimination, substitution …..etc.). List all that are appropriate.

What was the task being performed at the time of the incident? _____
Was the person trained / inducted? _____
Was there adequate Supervision? _____
Was there a risk assessment for the task, were controls implemented? _____
_____

ACTION PLAN (RECTIFICATION / PREVENT RECURRENCE)

Head contractor to assess and decide on appropriate actions in response to the incident. Upon completion of recommended action(s), the Head contractor is to sign off as confirmation. Completion of the actions shall also act as the close out of the report.

| Recommended Action | Target Date | Action By | Task Completed (Initial and Date) |
|---|---|---|---|
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |

Agreed Actions Complete and Incident Closed Out
Authorised by Head contractor: _____ (Signature and date)

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ADMINISTRATION

Improvement Register is to be updated by the Head contractor, ensuring confidentiality of persons involved in the incident.
Incident has been added to Improvement Register: # _____
WorkCover or Insurer Notification required: _____ Completed Date: _____

Circulation register to be completed upon receiving and reviewing this report.
CIRCULATION

Name: _____ Signature: _____
Date: _____
(Person Reporting)

Name: _____ Signature: _____
Date: _____
(Head contractor)

Name: _____ Signature: _____
Date: _____
(Client – if applicable)

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| Record Keeping | | SWMP12 |
|---|---|---|
| Responsibility: | The Responsible Person (refer to **Section 1.4**) | |
| Frequency: | As required | |
| Objective: | Records of the implementation of the SWMP require to be retained. | |

**Procedure**

The Responsible Person shall be responsible for the maintenance of all documents relating to the implementation of the SWMP. This shall include any additional assessment undertaken, registers for the maintenance of the SWMP (site inspection forms, works approval checklists, revised plans, *etc.*) and any relevant correspondence between the Responsible Person, Contractors, environmental consultant and/or any other party.

All records shall be retained by the Responsible Person throughout the time of implementation of the SWMP. In the event that the role of Responsible Person is transferred from one organisation to another, control of all relevant (historical and current) documents will be transferred for safe keeping to the current Responsible Person.

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| SWMP Review | | SWMP13 |
|---|---|---|
| Responsibility: | Responsible Person / Site Owner | |
| Frequency: | As required in response to revisions to supporting documents or in response to non-compliances with SWMP | |
| Objective: | The SWMP requires review to ensure its continued appropriateness to be used on the site | |

**Procedure**

A review of the SWMP shall be undertaken yearly by an appropriately qualified contractor/consultant in conjunction with the Responsible Person in response to a non-compliance with the EMP. This review shall consider:

- Any non-compliances with the SWMP that have been unable to be resolved;
- Where an incident is reported as occurring under the control of EMP as per **SWMP11** Incident Reporting;
- Practicalities and efficiencies of management measures and whether there are more effective ways to improve environmental compliance;
- Any changes in state or national environmental protection legislation or guidelines that impact any part of the EMP; or
- Any proposed changes in land-use of the site or adjoining sites which may impact upon exposure pathways.

In the event that head contractor (**Section 1.4**) cease to be recognised as the Responsible Person, a complete review of the SWMP document and compliance measures will be necessary to identify suitable replacement SWMP compliance mechanisms.

In addition, where a review identifies items which are required to be modified, or added to the SWMP, then a revision of the SWMP shall be prepared by a suitably qualified person.

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# Appendix C Contingency Plan

A review has been undertaken of potential contingency scenarios that may be identified during the construction works. The following scenarios have been identified:

- Unexpected finds, particularly inclusive of significantly contaminated material (e.g. elemental mercury) or pits/sumps that may have additionally been used to historically dispose of hazardous substances; and/or
- Emissions / pollution complaints during storage and handling of high-level chlorinated hydrocarbon / mercury / asbestos contaminated soils.

The proposed response to each contingency scenario is detailed following.

**Unexpected Finds**

The possibility exists for hazards that have not been identified to date to be present within fill materials or underlying pavements on the site. The nature of hazards which may be present, and which may be discovered at the site are generally detectable through visual or olfactory means, for example:

- Excessive quantities of construction/demolition waste that represents an aesthetics issue beyond that reported to date (visible); and/or
- Hydrocarbon (petroleum/chlorinated)/chemical impacted materials beyond that reported to date, including NAPL; and/or
- Drums, waste pits (visible); and/or
- Oily Ash and/or oily slag contaminated soils/fill materials (visible/odorous); and/or
- Tarry like impacted soil/fill material (visible/odorous).

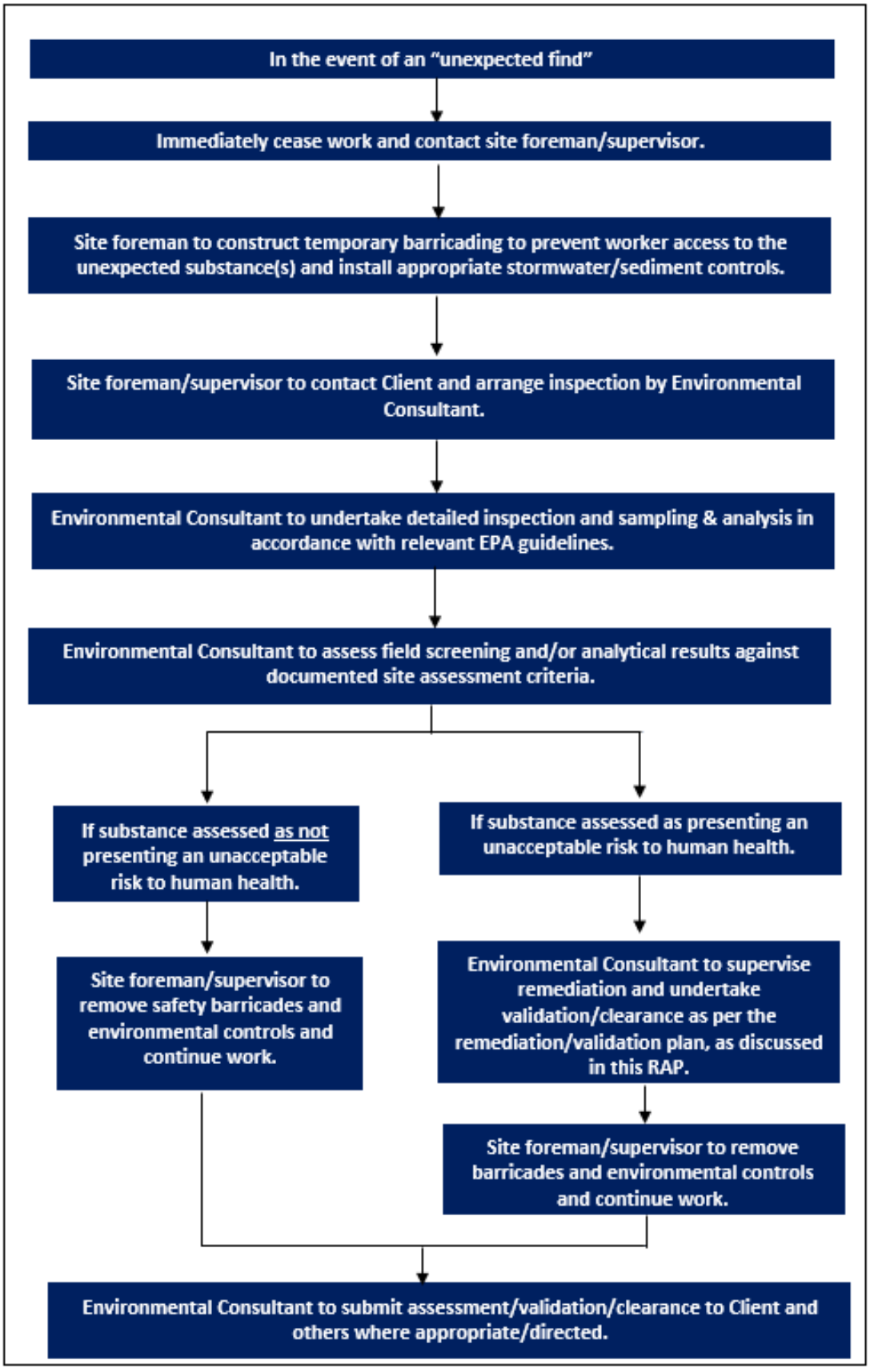
As a precautionary measure to ensure the protection of the workforce and surrounding community, should any of the abovementioned substances (or any other unexpected potentially hazardous substance) be identified, the procedure summarised in **Flow Chart C1** is to be followed.

An enlarged version of the Unexpected Finds Protocol, suitable for use on the site, should be posted in the Site Office and referred to during the site-specific induction by the Principal Contractor.

The sampling strategy for each “unexpected find” shall be designed by the environmental consultant. The strategy will, however, be aimed at determining the nature of the substance – that is, is it hazardous and, if so, is it at concentrations which pose an unacceptable risk to human health or the environment.

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## Flow Chart C1 Unexpected Finds Protocol




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**Emissions / Pollution**

Due to the nature of the activities and type of contaminants identified within the site, there is a potential for complaints to be received from members of the public and/or occupants of surrounding properties relating to environmental emissions associated with excavation works, including:

- Odour emissions arising from handling of malodorous soil;
- Noise and vibration arising from construction excavations or other works required for construction; and/or
- Dust emissions arising from excavation, material handling and placement.

Monitoring of potential environmental emissions from the site shall be undertaken during the development works as detailed in the environmental procedures (refer to **Appendix B**) and appropriate actions taken to further control emissions following receipt of a complaint such as:

- Increased application of odour screening/masking chemicals on odorous materials;
- Disturbance of soils during meteorologically favourable periods only; and/or
- Covering of impacted soils; and/or
- Implementation of alternate construction methods.

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