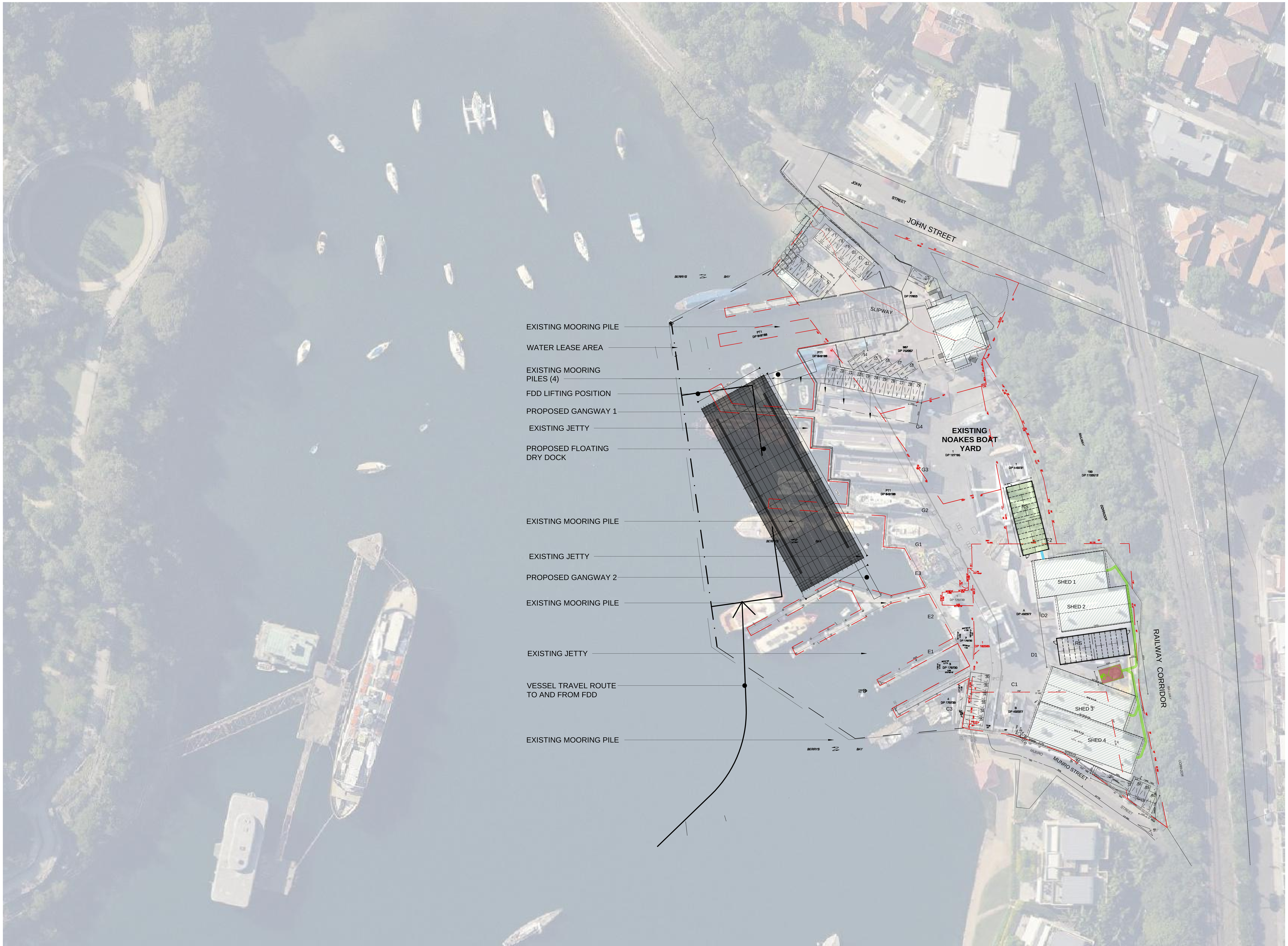

ACCESSIBLE SITE BOUNDARY AT GROUND LEVEL

PROPOSED FIRE SERVICES PIPE WORK REFER TO (ENG'S DETAIL /PLANS)

BOUNDARY LINE

(a) RS WHEN IN USE

(b) PIPE CONNECTING RS TO SHED 1

(c) CFS SERVICING RS & SHEDS 1,3&4

CFS CARBON FILTRATION SYSTEM ON 200 PRE-CAST CONCRETE RAFT FOUNDATION 4000x6300mm

RS RELOCATABLE SHED

SUITE 3.01, LEVEL 3 80 MOUNT STREET
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NOMINATED ARCHITECTS:
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ISSUE	DATE	AMENDMENTS
07	22.04.27	PLAN ISSUE

CLIENT
NOAKES GROUP
6 JOHN STREET, MCMAHONS POINT NSW 2060

PROJECT
NOAKES SHIPYARD
6 JOHN STREET, MCMAHONS POINT NSW 2060

TITLE
GENERAL SITE PLAN
FULL SITE

SCALE 1:500 @ A1
APPROVED
DRAWN JC HJ
CHECKED
DATE APRIL 2022
STATUS DA

PROJECT NUMBER 20051
DRAWING NUMBER A004
ISSUE 07

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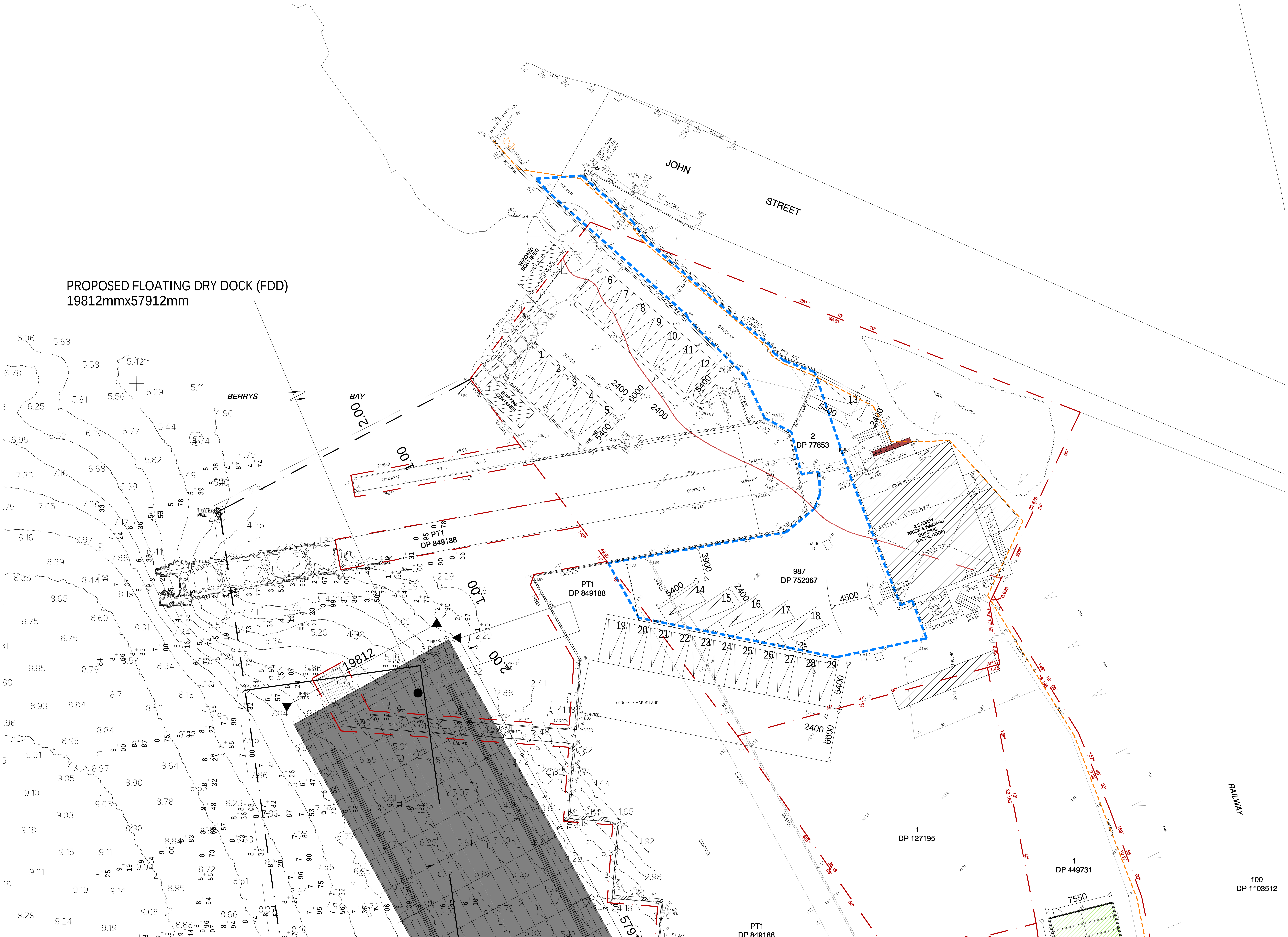

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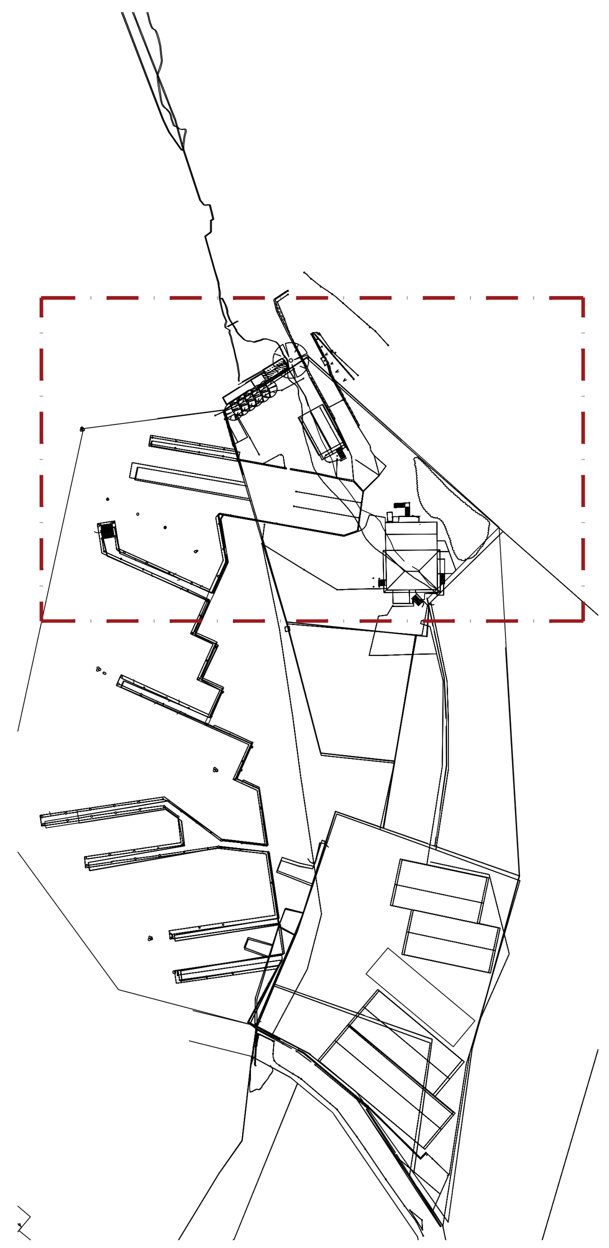

ACCESSIBLE SITE BOUNDARY AT GROUND LEVEL

PROPOSED FIRE SERVICES PIPE WORK REFER TO (ENG'S DETAIL /PLANS)

BOUNDARY LINE

(a) RS WHEN IN USE

(b) PIPE CONNECTING RS TO SHED 1

(c) CFS SERVICING RS & SHEDS 1,3&4

CFS CARBON FILTRATION SYSTEM ON 200 PRE-CAST CONCRETE RAFT FOUNDATION 4000x6300mm

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PROJECT
NOAKES SHIPYARD
6 JOHN STREET, MCMAHONS POINT NSW 2060

TITLE
GENERAL SITE PLAN SHEET_01

SCALE 1:200 @ A1
APPROVED DRAWN CHECKED JC HJ
DATE APRIL 2022
STATUS DA

PROJECT NUMBER 20051
DRAWING NUMBER A005
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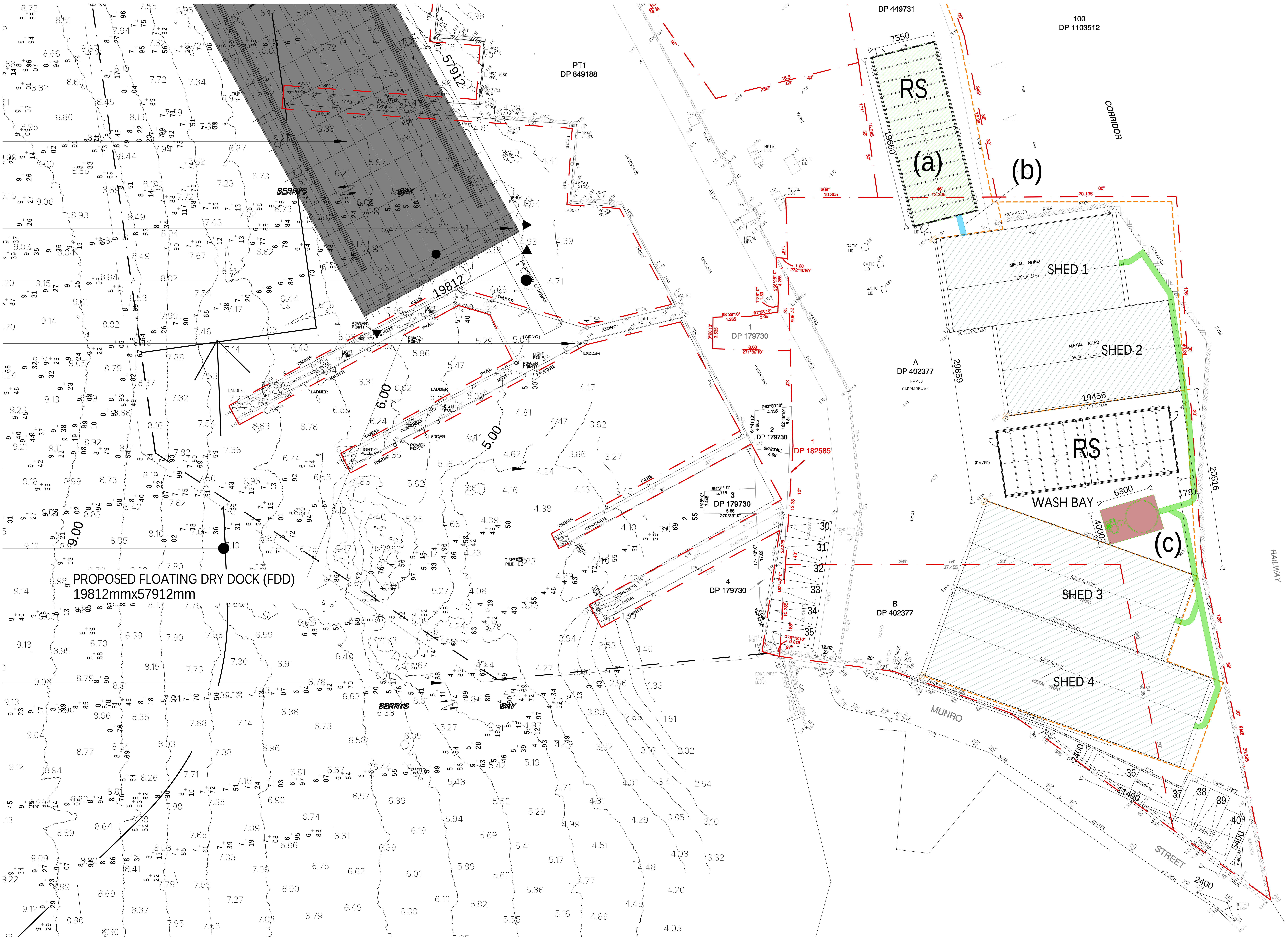

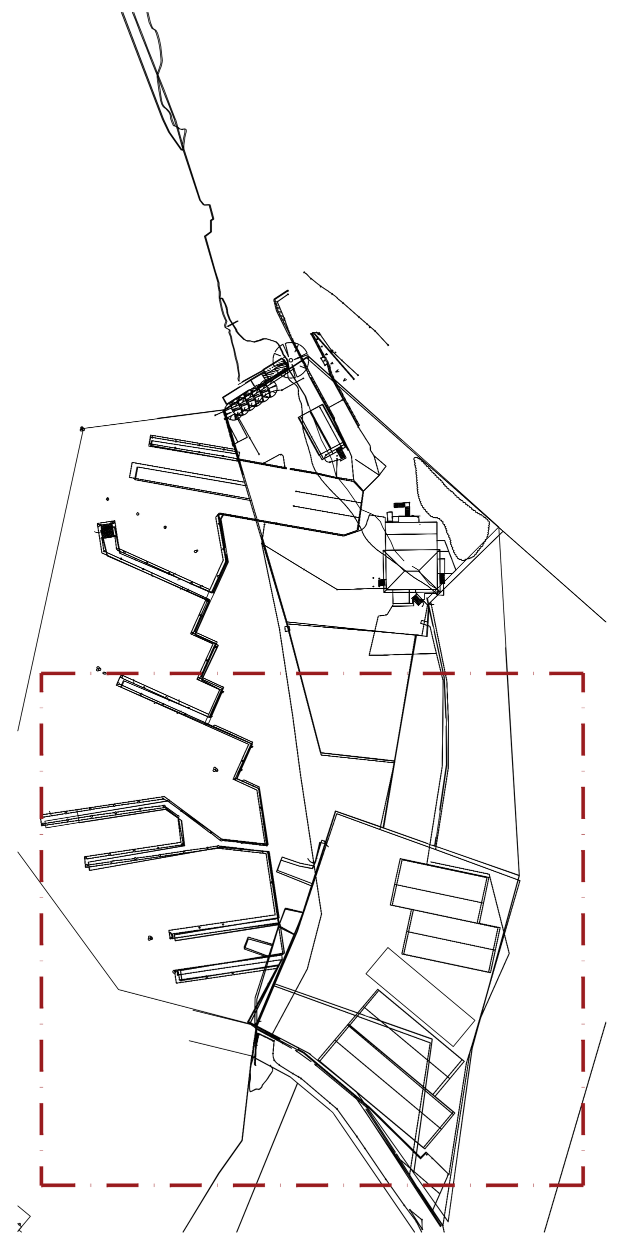

LEGEND

ACCESSIBLE SITE BOUNDARY AT GROUND LEVEL

PROPOSED FIRE SERVICES PIPE WORK REFER TO (ENG'S DETAIL /PLANS)

BOUNDARY LINE

(a) RS WHEN IN USE

(b) PIPE CONNECTING RS TO SHED 1

(c) CFS SERVICING RS & SHEDS 1,3&4

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ISSUE	DATE	AMENDMENTS
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CLIENT: NOAKES GROUP
6 JOHN STREET, MCMAHONS POINT NSW 2060

PROJECT: NOAKES SHIPYARD
6 JOHN STREET, MCMAHONS POINT NSW 2060

TITLE: GENERAL SITE PLAN SHEET_02

SCALE: 1:200 @ A1
APPROVED
DRAWN: JC HJ
CHECKED
DATE: APRIL 2022
STATUS: DA

PROJECT NUMBER: 20051
DRAWING NUMBER: A006
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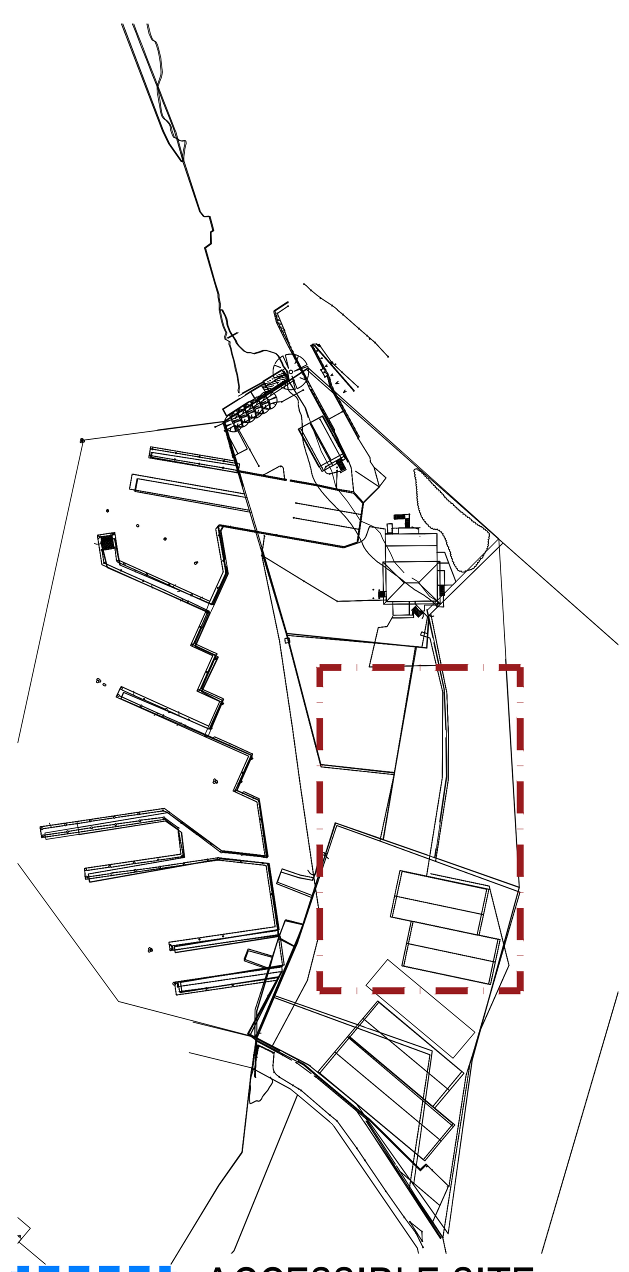
LEGEND



ACCESSIBLE SITE BOUNDARY AT GROUND LEVEL

PROPOSED FIRE SERVICES PIPE WORK REFER TO (ENG'S DETAIL /PLANS)

BOUNDARY LINE

(a) RS WHEN IN USE

(b) PIPE CONNECTING RS TO SHED 1

(c) CFS SERVICING RS & SHEDS 1,3&4

CFS CARBON FILTRATION SYSTEM ON 200 PRE-CAST CONCRETE RAFT FOUNDATION 4000x6300mm

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NOAKES GROUP
6 JOHN STREET, MCMAHONS POINT NSW 2060

PROJECT
NOAKES SHIPYARD
6 JOHN STREET, MCMAHONS POINT NSW 2060

TITLE
SITE PLAN
SHEET_01

SCALE 1:100 @ A1 / 1:200 @ A3
APPROVED
DRAWN JC HJ
CHECKED
DATE APRIL 2022
STATUS DA

PROJECT NUMBER 20051
DRAWING NUMBER A010
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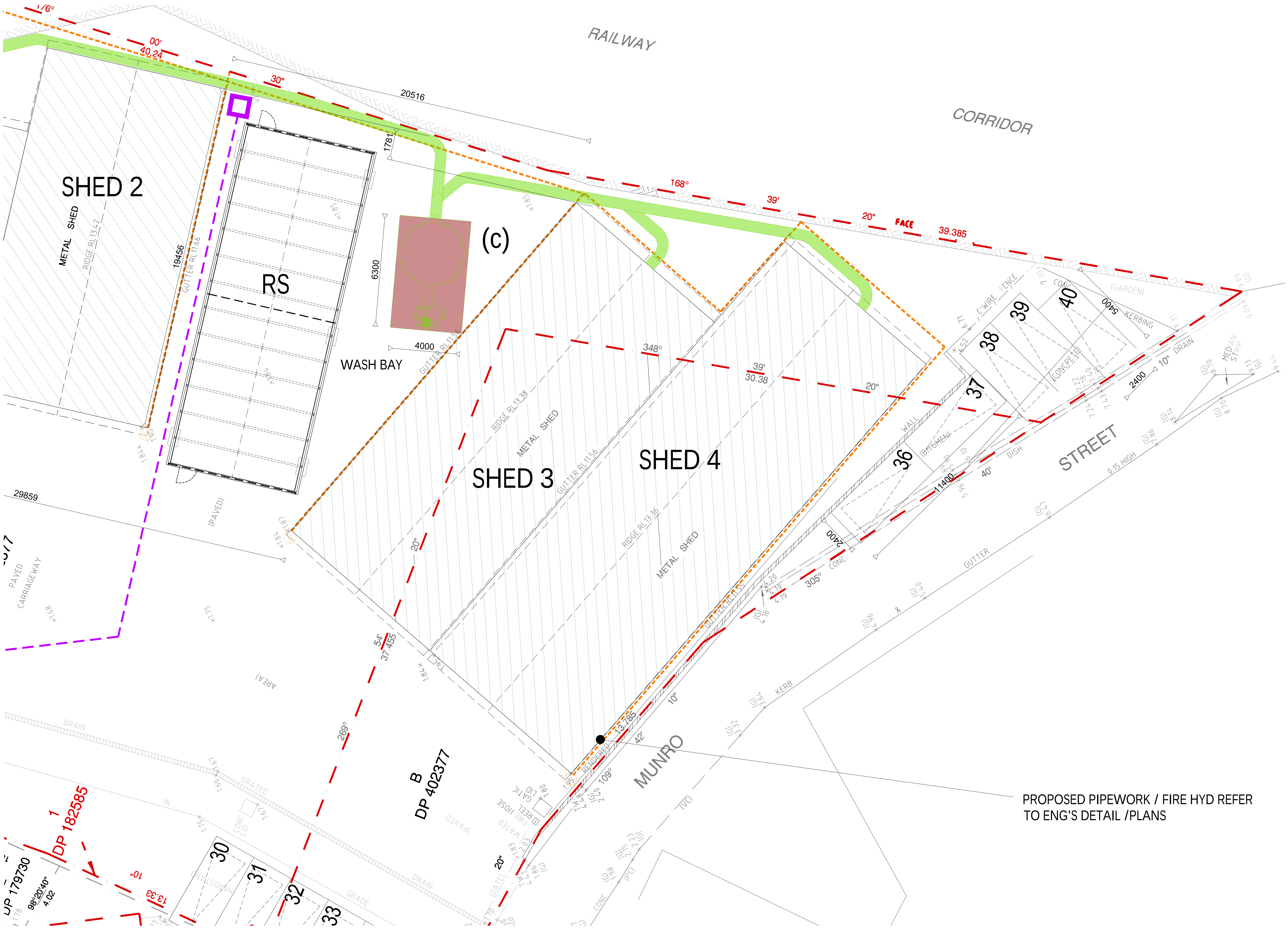

LEGEND

ACCESSIBLE SITE BOUNDARY AT GROUND LEVEL

PROPOSED FIRE SERVICES PIPE WORK REFER TO (ENG'S DETAIL /PLANS)

BOUNDARY LINE

(a) RS WHEN IN USE

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ISSUE	DATE	AMENDMENTS
07	22.04.27	PLAN ISSUE

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6 JOHN STREET, MCMAHONS POINT NSW 2060

PROJECT: NOAKES SHIPYARD
6 JOHN STREET, MCMAHONS POINT NSW 2060

TITLE: SITE PLAN SHEET_02

SCALE: 1:100 @ A1 / 1:200 @ A3
APPROVED / DRAWN / CHECKED: JC HJ
DATE: APRIL 2022
STATUS: DA

PROJECT NUMBER: 20051
DRAWING NUMBER: A011
ISSUE: 07

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NOAKES GROUP PTY LTD

ASBESTOS SURVEY

NOAKES FLOATING DRY DOCK

MOORED AT SNAILS BAY, SYDNEY HARBOUR NSW

REFERENCE NO. S12054-R01

APRIL 2022

Copy: 2

Copies: 1. Site Copy
2. Noakes Group Pty Ltd
3. Hibbs & Associates Pty Ltd.

REPORT

for

ASBESTOS SURVEY
NOAKES FLOATING DRY DOCK
CURRENTLY MOORED AT SNAILS BAY
SYDNEY HARBOUR NSW

Prepared for

NOAKES GROUP PTY LTD

6 John Street
McMahons Point NSW 2060

by

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Our Reference: S12054

April 2022

Prepared by: ____________________
David Edwards-Davis
Hazardous Materials and
Environmental Consultant

Reviewed by: ____________________
Samantha O'Callaghan
Principal Hazardous
Materials Consultant

Date: 13 April 2022

NOAKES FLOATING DRY DOCK
ASBESTOS SURVEY

EXECUTIVE SUMMARY

This report presents the findings of an Asbestos Survey and Qualitative Risk Assessment of the Noakes Floating Dry Dock which was moored at Snails Bay, Sydney Harbour NSW at the time of the survey. The survey was authorised by Owen Kenny, General Manager Commercial and Defence of Noakes Group Pty Ltd and was conducted by David Edwards-Davis of Hibbs & Associates Pty Ltd. The site inspection was carried out on 11 April 2022.

Overall Status

The overall asbestos status of the structure is outlined below.

Site Name	Asbestos (Friable)	Asbestos (Non - friable)
Noakes Floating Dry Dock	Negative	Negative

Summary of Findings and Risk Assessment

<u>Asbestos Materials</u>

No asbestos-containing materials were identified during the survey.

NOAKES FLOATING DRY DOCK
ASBESTOS SURVEY

TABLE OF CONTENTS

1.0 INTRODUCTION

This report presents the findings of an Asbestos Survey and Qualitative Risk Assessment of the Noakes Floating Dry Dock which was moored at Snails Bay, Sydney Harbour NSW at the time of the survey.

The survey was authorised by Owen Kenny, General Manager Commercial and Defence of Noakes Group Pty Ltd and was conducted by Hibbs & Associates Pty Ltd. The site inspection was carried out on 11 April 2022.

The client indicated that the asbestos survey was to be undertaken prior to relocating the vessel to be closer to the Noakes' workshops in Berrys Bay.

1.1 Consultant's Brief

The aim of the commission was to:

1. Conduct an inspection of the premises to identify the typical locations and applications in which asbestos-containing materials have been used.

2. Conduct a qualitative assessment of the risk that the identified asbestos-containing materials pose to the users of the site.

3. Recommend hazard control strategies for management of the asbestos-containing materials identified.

4. Provide recommendations where remediation works are identified.

5. Prepare a report including an Asbestos Register and recommendations from which an Asbestos Management Plan can be implemented.

1.2 Report Structure

The Survey Methodology is contained in Section 2.0, a brief description of the site is contained in Section 3.0 and a historical Remedial Works Table is in Section 4.0.

The qualitative risk assessment criteria and a risk assessment and recommendations are presented in Sections 5.0 and 6.0, respectively.

An Asbestos Register in a tabulated format detailing the location of the asbestos materials identified, the type and description of the asbestos material, priority rating and recommendations, and the timing for remedial works or re-inspection is contained in Appendix 1.

A sample analysis register is contained in Appendix 2. Photographs are included in Appendix 3 and a NATA endorsed asbestos sample analysis report is contained in Appendix 4.

2.0 SURVEY METHODOLOGY

2.1 General Methodology

An inspection of the vessel was performed to establish the typical locations and applications in which asbestos-containing materials have been used, for the purpose of preparing a qualitative risk assessment.

The scope of the survey was limited to a visual inspection of the accessible and representative construction materials, finishing materials and building services, and the collection of materials suspected of containing asbestos. Representative samples of suspected asbestos containing materials were collected where it was possible to do so without substantially damaging the decorative finishes, waterproofing membranes, equipment etc. No destructive sampling or damage to the existing finishes or services was performed to obtain samples or gain access to otherwise inaccessible areas. Equipment not associated with the building fabric and operational services was not included in the survey.

Due to the destructive nature of the sampling process, it is not possible to collect samples of all materials. Where it is not possible to collect a sample of material, the inspector has used their professional experience to make a judgement on the status of the material or the areas concerned. Where the inspector believes or suspects the material may contain asbestos this has been recorded in the survey report and these materials should be treated as an asbestos containing material. If work is to be performed on these materials, they should first be analysed to confirm their status.

No previous documentation or reports were available for review.

Hibbs were informed that the plant room was removed approximately 20 years ago. A new working room on the starboard wall and new generator on the port wall were witnessed during the vessel survey. The client also indicated that Harwood Marine have serviced the vessel and have routinely removed older parts and replaced gaskets throughout.

2.2 Material Sample Identification

2.2.1 Asbestos Samples

Any representative samples of materials suspected of containing asbestos collected were analysed for the presence of asbestos using Hibbs & Associates Pty Ltd Test Method No. 2. This method is based on the Australian Standard *AS4964-2004 Method for the qualitative identification of asbestos in bulk samples.*

The samples were examined by stereo microscopy. Fibrous materials identified under stereo microscopy were extracted and analysed by Polarised Light Microscopy supplemented with Dispersion Staining. This analysis was performed in-house. The reporting limit of the method is 0.1 g/kg.

The Hibbs & Associates Pty Ltd NATA endorsed analysis report is contained in Appendix 4.

Asbestos Types and Common Name: Chrysotile - White Asbestos

Amosite - Brown Asbestos

Crocidolite - Blue Asbestos

The identifying sample number within the Asbestos Register (Appendix 1), Sample Analysis Register (Appendix 2) and Asbestos Analysis Report (Appendix 4) is the job number (S12054) followed by a sequential sample number e.g. S12054-BSA01/01.

2.3 Statement of Building Survey Limitations

This report was prepared for Noakes Group Pty Ltd solely for the purposes set out herein and it is not intended that any other person use or rely on the contents of the report. The information contained in this report is based on a limited review of the site, interviews with site personnel and review of documentation provided to Hibbs & Associates Pty Ltd at the time of the review. Whilst the information contained in the report is accurate to the best of our knowledge and belief, Hibbs & Associates Pty Ltd cannot guarantee the completeness or accuracy of any of the descriptions or conclusions based on the information supplied to it or obtained during the investigations, site surveys, visits and interviews. Furthermore, conditions can change within limited periods of time, and this should be considered if the Report is to be used after any elapsed time period subsequent to its issue.

Hibbs & Associates Pty Ltd has exercised reasonable care, skill and diligence in preparation of the Report. However, except for any non-excludable statutory provision, Hibbs & Associates Pty Ltd gives no warranty in relation to its services or the report, and is not liable for any loss, damage, injury or death suffered by any party (whether caused by negligence or otherwise) arising from or relating to the services or the use or otherwise of this report.

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This Report lists the known specific and typical locations/applications/sources of the asbestos containing materials identified in the areas of the vessel inspected. Whilst the Report has been prepared with all due care and every reasonable attempt has been made to identify and locate all the sources of asbestos containing materials, as the survey involves a visual inspection and sampling process, only those materials that are physically accessible and recognisable as asbestos containing materials, can be located and identified. Therefore, it is possible that asbestos containing materials which may be concealed within inaccessible areas / voids or have been installed in non-typical applications or installed in such a manner as to conceal their nature/identity, may not be identified and located during the survey. Such concealed and / or inaccessible areas fall into a number of categories.

(i) Inside set ceilings or wall cavities.

(ii) Vessel facades or other height restricted areas.

(iii) Those areas accessible only by dismantling equipment or performing minor local demolition work.

(iv) Service shafts, ducts etc., concealed within the vessel structure or internal areas of the plant or equipment.

(v) Totally inaccessible areas such as voids and cavities created and intimately concealed within the vessel structure. These voids are only accessible during building works.

(vi) Asbestos containing materials covered or concealed (partially or otherwise) by other materials/items preventing or limiting visual access or identification/recognition.

(vii) Asbestos containing materials installed in non-typical applications, covered by other materials or installed in such a manner that disguises or conceals their nature in any way that may hinder their identification or recognition as an asbestos containing material.

Therefore, without substantial demolition of the vessel, it is not possible to guarantee that every source of asbestos containing material has been identified / detected.

During the course of future refurbishment or demolition works, care should be exercised when entering any previously inaccessible areas and it is imperative that work cease pending further sampling if any unknown materials or suspected asbestos materials are encountered.

This Report should not be used for the purpose of tendering, preparing costing or budgets, programming of works, refurbishment works or demolition works, unless used in conjunction with a technical specification report. The Report must be read in its entirety and must not be copied, distributed or referred to in part only. The Report must not be reproduced without the written approval of Hibbs & Associates Pty Ltd.

3.0 BRIEF DESCRIPTION OF THE SITE

3.1 Site Details

The Noakes Floating Dry Dock which was moored at Snails Bay, Sydney Harbour NSW at the time of the survey.

The dry dock is a large flat bottomed floating steel structure with tall port and starboard walls. Between the walls is a large flat working surface designed to accommodate vessels to be worked upon. We were informed the internal areas of the walls and floor are mostly empty. The steel structures are supported by internal rows of steel girders.

The client indicated that the asbestos survey was to be undertaken prior to relocating the vessel to be closer to the Noakes workshops in Berrys Bay.

3.2 Site Description

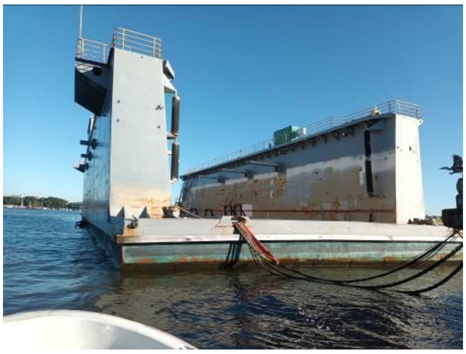
The following is a brief description of the vessel inspected.

<u>FDD</u>

The FDD is a large two walled flat bottomed floating steel structure.

The vessel was completed in 1944.

The vessel is a multi level structure with steel roofs, steel external walls, steel internal walls, steel and timber ceilings and steel and timber floors.



3.3 Areas Not Accessible

Within the limitations of Section 2.3, all areas were accessed during the site inspection.

4.0 Remedial Works

Hibbs was informed that the plant room was removed approximately 20 years ago. A new steel working room on the starboard wall and new generator on the port wall were witnessed during the vessel survey.

The client indicated that Harwood Marine have serviced the vessel and have routinely removed older parts and replaced gaskets throughout. No clearance certificates were witnessed, however, as this was to Hibbs' knowledge the first asbestos survey of the vessel, it is unknown if there were any historic asbestos materials on the Floating Dry Dock.

5.0 QUALITATIVE RISK ASSESSMENT – METHODOLOGY

5.1 Introduction

The consultant who undertook the site inspection and survey identified and recorded the locations of the asbestos containing materials, which are summarised in the Register in Appendix 1. The following section outlines the principal factors used for making a qualitative assessment of the risk the hazardous materials pose to all the building's occupants and the priority rating system for control of the hazardous materials. Section 6.0 outlines general comments on the condition of the hazardous material identified, remediation works that are recommended and areas where the condition of the hazardous materials has deteriorated.

The priority rating system outlined below is designed as a guide to those responsible for the development of a comprehensive asbestos management plan. The actual setting of priorities for the implementation of control procedures for the hazards will be dependent not only on the allocated rating but also on factors such as changes to work practices or the physical environment which would occur during refurbishment or demolition. Notwithstanding this, the allocated rating does provide a reasonable guide to appropriate priority setting with regard to the current condition of the materials.

5.2 Asbestos Materials

The purpose of the on-site phase of the survey is to identify the presence of asbestos materials through a combination of visual inspection and material sampling. The qualitative risk assessment of any asbestos materials identified is based upon an evaluation of factors, such as the friability, location and condition of the identified materials, whether the nature of the work carried out in the area is likely to disturb the asbestos, the likelihood of fibres released entering the occupied space and any other information considered important or relevant.

These factors have also been utilised in the process of determining appropriate recommendations for the timing of future assessment activities. As part of the risk assessment process, each asbestos hazard identified has been allocated a Priority Rating. This will assist in the development of a comprehensive asbestos management control and abatement programme.

<u>Priority Rating for Control of Asbestos Hazards</u>

Priority 1: Immediate Elevated Risk Level

Friable material which, due to its present condition and location, presents an immediate health risk. Immediate control measures are required and the area containing this material should be isolated from personnel. Abatement of this particular hazard is strongly recommended at the earliest practicable time.

Priority 2: Potential Elevated Risk Level

Damaged or unstable material, which if disturbed is likely to present an immediate health risk, with the likelihood that contamination may be spread to other areas. Control measures to stabilise this material should be initiated immediately, with formal abatement of the hazard being considered.

Priority 3: Low Risk

Non-friable or stable material that has some minor areas of damage requiring remedial action or is likely to be subject to damage or to degrade due environmental conditions. It is recommended that maintenance work be performed to stabilise and repair damaged areas. Controls should be implemented to protect these materials from further damage or degrading factors.

Priority 4: Negligible Risk under Present Conditions

Non-friable or stable material that is unlikely to present a risk to health unless damaged, tooled, cut, sanded, abraded or machined. It is recommended that these materials be maintained in good order. Reassessment of the priority rating will be required if planned works are likely to have an impact on these materials.

6.0 QUALITATIVE RISK ASSESSMENT – HAZARD CONTROL STRATEGIES AND RECOMMENDATIONS

6.1 Asbestos Materials

6.1.1 Risk Assessment

No asbestos containing materials were identified in the Noakes Floating Dry Dock.

APPENDIX 1: ASBESTOS REGISTER

INSTRUCTIONS TO SITE MANAGERS

ALL TRADESPERSONS *must be instructed to check this register before commencing any work on the premises and to identify whether or not their work could involve contact with asbestos containing materials. If any work requires the disturbance of asbestos (whether or not they are listed in the register), appropriate safety procedures must be employed.*

Key and Explanatory Notes to Asbestos Register

Column Heading	Description
Location	A detailed description of the location of the asbestos containing material relevant to this entry.
Material Type	The specific building material type, e.g. **Asbestos:** flat asbestos cement sheet, corrugated asbestos cement sheet, vinyl asbestos tiles, CAF gasket, etc.
Sample / Photograph Reference	**Sample Reference** number allocated to the sample collected from this asbestos containing material; refer also Appendix 2 for asbestos samples. **Photograph Reference** number, refer Appendix 3.
Quantity	The quantity of asbestos containing material relevant to this location. Depending on the nature of the material, the quantity is given as an area (m^2), length (m) or number of pieces/units.
Condition	**Good**: good and stable condition. **Fair**: early signs of deterioration or localised areas of minor mechanical damage. **Poor**: the material is in poor condition and remedial action is required, e.g. damaged friable asbestos pipe lagging, etc.
Accessibility	**Regular:** in the occupied space of the building and accessible to all personnel using/entering the building. **Occasional:** buildings or rooms that are used infrequently. **Maintenance Only:** accessible to maintenance personnel only. **Prone to Mechanical Damage:** material that is fully exposed in the occupied area of the building that will be easily damaged if disturbed.
Risk Priority Rating	The allocated priority rating for this entry, refer Section 5.0.
Recommendations	Recommended remedial actions for damaged or deteriorating material.
Timing	Timing for implementing recommendations and remedial actions specified for this entry. Where a Priority Rating 4 is allocated for an asbestos containing material, this refers to the timing for re-inspection of this material.

ASBESTOS REGISTER: NOAKES FLOATING DRY DOCK (FDD) CURRENTLY MOORED AT SNAILS BAY, SYDNEY HARBOUR NSW								APRIL 2022
LOCATION	**MATERIAL TYPE**	**SAMPLE / PHOTOGRAPH REFERENCE**	**QUAN-TITY**	**COND-ITION**	**ACCESS-IBILITY**	**RISK PRIORITY RATING**	**RECOMMENDATIONS**	**TIMING**
Asbestos								
Refer to Section 3.3 of this report for a list of inaccessible areas and Section 2.3 for the Statement of Building Survey Limitations.								
FDD, Starboard aft hatch, port wall	Gasket	S12054-BSA01/01 Photograph 01	NA	NA	NA	No asbestos detected	NA	NA
FDD, Starboard aft hatch, overhead pipework	Gasket	S12054-BSA01/02 Photograph 02	NA	NA	NA	No asbestos detected	NA	NA
FDD, Starboard aft hatch, overhead steel girders	Insulation applied to structural steel	S12054-BSA01/03 Photograph 03	NA	NA	NA	No asbestos detected	NA	NA
FDD, Starboard aft hatch, fore pipework	Gasket	S12054-BSA01/04 Photograph 04	NA	NA	NA	No asbestos detected	NA	NA
FDD, Starboard aft capstan, adjacent winch handle	Gasket (light blue coloured)	S12054-BSA01/05 Photograph 05	NA	NA	NA	No asbestos detected	NA	NA
FDD, Starboard aft capstan, adjacent winch handle	Gasket (red coloured)	S12054-BSA01/06 Photograph 05	NA	NA	NA	No asbestos detected	NA	NA
FDD, Starboard fore hatch, fire hose reel	Woven fibrous material	S12054-BSA01/07 Photograph 06	NA	NA	NA	No asbestos detected	NA	NA
FDD, Starboard fore hatch, cut metal wiring internal insulation	Fibrous insulation	S12054-BSA01/08 Photograph 07	NA	NA	NA	No asbestos detected	NA	NA
FDD, Port fore hatch, bituminous flooring material	Membrane	S12054-BSA01/09 Photograph 08	NA	NA	NA	No asbestos detected	NA	NA

APPENDIX 2: ASBESTOS SAMPLE ANALYSIS REGISTER

Asbestos Analysis Results

Sample No.	Sample Location	Analysis Result
S12054-BSA01/01	FDD, Starboard aft hatch, port wall: Gasket.	No asbestos fibres detected Contains OF
S12054-BSA01/02	FDD, Starboard aft hatch, overhead pipework: Gasket.	No asbestos fibres detected Contains OF
S12054-BSA01/03	FDD, Starboard aft hatch, overhead steel girders: Insulation applied to structural steel.	No asbestos fibres detected
S12054-BSA01/04	FDD, Starboard aft hatch, fore pipework: Gasket.	No asbestos fibres detected
S12054-BSA01/05	FDD, Starboard aft capstan, adjacent winch handle (light blue gasket): Gasket.	No asbestos fibres detected Contains OF
S12054-BSA01/06	FDD, Starboard aft capstan, adjacent winch handle (red gasket): Gasket.	No asbestos fibres detected Contains SMF
S12054-BSA01/07	FDD, Starboard fore hatch, fire hose reel: Woven fibrous material.	No asbestos fibres detected Contains OF
S12054-BSA01/08	FDD, Starboard fore hatch, cut metal wiring internal insulation: Fibrous insulation.	No asbestos fibres detected Contains OF
S12054-BSA01/09	FDD, Port fore hatch, bituminous flooring material: Membrane.	No asbestos fibres detected Contains OF

(1) Chrysotile - White Asbestos

(2) Amosite – Brown Asbestos

(3) Crocidolite – Blue Asbestos

(4) SMF – Synthetic Mineral Fibre

(5) OF – Organic Fibre

APPENDIX 3: PHOTOGRAPHS

Photograph 01

Site: Noakes Floating Dry Dock.

Location: FDD, Starboard aft hatch, port wall

Description: The green arrow points to the non-asbestos Gasket.

Recommendation: NA

Photograph 02

Site:	Noakes Floating Dry Dock.
Location:	FDD, Starboard aft hatch, overhead pipework.
Description:	The green arrow points to the non-asbestos Gasket.
Recommendation:	NA

Photograph 03

Site: Noakes Floating Dry Dock.

Location: FDD, Starboard aft hatch, overhead steel girders

Description: The green arrow points to the non-asbestos insulation applied to structural steel.

Recommendation: NA

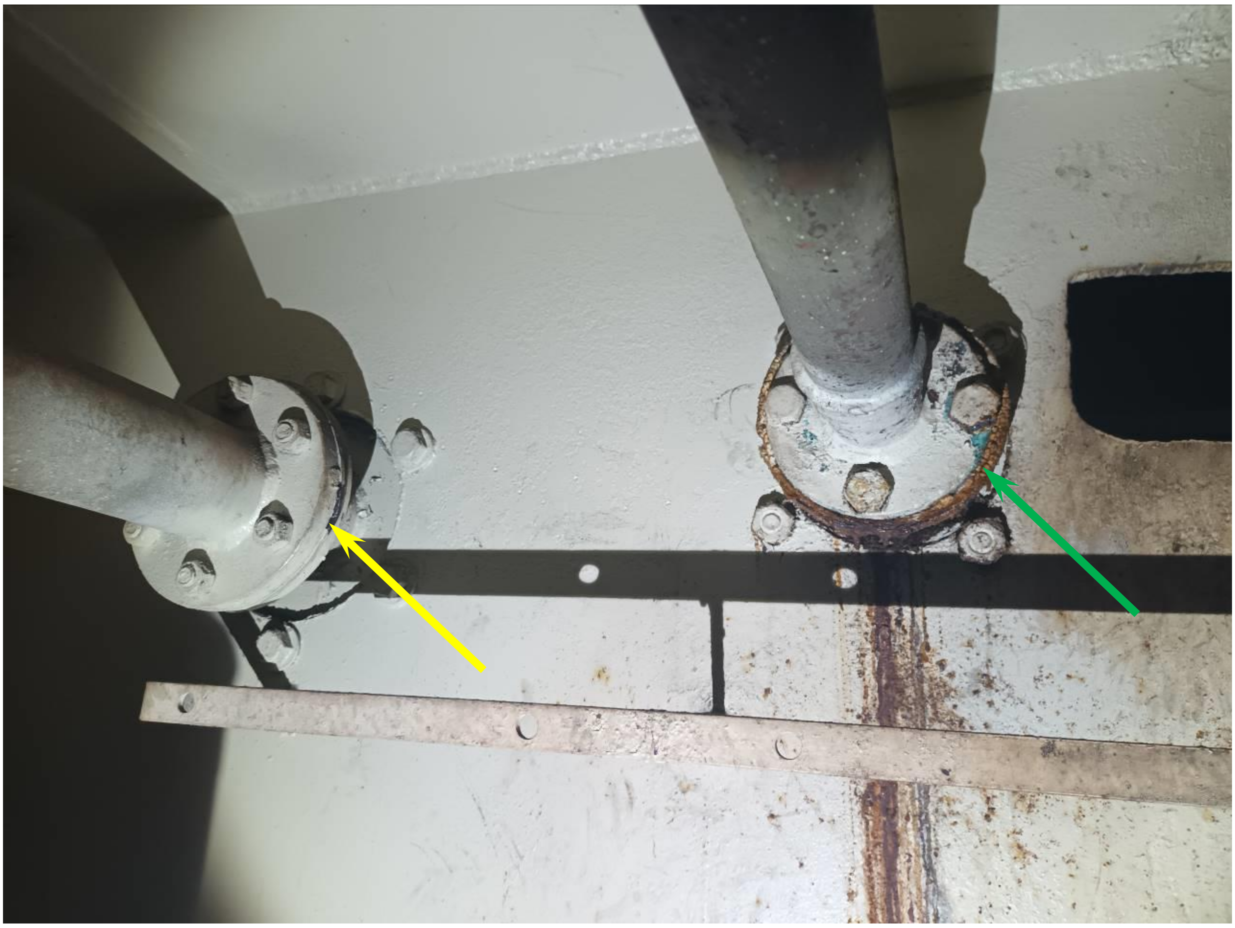
Photograph 04

Site: Noakes Floating Dry Dock.

Location: FDD, Starboard aft hatch, fore pipework

Description: The green arrow points to the non-asbestos Gasket. The yellow arrow points to a rubber Gasket.

Recommendation: NA



Photograph 05

Site: Noakes Floating Dry Dock.

Location: FDD, Starboard aft capstan, adjacent winch handle

Description: The green arrows point to the non-asbestos light blue Gaskets. The purple arrows point to the non-asbestos red Gaskets.

Recommendation: NA

Photograph 06

Site:	Noakes Floating Dry Dock.
Location:	FDD, Starboard fore hatch, fire hose reel
Description:	The green arrow points to the Woven fibrous material.
Recommendation:	NA

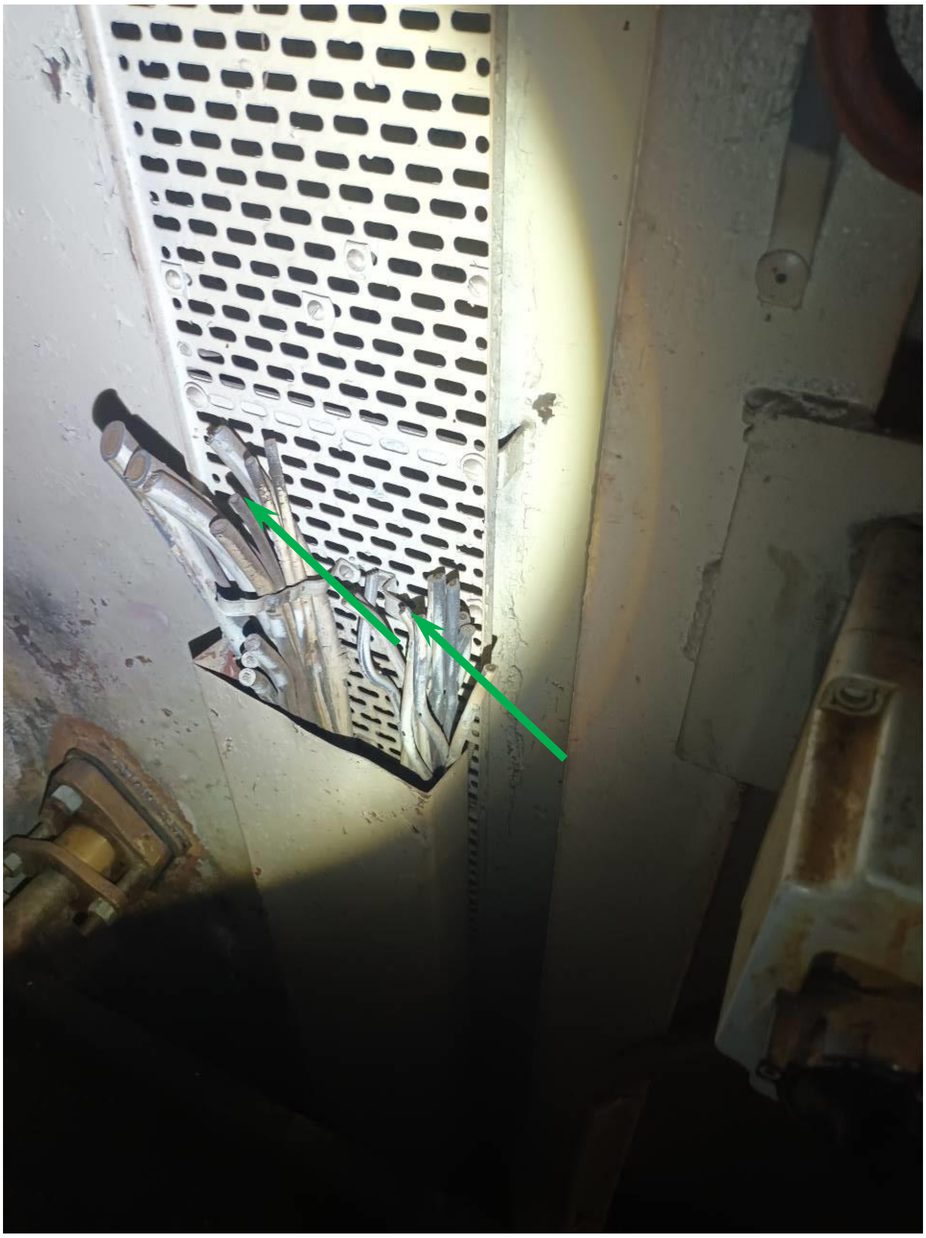
Photograph 07

Site: Noakes Floating Dry Dock.

Location: FDD, Starboard fore hatch, cut metal wiring internal insulation

Description: The green arrow points to the non-asbestos Fibrous insulation.

Recommendation: NA



Photograph 08

Site: Noakes Floating Dry Dock.

Location: FDD, Port fore hatch, bituminous flooring membrane

Description: The green arrow points to the non-asbestos Membrane.

Recommendation: NA

APPENDIX 4: ASBESTOS ANALYSIS REPORT

The analytical report in this appendix has a separate page numbering system.

Suite B, 255 Rawson Street, Auburn NSW 2144

NATA Accredited Laboratory Number: 14911

Accredited for compliance with ISO/IEC 17025 - Testing

Our Reference: S12054-BSA01

11 April 2022

Noakes Group Pty Ltd
6 John Street
MCMAHONS POINT NSW 2060

Attention: Owen Kenny
General Manager Commercial and Defence

CERTIFICATE OF ANALYSIS - BULK SAMPLE REPORT

Samples collected by:	David Edwards-Davis of Hibbs
Sample date:	11/04/2022
Analysis date:	11/04/2022

The samples were examined for the presence of asbestos by stereo microscopy and polarised light microscopy with dispersion staining. The analysis was conducted in accordance with Hibbs Test Method No. 2 and Australian Standard 4964-2004 Method for the qualitative identification of asbestos in bulk samples.

Results are contained in the following table.

Sample No.	Sample Details	Analysis Result
S12054-BSA01/01	Description: Black gasket with cream coating material Approx. sample weight: 2 g	No asbestos detected Organic fibres detected
S12054-BSA01/02	Description: Black gasket material Approx. sample weight: 1 g	No asbestos detected Organic fibres detected
S12054-BSA01/03	Description: Sprayed insulation with cream coating material Approx. sample weight: 4 g	No asbestos detected
S12054-BSA01/04	Description: Cream gasket material Approx. sample weight: 1 g	No asbestos detected
S12054-BSA01/05	Description: Light blue gasket material Approx. sample weight: 1 g	No asbestos detected Organic fibres detected

Sample No.	Sample Details	Analysis Result
S12054-BSA01/06	Description: Red gasket with yellow coating material Approx. sample weight: 1 g	No asbestos detected Organic fibres detected Synthetic mineral fibres detected
S12054-BSA01/07	Description: Woven material Approx. sample weight: 1 g	No asbestos detected Organic fibres detected
S12054-BSA01/08	Description: Wire insulation material Approx. sample weight: <1 g	No asbestos detected Organic fibres detected
S12054-BSA01/09	Description: Bituminous material Approx. sample weight: 30 g	No asbestos detected Organic fibres detected

Sampling not covered by scope of accreditation

KEY: 'No asbestos detected' or 'no asbestos detected by trace analysis'- no asbestos detected at the Reporting Limit of 0.1 g/kg.

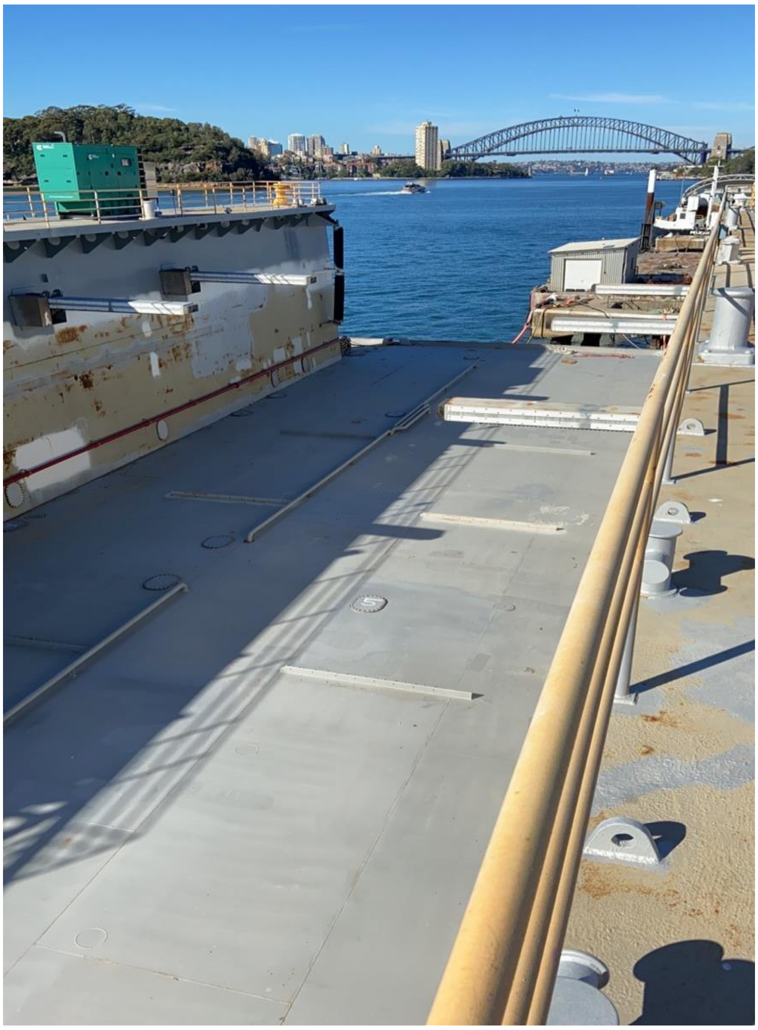
Reported by:

Mirtha Maravi
Analyst and Signatory

Safety Management System

This Safety Management System has been constructed for the management of Domestic Commercial Vessel 'FDD1N' owned by Noakes Group Pty Ltd.

'FDD1N', Domestic Commercial Vessel, UVI: 455344



Length: 59.24 metres

Beam: 19.8 metres

Date: April 2022

Survey Class: 1E and exemption 41

Noakes GROUP

ACMG AUSTRALIAN COMMERCIAL MARINE GROUP

NAUTICAL SYSTEMS PTY LTD

Version control and updates

Date	Reviewer	Amendments	Version
5/5/2020	Mark Cummins	Creation/Draft	1.1
9/10/2021	Mark Cummins / Gary Watt	Review	1.2
18/3/2022	Owen Kenny	Update	1.3
16/4/2022	Nautical Systems / Noakes Group	Review / Update	1.4

Annual review of the Safety Management System is required under Marine Order 504. This review requires the owner to engage with the crew for feedback on improvements for the safe operation of the vessel.

This document forms part of the overall Safety Management System.

The content of this document has been created in accordance with the requirements legislation, Marine Order 504 (Certificates of operation and operation requirement – national law) 2018, AMSA Mo 2018/10.

The purpose of the safety management system is a documented and practiced approach to managing safety for the vessel, its operation and all those onboard. The safety management system has been tailored to reflect the size and complexity of the specific operation of 'FDD1N', as well as the risks unique to the vessel and its operation. The owner understands the general safety duties to provide an effective safety management system to increases awareness of potential safety issues, operational risks and opportunities for improvement.

While every effort has been made to ensure the accuracy of the document, this publication is not intended to be a substitute for the legislation. For the specific requirements on any matters covered in this document, persons should refer directly to the appropriate legislation.

Guidelines for a safety management system published by the Australian Maritime Safety Authority has been utilised in developing this document.

Contents

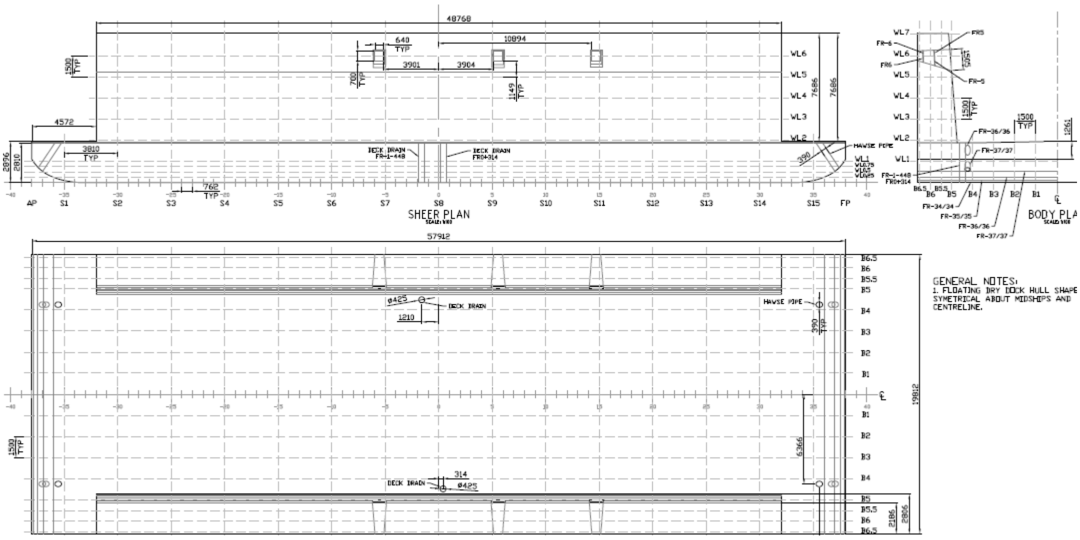
For further information regarding aspects of the contents listed within the Safety Management System, the Designated Person Ashore (DPA) will be the subject matter expert for the content of this system.

This System has been complied in accordance with the following legislation:

- Marine Safety (Domestic Commercial Vessel) National Law Act 2012
- Marine Order 504 (Certificates of operation and operation requirements national law) 2018
- Marine Safety Act 1998 (NSW)
- Protection of the Environment Legislation Amendment Act 2011
- Work, Health & Safety Act 2011

Section 1: Vessel Specifications

Vessel ‘FDD1N’ is operated as a Domestic Commercial Vessel as defined by the Marine Safety (Domestic Commercial Vessel) National Law Act 2012, Schedule 1, Section 7. The vessel holds a Certificate of Operation, COO-42678-001, annex *1* and Certificate of Survey 1E, COS-94928-002, *annex 2.* A detailed general arrangement, *annex 3.*



‘FDD1N’ is a steel constructed vessel designed to alight vessels for repairs and maintenance. ‘FDD1N’ has been designed and permissioned to partially submerge to provision another vessel to embark. The operation of submersion is controlled by onboard machinery and ballast pumping arrangement. The operation of the submersion evolution is conducted in accordance with the vessel specific Stability Assessment, *Annex 4* and operating procedures, Section 8.

General vessel data

- Unique Vessel Identification number: 455344
- Length: 59.24 metres
- Beam: 19.8 metres
- Draughts: Lightship 0.984 meters   Submerged 8.1 meters
- Construction: Steel
- Height of Wing Deck (Above BL): 10.582 meters
- Machinery: Cummins Diesel generator, model C170D5 50Hz, 1500RPM, Voltage 110 to 480 V
- Motors: 2x Brook Crompton 7-D225M electric induction motors, 30 Kw
- Pumps: 2 x 440V fixed impeller centrifugal
- Lift capacity: 1000 tonnes

Section 2: Company Details

The Noakes Group is Australia's leading general marine company. From its origins as a rigging provider in 1984 it has grown to include the full range of maintenance and repair services. The Group is led by Sean Langman, one of the nation's most successful and versatile yachtsmen.

Noakes operates two boat and shipyards - at North Sydney and Port Huon. From the smallest sailing dinghy to stately tall ships, from modest work boats to world-girdling cruisers, Noakes offers complete and expert support. Skilled and experienced marine trade professionals are on staff, and on site. Shipwrights, riggers, painters, engineers.

A measure of the high levels of workmanship and care at Noakes is that the company has recently been awarded long-term continuous maintenance contracts with the Royal Australian Navy and NSW Government. Power or sail, large or small. Noakes Group sets the standard.

Noakes Group is located at 6 John Street, McMahons Point, NSW, 2060 a commercial facility and boatyard adjacent to Berry Bay, New South Wales.

Managing Director: Sean Langman

Phone: 0419 415 032

Email: sean@noakes.net.au

Section 3: Owner's Responsibility and Authority Statement

This vessel is owned by Noakes Group Pty Ltd, 6 John Street, McMahons Point, NSW, 2060. This is the recorded owner on Certificate of Operation, Annex 1.

The person who has overall owner responsibilities is Sean Langman, Managing Director Noakes Group Pty Ltd.

Owner Statement: ***The Safety Management System for vessel 455344 has been created and implemented to enhance safety during operation of the vessel. Its intent is to increase awareness of hazards, reinforce safety training and a source of reference for all persons onboard the vessel. Feedback, ideas and reporting of incidents need to be provided to the master and owner to allow review of procedures and operation.***

Parts of this Safety management System relevant to general operation are to be kept onboard vessel 455344 whilst operating. This allows a person to understand and implement the vessel in the safest practicable methods. The Safety management System does not cover the masters' responsibilities of safe navigation, the navigation of the vessel must be in accordance with relevant both State and Commonwealth Acts and regulations. The correct qualification is required to operate the vessel as master except in exigent circumstances.

Section 4: Designated Person

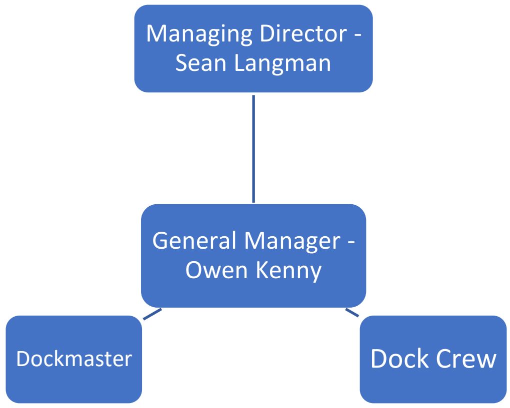
The owner of the vessel has appointed a designated person to has been given authority to act on their behalf with overall general control and management of the vessel and it's operation. The designated person's title is the Designated Person Ashore. The Designated Person ashore for Noakes Group Pty Ltd is the General Manager, Owen Kenny.

Designated Person: Owen Kenny

Phone: 0459 598 490

Email: owen@noakes.net.au

The organisation structure for control of the vessel is as follows:



Section 6: Resources and Personnel

Training:

Training for all persons who operate the vessel will be in accordance with this Safety Management System, this is policy for Noakes Group. Training will include competency training, general safety training, vessel induction training and ongoing training in the vessel and its operation.

The implementation of the training will be facilitated at the direction of the owner for initial general safety training, determination of competency and vessel induction training. Ongoing and refresher training will be conducted at the direction of the owner or master and can be undertaken at any time by a member of the crew.

Training records are held by Noakes Group.

Fatigue Management:

The owner and master must take all practicable steps to make sure the vessel and people are safe. Rest rates, work environment and time to recover should be considered when planning a work rest ratio that is indicative of a safe workplace. If a person feels fatigued, this needs to be communicated immediately to the master/owner, this will allow adequate rest to be allocated to prevent a fatigue related incident.

Covid 19:

All information relating to Covid-19 must comply with all federal, state or territory safety directions, including crew movements, isolation and social distancing requirements. Managing the risks through control measures should be done in accordance with government health advice.

Crewing Assessment:

'FDD1N' is approved under exemption 41, Marine Safety (Unpowered barges) exemption 2020, Annex 5. Within the exemption it defines *crew* has the same meaning as in NSCV Part B. *Minimum Crewing* means minimum crewing as determined with subclause 6(4) of schedule 1 of Marine order 504.

‘FDD1N’ would be defined as a Category 3 vessel – Barge with machinery and 1 or more persons on board who are crew or special personnel, but no berths in use. Within Exemption 41 it also specifies in section 5, <u>*Exemption from minimum crewing requirement*</u> *- An owner of an unpowered barge is not required to comply with the operation requirements in subsection 4(4) and subparagraph 5(b)(i) of Marine Order 504 to the extent that Schedule 1 of Marine Order 504 re quires compliance with minimum crewing.*

The crewing evaluation has considered using the following evaluation*:*

- The vessel is an unpowered barge and does no navigate a waterway without a support vessel to provide propulsion.
- The number of persons on board does not exceed 25 at any given time, all persons onboard are special personnel and have been received either a comprehensive operation induction or a induction into the safety management system. These inductions are at the discretion of the owner and designated person as most special personnel will be onboard to conduct maintenance and repairs of vessels embarked.
- The design of the vessel is noncomplex and allows good field of vision of operations onboard. The vessel is fitted with machinery, power and pumping arrangements which are specified in the Safety management System.
- The persons working onboard either have extensive marine knowledge or will be inducted to the risks as outlined by the Safety Management System.
- The area of operation is smooth waters in a protected bay. Nearby suitable vessels are available at short notice to assist if any movement is required.
- The vessel will operate alongside with movements being ‘cold moves’ with no work being carried out onboard when in transit.
- Fatigue is managed by the fatigue management plan. No overnight voyages the ability to step ashore and operating in smooth waters significantly reduce the fatigue that attributed to sea going vessels and the crew.
- The vessel is a commercial vessel which is clearly signposted, with safety equipment located in functional positions as aesthetics is not desired.

The crewing assessment has been considered using appropriate crewing, knowing that the vessels operates alongside or near the shore.

Dockmaster – The Dockmaster for the purpose of definition will be the vessel master. The dockmaster overseas the safe operation of the vessel and enforcement of safety.

Dock Crew – Dock crew are responsible for the operation of the machinery, pumping arrangements and the operation of the vessel.

Special Personnel – All personnel who includes the dock master and crew will be special personnel. Special personal must be inducted into the vessels Safety Management System including a rehearsal of emergency procedures. Special personnel will include but not limited to specialist trades people, owners of vessels and any person working onboard.

Crewing Assessment	
Dock master	Dock master requires no certification of a certificate of competency but has overall control of the vessel's onboard operation. Duties are outlined in the Dockmaster's Responsibilities and Standing orders document, Annex 6
Dock crew	1x has been determined to supplement the dock master. Requires to be inducted on all emergency procedures. No certification required.
Minimum crew	1x competent person is required as the minimum crew.

Noakes Group have implemented several polices regarding the welfare of the persons working onboard 'FDD1N'. These policies include but are not limited to determining if a person is fit for duty. The assessment to determine if a person is fit for duty will be calculated in accordance with the following company policies:

- Quality / Safety and Environmental Policy (ISO 9001-2008), Annex 7
- Drug and Alcohol Policy (ISO 9001:2008), *Annex 8*
- Smoking Policy, *Annex 9*
- Equal opportunity Employment Policy, *Annex 10*
- Occupational Health and Safety Policy (ISO 9001:2008), *Annex 11*
- Employee assistance – mental health and welfare service available to staff

Training:

Noakes Group recognises the need to train staff so that they can work safely and effectively. On the first day of training an "Employment Pack" will be issued including the following forms:

- Initial Company Induction
- FDD1N - Induction/Assessment
- FDD1N – Safety Management System induction
- ATO Form
- Personal Payroll Information Form

Each of these completed forms is kept in the new employee's personal file, along with photocopies of certification relevant to his/her employment. The "Initial Company Induction" is to be completed by the Operations Manager or the Dock Master for any staff member starting work for their first day of training. During the training period each new staff member must complete the "FDD Induction" with either a Dock Master or Operations Manager to be "signed-off" on a number of lifts and sinks.

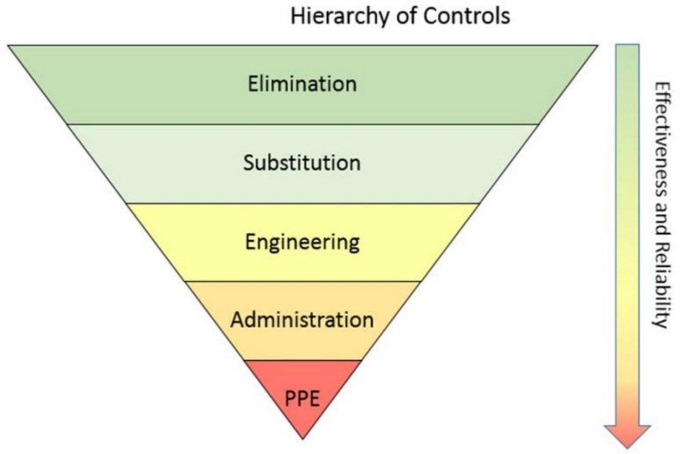
If a staff member needs or requests further training on an FDD or in a particular area of the operation they will not be asked to work in that capacity until they have been trained to achieve a sound knowledge with that task.

Section 7: Risk Assessments

This section is divided into three sections for onboard operations:

1. Daily onboard operations which covers special personnel working onboard the dock conducted maintenance, repairs, and general works afloat.
2. Lighting operations.
3. Environmental / pollution

Risk assessments are to be carried out for all foreseen operations whilst operating the vessel. A risk register has been created within the Safety Management System which identifies known risks, if a risk presents during the operation any person onboard the vessel must carry out a risk assessment considering the hierarchy of controls, considering the likelihood of occurrence and potential consequences. When the likelihood and consequences are determined than it must be applied to the risk rating matrix. Any additional risks must be recorded in the vessel log and brought to the attention of the dockmaster to record the risks and add to them to the risk register if deemed to be required. The risk register for 'FDD1N' has been created in consultation with the designated person ashore and dockmaster to explore potential hazards.



Likelihood	Explanation
Likely	Probably occur, but unlikely to occur often
Possible	Might occur at some time, unlikely to occur to every vessel but may occur to a few
Unlikely/ Remote	Unlikely to occur but is possible

Consequence	Explanation
Major	Severe injury, major vessel damage, major environmental impact major operational disruption, severe reputational damage
Moderate	Injury requiring someone to receive more than first aid, vessel damage, some environmental damage, operational disruption, finical loss
Minor	Injury requiring first aid, cosmetic vessel damage, some environmental impact additional work, minor operational disruption.

Risk Rating matrix			
Likelihood	Consequence		
	Minor	Moderate	Major
Likely	High	High	Extreme
Possible	Moderate	High	Extreme
Unlikely	Low	Moderate	High

Activitity	Likelihood (without controls)	Consequence	Risk Rating	Control	Likelihood	Consequence	Residual Risk rating	Accept Yes/No
Person overboard	Possible	Major	High	Safety Breifing Training and induction Emergancy MOB procedures Lifejackets	Unlikely / Remote	Moderate	Low	Yes
Collision with another vessel	Unlikely	Major	Low	Safety Breifing competnecy assessment Training and induction Emergancy procedures emergancy plan	Unlikey / Remote	Minor	Low	Yes
Collision with navigation hazard	Possible	Major	Low	Safety briefing Correct and current chart local knowledge (master) removal of vision obstructions	Unlikely / Remote	Major	Low	Yes
Crew affected by drugs, alcohol or fatigue	Unlikely	Major	High	Fitness for work procedure Owner / Master enforce work Rest ratio	Unlikely	Minor	Low	Yes
Inexperinced crew	Possible	Moderate	High	Safety Breifing Crew induction and training	Unlikely	Minor	Low	Yes
Adverse weather	Possible	Moderate	High	Master to conduct risk Assesssment	Possible	Minor	Moderate	Yes
Main generator failure	Unlikely	Major	High	Pre-departure checks Servicing and maintence of machinary	Unlikely	Moderate	Moderate	Yes
Master Incapcitated	Unlikey	Moderate	High	Crew induction and training Emergency procedures	Unlikely	Moderate	Moderate	Yes
Fire on board	Unlikely	Major	High	Correct fire equipment Crew induction and training Emergancy procedures	Unlikely	Moderate	Moderate	Yes
Polution / Oil spill	Unlikely	Major	High	Emergancy procedures Emergancy drills Crew induction and training	Unlikely	Minor	Low	Yes
Crushing, entanglement, shearing, striking and cutting hazards	Possible	Moderate	High	Crew induction and training Pre-departure checks PPE	Possible	Minor	Moderate	Yes
Comprimised stability	Unlikely	Major	High	Crew induction and training Stability book - notes to master Plimsal markings, draft marking Loading conditions - training Pre-departure checks	Unlikely	Moderate	Moderate	Yes
Emergancy Preperation	Unlikely	Major	High	Pre-departure checks Crew induction and training Maintenace of safety equipment	Unlikely	Minor	Low	Yes
Lifting failure	Unlikely	Major	High	Pre-departure checks Crew induction and training Emergancy procedures PPE	Unlikely	Minor	Low	Yes
Access below decks	Unlikely	Moderate	Moderate	Crew induction and training Maintenance of engress points	Unlikely	Minor	Low	Yes
Towing operations	Unlikley	Major	High	Pre-departure checks Crew induction and training Emergancy procedures, PPE Breifing with tow vessel	Unlikely	Minor	Low	Yes
Gangway Failure	Unlikely	Minor	Low	Crew induction and training regualar inspections	Unliklley	Minor	Low	Yes
Fuelling of vessel	Unlikely	Minor	Low	Isolate electronics (phone) Crew induction and training no smoking Maintence of fuel system, (breathers)	Unlikley	Minor	Low	Yes
Sun exposure	Likley	Minor	High	Crew induction and training PPE	Possible	Minor	Moderate	Yes

Risk assessments must be reviewed if the vessel undertakes an operation that differs from that normally undertaken by the vessel, or the dockmaster (master) considers that the risks may have changed or the vessel is involved in a marine incident. This can be carried out using the risk assessment tools and procedures outlined in section 7.

Section 8: Incident Reporting

Domestic commercial vessels are covered by several work health & safety and maritime laws. Incidents depending on the nature and type could be reported to one or more regulators and/or emergency services.

Marine Safety (Domestic Commercial Vessel) National Law Act 2012: A marine incident that requires to be reported to the National regulator (Australian Maritime Safety Authority) include the following:

- Death, or injury to, a person associated with the operation or navigation of a domestic commercial vessel;
- The loss or presumed loss of a domestic commercial vessel;
- A collision of a domestic commercial vessel with another vessel or object;
- The grounding, sinking, flooding or capsizing of a domestic commercial vessel;
- A fire onboard a domestic commercial vessel;
- Loss of stability of a domestic commercial vessel that affects the safety of the vessel;
- The structural failure of a domestic commercial vessel;
- A close quarter situation;
- An event that results in, or could have resulted in: the death of, or injury to a person onboard or the loss of a person or a vessel becoming disabled and requiring assistance.
- The fouling or damaging by a domestic commercial vessel of: any pipeline, or submarine cable or any aid to navigation withing the meaning of the *Navigation Act 2012*.
- A prescribed incident involving a domestic commercial vessel.

Incidents listed about need to be reported by the master and/or owner by submitting a form 18/19 to the Australian Maritime Safety Authority. This can be done by phone or online within 72 hours.

In addition, the above requirements, the Marine Safety Act 1998 (NSW) requires that marine incidents described above are required to be reported to Transport for NSW (Maritime). Additional incidents include;

- Any damage to the environment caused by the vessel or by any substance on, or discharged from the vessel

Reporting an incident with transport for NSW (Maritime) can be achieved through the Service NSW marine incident reporting online. If an authorised officer from transport for NSW (Maritime) attends the incident, you have met your reporting obligations.

The Environmental Protection Agency are the regulatory body for pollution. The Environmental Protection Agency also manage pollution response through the emergency management framework.

Emergency Response: In an emergency a person can contact police, fire brigade and ambulance on ‘000’.

Additional contacts are as follows for emergencies in Sydney harbour.

- Sydney Water Police – VHF 13 or 1800 658 784
- Sydney Ports – VHF 13 or 9296 4999, including environmental response
- NSW Maritime – 13 12 36
- AMSA – 1800 641 792
- Designated person Ashore – Owen Kenny 0459 598 490

Section 9: Procedures for on board operations

These emergency procedures have been developed in accordance with best practice and WHS Regulations. When creating these procedures, the owner has considered the design and construction of the vessel and its safety systems, emergency equipment provided and competence and training of the persons working onboard.

Some of the considerations in developing this system are as follows:

- Hierarchy of control measures
- Identifying hazards
- Personal Protective Equipment (PPE)
- Hazardous atmospheres
- Storage of flammable or combustible substances
- Slip, trips and falls
- Noise
- Hazardous manual tasks
- Confined spaces
- High risk work
- General risk and workplace management

Fire onboard

The following procedure is for the emergency response for fire onboard the vessel.

- Once a fire or smoulder has been identified immediately raise the alarm by shouting, "Fire, Fire, Fire"
- Assess the fire and if it can be safely extinguished
- Use the correct fire extinguisher on the fire, or fire blanket.
- Remove any nearby combustible materials
- Inform the dockmaster or Noakes Staff member
- Complete logbook entry
- Complete AMSA Form 18-19

Fire extinguishers are located as per the general arrangement, *Annex 3*.

Generator Room Fire

The following procedure is for an engine room or fire, weather involves the main engine or not, the following procedures are to be employed to control the spread of the fire.

- Smoke, flames, or fire detection alarm sounds
- Raise the alarm by shouting, “Fire, Fire”
- Immediately inform the master
- Attempt to inspect the space, DO NOT ENTER if not safe to do so, atmospheric contamination may be present.
- Make decision on best course of action upon visually inspecting the fire if able fight the fire.
- If visual inspection cannot be achieved, close engine room hatches
- Close fuel shut off cocks
- Close Air intakes
- Shut down engine
- Radio Channel 16 VHF or ‘000’ for urgent assistance if required
- Apply fire suppression system in engine room if required
- Complete AMSA form 18 -19

Four Stages in firefighting are:

  - Find
  - Inform
  - Restrict
  - Extinguish

Person overboard

- Raise the alarm by Shouting “Man overboard”
- Throw the person overboard a lifejacket of buoyant appliance
- Warn approaching vessels
- Maintain visual contact with the person and talk them to the nearest man overboard recovery point
- Tell any other person to keep look out and point at the person in the water
- Deploy the man overboard recovery system, line or ladder to aid the recovery of the person from the water.
- Conduct person injured medical emergency procedure, if required.
- Make record of the incident in the vessel logbook
- Assess the incident, report to the relevant authority in accordance with section 8

Person injured or medical Emergancy

Any injury onboard the vessel should be immediately assessed to its severity.

- Check the immediate area for any signs of danger and remove or control it (if safe to do so) to avoid further risk to the casualty and yourself
- Do not move the casualty unless they are exposed to a life-threatening situation
- If required, contact the ambulance service by dialling **000.** If you are unsure if an ambulance is required call 000 and they will advise you
- Remain with the casualty and administer first aid until assistance arrives.
- Obtain the medical kit yourself or by directing another person
- Follow the instructions if relevant emergency services personnel or advanced first aider
- Remember DRS ABCD
    - **D**anger
    - **R**esponse
    - **S**end for help after response
    - **A**irway
    - **B**reathing
    - **C**PR (start CPR, 30 chest compressions to 2 rescue breaths)
    - **D**efibrillation
- If possible, manoeuvre the vessel to the nearest pick-up pint, wharf, or marina
- Complete AMSA Form 18/19

Environmental Spill

In the event of a spill the staff will alert the Dock Master and other staff immediately. The Dock Master and staff will investigate the source of the spill and stop the operation immediately.

If the spill occurs whilst re-fuelling generator the procedure will be stopped and all available means of containing the spill will be utilised. This includes the fuel facilities / on board spill kit including soaker pads, bunting, rags, and squeegee. The Dock Master will then contact the fuel facility staff, inform them of the situation and liaise closely with them. Sydney Ports VTS should be informed of any large spill.

In the event of a sullage spill, the pump will be stopped immediately, and the appropriate authorities will be informed. Any spill must be recorded in the FDD's log, an incident report form is to be completed and the DPA must be notified.

An AMSA incident report will also be submitted.

Master Incapacitated

The vessel ‘FFD1N’ will not operate under it’s own power to navigate. However, the Dockmaster is assessed to have overall general control during movements and will communicate pushing/towing vessel’s to propel the vessel when required. If the dockmaster is incapacitated the following procedures are to be followed;

- Asses the situation
- Isolate the danger
- Stop the vessel
- Raise the alarm and being the person injured or medical emergency procedure.
- If possible navigate the vessel to the nearest wharf or marina.

Vessel Collision

- Account for all crew / passengers, check for injuries
- Check the vessel for damage
- If hull has been breeched shore up damage and prevent damage
- Assist the other vessel and persons if another vessel involved
- Make way to the nearest wharf or marina to conduct secondary / detailed inspection

Vessel Grounding

After the vessel is grounded the following procedures are to be followed. Knowing that not all possible circumstances can be predicted, these procedures must be used in conjunction with the master’s determination of best course of action.

- Account for all crew
- Check vessel for damage, assess the situation
- If possible, shore up damage and reduce flooding if possible
- If a compartment/s are flooded, close flooded compartment to prevent vessel sinking.
- Check crew for injuries
- Render first aid if required
- Make way to shore
- If necessary, use radio or mobile phone to alert emergency response agencies

Vessel Flooding

If the vessel begins to flood, the source of water ingress can be from a variety causes. These can include mechanical failure, failure of through hull fitting, collision, or down flooding. The key to vessel flooding emergency procedures its to identify the source of the ingress.

- Identify the point of water ingress
- Conduct a visual inspection and report to dockmaster
- Attempt to stop water ingress, shoring or other means available to stop or slow the flow.
- Activate bilge pump/s
- Make way to shore, Wharf or Marina
- Check for crew injuries
- Keep calm and work as a team

Adverse Weather Conditions

Vessel 'FFD1N' is operated in sheltered waters. However, in the event of serve adverse weather a determination is to be made to cease work. If it is determined that the weather conditions are too dangerous to continue to operate or work onboard the vessel the following procedures are to be conducted.

- Lash or fix loose items
- Ensure mooring lines are secured, doubled if required
- Cease work on deck
- Ensure safety equipment is in place
- Close weathertight and watertight hatches and apertures.
- Report to the dockmaster the vessel condition

Hook up - lines or submerged object

- Identify where the line is hooked up
- Inform the dockmaster
- Identify if the line is part of the vessels mooring arrangement
- Under direction release or cut line if necessary

If the vessel is under tow the following procedure is to be followed;

- Raise the alarm by shouting "hook up" and point to the line
- Make your way to the line using caution as it may be under tension
- If possible, release or cut the line
- Keep raising the alarm until the vessel pushing or towing acknowledges the hook up.

Tow line failure

In the unlikely event that the vessel was carrying out towing operations and the towline fails, the following procedures are to be considered.

- Stop the towing vessel
- Crew to maintain visual of the towed vessel
- All attempts to recover the adrift vessel to be made
- Heaving line or other suitable line to be ready when conducting towing

Tow lines can failure due to friction or overloading. When setting up tow consider rub/chafe points before conducting the tow. Master must be mindful when driving the vessel, as waves, swell can place additional load on the tow line. Controlling the throttle through the peaks and troughs will drastically reduce the additional strain on the tow line.

Smoke - no fire

When smoke can be seen/smelt the source must be investigated immediately. Possible causes can include:

- Electrical
- Engine
- Fixed fire protection, including structural or lagging
- Hydraulic fluid
- Exothermic reaction
- Oil
- Friction

The smell of the smoke can sometimes assist in determining the source. DO NOT intentionally inhale the fumes, they can be toxic.

- Locate the source of the smoke
- Isolate the source if possible
- Prepare a fire extinguisher or fire blanket and smother the smoke

Depending on the outcome of the above steps it will determine the next course of action. If a fire flares up, follow the fire procedures. If the smoke dissipates, establish the extent of the damage if any and the master is to determine if returning to the home berth is required. Monitor the source of the smoke to prevent re occurrence.

Section 10: Emergency Preparedness

Vessel 'FFD1N' has established emergency procedures in place as documented in section 9. These procedures are a 'live' and can be changed altered or amended if new workplace practices are developed. Feedback from person working onboard or operating the vessel is essential to develop these procedures.

This document is readily available to a person to review, if an increased risk is identified by review of the risk assessments changes will be considered to eliminate or minimise any increased risk so far as reasonably practicable.

Persons are informed of the risk assessments on induction and verified they have been explained the risks through the training record.

Drills will be conducted to implement the Safety Management System and further develop the system from observations and feedback of the effectiveness of the procedures.

The general assembly point in an emergency is identified through the induction process and recorded on the vessel general arrangement, *Annex 3*.

As the vessel is exempt from the crewing requirements in accordance with section 6, it is expected that any persons onboard will be able to carry out the emergency procedures. The nature and complexity of the operation presents minimal risk whilst under tow but risks are present when submerging and re floating the dock. As the vessel is designed to carry out general repair and maintenance of other vessels embarked, risks of general workplace hazards are present. The risks involved with general maintenance and repair are covered in the site induction.

If an incident occurs all persons are to be accounted for to record and confirm the presence of all persons onboard.

Section 11: Follow-up on Hazardous occurrences and non-conformances

When a hazard or non-conformance is identified the person who observed the hazard <u>must</u> report the hazard to the dockmaster or the designated person ashore. The hazard and/or non-conformance must be recorded in the vessel log. All hazards and/or non-conformances must be investigated. The result of the investigation into a hazard or non-conformance including any corrective action taken to prevent a re-occurrence will be recorded as a Non-Conformance Report (NCR) on the NCR register. If amendments, training or control measures are required a revision of the Safety Management System will be conducted.

Section 12: Maintenance of Vessel and Equipment

A maintenance record is maintained by Noakes Group for the vessel, machinery and its equipment. The maintenance record ensures the safe operation of the vessel, it's operational capacity and to ensure that it remains fit for purpose.

This system records arrangements for inspections and correcting deficiencies identified by internal or external inspections. The servicing of the vessel, machinery and its equipment is performed in accordance with the manufacture's specifications and requirements.

The Maintenance is documented separate to this document which forms part of the overall Safety Management System.

Section 13: Documentation / Logbook

Logbook

Vessel 'FFD1N' has a logbook which records the operation, inspections, incidents and record of feedback. The logbook is located on board the vessel but a electronic record is held to record further details and as a back-up arrangement to prevent loss of information recorded.

Within the vessel logbook in addition to the operation, incidents and feedback the dockmaster must record the following details;

- Any illness or injury of a person onboard
- Any assistance rendered to another vessel
- Any unusual occurrence or incident
- All communication sent or received for an emergency
- Any operation of the vessel for recreational use

The logbook is to be retained for a period of five years. The logbook must not be mutilated, destroyed or deliberately withheld from inspection. It cannot contain illegible, false or a fraudulent entry. The logbook is a working document that needs to be maintained by the persons operating the vessel under the direction of the dockmaster.

Crew / Special Personnel Documents

Personnel are inducted into the Noakes Group facility and vessel have site inductions and personal particulars recorded electronically. No documents for the personal details as required by Marine Order 504 are kept onboard. This ensures confidentiality of the person's details. Due to the nature of the operation vessel 'FDD1N' does not make voyages and is normally operated alongside the Noakes Group facility at 6 John Street, McMahons Point, NSW. The proximity to the crew / special personnel documents to the vessel would satisfy a requirement to produce a requested document by regulators or emergency services.

Noakes group assess staff before embarking that the persons have the ability to perform the task and have a level of medical fitness to undertake an activity for which the vessel is to be used.

Record of revisions

A record of the revisions and amendments of the safety management system are located on page 2 of this document.

Review

Noakes Group in consultation with key stakeholders regularly review the safety management system and its effectiveness. Reviews are conducted to ensure the following;

- Assess compliance with operation requirements developed internally
- Review of all procedures is conducted every twelve months
- Assess any updates or amendments made by regulators that may affect the safety management system.

Each review is documented electronically on the Noakes Group server. It will include recording of any outcome, consequential actions or changes to procedures. If any change to this component of the Safety

Management System is required a record of the revision is recorded on page two and all affected persons who operate or work on the vessel receive training on the change.

Section 15: On Board Operations

On board operations for vessel 'FDD1N' are conducted in accordance with the vessel operations manual, *Annex 12*. The vessel operations manual details the procedures to operate the vessel machinery and pumping arrangements. As the vessel is designed to partially submerge to allow another vessel to onboard then pump ballast water out lifting the vessel out of the water a comprehensive operations manual has been developed.

The unique nature of the operation requires attention to detail on how 'FFD1N' is operated to ensure the evolution is performed correctly.

Key task outside the operations manual is to conduct pre-operating checks to ensure that safety equipment is present and fit for purpose and that the vessel is in general good condition to perform the task. The pre-operating check is recorded I the vessels logbook.

Section 16: Environmental Controls

Please refer to *Annex 13* the Noakes Floating Dry Dock Operational Management Plan

Section 17: Safe Work Method Statements

The vessel operates under the Noakes Group Business Management System (BMS). The BMS is a Local Area Network (LAN) that has a register of the Controlled Documents. These documents outline policies and procedures for conducting work safely. The Health, Safety, Environment and Quality (HSEQ) Manager ensures that all high-risk work has a Risk Assessment (RA) completed then a Job Safety Environmental Analysis (JSEA) and a Safe Work Method Statement (SWMS) completed. A toolbox talk is then completed before work starts and adequate PPE is provided for the tasks.

Training Record

Induction	Facilitator:	Time / Date:

Inducted person name:

Inducted person position:

Previous experience / qualifications:

Notes:

Safety Management System training

Vessel walk around	☐
Safe boarding	☐
External crush points	☐
Bollard tie up	☐
Buffers, placment / crush points	☐
Emergancy assembly point	☐
Location of Safety Management System	☐
How the Safety Management System works	☐
Vessels logbook	☐
How to record feedback	☐
How to record incidents	☐
Discuss the risk register	☐
How to impliment the risk register on new task	☐
How to indetify a risk	☐
PPE	☐
Lifejacket donning	☐
Location of emergency equipment	☐
Generator emergancy shut down procedure	☐
Pipe or pump failure during operation	☐
Location of fire extingushers	☐
Vessel emergency plan diagram	☐
House keeping	☐
Indentifing leaks	☐
Vessel generator familisation	☐
Vessel pump arrangement familisation	☐
Vessel submersion revision	☐
Familisation of control panels	☐
Start up proceedure	☐
Shut down proceedure	☐
Marine incident reporting / emergancy contacts	☐
How to induct special personnel	☐

Emergancy Procedures as per SMS

Fire onboard	☐
Generator Room Fire	☐
Person overboard	☐
Person injured or medical Emergancy	☐
Enviromental spill	☐
Master Incapacitated	☐
Vessel Collision	☐
Vessel Grounding	☐
Vessel Flooding	☐
Adverse Weather Conditions	☐
Hook up - lines or submerged object	☐
Tow Line Failure	☐
Smoke - no fire	☐

Instructions to facilitator

Facilitator will discuss potential hazards such as contaminated atmospheres, lifting dangers and towing dangers.

Induction training is designed to be practically demonstrated followe by the inductee practically demonstrating the required procedures.

Discuss with inductee when engaging in an activity that is not regular or a person considers dangerous a asseement with all persons on site is to be conducted to indetify hazards and the risks. This can include vessel salvage, operating outside the designated area, working with aother vessels / plant / equipment.

Employee declaration

I .... Have been inducted in the operation of the vessel and its safety / emergacy equipment and procedures.

Worker signature: Date:

Facilitaor signature: Date:

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TECHNOLOGIES PTY LTD
ABN 76 100 555 904

Noakes Boat Yard – Basis of Ventilation Design Rev03
14 April 2022

General

The Noakes boat yard is a general marine maintenance company carrying out a wide range of activities. These include paint preparation work (sanding and abrasive blasting), painting and anti-fouling application, welding and wood working repairs.

Painting and abrasive blasting are not full time activities but do create emissions that need to be controlled.

Shed Extraction

We had available to us a report on measurements of shed emissions. This work was carried out by Stephenson Environmental Management (SEM). A copy of pages relevant to the extraction system design are attached.

The shed extraction was 6.4 m^3/s which gives a good number of air changes per hour. We regard this level as suitable for the activities being carried out.

Particulate emissions were low due to the wet wall dust collector fitted to each shed. The emission of volatile organic compounds (VOC) was small by industrial standards. This was still significant in light of odour complaints being received and it was determined by Noakes that measures were required to reduce the VOC emissions.

The SEM report identified a number of different VOC all of which are typical of what you expect to get from industrial painting activity. All the identified VOC are readily absorbed by activated carbon. This led to the decision to design a bespoke activated carbon system.

Off the shelf type activated carbon systems do not have the carbon bed depth, contact time and VOC holding capacity to meet the system requirements.

FDD Extraction

Initial work by Jacobs had used the same extraction airflow (6.4 m^3/s) for emission control from the floating dry dock (FDD).

Fowlerex reviewed this and agreed that this is sufficient provided there is appropriate use of screens and the like to confine dust and VOC to smaller working areas.

It will be practical to duct from the extraction spigots high in the FDD wall to a location close to the working area. Modular clip together ductwork and/or flexible ductwork can be used for this purpose.

The FDD system will have a dust collector to remove particulate prior to the activated carbon filter. The dust collector prevents the activated carbon filter from becoming plugged with particulate. It reduces system particulate emissions to a very low level.

The FDD ventilation system is a bespoke system. The design has evolved so that the equipment will be built into the wing walls of the FDD. There will be two fan, dust collector and activated carbon filter systems, each of 3.2 m^3/s capacity.

The dust collectors are a bespoke design to fit into the space available. Each dust collector will contain 49 pleated filter bags with a total of 132 m^2 of filter area.

Relocatable Shed

The proposal is that extraction from the relocatable shed (RS) will be blown into the extraction system for the fixed sheds. Only one shed, fixed or relocatable, will be operated at any one time.

The ventilation rate of the RS will be 50% of the ventilation rate from the fixed shed.

Ventilation Rates

Shed	Width m	Height m	Length m	Volume m^3	Airflow m^3/s	Air changes per hour
1	10	10	18	1800	6.4	12.8
2	10	10	23	2300	6.4	10.0
3	10	10	29	2900	6.4	7.9
Relocatable	7.35	5.15	19.6	740	3.2	15.6
FDD	14	7.8	49	5350	6.4	4.3

The relocatable shed may be difficult to seal so it was considered appropriate to have a higher ventilation rate.

The FDD will only be used for larger vessels which consequently reduces the volume to be ventilated and increases the air changes per hour.

Openings into the sheds and FDD should be a maximum of 4 m^2 and a minimum of 2 m^2. This will maintain a small negative pressure in the ventilated space and ensure an ingress of air through the openings.

Activated Carbon Filter Design

The shed filter and the FDD filter look different but have been designed using the same key criteria.

The required VOC collection efficiency is 95%.
The nominal velocity through the filter is 0.35 m/s.
The bed thickness of the activated carbon is 0.6 m.
The contact time is 0.6/0.35 = 1.7 seconds.
The activated carbon load is 5000 kg.
The predicted time between carbon changes greater than 12 months.

These design parameters were put to three different carbon manufacturers (or their local agents). These were Puragen, Norit and Jacobi. Puragen and Jacobi confirmed the design. Norit recommended a slightly longer contact time (1.9 seconds) which the design could accommodate if necessary.

Spent Carbon Disposal

Two waste companies were approached regarding disposal of the spent carbon. Both Cleanway and Enviro Waste were prepared to collect and dispose of the spent carbon. Carbon used in this application is not classified as toxic waste.

Fowlerex Emission Guarantees

Fowlerex guarantee the following:

1. The activated carbon filters will reduce VOC emissions by 95%.
2. Particulate emissions will be less than 1 mg/Nm^3 dry air.

Doug Pigou
Director

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Internet: www.fowlerex.com.au

Lance Hodgkinson
Hampton Property Services
Via email

26 April 2022

Technical Specifications for Filtration Systems for Floating Dry Dock

Dear Sir

The attached document (Ventilation Design Basis rev03) details the design basis for the filtration system for the floating dry dock (FDD). It also details the design basis for the land based sheds.

Drawings of the FDD system have been provided. The most relevant drawing of the filtration equipment is Noakes-FD-010 issue 3. A copy of this is attached.

Further we advise that the emission guarantees provided by Fowlerex Technologies Pty Ltd are:

1. VOC will be reduced by 95%.
2. Particulate emissions will be less than 1.0 mg/m^3.

Your sincerely

Doug Pigou
Director

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14 April 2022

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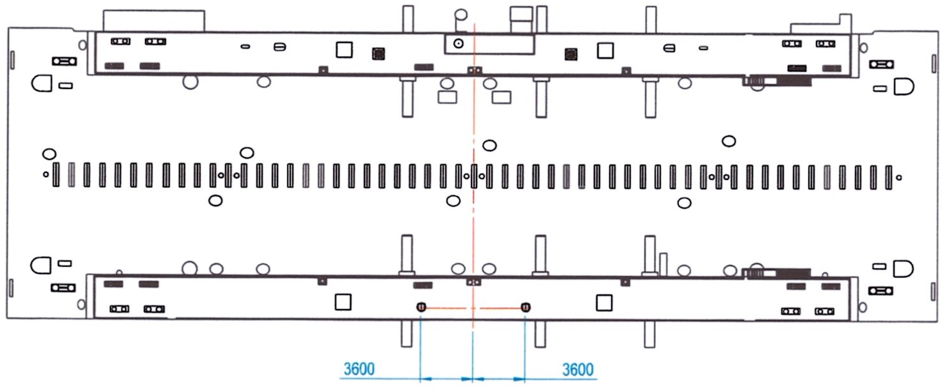
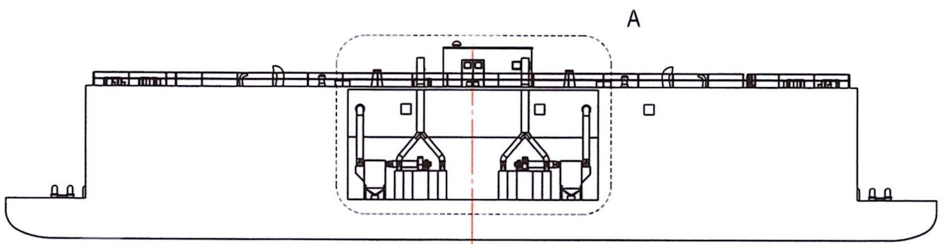
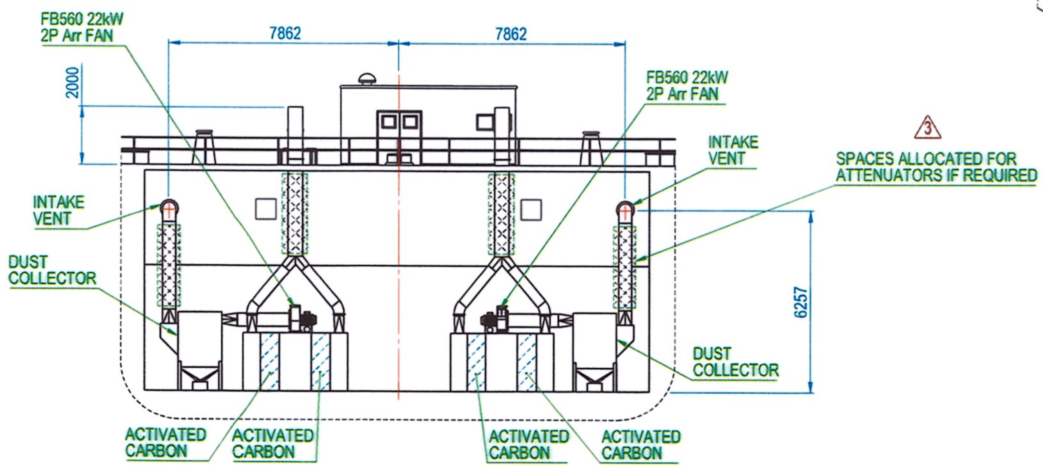
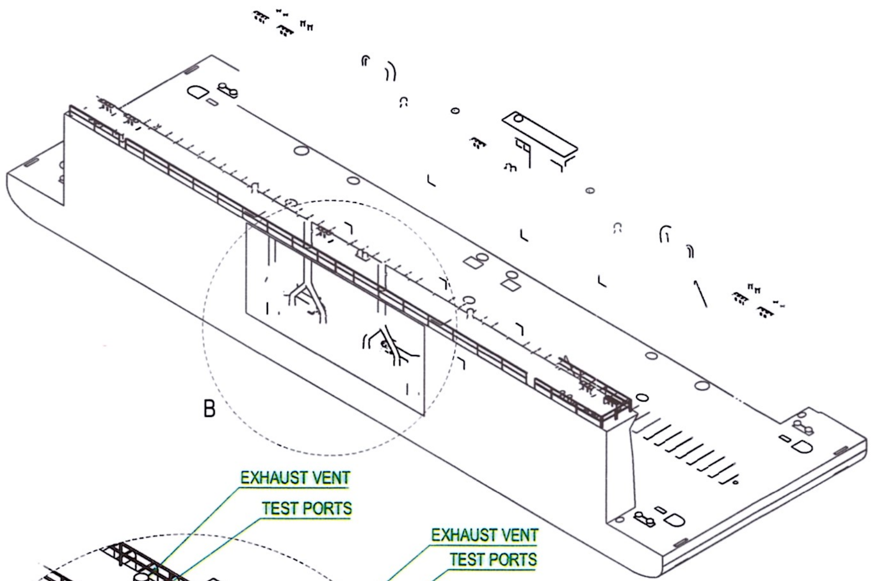
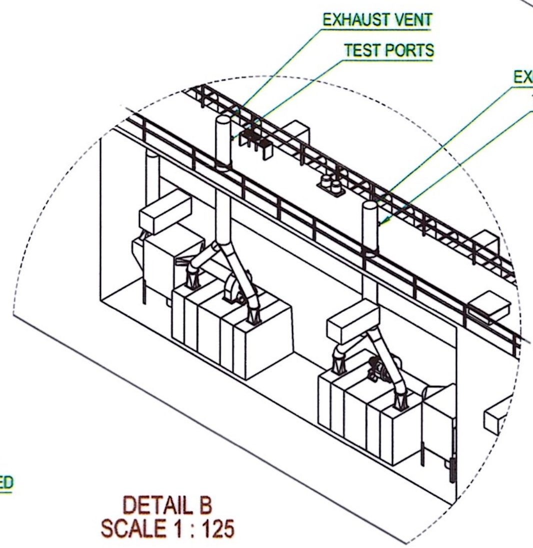
Doug Pigou
Director











DETAIL B
SCALE 1 : 125

This drawing and the information contained herein is the sole property of FOWLEREX TECHNOLOGIES Pty Ltd, is strictlyconfidential and must not be disclosed without the written consent of FOWLEREX TECHNOLOGIES Pty Ltd

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NOAKES

VENTILATION SYSTEM
100T FLOATING DOCK

SCALE	1:250	A2	A.B.N. 74 100 555 904
PROJECTION	DRAWN	RIM	21/9/21
	CHECKED	...	. .
	APPROVED	...	. .

DO NOT SCALE THIS DWG.

DRAWING No.	ISSUE
NOAKES-FD-010	3
SHEET 1 OF 1	

DWG #	DESCRIPTION
REFERENCE DRAWINGS	

DESCRIPTION	ISSUE	APPROVED	DATE
ATTENUATOR DETAIL ADDED	3	DP	28-09-21
...			
...			

LAST SAVED: Wednesday, 22 September 2021 10:34:52 AM

DOC22/291673

Mr George Youhanna
NORTH SYDNEY COUNCIL
ABN 32 353 260 317
PO BOX 12,
NORTH SYDNEY NSW 2059
Email: George.Youhanna@northsydney.nsw.gov.au

Dear Mr Youhanna,

DA57/19 – Floating Dry Dock Proposal – EPA review of additional documents

I refer to North Sydney Council's request for comments from the NSW Environment Protection Authority (EPA) on the further documents submitted by the applicant (documents detailed below) for Concurrence and Referral (CNR) CNR-5551, DA 57/19 at 6 John Street, McMahons Point NSW 2060 (the premises). The request for comments was received by the EPA on 1 February 2022. The EPA provided an initial response to the additional documents via the CNR portal dated 3 March 2022.

The EPA understands that development consent for this proposal was refused by the Sydney North Planning Panel on 1 September 2020 and that the applicant has appealed that refusal to the Land and Environment Court (LEC matter 2021/63136).

The EPA provided comments on development application DA57/19 (the original development application) (DOC19/233121-8) requesting additional information on 8 May 2019. Council referred the applicant's response to EPA submissions dated 8 May 2019 to the EPA on 4 March 2020. The EPA provided comments on the applicant's response to the EPA's submissions by letter dated 5 June 2020 (DOC20/183986).

The purpose of this letter is to provide the EPA's comments on the additional documents received by the EPA on 1 February 2022. These comments should be read together with the EPA's previous responses to this development proposal dated 8 May 2019 (DOC19/233121-8) and 5 June 2020 (DOC20/183986).

On this occasion the EPA has reviewed the following documents:

- Land & Environment Court of NSW, Proceedings No. 2021/00063136, Stannards Marine Pty Limited Vs North Sydney Council, <u>Surface Water and Wastewater Management Strategy</u> – Prepared by Advisian (Worley Group) – December 2021
- Stannards Marine Pty Ltd V North Sydney Council L&E 63136/2021, <u>Marine Ecology Impact Assessment</u> – Prepared by Marine Pollution Research Pty Ltd – 03 December 2021
- Stannards Marine Pty Ltd Vs North Sydney Council L&E 63136/2021, <u>Responses to Contamination Issues</u> – Prepared by Geosyntec Consultants – 03 December 2021

- Air Quality- Stannards Marine Pty Ltd v North Sydney Council – 2021/00063136 -Astute Environmental Consulting on behalf of Stannards Marine Pty Ltd – 03 December 2021 (Version R1-2) (the Astute Report)
- Acoustic Report, Stannards Marine – 6 John Street, McMahons Point, Land and Environment Court, Stannards Marine Pty Ltd v North Sydney Council 63136 of 2021 (REPORT NUMBER 7281-1.1R Rev A DATE ISSUED 04 December 2021) Prepared by Day Design Pty Ltd (hereafter referred to as the “Day Design NIA”)
- 6 JOHN STREET, MCMAHONS POINT, Noise Impact Assessment, EPL 10893 - Condition U1, Prepared for: Hamptons Property Services PO Box 954 Edgecliff NSW 2027 prepared by SLR Consulting (hereafter referred to as “SLR NIA - PRP U1”)
- 6 JOHN STREET, MCMAHONS POINT, Noise Management Plan, EPL 10893 Condition U2, Prepared for: Hamptons Property Services PO Box 954 Edgecliff NSW 2027 (hereafter referred to as SLR NIA – PRP U2”)

Advice
The EPA is unable to adequately assess the application, and provide a complete response, because the applicant has not provided sufficient information to date. The EPA’s response dated 5 June 2020 identified information that was still required to understand the air and noise impacts of the proposed development. The EPA has not received any reports as part of the development application process in response to the correspondence dated 5 June 2020, that address the request for further technical information on air quality and noise impacts of the proposed development. Further information on this is provided below.

Air Quality
The EPA has received only one additional document relating to air quality – the Astute Report. This report was obtained from Council’s lawyers but was not referred to the EPA via the CNR portal. The EPA has reviewed the Astute Report and notes the following:

1) It refers to an Air Quality Impact Assessment (AQIA) prepared by SLR consulting, denoted as “the new assessment” (see point 30 of the Report). No specific reference to the AQIA is provided, and as such it is unclear which AQIA the Report refers to. The EPA believes that the AQIA referred to in the Astute Report has not been provided to it and that it is likely to contain additional information about air quality impacts associated with the proposal that the EPA has not had the opportunity to review.

2) It refers to a bespoke ventilation and control system, designed by Fowlerex, for controlling emissions from the floating dry dock. The EPA has not received any information detailing the Fowlerex air extraction system referred to in the Report. The specifications of the design have not been previously provided. Therefore, the EPA cannot provide comments or recommendations on the adequacy of the design.

Noise
In order to complete its assessment of the proposal, the EPA still requires the following information on the noise impacts associated with the proposal:

1) An assessment of the FDD against a level of LAeq,15minutes 43dB (i.e. PNTL minus 10dB) to ensure that it does not result in cumulative impacts, and allows other noise sources on the site the scope to contribute to a cumulative level of 53dB through mitigation measures required to be applied through EPL10893, Condition U1.
2) An assessment of the use of tugs, including identified impacts and appropriate mitigation measures,
3) Consideration of the water pumps to raise and submerge the FDD within noise modelling
4) Analysis of the performance of the sound absorptive material proposed to be lining the inside face of the side wall of the FDD to be maintained after being submerged and raised, noting that the recommendation is for rockwool with a perforated metal facing.
5) Details of whether calculations of room absorption (i.e. the FDD enclosure) considered the reflective area of the vessel within the FDD “enclosure” and the reduction of volume in the space when a vessel is in the FDD.

6) The sound reduction index of the acoustic curtains (Flexshield 6kg) reflects laboratory test conditions (i.e. sealed airtight) and does not appear to take into account any derating on the basis of imperfect seals in a field situation. The material supplier should provide comment on the ability of the product to be sealed essentially airtight in the proposed FDD scenario under a range of vessel scenarios and how this will be achieved in practice.
7) Details of the considered regenerated or reradiated noise from the top of the vessel which will be above the acoustic curtain.
8) The modelling of the ventilation silencers has considered inline silencers (in series) and simply added the attenuation of each unit arithmetically. Confirmation from supplier (Fantech) that the performance of three inline silencers installed in series is cumulative must be obtained. Confirmation from the supplier of the FDD air system that the silencers backpressure will not result in the need for larger fans must also be explored.
9) Justification of the modelling used, which appears to be based on relatively simple spreadsheets calculations that would more typically be used to design building mechanical ventilation systems and plant rooms etc
10) Advice provided by the EPA through correspondence on 5 June 2020 is still relevant, and requested information is still required.

Summary

As the applicant has not provided sufficient information to enable the EPA to complete its assessment of the proposed development despite the EPA's requests, the EPA is not in a position to issue General Terms of Approval. The EPA understands that the Land and Environment Court has the power to grant development consent to the application. If the Court is minded to approve the development despite the deficiencies in the information currently submitted as part of the development application as set out in this letter, the EPA requests a further opportunity to submit appropriate conditions for air and noise. The EPA will be in a position to provide conditions on contamination, water and waste once the air and noise issues are resolved.

Given this development application has involved the submission of a large number of reports at different points in time, the EPA requests that any further reports submitted be accompanied by a summary of the reports provided at each stage of the planning process to assist in ensuring all currently relevant reports and information are easily identifiable and accessible. It would also assist the EPA's review of further documents if they are submitted as individual documents and not as a very large single pdf where there is a risk of documents being missed.

If you have any questions about this request, please contact Jordan Gavel on (02) 8275 1224 or via email at Jordan.Gavel@epa.nsw.gov.au.

Yours sincerely

Erin Barker

12 April 2022

Erin Barker
Manager Regional Operations

14 October 2021

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Hamptons Property Services
PO Box 954
Edgecliff NSW 2027

Attention: **Lance Hodgkinson**

Dear Lance

6 John Street, McMahons Point
Air Quality Impact Assessment
Addendum Report

In February 2019, an air quality impact assessment (AQIA) was prepared by Jacobs for the proposed construction and operation of a floating dry dock (FDD) facility (the proposal) at the Noakes Marine Repair Facility located at 6 John Street, McMahons Point (the site).

In May 2019, NSW Environment Protection Authority (EPA) requested additional information, with a response to this request provided by Jacobs on 18 July 2019 accompanied by a revised AQIA. This revised AQIA was supplemented by a letter prepared by SLR Consulting Australia Pty Ltd (SLR) on 16 December 2019 which quantified the expected reduction in ground level concentration of pollutants released by the proposal as a result of the inclusion of a proposed carbon filtration system.

On 5 June 2020, the NSW EPA provided North Sydney Council (the Council) with a letter stating that the EPA required additional information in order to enable an assessment of the proposal. A response was provided by SLR on 28 August 2020 addressing these comments together with a copy of the model input and output files.

On 17 December 2020, the EPA provided a "*high-level review*" of the additional reports provided including the SLR response dated 28 August 2020 (the EPA review).

Table 1 identifies the comments raised by the EPA review with regards to air quality issues, provides a brief response to these comments and references the relevant sections within this report that include additional details. It is noted that comments 1.1 and 1.2 of the EPA review which relate to the carbon filtration system design and stack design were addressed by the pollution control system providers (Fowlerex). A copy of their report and latest drawings are provided in **Appendix A**.

Yours sincerely

ALI NAGHIZADEH
Principal

Checked/
Authorised by: GS

Table 1 EPA Review Comments – Noakes Marine Repair Facility

EPA Comment	SLR Brief Response	Addressed in Section
1.3 Revised Air Quality Impact Assessment • *The submitted Air Quality Impact Assessment predicts one exceedance of the EPA's PM_{10} (24-Hour) Impact Assessment Criterion (IAC). The exceedance is due to an elevated background concentration of 48.1 ug/m_3. Consideration should be given to further refinement of the adopted assumptions, further review of the site selection, or the application of more effective mitigation measures or emission controls to reduce emissions to a greater extent.*	To further reduce the potential for air quality impacts at surrounding receptor locations: 1. The emission control system design was re-visited and a higher efficiency system has been designed. 2. The location of ventilation stacks have been optimised. 3. The ventilation systems have been designed to ensure negative pressure is maintained within the Sheds and FDD at all times; eliminating the potential for fugitive emissions from these sources. As a result of the above, additional exceedances of the relevant air quality criteria (over background) are no longer predicted.	**Section 3** **Section 6** **Section 7** **Appendix A**
1.4 Meteorological data • A detailed review of the meteorological modelling has not been undertaken. It is noted that observational data from Canterbury Racecourse has been used to validate the TAPM predictions. Canterbury Racecourse is 10km from the project site, and the topography is distinctly different to that at Berry's Bay. Validation of the representativeness of the meteorological modelling could be better demonstrated using meteorology observation data from a weather station closer to the project site.	In SLRs experience, when a meteorological model run performs well at a location within the modelling domain, it could be expected to perform just as well at any other location within the domain. However, it is noted that TAPM/CALMET models are inherently limited in predicting wind fields in locations with very complex topographical and land use features (such as the site) and the inclusion of surface observations within such locations could significantly improve model predictions. Given the above, the observational data from the weather stations closest to the site were used to nudge TAPM and CALMET predictions. It is noted that exclusion of the closest observational station (so it could be used for the validation of model performance) would lead to a significant drop in the frequency of winds blowing from the site towards sensitive receptors. As expected, validation of TAPM predictions at Fort Denison (closest weather station to the site which was included in the model runs) show very little positive or negative bias of wind speed and direction. Moreover, a review of wind vectors at the site shows that the model has captured effects of terrain, slope flows and terrain blocking effects well.	**Section 4**

1 Introduction

This report addresses the comments raised by the NSW EPA in the EPA review dated 17 December 2020, as well as additional changes to the modelled operational scenario.

This report should be read in conjunction with the original AQIA prepared by Jacobs dated 18 July 2019 and the SLR response to previous EPA comments dated 28 August 2020. These documents contain detailed information on the project, architectural drawings and site layout plans, the existing environment, relevant pollutants, air quality impact assessment criteria, emission factors and monitoring data used for the development of the emission inventory and an assessment of potential construction stage impacts.

2 Site Operations

The existing operations at the site include service, repair and maintenance of marine vessels. The majority of existing works that would potentially lead to the emission of air pollutants (surface preparation, welding and spray painting) are carried out in the three maintenance sheds located at the site. Emissions from these sheds are treated using a wet scrubber system before discharge to atmosphere.

Existing works that would potentially lead to the emission of air pollutants are also performed on the yard within areas encapsulated with plastic/tarpaulin sections which are taped together to form a seal. It is expected that in the future most of the work currently performed in encapsulated areas will be carried out within a proposed mobile shed which will be connected to the proposed pollution control system.

It is proposed that a Floating Dry Dock (FDD) would be located at the site, which would be used to service commercial vessels up to 50 metres (m) in length. Typical service, repair and maintenance activities that would be undertaken at the FDD are similar to those currently undertaken within the sheds.

Air emission generating activities (painting, welding and surface preparation) conducted within the FDD are proposed to be at the same intensity as that currently undertaken within one existing shed.

Standard hours of operation at the facility are not proposed to change from the existing hours, which are 7 am to 6 pm Monday to Saturday, with no work on Sundays or public holidays. Surface preparation activities are restricted to 9 am and 3 pm.

The previous air quality assessments did not consider emissions from encapsulated area activities as the site operators had advised that air emission generating activities would not occur concurrently at the FDD and encapsulated areas. However, in order to assess absolute worst case impacts in the event that the same type of air emission generating activity (eg spray painting) is performed in a shed, the FDD and an encapsulated area simultaneously, the modelling scenario has been updated with the following assumption:

- All potential air emission generating activities (painting, welding and surface preparation) will be carried out at one shed, the proposed FDD and an encapsulated area on the yard simultaneously every hour of the year between 7 am and 6 pm (ie 365 days per year, 10 hours per day for all activities).

As the three activities cannot be performed at one location concurrently (considering safety and logistical requirements), the above scenario is deemed to be very conservative.

It is noted that between the three fixed sheds in which air emission generating activities occur and the proposed mobile shed, only one shed is proposed to operate at a time.

An updated emissions inventory for the above scenario is presented in **Section 6**.

3 Revisions to Proposed Pollution Control Equipment

Since the previous round of air quality modelling performed by SLR in response to EPA comments dated 28 August 2020, Fowlerex has been engaged by Noakes to prepare a detailed design of a pollution control and air extraction systems. The design criteria provided to Fowlerex are as follows:

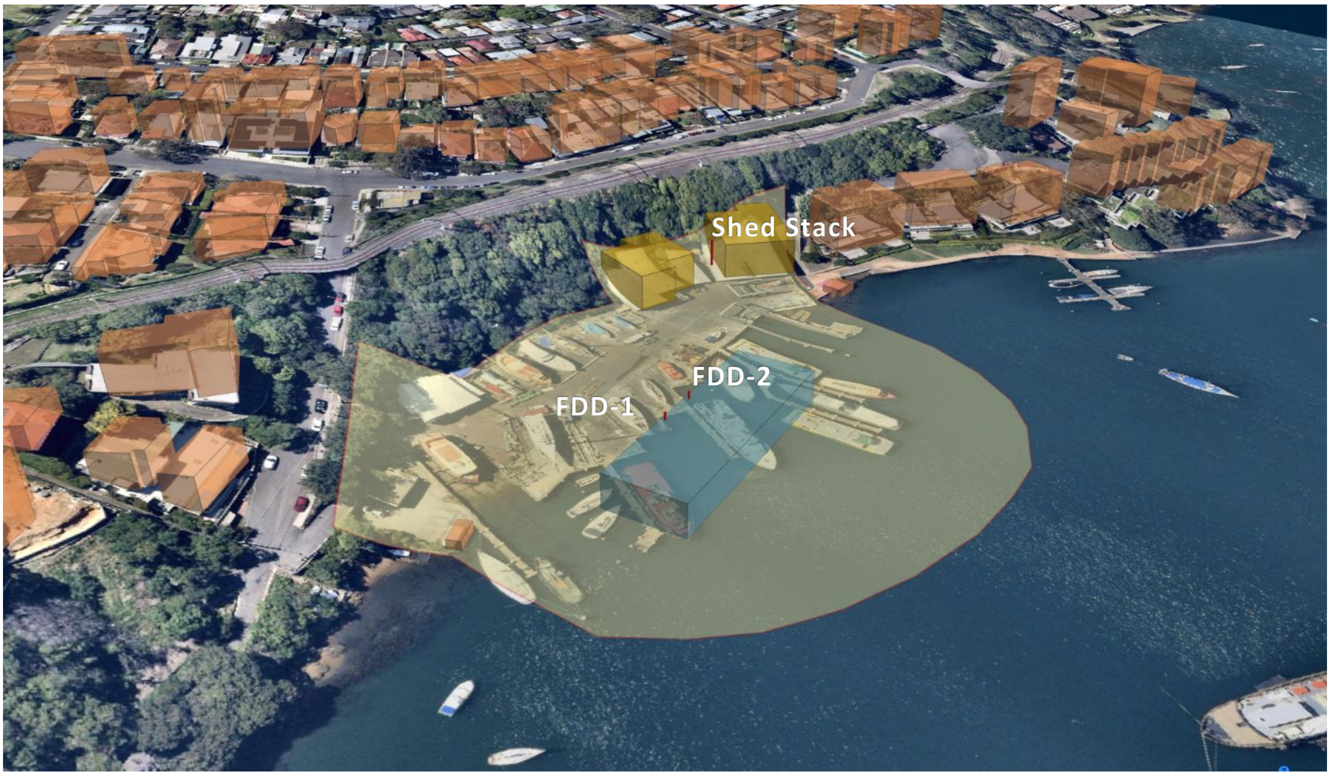
- 95% VOC and odour removal efficiency and 1 mg/m^3 particulate matter emissions for the pollution control system serving the FDD .
- 95% VOC and odour removal efficiency for the carbon filtration system serving the sheds (the existing wet scrubbers installed in the sheds effectively remove particulate emission from the extracted air and will be maintained).
- Negative pressure in the FDD and sheds (including mobile shed) avoiding fugitive emissions from these sources.

The Fowlerex design, which meets the above design criteria includes three separate stacks as follows:

1. An 8 m high, 0.71 m diameter stack located to the north of Shed 3 which is proposed to serve the mobile and fixed sheds wet scrubbers and carbon filter.
2. Two 0.5 m diameter stacks to a height of 2 m above the FDD deck serving the FDD baghouse and carbon filter

The existing stack, which is located to the north of Shed 1 is proposed to be decommissioned. The location of the proposed stacks (in red) are illustrated in **Figure 1**. Full details of the proposed Fowlerex design are provided in **Appendix A**.

Figure 1 Proposed Stack Locations



4 Meteorological Model Validation

The SLR response to previous EPA comments dated 28 August 2020 validated TAPM/CALMET model predictions extracted at Canterbury Racecourse AWS (Station #66194) against observations recorded by this AWS. Validation was performed for Canterbury Racecourse AWS rather than the weather station closest to the site (ie Fort Denison AWS Station # 66022) as:

- There is only one weather station located within a 5 km radius of the site (ie Fort Denison AWS, located approximately 2.5 km east-southeast of the site) with high resolution (hourly averages based on one-minute data) available for 2018.
- The TAPM and CALMET models have inherent limitations in predicting accurate wind fields in locations with very complex topographical and land use features (such as the site). However, model predictions can be improved through the inclusion of surface observations within such locations.
- Ideally, observational data from the weather station that model predictions are being validated against should not be assimilated into the meteorological model to ensure a robust validation.

It is noted that Rozelle Air Quality Monitoring Station (AQMS) is also located within 5 km of the site. However, data from this location was not included in the air quality model and validation was not performed against this station as it does not comply with the relevant siting standards as the clear sky angle is < 120° due to trees within 20 m to the west of the monitoring site.

In SLRs experience, excluding surface observations from the model, particularly from locations with complex terrain and land use, would result in a meteorological data set which is less representative of actual wind conditions. Furthermore, when a meteorological model performs well at a location within the modelling domain, it could be expected to perform just as well at any other location within the domain (provided appropriate surface observations are included).

Notwithstanding the above, an additional meteorological model run was completed with Fort Denison data excluded (Met Run 2). The original meteorological model run was also amended with the inner CALMET domain expanded to include Fort Denison AWS (and other minor adjustments) (hereafter called Met Run 1). Details of the two model set ups are presented in **Appendix B**.

4.1 Comparison of Model Predictions with Weather Station Observations

Figure 2 presents the wind direction and wind speed biases of the Met Run 1 model predictions at Fort Denison AWS compared with recorded observations. As expected, for Met Run 1, insignificant bias is present between CALMET predicted and measured wind speed and wind directions at Fort Denison AWS. Over 95% of winds have no significant direction bias (±7.5 degrees). No significant wind speed bias (± 0.5 m/s) is observed for approximately 70% of the winds and the mean wind speed predicted by the model is only 0.4 m/s lower than the mean observed wind speed. Lower wind speeds, however, are more conservative for near field impacts.

Figure 3 illustrates the meteorological model performance (as wind direction and wind speed biases) at Canterbury Racecourse for Met Run 1 which excluded Canterbury Racecourse AWS observational data. The comparison of data predicted by the model at Canterbury Racecourse and those recorded by the Canterbury Racecourse AWS for this model run shows that for the majority of hours in the modelled year (approximately 65%), winds are predicted to have a bias of less than 22.5 degrees. As illustrated, this model run has some bias towards underestimating high wind speeds and overestimating low wind speeds. However, the mean wind speed predicted by the model is only 0.4 m/s lower than the mean observed wind speed. Further, there is a marginally smaller bias in wind direction (negative or positive) and a larger negative wind speed bias during the daytime (when the site is operational).

It is noted that the Met Run 1 validation for Canterbury Racecourse AWS uses data extracted from the outer CALMET domain, which includes coarse landuse and topography data and a 400 m grid resolution.

Figure 4 illustrates the meteorological model performance (as wind direction and wind speed biases) at Fort Denison AWS for Met Run 2. As illustrated, the wind speed and wind directions biases are larger. Approximately 55% of winds are predicted to have a bias of greater than 22.5 degrees. Similar to Met Run 1, this model run also has some bias towards underestimating high wind speeds and overestimating low wind speeds. However, there is a larger negative bias in wind speed overall, with the mean wind speed predicted by the model 1.7 m/s lower than the mean observed wind speed. Similar to Met Run 1, there is a marginally smaller bias in wind direction (negative or positive) and a larger negative wind speed bias during the daytime (when the site is operational).

Given the above and considering high resolution topography (5 m resolution LiDAR) and landuse (30 m resolution) data has been used for the inner domains of the two model runs, it could be concluded that the land use and topography surrounding the site and Fort Denison AWS are likely too complex for the TAPM/CALMET models to resolve local wind fields accurately without the inclusion of local surface observation data. Moreover, from the above analysis it could be concluded that the model is incorporating provided observational data appropriately (see **Figure 2**).

Figure 2 Meteorological Model Bias - CALMET Predictions vs Fort Denison Observations - Met Run 1

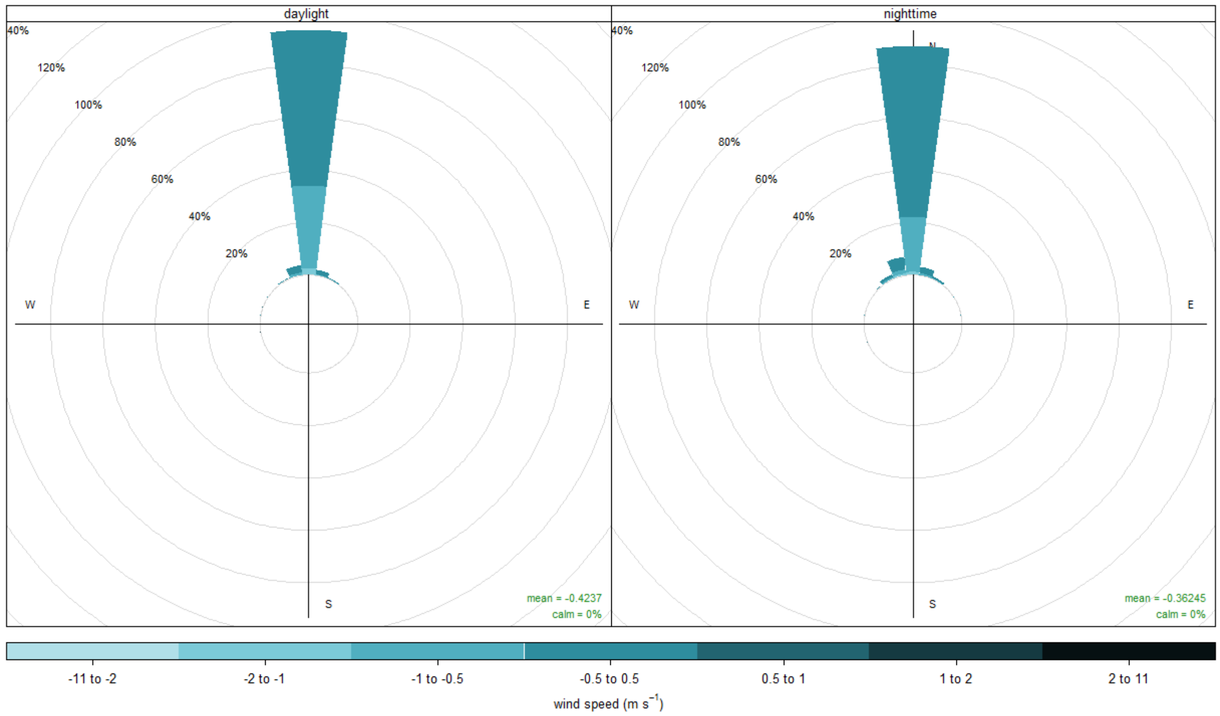


Figure 3 Meteorological Model Bias - CALMET Predictions vs Canterbury Racecourse Observations - Met Run 1

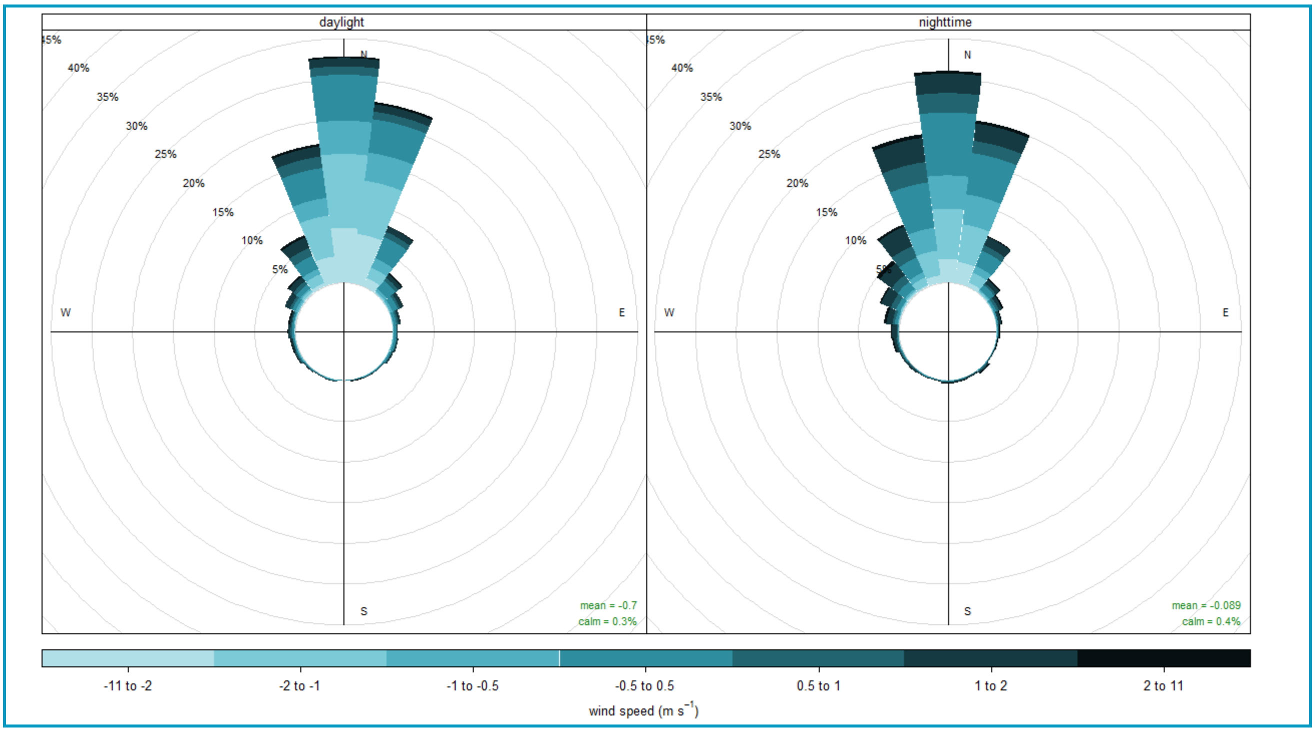
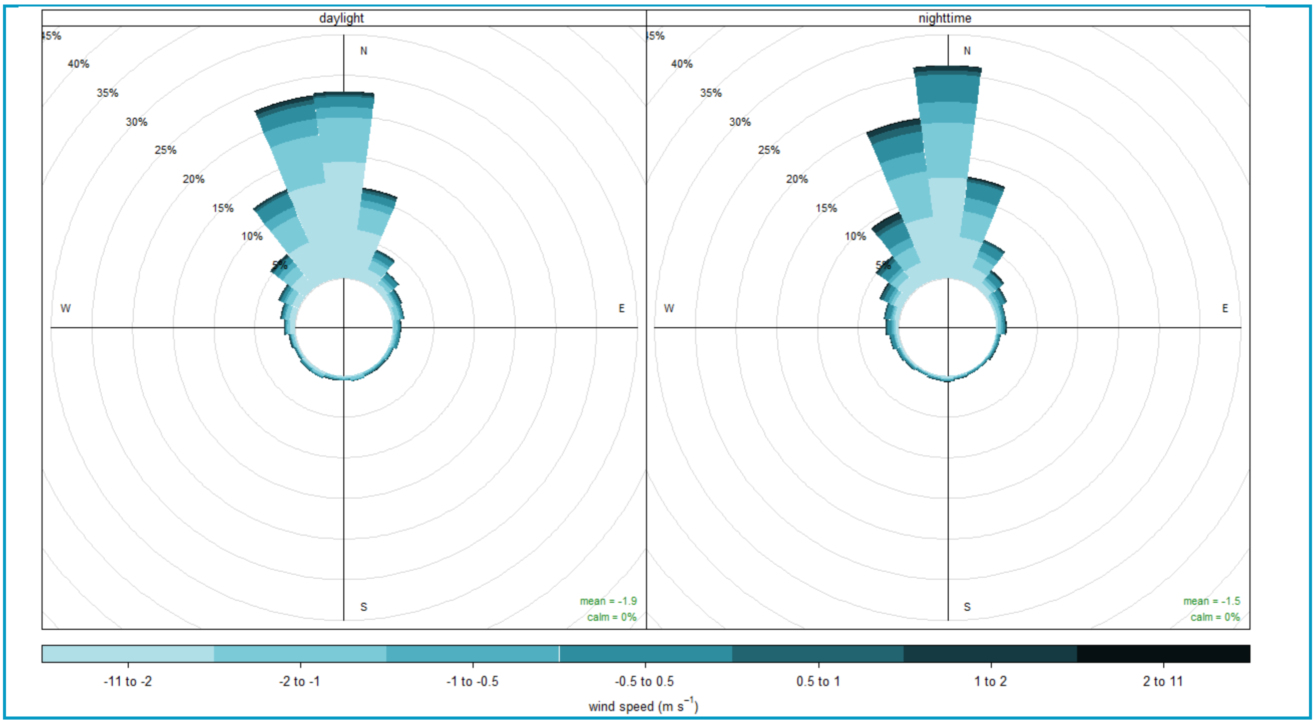


Figure 4 Meteorological Model Bias - CALMET Predictions vs Fort Denison Observations - Met Run 2

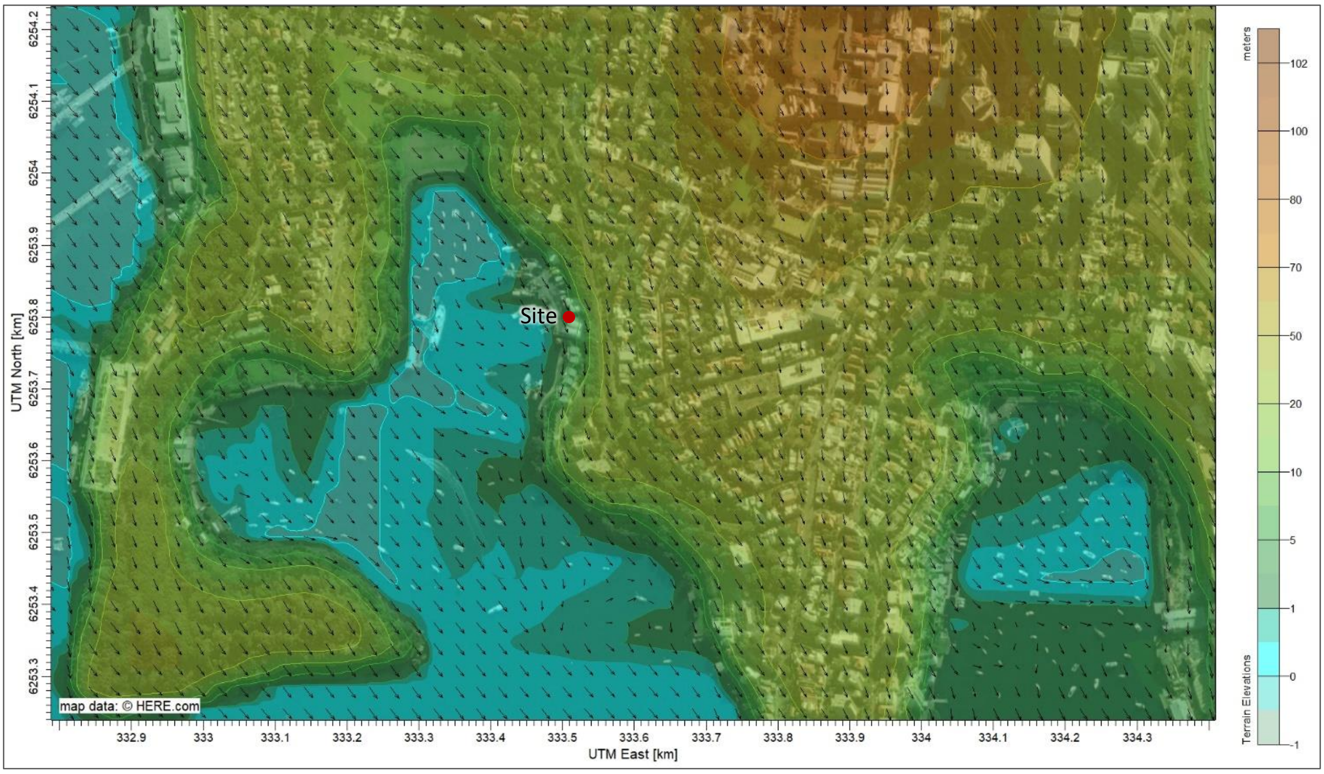


4.2 Review of the Model Performance in Capturing Terrain Effects

To demonstrate the models handling of the terrain in the area surrounding the site, CALMET wind fields were extracted from the original meteorological model run. The wind fields illustrated in **Figure 5** are representative of winds predicted by the CALMET model for 6 am on the 29th October 2018 at a 10 m elevation. As illustrated, the effects of terrain, slope flows and terrain blocking effects have been captured by the model. Therefore, provided sufficient local surface observational data is provided, model predictions are expected to be a good representation of site conditions.

Given the above and the wind speed and wind direction bias analysis, the inclusion of Fort Denison AWS observations are expected to improve model performance.

Figure 5 CALMET model wind fields overlayed on the topography plot

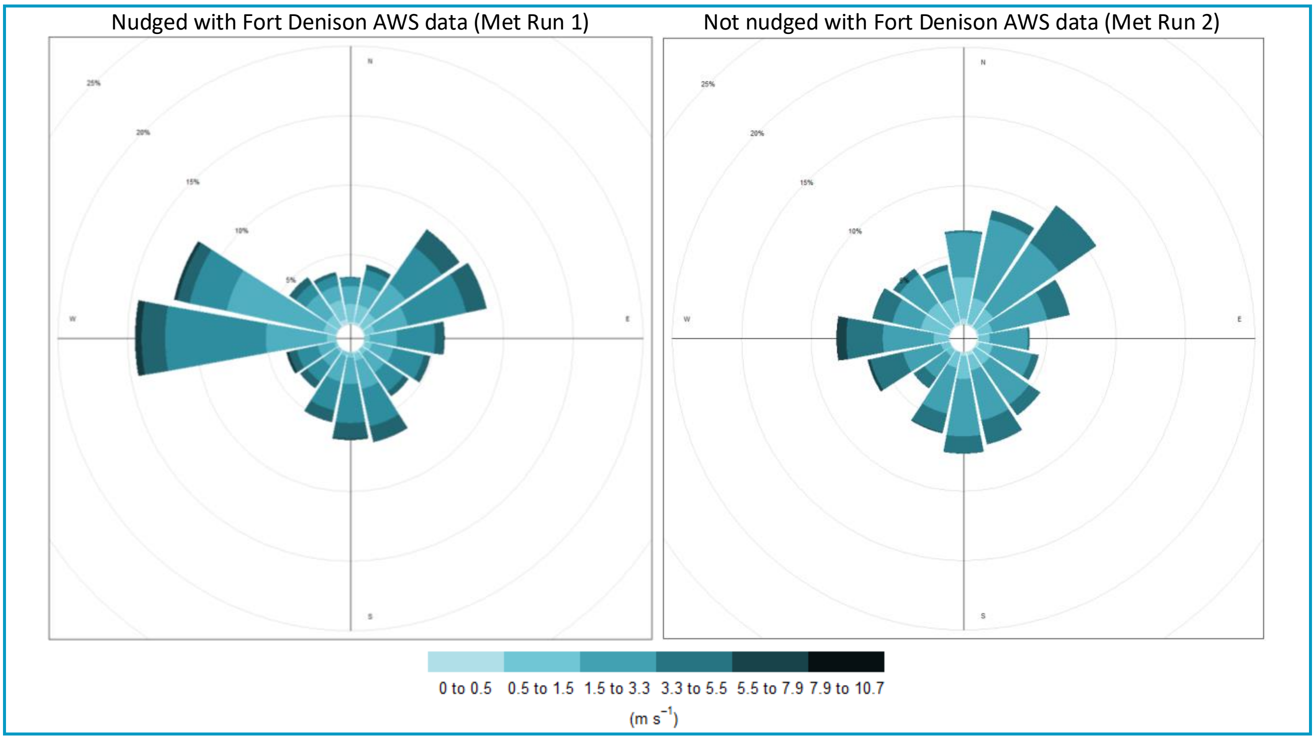


4.3 Wind Behaviour Predicted by CALMET at the Site

A summary of the annual wind behaviour predicted by CALMET at the site for Met Run 1 and Met Run 2 is presented as wind roses in **Figure 6**. A review of the wind roses indicates that, on an annual basis, there are a higher percentage of winds blowing towards the surrounding sensitive receptors for Met Run 1. The frequency of calm conditions is marginally higher for Met Run 2 (1.6% vs 2.2%).

Given the above, and the bias and wind vector analysis findings (see **Section 4.1**), Met Run 1, which is similar to the meteorological model run from SLR's original report with minor improvements (see **Appendix B** for details), is considered to be more representative (and conservative) than Met Run 2. Therefore, Met Run 1 has been used for the updated air quality assessment presented in **Section 7** of this report.

Figure 6 Predicted Annual Wind Roses for the Site (CALMET, 2018)



5 Odour and VOC Emissions Testing

Since the previous SLR response to EPA comments, additional odour and VOC emission testing was performed by SLR in order to:

- Quantify odour emissions from spray painting and antifoul application in the encapsulated areas and sheds (not previously measured or modelled).
- Determine the effectiveness of the encapsulation in containing VOCs and odours generated by spray painting operations. This was done through comparison of VOC results collected simultaneously from inside and outside (at a location downwind and in very close proximity) of the encapsulated areas.
- Determine the odour removal efficiency of the wet scrubbers serving the existing sheds;
- Ensure that the previous emission testing completed by Stephenson Environmental (dated 28 April 2017) identifies all VOCs which could potentially be emitted by the spray painting operations.

Table 2 presents a summary of locations sampled. The results of the emission testing are presented in **Appendix C**.

Table 2 Odour and VOC Emissions Testing Locations

Vessel\Location Name		Air Quality Parameters	Paint/Antifoul Used	Quantity of Paint/Antifoul Used
Axopar 37	Encapsulated Area	Odour	Altex Epoxy primer	8 L
		VOC		
	Fugitive (immediately outside Encapsulated Area, downwind)	VOC		
Hardstand - Eastern Boundary	Encapsulated Area	Odour	International Awlcraft 2000	1 L
		VOC		
	Fugitive (immediately outside Encapsulated Area, downwind)	VOC		
Marloo	Encapsulated Area	Odour	International Highbuild	30 L
		VOC		
	Fugitive (immediately outside Encapsulated Area, downwind)	VOC		
Wet Scrubber – Shed 4	Inlet	Odour	International Interprotect	20 L
	Outlet			

The emission testing found that:

- No significant fugitive emissions occur during spray painting in encapsulated areas. For all fugitive samples collected outside encapsulated areas, measured concentrations of all analysed VOC compounds were below the detection threshold of the analysis method except fugitive toluene concentrations at Marloo which were less than 1% of what was measured inside the encapsulated area.
- The existing wet scrubber systems have a low odour removal efficiency (approximately 20%). This is expected as impingement wet scrubbers are not designed to remove organic odorous compounds.
- In addition to VOC compounds reported in the Stephenson Environmental emission test report dated 28 April 2017, the following VOC compounds with associated air quality impact assessment criteria could be emitted from the spray painting operations at concentrations above the relevant criteria:
  - Methylisobutylketone (MIBK)
  - Trimethylbenzene
  - Propylene Oxide

6 Revised Emissions Inventory and Source Parameters

The emission inventory presented in the SLR response to previous EPA comments dated 28 August 2020 (the Previous Emission Inventory) was updated to reflect changes to the proposed air extraction and pollution control system design. The amended emission inventory also quantifies potential emissions from activities within encapsulated areas as well as odour emissions from the various sources.

Table 3 presents a summary of the amended emission inventory including source parameters and emission rates. The main changes to the emission inventory and source parameters are as follows:

- Removal of fugitive emissions from the sheds and FDD included in the Previous Emission Inventory as the amended pollution control system design ensures negative pressure is maintained at these locations while air emission generating activities are taking place.
- Addition of encapsulated area and yard fugitive emission sources.
- Removal of the 20% control factor applied to welding emission rates from fugitive emission sources. It is noted that the control factor is maintained for the FDD and Shed stacks.
- Reduction of FDD particulate matter emissions by half based on the Fowlerex particulate matter guarantee of 1 mg/m^3
- Quantification of odour, MIBK, trimethylbenzene and propylene oxide emissions.
- Recalculation of VOC emissions based on the Fowlerex VOC removal guarantee of 95% and using the higher VOC concentrations between those measured by Stephenson Environmental in 2017 and by SLR in 2021. To estimate peak emissions, the emission concentrations measured by SLR were scaled up by multiplying the measured concentrations by the “maximum amount of paint used per job” (100 L) to “amount of paint used during the emission testing” (refer **Table 2**) ratio.
- Stack exhaust gases are now assumed to be release at ambient temperatures rather than 20 degrees Celsius. This is considered to be conservative especially during cooler months.
- Addition of an additional stack for the release of treated FDD emissions and relocation of FDD stacks.
- Relocation of the Shed Stack and reduction of exhaust diameter from 1.03 m to 0.71 m.

Figure 7 illustrates the location of the sources and buildings modelled for the worst-case cumulative scenario. The existing 10 m high sheds and FDD structure were included in the modelling to account for potential building downwash effects. As illustrated the encapsulated area/ yard fugitive emission sources have been conservatively located in close proximity to the eastern boundary of the site and sensitive receptors.

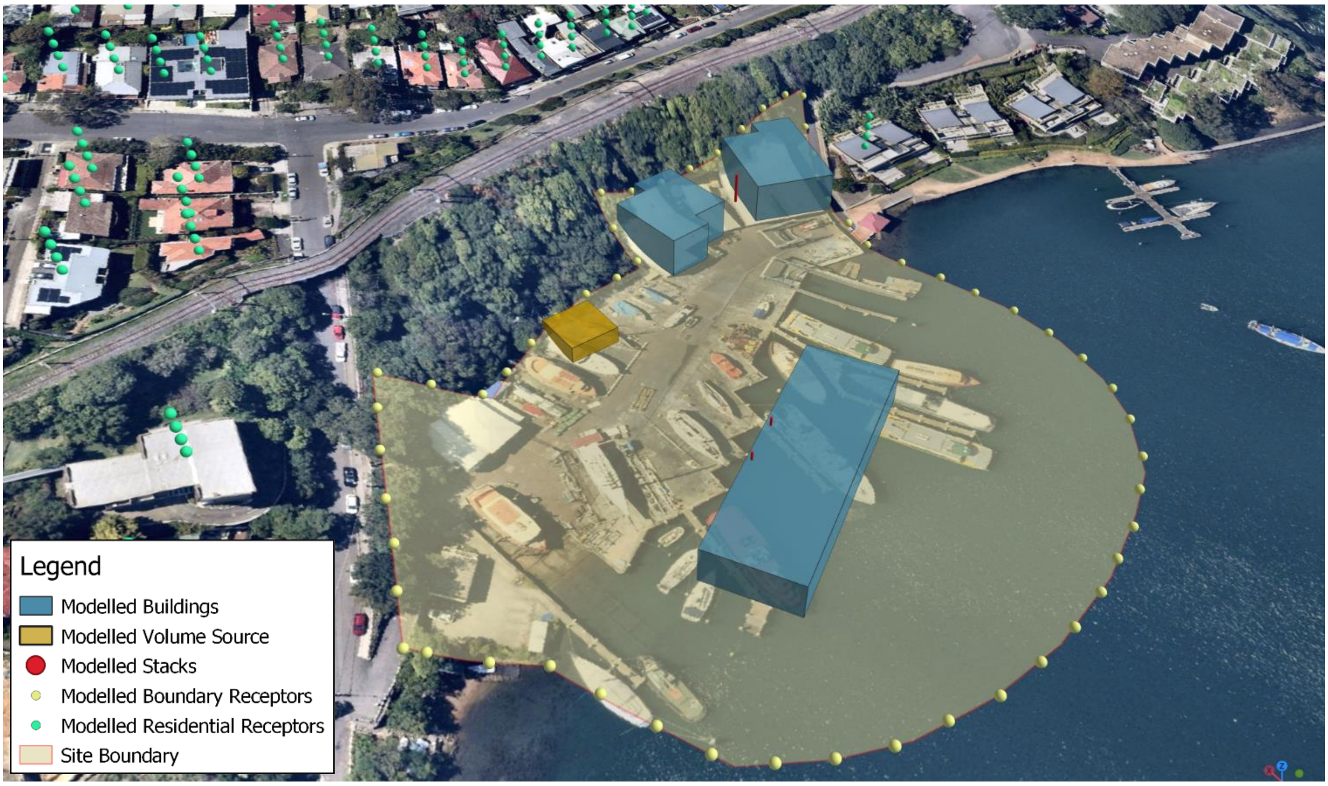
Table 3 Emission Rates and Source Parameters Adopted by the Revised Modelling

Proposed	Outlet Stack - Shed	Outlet Stack - FDD1	Outlet Stack - FDD2	Encapsulated Area on Yard *	Yard Fugitive Emissions
Source type	Point	Point	Point	Volume	Volume
Easting (m)	333,525	333,446	333,451	333,503	333,503
Northing (m)	6,253,788	6,253,848	6,253,839	6,253,849	6,253,849
Source height (m)	8	10.5	10.5	4	4
Base elevation (m)	2	0	0	5	5
Stack diameter (m)	0.71	0.50	0.50	-	-
Actual flow rate (m^3/s)	6.4	3.2	3.2	-	-
Exit velocity (m/s)	16.2	16.3	16.3	-	-
Exit temperature (K)	ambient	ambient	ambient	-	-
Initial horizontal spread (m)	-	-	-	2.8	2.79
Initial vertical spread (m)	-	-	-	0.93	0.93
PM_{10} (g/s)	0.00064	0.0032	0.0032	-	0.009338
$PM_{2.5}$ (g/s)	0.00064	0.0032	0.0032	-	0.001238
Arsenic and compounds (g/s)	0.0000069	0.000003	0.000003	-	0.000007

Proposed	Outlet Stack - Shed	Outlet Stack - FDD1	Outlet Stack - FDD2	Encapsulated Area on Yard *	Yard Fugitive Emissions
Chromium III and compounds (g/s)	0.0000461	0.000023	0.000023	-	0.000057
Chromium VI and compounds (g/s)	0.00000084	0.0000004	0.0000004	-	0.000001
Copper and compounds (g/s)	0.0000014	0.0000007	0.0000007	-	0.000001
Lead and compounds (g/s)	0.0000042	0.000002	0.000002	-	0.000004
Nickel and compounds (g/s)	0.0000204	0.000010	0.000010	-	0.000025
Manganese and compounds (g/s)	0.000021	0.000010	0.000010	-	0.000026
Ethyl benzene (g/s)	0.0005	0.000242	0.000242	0.0119	0.00002
Toluene (g/s)	0.0007	0.000360	0.000360	0.2362	0.00039
Xylene (g/s)	0.0023	0.001131	0.001131	0.0094	0.00002
MIBK (g/s)	0.0014	0.000694	0.000694	0.1215	0.00020
Trimethylbenzene	0.00004	0.000022	0.000022	0.0038	0.00001
Propylene Oxide	0.0003	0.000166	0.000166	0.1090	0.00018
Odour (ou/s)	276	138	138	5561	9.3

* modelled as instantaneous release over 60 seconds

Figure 7 Modelled Buildings and Point and Volume Sources



7 Dispersion Modelling Results

Table 4 presents a summary of the air quality impacts predicted by the modelling at the modelled receptors. Conservative cumulative concentrations, representative of potential worst case impacts associated with concurrent operation of the FDD, one shed and one encapsulated area is presented as well as impacts associated with each individual source. Isopleth plots of the predicted incremental pollutant concentrations (combined FDD, shed and encapsulated area) are presented in **Appendix D**.

The air quality impact assessment criteria for toxic air pollutants (including ethylbenzene, arsenic, chromium III and compounds, chromium VI and compounds, copper and compounds, manganese and compounds and nickel, MIBK, trimethylbenzene and propylene oxide.) apply '*at and beyond the boundary of the facility*'. For these substances, incremental contributions from the proposal are reported at the site boundary, as well as the most impacted sensitive receptor.

For PM_{10} and $PM_{2.5}$ hourly varying concentrations recorded by the Rozelle AQMS during the modelling period (2018) were used for the contemporaneous assessment of cumulative ground level concentrations. Where gaps in the Rozelle AQMS monitoring data were present (the most significant gap being 15 February 2018 to 30 May 2018 while the AQMS was recommissioned), the 90th percentile concentration of the 2018 dataset was used to fill these gaps to assess 24-hour average concentrations.

The cumulative particulate matter results presented in **Table 4** excludes days when the background particulate matter concentrations exceeded the relevant criteria. Background PM_{10} concentrations recorded by Rozelle AQMS exceeded the 24-hour average criterion for 2 days in 2018 on the 21st and 22nd of November. No exceedances of the 24-hour average $PM_{2.5}$ criterion were recorded. The Approved Methods states that in situations where background levels are elevated, it must be demonstrated that "no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity".

In the absence of background pollutant concentration datasets for other modelled pollutants, and given there are no significant sources of VOC emissions within 500 m of the site, It has been assumed that background concentration of these pollutants are negligible and the incremental results have been assessed against the relevant criteria. As the predicted worst-case incremental concentrations of these pollutants are well below the relevant criteria at the worst impacted sensitive receptors, exceedances of the criteria are deemed to be very unlikely even with background concentrations added.

As shown in **Table 4**, the operations at the site are predicted to have a small contribution to cumulative downwind air pollutant concentrations and are not likely to cause any additional exceedances of the impact assessment criteria.

Of the three sources modelled, the highest predicted incremental impacts are associated with activities in encapsulated areas in the yard. This is primarily due to the following conservative assumptions:

- The location of the volume source which has been placed on the eastern boundary of the site.
- All air emission generating activities in the yard area will be performed in encapsulated areas. It is noted that Noakes plans to use the mobile shed (which will be connected to the proposed Shed pollution control system and exhaust stack) for the majority of air emission generating works not performed in the FDD or fixed Sheds.

Given the conservative assumptions adopted by the emission inventory and modelling, the actual impacts from the facility are likely to be lower than what has been predicted.

Table 4 Predicted Pollutant Concentrations

Pollutant	Averaging Period / Percentile	Units	Criterion	FDD + Shed + Encapsulated Area		Encapsulated Area		Shed		FDD	
				Worst Impacted at/beyond Boundary	Worst Impacted Sensitive Receptor	Worst Impacted at/beyond Boundary	Worst Impacted Sensitive Receptor	Worst Impacted at/beyond Boundary	Worst Impacted Sensitive Receptor	Worst Impacted at/beyond Boundary	Worst Impacted Sensitive Receptor
Cumulative Results											
PM_{10}	24-hour - 100th	µg/m³	50	N/A	49.3	N/A	49.0	N/A	48.6	N/A	48.2
	Annual	µg/m³	25	N/A	18.8	N/A	18.7	N/A	18.6	N/A	18.5
$PM_{2.5}$	24-hour - 100th	µg/m³	25	N/A	19.4	N/A	19.2	N/A	19.3	N/A	19.3
	Annual	µg/m³	8.0	N/A	7.5	N/A	7.3	N/A	7.5	N/A	7.4
Incremental Results											
PM_{10}	24-hour - 100th	µg/m³	-	N/A	1.77	N/A	1.50	N/A	0.10	N/A	0.50
	Annual	µg/m³	-	N/A	0.26	N/A	0.22	N/A	0.02	N/A	0.05
$PM_{2.5}$	24-hour - 100th	µg/m³	-	N/A	0.53	N/A	0.20	N/A	0.10	N/A	0.50
	Annual	µg/m³	-	N/A	0.1	N/A	0.03	N/A	0.02	N/A	0.05
Lead	Annual	µg/m³	0.5	0.0013	0.0002	0.0011	0.0001	0.0002	0.0001	0.0001	0.00003
Arsenic	1-hour 99.9th	µg/m³	0.09	0.03	0.01	0.03	0.01	0.004	0.003	0.003	0.002
Chromium3	1-hour 99.9th	µg/m³	9	0.25	0.07	0.24	0.06	0.03	0.02	0.03	0.01
Chromium6	1-hour 99.9th	µg/m³	0.09	0.004	0.001	0.004	0.001	0.0005	0.0004	0.0005	0.0002
Copper	1-hour 99.9th	µg/m³	18	0.0044	0.0013	0.0043	0.0011	0.0008	0.0007	0.0008	0.0004
Nickel	1-hour 99.9th	µg/m³	0.18	0.108	0.029	0.107	0.028	0.012	0.010	0.011	0.006
Manganese	1-hour 99.9th	µg/m³	18	0.112	0.030	0.111	0.029	0.012	0.011	0.011	0.006

Pollutant	Averaging Period / Percentile	Units	Criterion	FDD + Shed + Encapsulated Area		Encapsulated Area		Shed		FDD	
				Worst Impacted at/beyond Boundary	Worst Impacted Sensitive Receptor	Worst Impacted at/beyond Boundary	Worst Impacted Sensitive Receptor	Worst Impacted at/beyond Boundary	Worst Impacted Sensitive Receptor	Worst Impacted at/beyond Boundary	Worst Impacted Sensitive Receptor
Ethyl Benzene	1-hour 99.9th	µg/m^3	8000	1.5	0.4	1.5	0.3	0.3	0.3	0.3	0.1
Toluene	1-hour 99.9th	µg/m^3	360	30.3	5.1	30.3	5.0	0.4	0.4	0.4	0.2
Xylene	1-hour 99.9th	µg/m^3	190	1.5	1.5	1.2	0.2	1.3	1.2	1.3	0.6
MIBK	1-hour 99.9th	µg/m^3	230	15.6	2.7	15.6	2.6	0.8	0.7	0.8	0.4
Odour	1-hour 99th	ou	2	N/A	0.2	N/A	0.05	N/A	0.2	N/A	0.1
Propylene Oxide	1-hour 99.9th	µg/m^3	90	14.0	2.3	14.0	2.3	0.2	0.2	0.2	0.1
Trimethylbenzene	1-hour 99.9th	µg/m^3	2200	0.488	0.084	0.488	0.081	0.023	0.020	0.025	0.012

conc. = concentration

8 Conclusions

In summary, the operations at the site are predicted to have a small contribution to cumulative downwind air pollutant concentrations and are not likely to cause any additional exceedances of the impact assessment criteria.

The predicted air quality impacts associated with the concurrent operation of the FDD, sheds and encapsulated area presented in this report are lower than those predicted by the previous round of modelling at the worst impacted sensitive receptors and for all pollutants (except toluene, which is still predicted to be well below the relevant criteria at all modelled locations at and beyond the site boundary). These reductions are due to improvements made in the design of the air extraction and pollution control systems which ensure high pollutant removal efficiency and no fugitive emissions. The location of the stacks have also been refined to minimise impacts at sensitive receptor locations.

It is noted that impacts at the site boundary presented in this report are higher than those predicted by the previous round of modelling. However, this is due to the conservative location of the encapsulated area volume sources which are placed on the site boundary.

It is important to note that the air quality impact assessment presented in this report makes several conservative assumptions, meaning the actual impacts from the facility are likely to be lower than what has been predicted.

APPENDIX A

Fowlerex Report

FOWLEREX

TECHNOLOGIES PTY LTD
ABN 76 100 555 904

Environmental Management ISO14001 Global-Mark.com.au®

Noakes Boat Yard – Basis of Ventilation Design Rev02
23 September 2021

General

The Noakes boat yard is a general marine maintenance company carrying out a wide range of activities. These include paint preparation work (sanding and abrasive blasting), painting and anti-fouling application, welding and wood working repairs.

Painting and abrasive blasting are not full time activities but do create emissions that need to be controlled.

Shed Extraction

We had available to us a report on measurements of shed emissions. This work was carried out by Stephenson Environmental Management (SEM). A copy of pages relevant to the extraction system design are attached.

The shed extraction was 6.4 m^3/s which gives a good number of air changes per hour. We regard this level as suitable for the activities being carried out.

Particulate emissions were low due to the wet wall dust collector fitted to each shed. The emission of volatile organic compounds (VOC) was small by industrial standards. This was still significant in light of odour complaints being received and it was determined by Noakes that measures were required to reduce the VOC emissions.

The SEM report identified a number of different VOC all of which are typical of what you expect to get from industrial painting activity. All the identified VOC are readily absorbed by activated carbon. This led to the decision to design a bespoke activated carbon system.

Off the shelf type activated carbon systems do not have the carbon bed depth, contact time and VOC holding capacity to meet the system requirements.

FDD Extraction

Initial work by Jacobs had used the same extraction airflow for emission control from the floating dry dock (FDD).

Fowlerex reviewed this and accept that this is sufficient provided there is appropriate use of screens and the like to confine dust and VOC to smaller working areas.

It will be practical to duct from the extraction spigots high in the FDD wall to a location close to the working area.

The FDD system will have a dust collector to remove particulate prior to the activated carbon filter. The dust collector prevents the activated carbon filter from becoming plugged with particulate.

The FDD ventilation system is a bespoke system. The design has evolved so that the equipment will be built into the wing walls of the FDD. There will be two fan and activated carbon filter systems.

The dust collectors are a bespoke design to fit into the space available. Each dust collector will contain 49 pleated filter bags with a total of 132 m^2 of filter area.

Relocatable Shed

The proposal is that extraction from the relocatable shed will be blown into one of the fixed sheds, or possible to the FDD. These destinations will not be able to operate simultaneous with the relocatable shed.

The ventilation rate will be 50% of the ventilation rate from the fixed shed or FDD. This means that the destination will maintain a slight negative pressure and thus avoid fugitive emission.

Ventilation Rates

Shed	Width m	Height m	Length m	Volume m^3	Airflow m^3/s	Air changes per hour
1	10	10	18	1800	6.4	12.8
2	10	10	23	2300	6.4	10.0
3	10	10	29	2900	6.4	7.9
Relocatable	7.35	5.15	19.6	740	3.2	15.6
FDD	14	7.8	49	5350	6.4	4.3

The relocatable shed may be difficult to seal so it was considered appropriate to have a higher ventilation rate.

The FDD will only be used for larger vessels which consequently reduces the volume to be ventilated and increases the air changes per hour.

Openings into the sheds and FDD should be a maximum of 4 m^2 and a minimum of 2 m^2. This will maintain a small negative pressure in the ventilated space and ensure an ingress of air through the openings.

Activated Carbon Filter Design

The shed filter and the FDD filter look different but have been designed using the same key criteria.

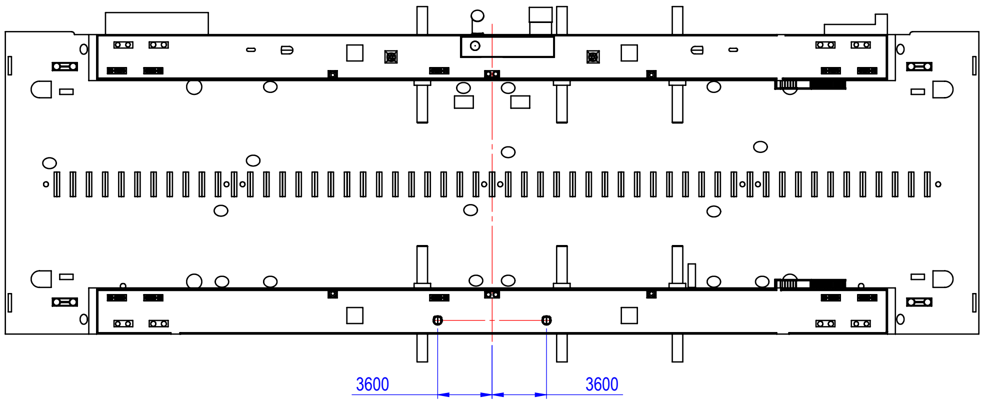
The required VOC collection efficiency is 95%.
The nominal velocity through the filter is 0.35 m/s.
The bed thickness of the activated carbon is 0.6 m.
The contact time is 0.6/0.35 = 1.7 seconds.
The activated carbon load is 5000 kg.
The predicted time between carbon changes greater than 12 months.

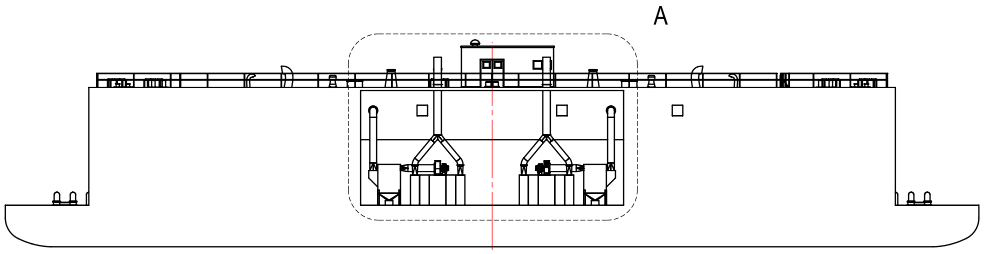
These design parameters were put to three different carbon manufacturers (or their local agents). These were Puragen, Norit and Jacobi. Puragen and Jacobi confirmed the design. Norit recommended a slightly longer contact time (1.9 seconds) which the design could accommodate if necessary.

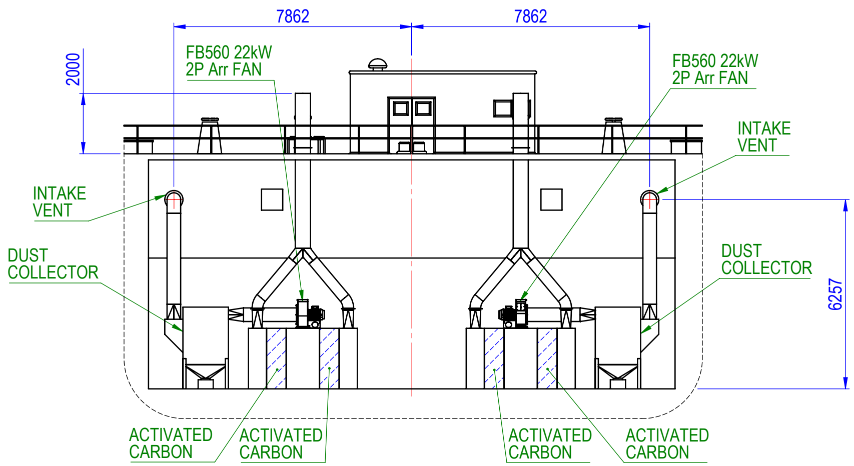
Spent Carbon Disposal

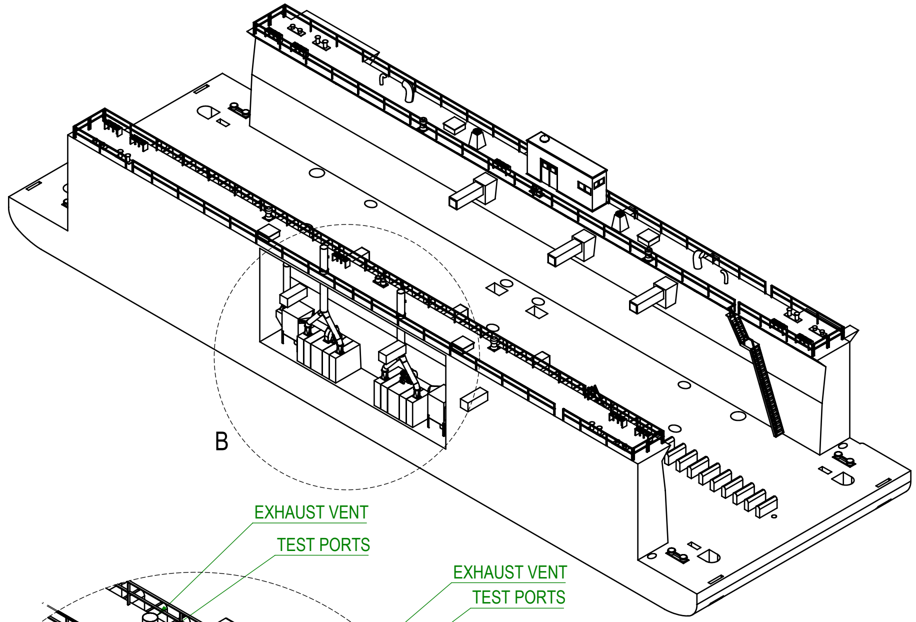
Two waste companies were approached regarding disposal of the spent carbon. Both Cleanway and Enviro Waste were prepared to collect and dispose of the spent carbon. Carbon used in this application is not classified as toxic waste.

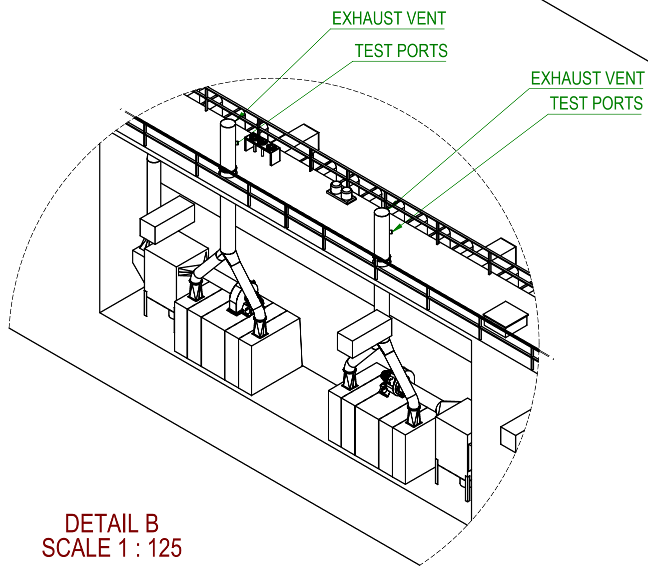
Doug Pigou
Director











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REFERENCE DRAWINGS	

DESCRIPTION	ISSUE	APPROVED	DATE

FOWLEREX TECHNOLOGIES PTY. LTD.

Postal Address: PO Box 6282
Wetherill Park DC NSW 1851
PH: (02) 8850 7611 FX: (02) 8850 7622
EMAIL: admin@ fowlerex.com.au
Address: Unit 1 / 3 Muir Place
Wetherill Park NSW 2164

NOAKES

VENTILATION SYSTEM
100T FLOATING DOCK
...
...

SCALE	1:250	A2	A.B.N. 76 100 555 904
PROJECTION	DRAWN	RIM	21/9/21
	CHECKED	...	. .
	APPROVED	...	. .

DO NOT SCALE THIS DWG.

DRAWING No.	ISSUE
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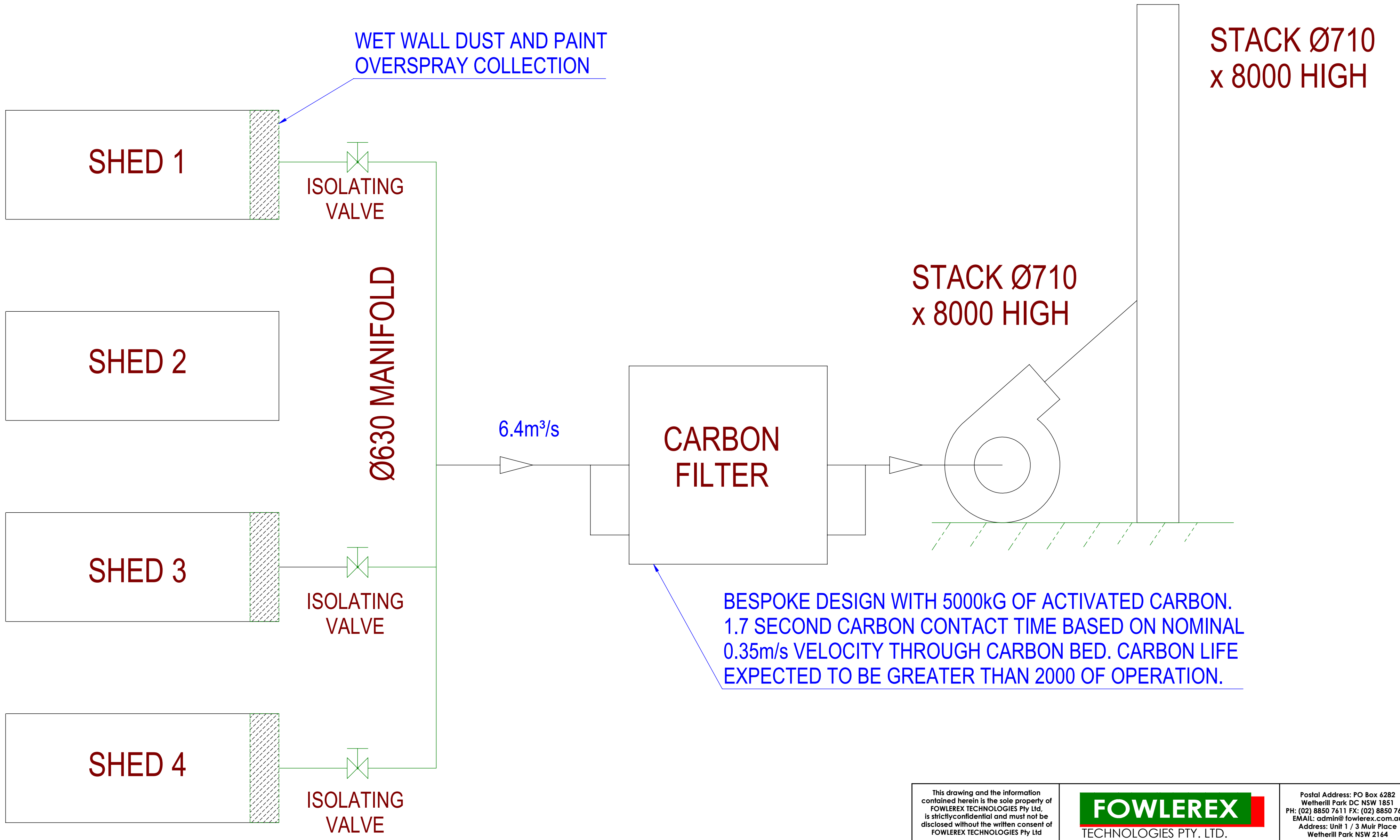
SHEET 1 OF 1	



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Wetherill Park NSW 2164

NOAKES

FILTRATION SYSTEM
SHED EXTRACTION FLOW DIAGRAM

...

SCALE	1:200	A2	A.B.N. 76 100 555 904
PROJECTION	DRAWN	RIM	17-08-21
	CHECKED	...	. .
	APPROVED	...	. .

DO NOT SCALE THIS DWG.

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REFERENCE DRAWINGS

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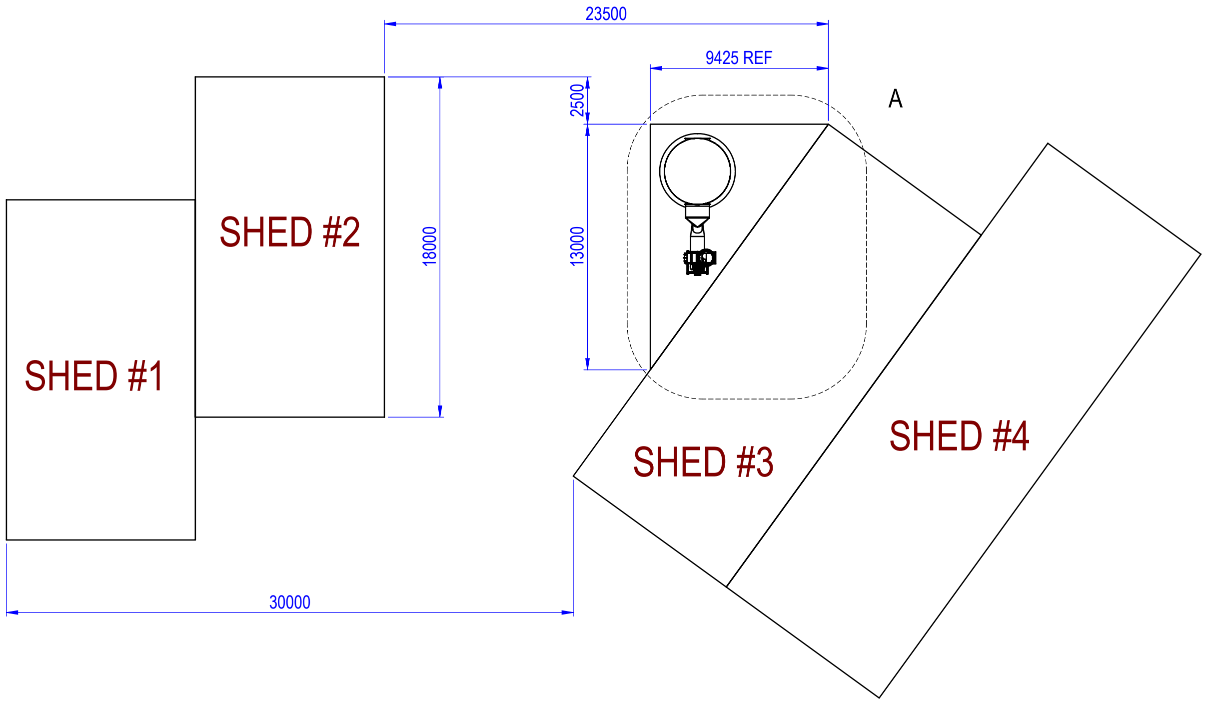

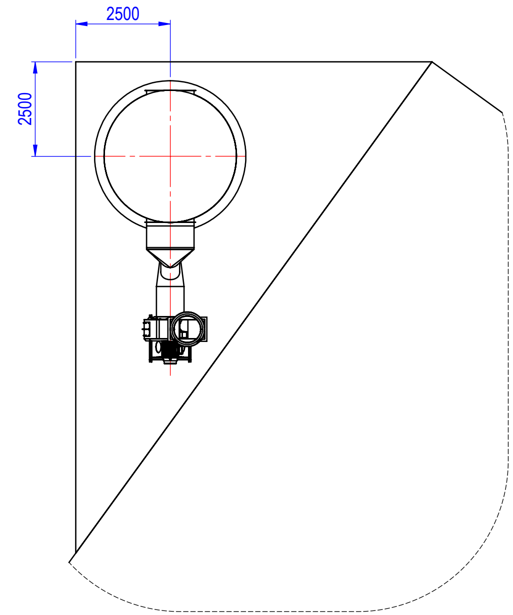

DETAIL A
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Address: Unit 1 / 3 Muir Place
Wetherill Park NSW 2164

NOAKES

FILTRATION SYSTEM
PRELIMINARY GA

...
...

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	CHECKED	...	. .
	APPROVED	...	. .

DO NOT SCALE THIS DWG.

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REFERENCE DRAWINGS	

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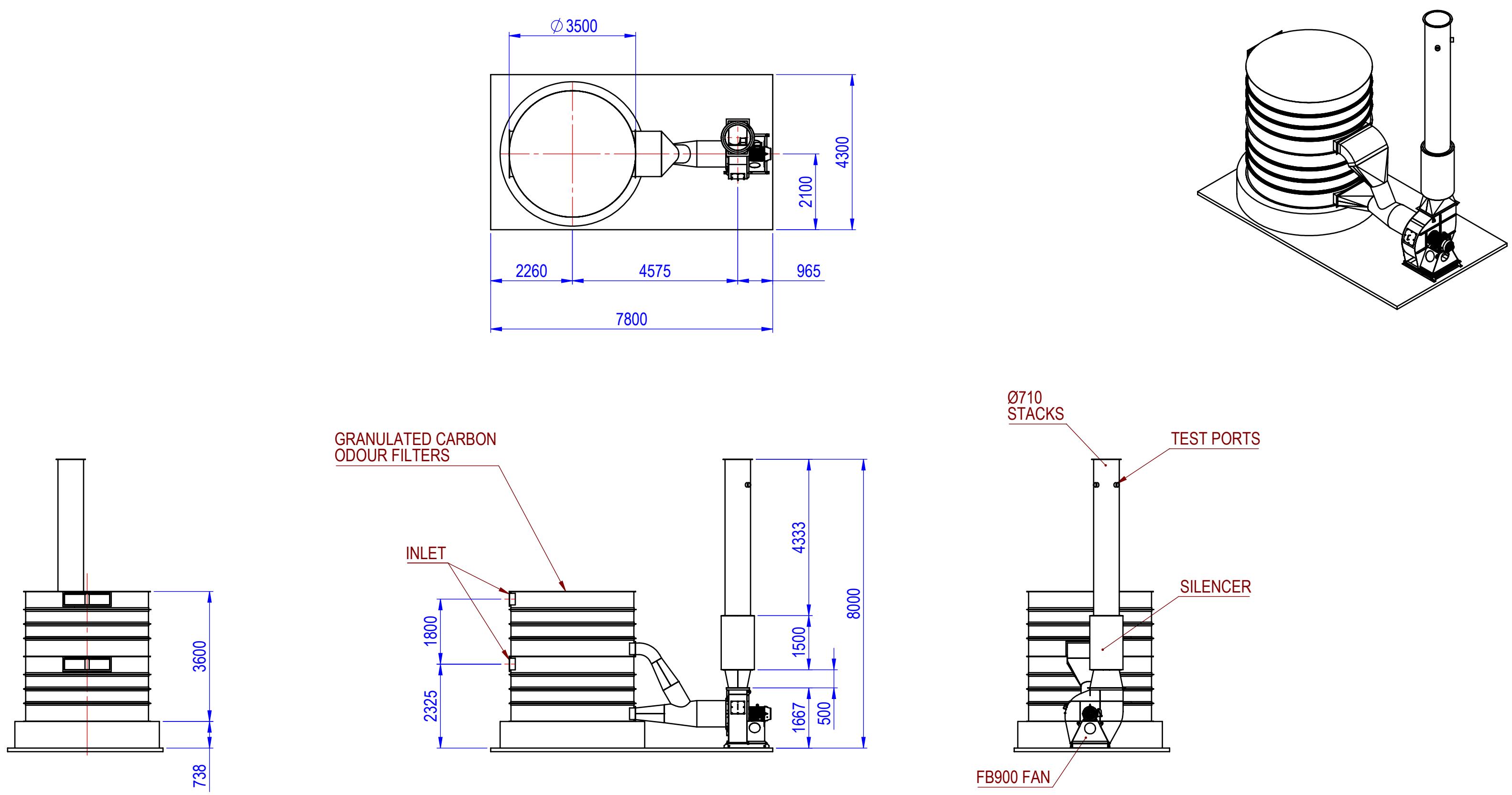

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PH: (02) 8850 7611 FX: (02) 8850 7622
EMAIL: admin@ fowlerex.com.au
Address: Unit 1 / 3 Muir Place
Wetherill Park NSW 2164

NOAKES

FILTRATION SYSTEM PRELIMINARY GA

...

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	APPROVED	...	. .

DO NOT SCALE THIS DWG.

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SHEET 1 OF 1
ISSUE 1

DWG #	DESCRIPTION
REFERENCE DRAWINGS	

DESCRIPTION	ISSUE	APPROVED	DATE

APPENDIX B

Meteorological Model Set Up

Meteorological Modelling - TAPM

In order to calculate all required meteorological parameters required by the dispersion modelling process, meteorological modelling using The Air Pollution Model (TAPM, v 4.0.4) has been performed. TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model that may be used to predict three-dimensional meteorological data and air pollution concentrations.

TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

TAPM may assimilate actual local wind observations so that they can optionally be included in a model solution. Given that TAPM is known to underpredict calm wind conditions, the wind speed and direction observations obtained from the nearest BoM and EES AQMS stations have also been used in the subsequent CALMET component of the modelling. as described in **Section** Error! Reference source not found..

Error! Reference source not found. shows the parameters used in the two TAPM model set ups. The Met Run 1 TAPM configuration is identical to the TAPM model set up presented in the SLR response to EPA comments dated 28 August 2020.

Table 5 Meteorological Parameters used for this Study (TAPM v 4.0.4)

Modelling Parameters	Met Run 1	Met Run 2
Modelling Period	31 December 2017 to 1 January 2019	31 December 2017 to 1 January 2019
Centre of analysis	331,175 mE 6,252,053 mS (UTM Coordinates)	331,175 mE 6,252,053 mS (UTM Coordinates)
Number of grid points	42 × 42 × 35	42 × 42 × 35
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)	4 (30 km, 10 km, 3 km, 1 km)
Data assimilation	Fort Denison (#66022), Sydney Olympic Park AWS (#66212), Manly AWS (#66197), Sydney Airport AWS (#66037), Kurnell AWS (#66043), Little Bay AWS (#66051), Terrey Hills AWS (#66059), Bankstown AWS (#66137), Randwick AQMS, Lindfield AQMS, Macquarie Park AQMS	Sydney Olympic Park AWS (#66212), Manly AWS (#66197), Sydney Airport AWS (#66037), Kurnell AWS (#66043), Little Bay AWS (#66051), Terrey Hills AWS (#66059), Bankstown AWS (#66137), Randwick AQMS
Terrain	AUSLIG 9 second DEM	AUSLIG 9 second DEM

Meteorological Modelling - CALMET

In the simplest terms, CALMET is a meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field. The final wind field thus reflects the influences of local topography and current land uses.

CALMET modelling was conducted using a nested approach to generate 30 m resolution wind fields across the innermost grid to ensure that the complex topography and land use of the area surrounding the site is appropriately accounted for. Data extracted from the innermost TAPM grid were incorporated into the model.

Error! Reference source not found. details the parameters used in the CALMET meteorological modelling for the two modelled runs.

The Met Run 1 CALMET configuration is similar to the CALMET set up presented in the SLR response to EPA comments dated 28 August 2020 with the following modifications:

- **TERRAD** –A TERRAD value of 0.3km has been used in MET Run 1 for the inner domain while previously TERRAD was set to 5km. This seemingly large change, which was made to ensure the complex topography surrounding the site is adequately considered by the model, did not have a significant impact on model predictions at the site.
- **Modelling Nests** – The number of modelling nests was reduced from four to three, with the grid resolution of Nest 3 increased from 0.1 km to 0.03 km. This change was made to include Fort Denison AWS in the inner grid for validation purposes.

Table 6 CALMET Configuration Used for this Study

Modelling Parameters	Met Run 1	Met Run 2
Modelling Period	1 January 2018 to 31 December 2018	1 January 2018 to 31 December 2018
Nest 1		
Southwest Corner of analysis	320,000 mE, 6,241,100 mS (UTM Coordinates)	320,000 mE, 6,241,100 mS (UTM Coordinates)
Meteorological grid domain (Meteorological grid resolution)	20 km x 20 km (0.4 km)	20 km x 20 km (0.4 km)
Vertical Resolution (Cell Heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data Assimilation	TAPM Nest 4 (1 km resolution) outputs	TAPM Nest 4 (1 km resolution) outputs
Surface Observations	Sydney Olympic Park AWS (66212), Sydney Airport AWS (66037), Fort Denison AWS (66022), gap filled with TAPM[1]	Sydney Olympic Park AWS (66212), Sydney Airport AWS (66037), Manly AWS (66197), gap filled with TAPM[2]
Nest 2		
Southwest Corner of analysis	327,538 mE, 6,247,830 mS (UTM Coordinates)	327,538 mE, 6,247,830 mS (UTM Coordinates)
Meteorological grid domain (Meteorological grid resolution)	10 km x 10 km (0.2 km)	10 km x 10 km (0.2 km)
Vertical Resolution (Cell Heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data Assimilation	Nest 1 outputs	Nest 1 outputs

[1] Data predicted by TAPM (extracted at 337,925 mE, 6,260,303 mS) was used to complete the surface meteorology dataset. TAPM data was only used for hours that data was missing from all three included BoM weather stations. In total, between 1 to 10 hours of missing data were identified for the various parameters required by CALMET.
[2] Data predicted by TAPM (extracted at 335,955 mE, 6,242,442 mS) was used to complete the surface meteorology dataset. TAPM data was only used for hours that data was missing from all three included BoM weather stations. In total, between 1 to 10 hours of missing data were identified for the various parameters required by CALMET.

Modelling Parameters	Met Run 1	Met Run 2
Nest 3		
Southwest Corner of analysis	331,056 mE, 6,251,350 mS (UTM Coordinates)	331,056 mE, 6,251,350 mS (UTM Coordinates)
Meteorological grid domain (Meteorological grid resolution)	5 km x 5 km (0.03 km)	5 km x 5 km (0.03 km)
Vertical Resolution (Cell Heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data Assimilation	Nest 2 outputs	Nest 2 outputs

It is noted that several additional TAPM and CALMET model configurations were executed (with varying observational data inclusion, grid resolution, TERRAD, R & RMAX, nesting, etc.). However, changing these settings did not lead to any improvement in the meteorological model validation.

APPENDIX C

Emission Test Report

BERRYS BAY FLOATING DRY DOCK

Odour and VOC Emissions

Prepared for:

Noakes Group Ptd Ltd
6 John St
McMahons Point
Sydney NSW 2060

SLR Ref: 610.19179-TR01R00
August 2021

PREPARED BY

SLR Consulting Australia Pty Ltd
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E: sydney@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Noakes Group Ptd Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.19179-TR01R00	14 October 2021	Danny Echeverri	Graeme Starke	Graeme Starke

CONTENTS

DOCUMENT REFERENCES

TABLES

APPENDICES

1 NOMENCLATURE

o	degrees	l/min	litres per minute
>	greater than	Max	maximum
≥	greater than or equal to	m	metres
<	less than	m/s	metres per second
≤	less than or equal to	m^2	square metres
%	percentage	m^3	cubic metres
#	denotes reporting conditions not specified in EPL and therefore adopted from POEO Schedule 5 Test methods, averaging periods and reference conditions for scheduled premises – Group 5	m^3/s	cubic metres of air per second
§	denotes concentration limit not specified in EPL and therefore adopted from POEO Schedule 4 Standards of concentration for scheduled premises: general activities and plant – Group 5	$\mu g/m^3$	micrograms per cubic metre of air
^	denotes Special Condition in EPL No. 10000 Condition L3.4 - Oxygen correction is not required for Nitrogen Oxides for emission Points 12 and 13	mg/m^3	milligrams per cubic metre of air
AESTD	Australian Eastern Standard Time Daylight Savings	Min	minimum
AEST	Australian Eastern Standard Time	min	minutes
ALS	Australian Laboratory Services	NA	not applicable
AM	ambient method	NATA	National Association of Testing Authorities
Am^3/s	actual cubic metres of air per second	NSW	New South Wales
Avg	average	NM	not measured
AS	Australian Standard	No.	number
AS/NZS	Australian Standards/New Zealand Standards	NO_x	oxides of nitrogen
CO^2	carbon dioxide	OEH	Office of Environment and Heritage
CO	carbon monoxide	OM	other method
CSC	certified span concentration	O_2	oxygen
Conc.	concentration	PM_{10}	particulate matter less than 10 microns
ºC	degrees Celsius	$PM_{2.5}$	particulate matter less than 2.5 microns
D	duct diameter	Ppb	parts per billion
EPA	Environment Protection Agency / Environment Protection Authority	ppm	parts per million
EPL	Environment Protection Licence	POEO	Protection of the Environment and Operations (Clean Air) Regulations 2010
F	fluoride	Qld	Queensland
g/g mole	grams per gram mole	SLR	SLR Consulting Australia Pty Ltd
GC/MS	Gas Chromatography/Mass Spectrometry	SO_2	sulphur dioxide
HCl	hydrogen chloride	SO_3/H_2SO_4	sulphur trioxide / sulphuric acid mist
hr	Hours	TM	Test Method
ID	identification	TSP	total suspended particulate
K	kelvin	UNSW	University of New South Wales
kg/m^3	kilograms per cubic metre	USEPA M	United States Environment Protection Agency Method
kPa	kilopascals	UTM	Universal Transverse Mercator
LOR	limit of reporting		

2 Introduction

SLR Consulting Australia Pty Ltd (SLR Consulting) was commissioned by Noakes Group Pty Ltd (Noakes) to undertake odour and volatile organic compounds (VOC) emission monitoring at their Berrys Bay Shipyard located at 6 John Street, McMahons Point NSW (the Site).

The objective of the testing was to obtain data to be used as input to the air quality impact modelling assessment for the site.

The following tables describes the scope of work performed at each location:

Table 1 Monitoring locations

Location Name	Location Specific	Air Quality Parameters	Number of Samples	Method
Axopar 37	Encapsulated Area	Odour	2	NSW OEH OM-7 (AS4323.3)
		VOC	1	TO-15[a]
	Fugitive (immediately outside Encapsulated Area)	VOC	1	NSW OEH TM-34 (USEPA M18)
Hardstand - Eastern Boundary	Encapsulated	Odour	2	NSW OEH OM-7 (AS4323.3)
		VOC	1	TO-15 [a]
	Fugitive (immediately outside Encapsulated Area)	VOC	1	NSW OEH TM-34 (USEPA M18
Marloo	Encapsulated	Odour	2	NSW OEH OM-7 (AS4323.3)
		VOC	1	NSW OEH TM-34 (USEPA M18)
	Fugitive	VOC	1	
Wet Scrubber	Inlet	Odour	2	NSW OEH OM-7 (AS4323.3)
	Outlet		1	

[a] US EPA Method TO-15 not covered under SLR's NATA accreditation.

Where appropriate, monitor airflow, temperature and moisture and calculate mass odour emission rates.

This letter report outlines the sampling methodologies, the odour monitoring results, and includes the calculations of odour emission rates for each source, where appropriate.

2.1 Operating Conditions

On the day of testing, the plant operating procedures and production rates were considered normal by Noakes. The paints and antifoul products used on the day were considered by Noakes to be representative of material with high VOC content. The Duration of spray painting and antifoul applications were considered by Noakes to be representative of peak operations.

3 Process Emissions Monitoring

3.1 Test Methods and Analysis References

All sampling and monitoring were performed by SLR unless otherwise specified. The following sections outline for each parameter requested to be tested, a brief description of the relevant test method for sampling and analysis and the NATA Accredited Laboratory that completed the analysis.

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Appendix A

3.1.1 Flow and Temperature Sampling and Analysis

Flow and temperature sampling and analysis was performed in accordance with NSW OEH TM-1 and TM-2 (USEPA M2 *Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)*). Where possible, a velocity profile was obtained utilising an S-Type pitot tube and manometer.

Temperatures were measured using a digital thermometer connected to a Type K chromel/alumel thermocouple probe.

3.1.2 Odour Sampling and Analysis

All Odour sampling and analysis was performed in accordance with NSW OEH OM-7 (AS/NZS 4323.3-2001 "*Stationary source emissions Part 3: Determination of odour concentration by dynamic olfactometry"*).

Odorous gas was drawn through a clean Teflon (PTFE) sample probe connected to a single use, odour-free Nalophan sampling bag. The sampling pump was connected to the airtight plastic container to provide a sample gas flow-rate of approximately 2 l/min. After the required volume has been sampled, the pump was stopped, and the bag was sealed.

All collected samples were labelled with reference number, location, sampling date and times, kept under dark conditions. Samples were handled in accordance with SLR's QA/QC procedures and delivered to The Odour Unit, NATA accreditation number 14974, for analysis in accordance with AS/NZS 4323.3.

As required by the Australian Standard, all samples were analysed within 30 hours of sampling using dynamic olfactometry. Laboratory certificates of analysis are presented in **Appendix A.**

3.1.3 VOC Sampling and Analysis

VOC samples were collected in accordance with the following methods:

- NSW OEH TM-34 (USEPA M18 "*Measurement of Gaseous Organic Compound Emissions By Gas Chromatography*")
- US EPA Method TO-15 "*Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) Determination of Volatile Organic Compounds (VOCs) in Air"*

NSW OEH TM-34 VOC samples were collected by drawing air at a rate of approximately 100 ml/min through an activated carbon tube using a sampling pump. All collected samples were labelled with reference number, location, sampling date and times, and kept out of direct sunlight. Samples were handled in accordance with SLR's QA/QC procedures and delivered to Envirolab Australia, NATA accreditation number 2901, for analysis using GC/GC-MS. Laboratory certificates of analysis are presented in **Appendix C.** This sampling method was used for locations where a low concentration of VOCs was expected (with the exception of Marloo Encapsulated Area).

US EPA Method TO-15 samples were collected using SUMMA cannisters. Each sample was taken over a 1-hour period. Samples were processed using the company's quality assurance and quality control (QA/QC) checks to ensure all samples were labelled and handled correctly. As required by AS/NZS 4323.3: 2001 and USEPA Method 15, all odour samples were delivered to Envirolab for analysis within 30 hours of sample collection. Laboratory certificates of analysis are presented in **Appendix B**. This sampling method was used for locations where a high concentration of VOCs was expected as USEPA M18 could lead to breakthrough of VOCs on the sorbent tube invalidating the results.

SLR's NATA accreditation does not cover US EPA method TO-15. However, all canisters used were prepared by NATA accredited Envirolab in accordance with TO-15 requirements.

3.2 Deviations from Test Methods

There were deviations to the specified test reference methodologies, and these are specified below:

Sample Location – AS/NZS 4323.1:

- Wet Scrubber Inlet - The sample location for the Wet Scrubber Inlet was deemed non-ideal in accordance with AS/NZS 4323.1. The sample location consisted of a rectangular air wet scrubber inlet with an approximate effective opening width estimated at 0.14 m x 5.4. SLR therefore adopted additional sampling points in accordance with AS/NZS 4323.1 to improve the accuracy of the measurement. However, it is noted that the Wet Scrubber Inlet location does not meet the minimum criteria set out in AS/NZS 4323.1. Refer to **Table 5** for detailed summary of the sample location recordings and illustrative representation of each location.
- Wet Scrubber Outlet - The sample location for the Wet Scrubber Outlet did not meet ideal sampling plane requirements for downstream distance requirements. Refer to **Table 6** for detailed summary of the sample location recordings and illustrative representation of each location.

3.3 Reference Conditions

Reference conditions for all reported concentrations and flow rates are at measured temperature, pressure, moisture, and oxygen concentration.

4 Results

SLR Consulting completed all the sampling as per the relevant standards, methods and analysis of flow and temperature. Results are presented in the following tables.

Table 2 Emissions Monitoring: Axopar 37

Test Details			
Sample date	04 March 2021		
Conditions	Normal		
Sampling plane description	Trapezoidal prism vessel encapsulation using plastic tarps to cover all areas of the boat. Total area measured to be 4.275 m^2. Air space within the area was estimated to be approximately 33 m^3. Volume was calculated to be approximately 66 m^3		
Sample plane compliance	N/A		
Additional Notes	The paint used during the sample period was Altex Epoxy primer (8 litres). Easterly winds		
Testing officer(s)	Danny Echeverri and Ali Naghizadeh		
Source Conditions			
Approximate Volume (m^3)	66		
Temperature Inside (°C)	Not measured		
Temperature outside (°C)	23.3		
Barometric pressure (kPa)	101.22		
Average velocity measured outside (m/sec)	0.18		
Odour			
Run No.	1	2	
SLR Sample ID No.	10694	10695	
Sample Period (hrs)	1200 – 1210	1203 – 1213	
Odour Concentration (OU)	790	664	
Mass Odour Emission Rate (OU/s)	7.3[a]	6.1[a]	

[a] Results not covered by SLR's NATA accreditation as emissions are based on calculations from estimated volume.

Table 2 Emissions Monitoring: Axopar 37 continued

VOC Fugitive		
SLR Sample ID No.	10718	
Sample Period	1143 - 1243	
	Concentration (mg/m³)	
Total VOCs (as propane)	< 4.0	
Benzene	< 0.3	
Toluene	< 7.3	
Ethylbenzene	< 7.3	
p-Xylene & m-xylene	< 1.5	
o-Xylene	< 7.3	

VOC Encapsulated Area			
SLR Sample ID No.	10714		
Sample Period	1200-1300		
	Concentration (mg/m³)	**Emission Rate (g/s)**	
Total VOCs (as toluene)	261[a]	NA	
Toluene	0.2	0.000002	
Ethylbenzene	4.5	0.000041	
Xylene	17.1	0.000157	
Isopropyl Alcohol	2.5	0.000023	
MIBK	220	0.002025	
4-ethyl toluene	7.8	0.000072	
1,3,5-Trimethylbenzene	6.9	0.000064	
1,2,4-Trimethylbenzene	23	0.000212	

Note: Instantaneous release assumed for encapsulated areas.
[a] Results not covered by Envirolab NATA accreditation.

Table 3 Emissions Monitoring: Hardstand - Eastern Boundary

Test Details			
Sample date	04 March 2021		
Conditions	Normal		
Sampling plane description	Encapsulated area using plastic tarps with total areas measured to be 3.9 m^2. Volume was calculated to be approximately 14 m^3.		
Sample plane compliance	N/A		
Additional Notes	The paint used during the sample period was International Awlcraft 2000 (1 litre).		
Testing officer(s)	Danny Echeverri and Ali Naghizadeh		
Source Conditions			
Approximate Volume ($m^{3)}$	14		
Temperature Inside (°C)	Not measured		
Temperature outside (°C)	23.3		
Barometric pressure (kPa)	101.22		
Average velocity outside (m/sec)	Not measured		
Odour			
Run No.	1	2	
SLR Sample ID No.	10700	10701	
Sample Period (hrs)	1429 – 1439	1419 – 1429	
Odour Concentration (OU)	790	431	
Mass Odour Emission Rate (OU/s)	3.1 [a]	1.7 [a]	

[a] Results not covered by SLR's NATA accreditation as emissions are based on calculations from estimated volume.

Table 3 Emissions Monitoring: Hardstand - Eastern Boundary continued

VOC Fugitive			
SLR Sample ID No.	10719		
Sample Period	1424 – 1524		
	Concentration (mg/m³)		
Total VOCs (as propane)	< 4		
Benzene	< 0.3		
Toluene	< 7.4		
Ethylbenzene	< 7.4		
p-Xylene & m-xylene	< 1.5		
o-Xylene	< 7.4		
VOC Encapsulated Area			
SLR Sample ID No.	10716		
Sample Period	1419-1519		
	Concentration (mg/m³)	**Emission Rate (g/s)**	
Total VOCs (toluene)	48.9 [a]	NA	
Toluene	6.9	0.00003	
Ethylbenzene	1.1	0.000004	
Xylene	6.5	0.000025	
Ethanol	0.18	0.000001	
Acetone	0.57	0.000002	
Ethyl acetate	10	0.000039	
Methyl methacrylate	0.1	0.000000	
MIBK	0.32	0.000000	
4-ethyl toluene	0.14	0.000001	
1,3,5- Trimethylbenzene	0.1	0.000000	
1,2,4 - Trimethylbenzene	0.47	0.000002	

Note: Instantaneous release assumed for encapsulated areas.
[a] Results not covered by Envirolab NATA accreditation.

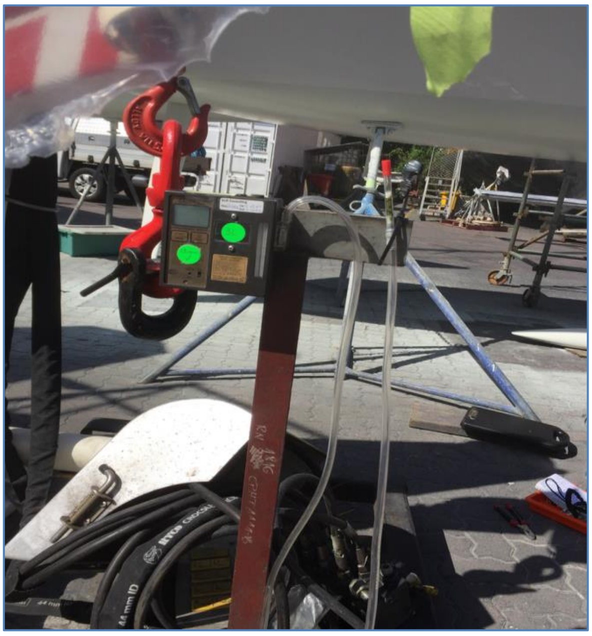
Table 4 Emissions Monitoring: Marloo

<table>
<tr><th colspan="4">Test Details</th></tr>
<tr><td>Sample date</td><td colspan="3">04 March 2021</td></tr>
<tr><td>Conditions</td><td colspan="3">Normal</td></tr>
<tr><td>Sampling plane description</td><td colspan="3">Trapezoidal prism vessel encapsulation using plastic tarps to cover lower area of the boat. Total area measured to be 7.875 m^2. Air space within the area was estimated to be approximately 81 m^3. Volume was calculated to be approximately 122 m^3.</td></tr>
<tr><td>Sample plane compliance</td><td colspan="3">N/A</td></tr>
<tr><td>Additional Notes</td><td colspan="3">The paint used during the sample period was International Highbuild (30 litres).</td></tr>
<tr><td>Testing officer(s)</td><td colspan="3">Danny Echeverri and Ali Naghizadeh</td></tr>
<tr><th colspan="4">Source Conditions</th></tr>
<tr><td>Approximate Volume (m^3)</td><td colspan="2">122</td><td rowspan="5"></td></tr>
<tr><td>Ambient Temperature Inside (°C)</td><td colspan="2">No measured</td></tr>
<tr><td>Ambient Temperature outside (°C)</td><td colspan="2">23.3</td></tr>
<tr><td>Barometric pressure (kPa)</td><td colspan="2">101.22</td></tr>
<tr><td>Average velocity outside (m/sec)</td><td colspan="2">Not measured</td></tr>
<tr><th colspan="4">Odour</th></tr>
<tr><td>Run No.</td><td>1</td><td>2</td><td rowspan="5"></td></tr>
<tr><td>SLR Sample ID No.</td><td>10697</td><td>10717</td></tr>
<tr><td>Sample Period (hrs)</td><td>1601 – 1611</td><td>1601 – 1611</td></tr>
<tr><td>Odour Concentration (OU)</td><td>3760</td><td>4100</td></tr>
<tr><td>Mass Odour Emission Rate (OU/s)</td><td>85 [a]</td><td>93 [a]</td></tr>
</table>

[a] Results not covered by SLR's NATA accreditation as emissions are based on calculations from estimated volume.

Table 4 Emissions Monitoring: Marloo continued

VOC Fugitive	
SLR Sample ID No.	10721
Sample Period	1546 – 1632
	Concentration (mg/m³)
Total VOCs (as propane)	< 0.9
Benzene	< 0.4
Toluene	1.73
Ethylbenzene	< 1
p-Xylene & m-xylene	< 2
o-Xylene	< 1



VOC Encapsulated Area		
SLR Sample ID No.	10720	
Sample Period	1546 – 1632	
	Concentration (mg/m³)	**Emission Rate (g/s)**
Total VOCs (as propane)	174	NA
Toluene	174.1	0.004
Ethylbenzene	8.8	0.000199
Xylene	6.1	0.000138
Propylene oxide	80.4	0.001817
MIBK	22.9	0.001

Note: Instantaneous release assumed for encapsulated areas.

Table 5 Emissions Monitoring: Wet Scrubber Inlet

<table>
<tr><th colspan="5">Test Details</th></tr>
<tr><td>Sample date</td><td colspan="4">04 March 2021</td></tr>
<tr><td>Conditions</td><td colspan="4">Normal</td></tr>
<tr><td>Sampling plane description</td><td colspan="4">5.4 m x 0.42 m rectangular air wet scrubber inlet. The approximate effective opening width was estimated to be approximately 0.14 m x 5.4 to make up for water over the surface.</td></tr>
<tr><td>Sample plane compliance</td><td colspan="4">Not in compliance</td></tr>
<tr><td>Additional Notes</td><td colspan="4">The paint used during the sample period was International Interprotect (20 litres).</td></tr>
<tr><td>Testing officer(s)</td><td colspan="4">Danny Echeverri and Ali Naghizadeh</td></tr>
<tr><th colspan="5">Source Conditions</th></tr>
<tr><td>Source dimensions (m)</td><td colspan="2">5.4 m x 0.42 m</td><td colspan="2" rowspan="5"></td></tr>
<tr><td>Temperature Inside (°C)</td><td colspan="2">25</td></tr>
<tr><td>Temperature outside (°C)</td><td colspan="2">25</td></tr>
<tr><td>Barometric pressure (kPa)</td><td colspan="2">101.22</td></tr>
<tr><td>Average velocity (m/sec)</td><td colspan="2">8.7</td></tr>
<tr><th colspan="5">Inlet</th></tr>
<tr><td>Run No.</td><td>1</td><td>2</td><td rowspan="5"></td><td rowspan="5"></td></tr>
<tr><td>SLR Sample ID No.</td><td>10698</td><td>10699</td></tr>
<tr><td>Sample Period (hrs)</td><td>1310 – 1320</td><td>1328 – 1338</td></tr>
<tr><td>Odour Concentration (OU)</td><td>861</td><td>790</td></tr>
<tr><td>Mass Odour Emission Rate (Actual) (OU.m^3/s)</td><td>5.6</td><td>5.2</td></tr>
</table>

Table 6 Emissions Monitoring: Wet Scrubber outlet

Test Details		
Sample date	04 March 2021	
Conditions	Normal	
Sampling plane description	1.03 diameter circular vent.	
Sample plane compliance	Not in compliance	
Additional Notes	The paint used during the sample period was International Interprotect (20 litres).	
Testing officer(s)	Danny Echeverri and Ali Naghizadeh	
Source Conditions		
Source dimensions (m)	1.03	
Temperature Inside (°C)	No measured	
Temperature outside (°C)	25	
Barometric pressure (kPa)	101.22	
Average velocity (m/sec)	7.7	
Outlet		
Run No.	1	
SLR Sample ID No.	10696	
Sample Period (hrs)	1310 – 1320	
Odour Concentration (OU)	664	
Mass Odour Emission Rate (OU.m³/s)	4.3	

5 Monitoring Instrument Calibration

Details of the most recent calibration of each instrument used to take the measurements are provided in **Table 7**.

Table 7 Equipment Calibration Details

Asset Number	Name	Next Calibration / Due Date
2004	Pump	21-04-2021
2005	Pump	21-04-2021
N299	Pump	01-02-2022
2006	Pump	02-02-2022
Drum-001	Drum	NA
Drum-002	Drum	NA
2076	Tetracal	04-04-2021
3110	Anemometer	12-01-2022

6 Measurement Uncertainty

The estimated measurement uncertainty associated with the monitoring methods are provided in **Table 8.**

Table 8 Measurement Uncertainty

Parameter	Associated Test Method	Uncertainty
Velocity	TM-2, AS 4323.1, USEPA M2A, 2C	±5%
Temperature	TM-2, USEPA M2C	$\pm 2^{\circ}C$
Odour	OM-7, AS4323.3	± 50 - 124% (based upon a single determination)
VOCs (adsorption tube)	NSW TM-34, USEPA M 18	25%

7 References

AS/NZS. (n.d.). *4323.3:2001 - Stationary source emissions Part 3: Determination of odour concentration by dynamic olfactometry.*

NSW DEC. (2007). *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW.*

USEPA. (2019, January 14). Measurement of Gaseous Organic Compound Emission By Gas Chromatography.

APPENDIX A

Odour Laboratory Analysis Report

THE ODOUR UNIT PTY LTD

THE ODOUR UNIT

12/56 Church Ave
Mascot, NSW 2020

Phone: +61 2 9209 4420
Email: info@odourunit.com.au
Internet: www.odourunit.com.au
ABN: 53 091 163 061

NATA
Accreditation Number: 14974

Odour Concentration Measurement Report

The measurement was commissioned by:

Organisation	SLR Consulting	Telephone	+61 2 9424 2210
Contact	Danny Echeverri	Facsimile	--
Sampling Site	Not disclosed	Email	decheverri@slrconsulting.com
Sampling Method	Not disclosed	Sampling Team	SLR Consulting

Order details:

Order requested by	Danny Echeverri	Order accepted by	A. Schulz
Date of order	14/02/2021	TOU Project #	N1869R
Order number	PO 30054	Project Manager	A. Schulz
Signed by	Danny Echeverri	Panel Operator	A. Schulz

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian/New Zealand Standard: Stationary source emissions – *Part 3: 'Determination of odour concentration by dynamic olfactometry* (AS/NZS4323.3). The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 22 °C ±3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: TOU-OLF-001.
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the AS/NZS 4323.3. $r = 0.280$ (October 2019) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the AS/NZS 4323.3. $A = 0.076$ (October 2019) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou, which is 4 times the lowest dilution setting.
Traceability	The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen. Note Disclaimers on last page of this document.

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced, except in full.

Date: 17th March 2021

Panel Roster Number: SYD20210305_018

A. Schulz
Authorised Signatory

The Odour Unit Pty Ltd
ABN 53 091 165 061
Form 06B – Odour Concentration Results Sheet

Issue Date: 13.11.2003
Issued By: SB
Last printed 3/17/2021 2:35:00 PM

Revision: 13
Revision Date: 10.08.2020
Approved By: TJS

1

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20200101_001

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Dilution Equipment ID	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)
Axopar 37 (R1) 10694	SC21112	04/03/2021 1210 hrs	05/03/2021 1040 hrs	4	8	-	-	-	790	790
Axopar 37 (R2) 10695	SC21113	04/03/2021 1213 hrs	05/03/2021 1113 hrs	4	8	-	-	-	664	664
Wet scrubber outlet Shed 4 (R1) 10696	SC21114	04/03/2021 1320 hrs	05/03/2021 1151 hrs	4	8	-	-	-	664	664
Death Row (R1) 10700	SC21115	04/03/2021 1439 hrs	05/03/2021 1315 hrs	4	8	-	-	-	790	790
Death Row (R2) 10701	SC21116	04/03/2021 1429 hrs	05/03/2021 1350 hrs	4	8	-	-	-	431	431
Marloo (R1) 10697	SC21117	04/03/2021 1611 hrs	05/03/2021 1426 hrs	4	8	-	-	-	3760	3760
Marloo (R2) 10717	SC21118	04/03/2021 1611 hrs	05/03/2021 1457 hrs	4	8	-	-	-	4100	4100

Samples Received in Laboratory – From: SLR Consulting Date: 05/03/2021 Time: 09:00 am

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

The Odour Unit Pty Ltd
ABN 53 091 165 061
Form 06 – Odour Concentration Results Sheet

Issue Date: 13.11.2003
Issued By: SB
Last printed 3/17/2021 2:35:00 PM

Revision: 13
Revision Date: 10/08/20
Approved By: TJS

2

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Dilution Equipment ID	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)
Wet scrubber inlet Shed 4 (R1) 10698	SC21119	04/03/2021 1320 hrs	05/03/2021 1534 hrs	4	8	-	-	-	861	861
Wet scrubber inlet Shed 4 (R2) 10699	SC21120	04/03/2021 1338 hrs	05/03/2021 1621 hrs	4	8	-	-	-	790	790

Samples Received in Laboratory – From: SLR Consulting Date: 05/03/2021 Time: 09:00 am

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

The Odour Unit Pty Ltd
ABN 53 091 165 061
Form 06 – Odour Concentration Results Sheet

Issue Date: 13.11.2003
Issued By: SB
Last printed 3/17/2021 2:35:00 PM

Revision: 13
Revision Date: 10/08/20
Approved By: TJS

3

THE ODOUR UNIT

THE ODOUR UNIT PTY LTD

NATA
Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS 4323.3 (Yes / No)
n-butanol	SYD20210305_018	51,400	$20 \leq \chi \leq 80$	861	60	Yes

Comments

Odour characters (non-NATA accredited) as determined by odour laboratory panel:

SC21112	paint, sweet
SC21113	paint, sweet
SC21114	paint, sweet
SC21115	sour, paint
SC21116	sour, paint
SC21117	paint, sweet
SC21118	paint, sour
SC21119	paint, sour
SC21120	paint, sour

Disclaimers

1. Parties, other than The Odour Unit Pty Ltd, responsible for collecting odour samples have advised that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing.
2. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.
3. Any comments included in, or attachments to, this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.
4. This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd.

Report Status

Status	Version	Date	Prepared by	Checked by	Change	Reason
Draft	0.1	17/03/21	Isaac Farrugia	-	-	-
Final	1.0	17/03/20	Isaac Farrugia	Alex Schulz	-	-
Revised	-	-	-	-	-	-

END OF DOCUMENT

APPENDIX A

VOC Canisters Laboratory Analysis Report

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 263601

Client Details

Client	SLR Consulting Aust. Pty Ltd (Sydney)
Attention	D. Echeverri
Address	PO Box 2003, NORTH SYDNEY, NSW, 2059

Sample Details

Your Reference	**610.19179**
Number of Samples	2xCanisters
Date samples received	08/03/2021
Date completed instructions received	08/03/2021

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	15/03/2021
Date of Issue	15/03/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Giovanni Agosti, Group Technical Manager

Authorised By

Nancy Zhang, Laboratory Manager

Envirolab Reference: 263601
Revision No: R00

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Client Reference: 610.19179

TO15 in Canisters/Bags			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Vacuum before Shipment	Hg"	-30	-30
Vacuum before Analysis	Hg"	-7	-7
Date prepared	-	08/03/2021	08/03/2021
Date analysed	-	08/03/2021	08/03/2021
Propylene	ppbv	<50	<5
Dichlorodifluoromethane	ppbv	<50	<5
Chloromethane	ppbv	<50	<5
1,2-Dichlorotetrafluoroethane	ppbv	<50	<5
Vinyl chloride	ppbv	<50	<5
1,3-Butadiene	ppbv	<50	<5
Bromomethane	ppbv	<50	<5
Chloroethane	ppbv	<50	<5
Ethanol	ppbv	<500	95
Acrolein	ppbv	<500	<50
Trichlorofluoromethane (Freon 11)	ppbv	<50	<5
Acetone	ppbv	<500	240
Isopropyl Alcohol	ppbv	1,000	<50
1,1-Dichloroethene	ppbv	<50	<5
1,1,2-Trichlorotrifluoroethane	ppbv	<50	<5
Methylene chloride (Dichloromethane)	ppbv	<500	<50
Carbon Disulfide	ppbv	<500	<50
trans-1,2-dichloroethene	ppbv	<50	<5
MTBE	ppbv	<50	<5
1,1- Dichloroethane	ppbv	<50	<5
Vinyl Acetate	ppbv	<50	<5
MEK	ppbv	<500	<50
Hexane	ppbv	<50	<5
cis-1,2-Dichloroethene	ppbv	<50	<5
Ethyl Acetate	ppbv	<50	2,800
Chloroform	ppbv	<50	<5
Tetrahydrofuran	ppbv	<50	<5
1,1,1-Trichloroethane	ppbv	<50	<5
1,2-Dichloroethane	ppbv	<50	<5
Benzene	ppbv	<50	<5
Carbon tetrachloride	ppbv	<50	<5

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TO15 in Canisters/Bags			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Cyclohexane	ppbv	<50	<5
Heptane	ppbv	<50	<5
Trichloroethene	ppbv	<50	<5
1,2-Dichloropropane	ppbv	<50	<5
1,4-Dioxane	ppbv	<50	<5
Bromodichloromethane	ppbv	<50	<5
Methyl Methacrylate	ppbv	<50	25
MIBK	ppbv	54,000	78
cis-1,3-Dichloropropene	ppbv	<50	<5
trans-1,3-Dichloropropene	ppbv	<50	<5
Toluene	ppbv	53	1,800
1,1,2-Trichloroethane	ppbv	<50	<5
Methyl Butyl Ketone	ppbv	<50	<5
Dibromochloromethane	ppbv	<50	<5
Tetrachloroethene	ppbv	<50	<5
1,2-Dibromoethane	ppbv	<50	<5
Chlorobenzene	ppbv	<50	<5
Ethylbenzene	ppbv	1,000	260
m-& p-Xylene	ppbv	3,000	1,100
Styrene	ppbv	<50	<5
o-Xylene	ppbv	940	380
Bromoform	ppbv	<50	<5
1,1,2,2-Tetrachloroethane	ppbv	<50	<5
4-ethyl toluene	ppbv	1,600	29
1,3,5-Trimethylbenzene	ppbv	1,400	20
1,2,4-Trimethylbenzene	ppbv	4,800	96
1,3-Dichlorobenzene	ppbv	<50	<5
Benzyl chloride	ppbv	<50	<5
1,4-Dichlorobenzene	ppbv	<50	<5
1,2-Dichlorobenzene	ppbv	<50	<5
1,2,4-Trichlorobenzene	ppbv	<50	<5
Naphthalene	ppbv	<50	<5
Hexachloro- 1,3-butadiene	ppbv	<50	<5
TVOC's as toluene*	$\mu g/m^3$	69,200	13,000
Surrogate-Bromochloromethane	% rec	104	100
Surrogate -1,4-Difluorobenzene	% rec	100	99

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TO15 in Canisters/Bags			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Surrogate-Chlorobenzene-D5	% rec	101	98

Client Reference: 610.19179

TO15 in Canisters ug/m3			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Vacuum before Shipment	Hg"	-30	-30
Vacuum before Analysis	Hg"	-7	-7
Date prepared	-	08/03/2021	08/03/2021
Date analysed	-	08/03/2021	08/03/2021
Propylene	µg/m³	<90	<9
Dichlorodifluoromethane	µg/m³	<250	<25
Chloromethane	µg/m³	<100	<10
1,2-Dichlorotetrafluoroethane	µg/m³	<250	<25
Vinyl chloride	µg/m³	<130	<13
1,3-Butadiene	µg/m³	<110	<11
Bromomethane	µg/m³	<190	<19
Chloroethane	µg/m³	<130	<13
Ethanol	µg/m³	<900	180
Acrolein	µg/m³	<1100	<110
Trichlorofluoromethane (Freon 11)	µg/m³	<280	<28
Acetone	µg/m³	<1190	570
Isopropyl Alcohol	µg/m³	2,500	<120
1,1-Dichloroethene	µg/m³	<200	<20
1,1,2-Trichlorotrifluoroethane	µg/m³	<380	<38
Methylene chloride (Dichloromethane)	µg/m³	<1700	<170
Carbon Disulfide	µg/m³	<1600	<160
trans-1,2-dichloroethene	µg/m³	<200	<20
MTBE	µg/m³	<180	<18
1,1- Dichloroethane	µg/m³	<200	<20
Vinyl Acetate	µg/m³	<180	<18
MEK	µg/m³	<1500	<150
Hexane	µg/m³	<180	<18
cis-1,2-Dichloroethene	µg/m³	<200	<20
Ethyl Acetate	µg/m³	<180	10,000
Chloroform	µg/m³	<240	<24
Tetrahydrofuran	µg/m³	<150	<15
1,1,1-Trichloroethane	µg/m³	<270	<27
1,2-Dichloroethane	µg/m³	<200	<20
Benzene	µg/m³	<160	<16
Carbon tetrachloride	µg/m³	<310	<31

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TO15 in Canisters ug/m3			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Cyclohexane	μg/m³	<170	<17
Heptane	μg/m³	<200	<20
Trichloroethene	μg/m³	<270	<27
1,2-Dichloropropane	μg/m³	<230	<23
1,4-Dioxane	μg/m³	<180	<18
Bromodichloromethane	μg/m³	<340	<34
Methyl Methacrylate	μg/m³	<200	100
MIBK	μg/m³	220,000	320
cis-1,3-Dichloropropene	μg/m³	<230	<23
trans-1,3-Dichloropropene	μg/m³	<230	<23
Toluene	μg/m³	200	6,900
1,1,2-Trichloroethane	μg/m³	<270	<27
Methyl Butyl Ketone	μg/m³	<200	<20
Dibromochloromethane	μg/m³	<160	<16
Tetrachloroethene	μg/m³	<340	<34
1,2-Dibromoethane	μg/m³	<380	<38
Chlorobenzene	μg/m³	<230	<23
Ethylbenzene	μg/m³	4,500	1,100
m-& p-Xylene	μg/m³	13,000	4,900
Styrene	μg/m³	<210	<21
o-Xylene	μg/m³	4,100	1,600
Bromoform	μg/m³	<520	<52
1,1,2,2-Tetrachloroethane	μg/m³	<340	<34
4-ethyl toluene	μg/m³	7,800	140
1,3,5-Trimethylbenzene	μg/m³	6,900	100
1,2,4-Trimethylbenzene	μg/m³	23,000	470
1,3-Dichlorobenzene	μg/m³	<300	<30
Benzyl chloride	μg/m³	<260	<26
1,4-Dichlorobenzene	μg/m³	<300	<30
1,2-Dichlorobenzene	μg/m³	<300	<30
1,2,4-Trichlorobenzene	μg/m³	<370	<37
Naphthalene	μg/m³	<260	<26
Hexachloro- 1,3-butadiene	μg/m³	<530	<53
TVOC's as toluene*	μg/m³	261,000	48,900
Surrogate-Bromochloromethane	% rec	104	100
Surrogate -1,4-Difluorobenzene	% rec	100	99

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TO15 in Canisters ug/m3			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Surrogate-Chlorobenzene-D5	% rec	101	98

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Method ID	Methodology Summary
TO15	USEPA TO15 - Analysis of VOC's in air using USEPA TO15 and in house method AT-002. Note, longer term stability of some oxygenated compounds is questionable where significant humidity is present.
USEPA 18	Measurement of Gaseous Organic Compound Emissions by Gas Chromatography using USEPA m18.

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QUALITY CONTROL: TO15 in Canisters/Bags						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Vacuum before Shipment	Hg"			[NT]	2	-30	-30	0	[NT]	[NT]
Vacuum before Analysis	Hg"			[NT]	2	-7	-7	0	[NT]	[NT]
Date prepared	-			08/03/2021	2	08/03/2021	08/03/2021		08/03/2021	[NT]
Date analysed	-			08/03/2021	2	08/03/2021	08/03/2021		08/03/2021	[NT]
Propylene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	99	[NT]
Dichlorodifluoromethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Chloromethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2-Dichlorotetrafluoroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Vinyl chloride	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,3-Butadiene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Bromomethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Chloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Ethanol	ppbv	5	TO15	<5	2	95	95	0	[NT]	[NT]
Acrolein	ppbv	5	TO15	<5	2	<50	<50	0	[NT]	[NT]
Trichlorofluoromethane (Freon 11)	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Acetone	ppbv	5	TO15	<5	2	240	220	9	[NT]	[NT]
Isopropyl Alcohol	ppbv	5	TO15	<5	2	<50	<50	0	[NT]	[NT]
1,1-Dichloroethene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,1,2-Trichlorotrifluoroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Methylene chloride (Dichloromethane)	ppbv	5	TO15	<5	2	<50	<50	0	[NT]	[NT]
Carbon Disulfide	ppbv	5	TO15	<5	2	<50	<50	0	[NT]	[NT]
trans-1,2-dichloroethene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
MTBE	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,1- Dichloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Vinyl Acetate	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
MEK	ppbv	5	TO15	<5	2	<50	<50	0	[NT]	[NT]
Hexane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	86	[NT]
cis-1,2-Dichloroethene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Ethyl Acetate	ppbv	0.5	TO15	<0.5	2	2800	2700	4	[NT]	[NT]
Chloroform	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Tetrahydrofuran	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,1,1-Trichloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2-Dichloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Benzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	82	[NT]
Carbon tetrachloride	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Cyclohexane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Heptane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	92	[NT]

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QUALITY CONTROL: TO15 in Canisters/Bags						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Trichloroethene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2-Dichloropropane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,4-Dioxane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Bromodichloromethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Methyl Methacrylate	ppbv	0.5	TO15	<0.5	2	25	24	4	[NT]	[NT]
MIBK	ppbv	5	TO15	<5	2	78	75	4	[NT]	[NT]
cis-1,3-Dichloropropene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
trans-1,3-Dichloropropene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Toluene	ppbv	0.5	TO15	<0.5	2	1800	1700	6	90	[NT]
1,1,2-Trichloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Methyl Butyl Ketone	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Dibromochloromethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Tetrachloroethene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2-Dibromoethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Chlorobenzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Ethylbenzene	ppbv	0.5	TO15	<0.5	2	260	250	4	92	[NT]
m-& p-Xylene	ppbv	1	TO15	<1	2	1100	1100	0	93	[NT]
Styrene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	100	[NT]
o-Xylene	ppbv	0.5	TO15	<0.5	2	380	360	5	96	[NT]
Bromoform	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,1,2,2-Tetrachloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
4-ethyl toluene	ppbv	0.5	TO15	<0.5	2	29	28	4	99	[NT]
1,3,5-Trimethylbenzene	ppbv	0.5	TO15	<0.5	2	20	19	5	99	[NT]
1,2,4-Trimethylbenzene	ppbv	0.5	TO15	<0.5	2	96	91	5	102	[NT]
1,3-Dichlorobenzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Benzyl chloride	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,4-Dichlorobenzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2-Dichlorobenzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2,4-Trichlorobenzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Naphthalene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Hexachloro- 1,3-butadiene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
TVOC's as toluene*	µg/m³	188	TO15	<188	2	13000	12900	1	[NT]	[NT]
Surrogate-Bromochloromethane	% rec		TO15	88	2	100	100	0	89	[NT]
Surrogate -1,4-Difluorobenzene	% rec		TO15	77	2	99	100	1	80	[NT]
Surrogate-Chlorobenzene-D5	% rec		TO15	77	2	98	99	1	79	[NT]

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QUALITY CONTROL: TO15 in Canisters ug/m3						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Vacuum before Shipment	Hg"			[NT]	2	-30	-30	0	[NT]	[NT]
Vacuum before Analysis	Hg"			[NT]	2	-7	-7	0	[NT]	[NT]
Date prepared	-			08/03/2021	2	08/03/2021	08/03/2021		[NT]	[NT]
Date analysed	-			08/03/2021	2	08/03/2021	08/03/2021		[NT]	[NT]
Propylene	µg/m^3	0.9	TO15	<0.9	2	<9	<9	0	[NT]	[NT]
Dichlorodifluoromethane	µg/m^3	2.5	TO15	<2.5	2	<25	<25	0	[NT]	[NT]
Chloromethane	µg/m^3	1.0	TO15	<1.0	2	<10	<10	0	[NT]	[NT]
1,2-Dichlorotetrafluoroethane	µg/m^3	2.5	TO15	<2.5	2	<25	<25	0	[NT]	[NT]
Vinyl chloride	µg/m^3	1.3	TO15	<1.3	2	<13	<13	0	[NT]	[NT]
1,3-Butadiene	µg/m^3	1.1	TO15	<1.1	2	<11	<11	0	[NT]	[NT]
Bromomethane	µg/m^3	1.9	TO15	<1.9	2	<19	<19	0	[NT]	[NT]
Chloroethane	µg/m^3	1.3	TO15	<1.3	2	<13	<13	0	[NT]	[NT]
Ethanol	µg/m^3	9	TO15	<9	2	180	180	0	[NT]	[NT]
Acrolein	µg/m^3	11	TO15	<11	2	<110	<110	0	[NT]	[NT]
Trichlorofluoromethane (Freon 11)	µg/m^3	2.8	TO15	<2.8	2	<28	<28	0	[NT]	[NT]
Acetone	µg/m^3	11.9	TO15	<11.9	2	570	520	9	[NT]	[NT]
Isopropyl Alcohol	µg/m^3	12	TO15	<12	2	<120	<120	0	[NT]	[NT]
1,1-Dichloroethene	µg/m^3	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]
1,1,2-Trichlorotrifluoroethane	µg/m^3	3.8	TO15	<3.8	2	<38	<38	0	[NT]	[NT]
Methylene chloride (Dichloromethane)	µg/m^3	17	USEPA 18	<17	2	<170	<170	0	[NT]	[NT]
Carbon Disulfide	µg/m^3	16	TO15	<16	2	<160	<160	0	[NT]	[NT]
trans-1,2-dichloroethene	µg/m^3	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]
MTBE	µg/m^3	1.8	TO15	<1.8	2	<18	<18	0	[NT]	[NT]
1,1- Dichloroethane	µg/m^3	2.0	TO15	<2.0	2	<20	<2.0	164	[NT]	[NT]
Vinyl Acetate	µg/m^3	1.8	TO15	<1.8	2	<18	<18	0	[NT]	[NT]
MEK	µg/m^3	15	TO15	<15	2	<150	<150	0	[NT]	[NT]
Hexane	µg/m^3	1.8	TO15	<1.8	2	<18	<18	0	[NT]	[NT]
cis-1,2-Dichloroethene	µg/m^3	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]
Ethyl Acetate	µg/m^3	1.8	TO15	<1.8	2	10000	9700	3	[NT]	[NT]
Chloroform	µg/m^3	2.4	TO15	<2.4	2	<24	<24	0	[NT]	[NT]
Tetrahydrofuran	µg/m^3	1.5	TO15	<1.5	2	<15	<15	0	[NT]	[NT]
1,1,1-Trichloroethane	µg/m^3	2.7	TO15	<2.7	2	<27	<27	0	[NT]	[NT]
1,2-Dichloroethane	µg/m^3	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]
Benzene	µg/m^3	1.6	TO15	<1.6	2	<16	<16	0	[NT]	[NT]
Carbon tetrachloride	µg/m^3	3.1	TO15	<3.1	2	<31	<31	0	[NT]	[NT]
Cyclohexane	µg/m^3	1.7	TO15	<1.7	2	<17	<17	0	[NT]	[NT]
Heptane	µg/m^3	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]

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QUALITY CONTROL: TO15 in Canisters ug/m3						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Trichloroethene	µg/m³	2.7	TO15	<2.7	2	<27	<27	0	[NT]	[NT]
1,2-Dichloropropane	µg/m³	2.3	TO15	<2.3	2	<23	<23	0	[NT]	[NT]
1,4-Dioxane	µg/m³	1.8	TO15	<1.8	2	<18	<18	0	[NT]	[NT]
Bromodichloromethane	µg/m³	3.4	TO15	<3.4	2	<34	<34	0	[NT]	[NT]
Methyl Methacrylate	µg/m³	2.0	TO15	<2.0	2	100	100	0	[NT]	[NT]
MIBK	µg/m³	20	TO15	<20	2	320	310	3	[NT]	[NT]
cis-1,3-Dichloropropene	µg/m³	2.3	TO15	<2.3	2	<23	<23	0	[NT]	[NT]
trans-1,3-Dichloropropene	µg/m³	2.3	TO15	<2.3	2	<23	<23	0	[NT]	[NT]
Toluene	µg/m³	1.9	TO15	<1.9	2	6900	6500	6	[NT]	[NT]
1,1,2-Trichloroethane	µg/m³	2.7	TO15	<2.7	2	<27	<27	0	[NT]	[NT]
Methyl Butyl Ketone	µg/m³	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]
Dibromochloromethane	µg/m³	1.6	TO15	<1.6	2	<16	<16	0	[NT]	[NT]
Tetrachloroethene	µg/m³	3.4	TO15	<3.4	2	<34	<34	0	[NT]	[NT]
1,2-Dibromoethane	µg/m³	3.8	TO15	<3.8	2	<38	<38	0	[NT]	[NT]
Chlorobenzene	µg/m³	2.3	TO15	<2.3	2	<23	<23	0	[NT]	[NT]
Ethylbenzene	µg/m³	2.2	TO15	<2.2	2	1100	1100	0	[NT]	[NT]
m-& p-Xylene	µg/m³	4.3	TO15	<4.3	2	4900	4600	6	[NT]	[NT]
Styrene	µg/m³	2.1	TO15	<2.1	2	<21	<21	0	[NT]	[NT]
o-Xylene	µg/m³	2.2	TO15	<2.2	2	1600	1600	0	[NT]	[NT]
Bromoform	µg/m³	5.2	TO15	<5.2	2	<52	<52	0	[NT]	[NT]
1,1,2,2-Tetrachloroethane	µg/m³	3.4	TO15	<3.4	2	<34	<34	0	[NT]	[NT]
4-ethyl toluene	µg/m³	2.5	TO15	<2.5	2	140	140	0	[NT]	[NT]
1,3,5-Trimethylbenzene	µg/m³	2.5	TO15	<2.5	2	100	95	5	[NT]	[NT]
1,2,4-Trimethylbenzene	µg/m³	2.5	TO15	<2.5	2	470	450	4	[NT]	[NT]
1,3-Dichlorobenzene	µg/m³	3.0	TO15	<3.0	2	<30	<30	0	[NT]	[NT]
Benzyl chloride	µg/m³	2.6	TO15	<2.6	2	<26	<26	0	[NT]	[NT]
1,4-Dichlorobenzene	µg/m³	3.0	TO15	<3.0	2	<30	<30	0	[NT]	[NT]
1,2-Dichlorobenzene	µg/m³	3.0	TO15	<3.0	2	<30	<30	0	[NT]	[NT]
1,2,4-Trichlorobenzene	µg/m³	3.7	TO15	<3.7	2	<37	<37	0	[NT]	[NT]
Naphthalene	µg/m³	2.6	TO15	<2.6	2	<26	<26	0	[NT]	[NT]
Hexachloro- 1,3-butadiene	µg/m³	5.3	TO15	<5.3	2	<53	<53	0	[NT]	[NT]
TVOC's as toluene*	µg/m³	188	TO15	<188	2	48900	48600	1	[NT]	[NT]
Surrogate-Bromochloromethane	% rec		TO15	88	2	100	100	0	[NT]	[NT]
Surrogate -1,4-Difluorobenzene	% rec		TO15	77	2	99	100	1	[NT]	[NT]
Surrogate-Chlorobenzene-D5	% rec		TO15	77	2	98	99	1	[NT]	[NT]

Envirolab Reference: 263601
Revision No: R00

Page | 12 of 15

Client Reference: 610.19179

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

Client Reference: 610.19179

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

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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.

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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.

Client Reference: 610.19179

Report Comments

AIR_TO-15

PQL has been raised due to the high level of analytes present in the samples #1,#2.

TVOC is reported as C3 to Naphthalene (propylene to naphthalene)

APPENDIX A

VOC Carbon Tubes Laboratory Analysis Report

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CERTIFICATE OF ANALYSIS 264084

Client Details

Client	SLR Consulting Aust. Pty Ltd (Sydney)
Attention	D. Echeverri
Address	PO Box 2003, NORTH SYDNEY, NSW, 2059

Sample Details

Your Reference	610.19179
Number of Samples	4 carbon tube
Date samples received	11/03/2021
Date completed instructions received	11/03/2021

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.

Report Details

Date results requested by	18/03/2021
Date of Issue	18/03/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Dragana Tomas, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Envirolab Reference: 264084
Revision No: R00

ACCREDITED FOR TECHNICAL COMPETENCE

Client Reference: 610.19179

VOC in Carbon tubes					
Our Reference		264084-1	264084-2	264084-3	264084-4
Your Reference	UNITS	10718	10719	10720	10721
Type of sample		carbon tube	carbon tube	carbon tube	carbon tube
Date Sampled		4/03/2021	4/03/2021	4/03/2021	4/03/2021
Date extracted	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Acetone	µg/tube	<5	<5	<5	<5
Acrylonitrile	µg/tube	<5	<5	<5	<5
Methylethylketone (MEK)	µg/tube	<5	<5	<5	<5
Hexane	µg/tube	<5	<5	<5	<5
Ethylacetate	µg/tube	<5	<5	<5	<5
1,2-Dichloroethane	µg/tube	<5	<5	<5	<5
Benzene	µg/tube	<2	<2	<2	<2
Carbon Tetrachloride	µg/tube	<5	<5	<5	<5
Cyclohexane	µg/tube	<5	<5	<5	<5
Ethylacrylate	µg/tube	<5	<5	<5	<5
Trichloroethene	µg/tube	<5	<5	<5	<5
1,4-Dioxane	µg/tube	<5	<5	<5	<5
Propylene Oxide	µg/tube	<10	<10	420	<10
Epichlorohydrin	µg/tube	<5	<5	<5	<5
Methylisobutylketone (MIBK)	µg/tube	<5	<5	120	<5
Toluene	µg/tube	<5	<5	910	9
Tetrachloroethene	µg/tube	<5	<5	<5	<5
n-Butylacetate	µg/tube	<5	<5	<5	<5
Chlorobenzene	µg/tube	<5	<5	<5	<5
Ethylbenzene	µg/tube	<5	<5	46	<5
m+p-Xylene	µg/tube	<10	<10	32	<10
Styrene	µg/tube	<5	<5	<5	<5
o-Xylene	µg/tube	<5	<5	<5	<5
Cyclohexanone	µg/tube	<5	<5	<5	<5
Nonane	µg/tube	<5	<5	<5	<5
Isopropylbenzene	µg/tube	<5	<5	<5	<5
Diisobutylketone (DIBK)	µg/tube	<5	<5	<5	<5
a-Methylstyrene	µg/tube	<5	<5	<5	<5
Decane	µg/tube	<5	<5	<5	<5
Benzylchloride	µg/tube	<5	<5	<5	<5
Naphthalene	µg/tube	<5	<5	<5	<5
Dodecane	µg/tube	<5	<5	<5	<5
TVOC's as hexane in tubes*	µg/tube	<50	<50	3,000	<50
Surrogate Toluene-d8	%	73	72	75	74

Envirolab Reference: 264084
Revision No: R00

Client Reference: 610.19179

VOC in Carbon tubes					
Our Reference		264084-1	264084-2	264084-3	264084-4
Your Reference	UNITS	10718	10719	10720	10721
Type of sample		carbon tube	carbon tube	carbon tube	carbon tube
Date Sampled		4/03/2021	4/03/2021	4/03/2021	4/03/2021
Surrogate 4-Bromofluorobenzene	%	75	82	80	73

Client Reference: 610.19179

Method ID	Methodology Summary
ORG-022	Determination of volatile organic compounds in charcoal tubes/badges/sorbents using CS2 extraction, based on NIOSH methods using GC/GC-MS. Desorption efficiencies are not applied to results in ug/tube. Note where µg/m^3 results are supplied for SKC badges, the factors used are for 575-001, if 575-001 data is unavailable for an analyte then use 575-002 then 575-003 (exposure time must be supplied).

Client Reference: 610.19179

QUALITY CONTROL: VOC in Carbon tubes						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			17/03/2021	[NT]	[NT]	[NT]	[NT]	17/03/2021	[NT]
Date analysed	-			17/03/2021	[NT]	[NT]	[NT]	[NT]	17/03/2021	[NT]
Acetone	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	106	[NT]
Acrylonitrile	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Methylethylketone (MEK)	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Hexane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	101	[NT]
Ethylacetate	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	102	[NT]
1,2-Dichloroethane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	101	[NT]
Benzene	µg/tube	2	ORG-022	<2	[NT]	[NT]	[NT]	[NT]	100	[NT]
Carbon Tetrachloride	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	100	[NT]
Cyclohexane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	99	[NT]
Ethylacrylate	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Trichloroethene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	100	[NT]
1,4-Dioxane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	99	[NT]
Propylene Oxide	µg/tube	10	ORG-022	<10	[NT]	[NT]	[NT]	[NT]	118	[NT]
Epichlorohydrin	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	99	[NT]
Methylisobutylketone (MIBK)	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Toluene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Tetrachloroethene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	98	[NT]
n-Butylacetate	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	94	[NT]
Chlorobenzene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Ethylbenzene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
m+p-Xylene	µg/tube	10	ORG-022	<10	[NT]	[NT]	[NT]	[NT]	97	[NT]
Styrene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
o-Xylene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Cyclohexanone	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Nonane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Isopropylbenzene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Diisobutylketone (DIBK)	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	94	[NT]
a-Methylstyrene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Decane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	94	[NT]
Benzylchloride	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Naphthalene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Dodecane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	103	[NT]
TVOC's as hexane in tubes*	µg/tube	50	ORG-022	<50	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate Toluene-d8	%		ORG-022	75	[NT]	[NT]	[NT]	[NT]	97	[NT]
Surrogate 4-Bromofluorobenzene	%		ORG-022	83	[NT]	[NT]	[NT]	[NT]	95	[NT]

Client Reference: 610.19179

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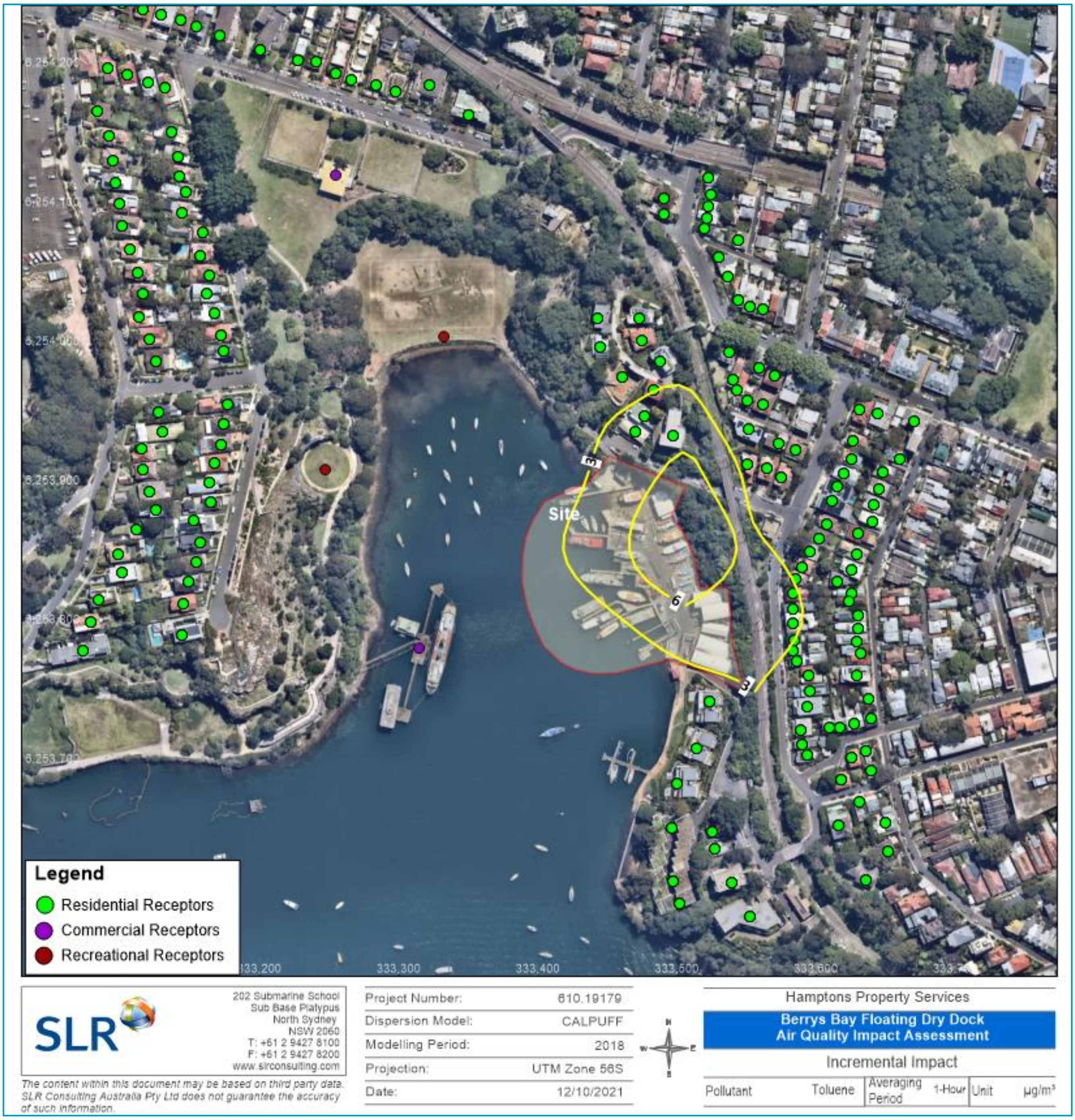
APPENDIX D

Incremental Isopleth Plots


Site
3
6
Legend
Residential Receptors
Commercial Receptors
Recreational Receptors
333,200
333,300
333,400
333,500
333,600
6,253,900
202 Submarine School
Sub Base Platypus
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www.slrconsulting.com
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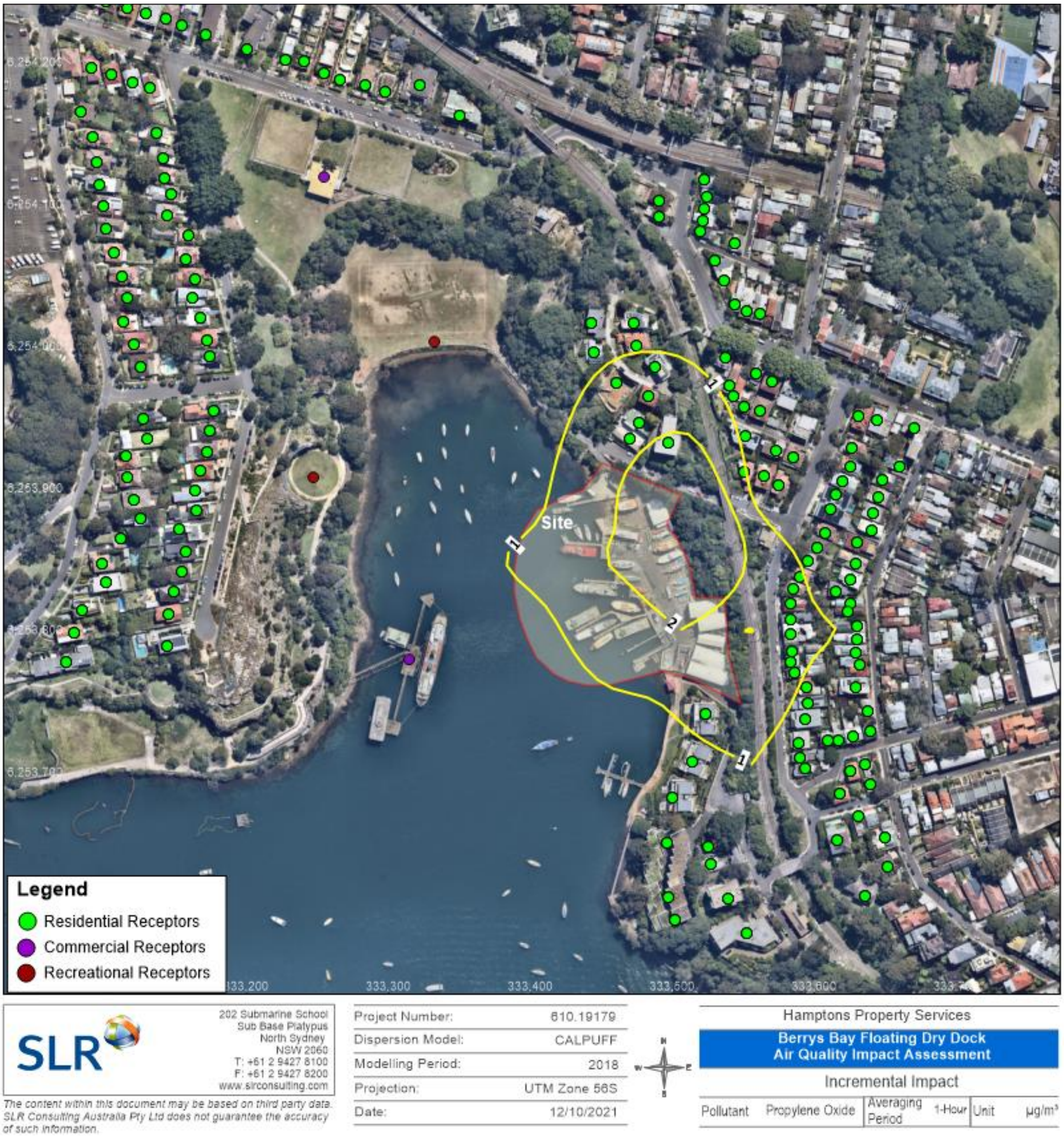
Project Number: 610.19179
Dispersion Model: CALPUFF
Modelling Period: 2018
Projection: UTM Zone 56S
Date: 12/10/2021
Hamptons Property Services
Berrys Bay Floating Dry Dock
Air Quality Impact Assessment
Incremental Impact
Pollutant Toluene
Averaging Period 1-Hour
Unit µg/m³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202 Submarine School
Sub Base Platypus
North Sydney
NSW 2060
T: +61 2 9427 8100
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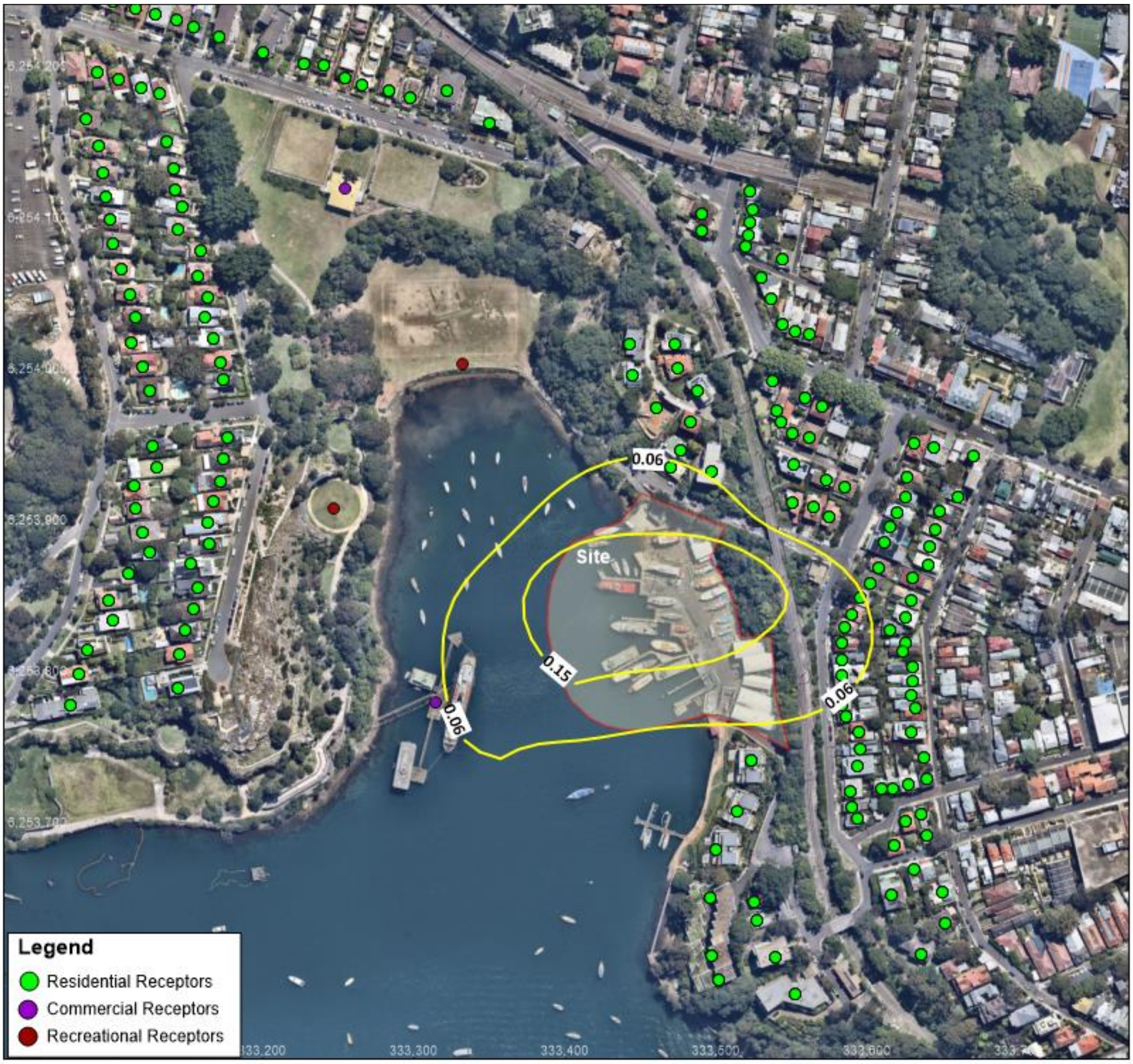
Date: 12/10/2021
Hamptons Property Services
Berrys Bay Floating Dry Dock
Air Quality Impact Assessment
Incremental Impact
Pollutant
Propylene Oxide
Averaging Period
1-Hour
Unit
µg/m³



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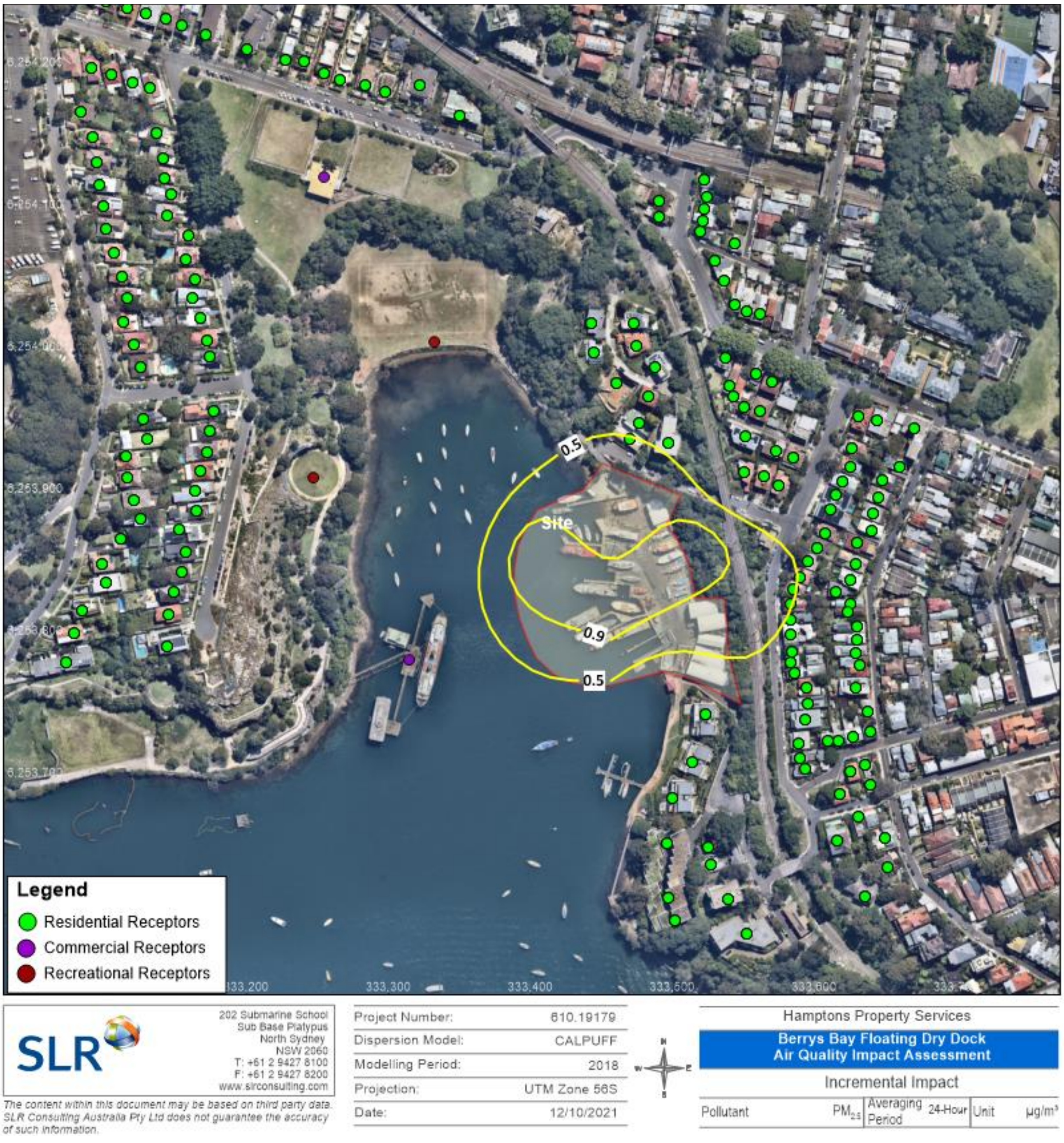
Hamptons Property Services

Berrys Bay Floating Dry Dock
Air Quality Impact Assessment

Incremental Impact

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	$\mu g/m^3$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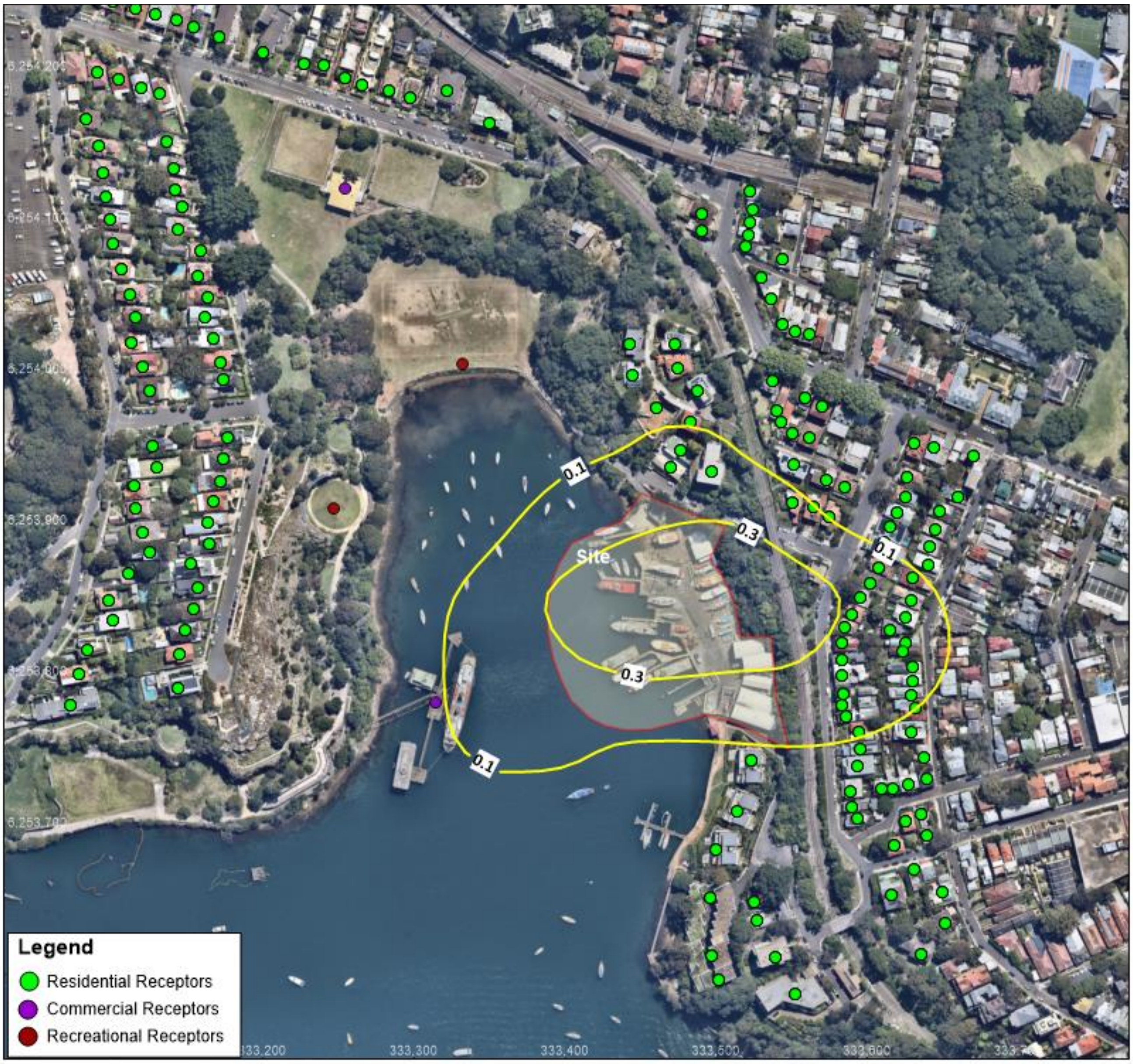
Berrys Bay Floating Dry Dock
Air Quality Impact Assessment
Incremental Impact
Pollutant PM2.5
Averaging Period 24-Hour
Unit µg/m³



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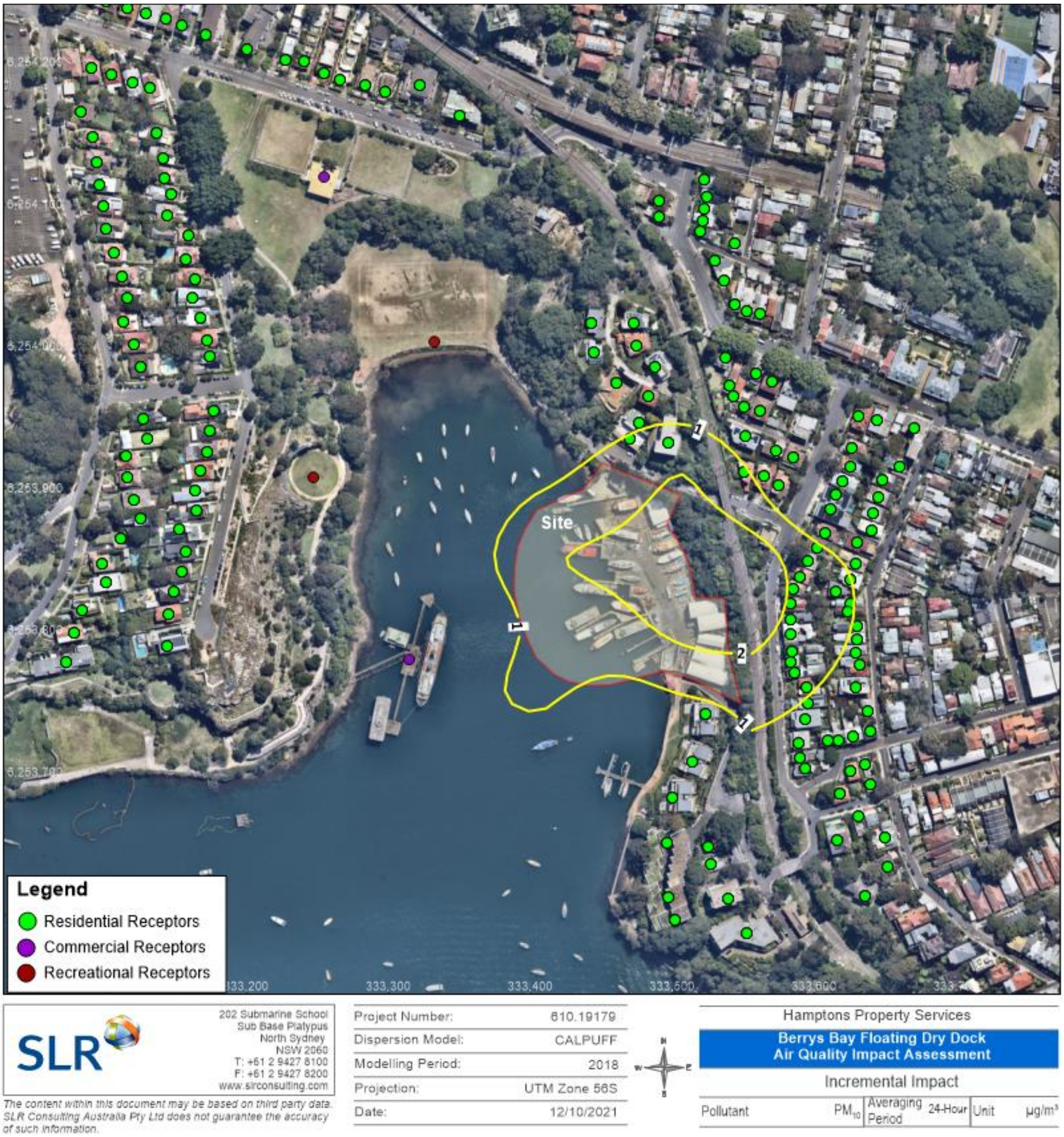
Hamptons Property Services

Berrys Bay Floating Dry Dock
Air Quality Impact Assessment

Incremental Impact

Pollutant	PM_{10}	Averaging Period	Annual	Unit	$\mu g/m^3$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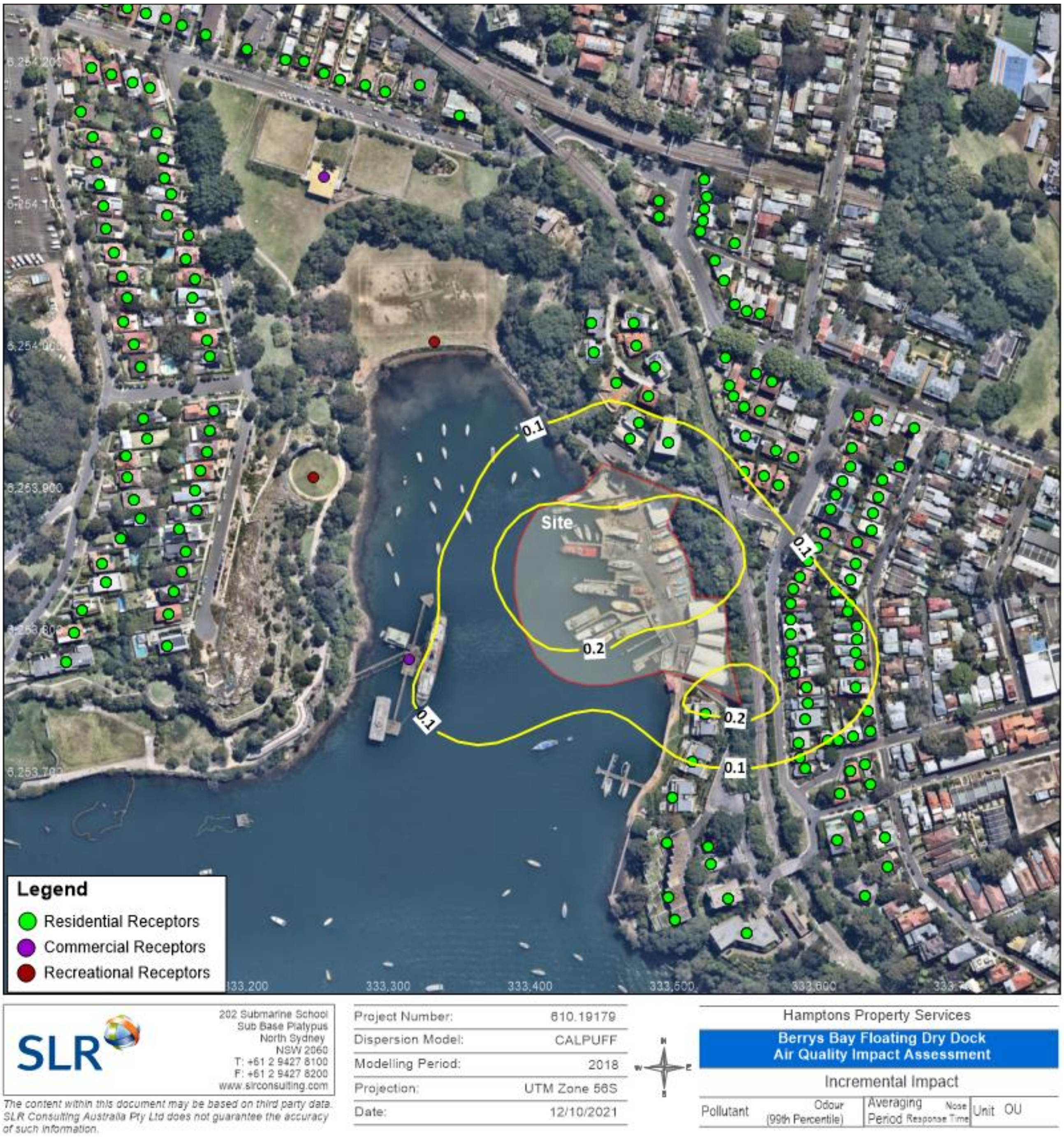
Berrys Bay Floating Dry Dock
Air Quality Impact Assessment
Incremental Impact
Pollutant PM10
Averaging Period 24-Hour
Unit µg/m³



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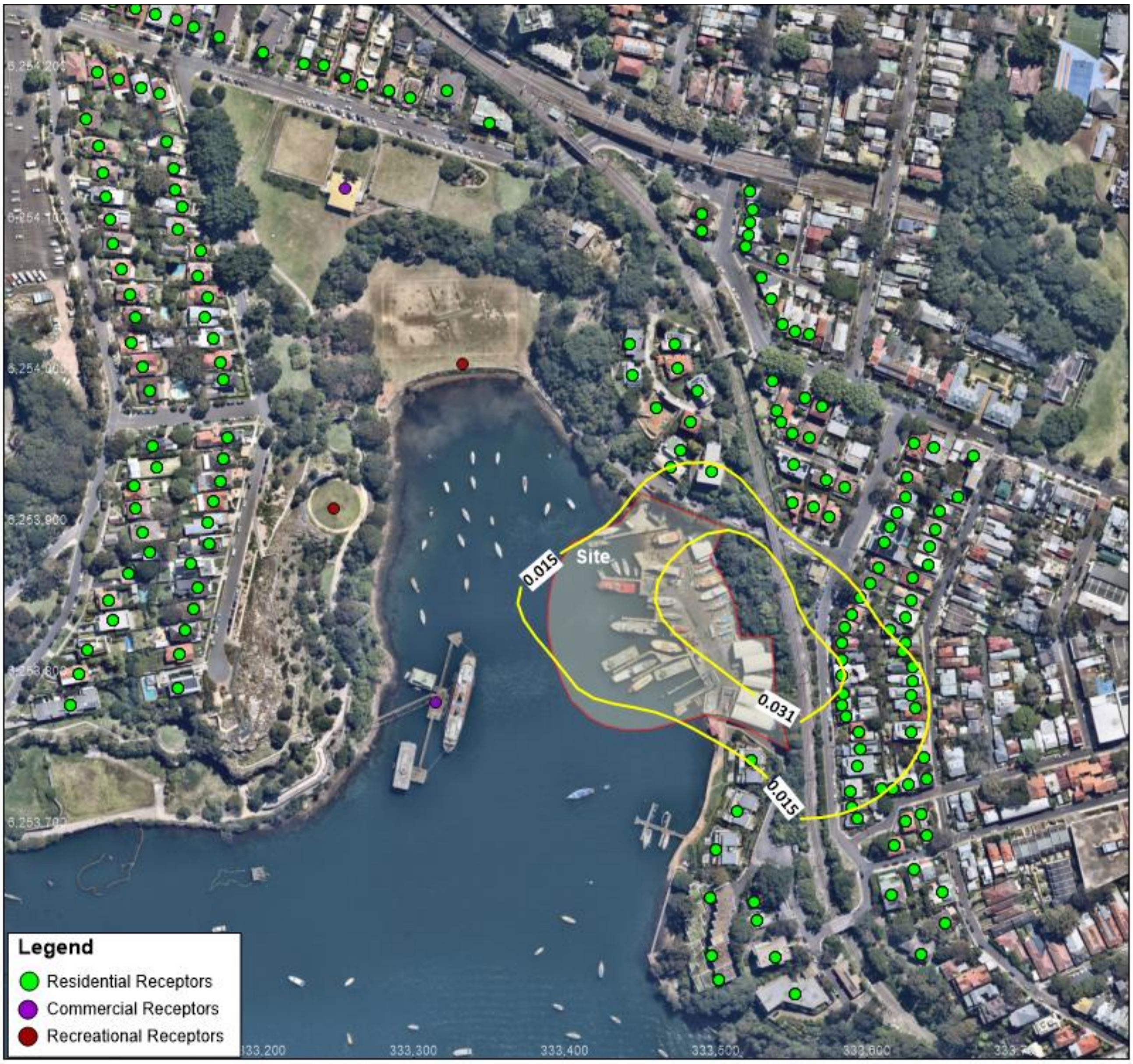

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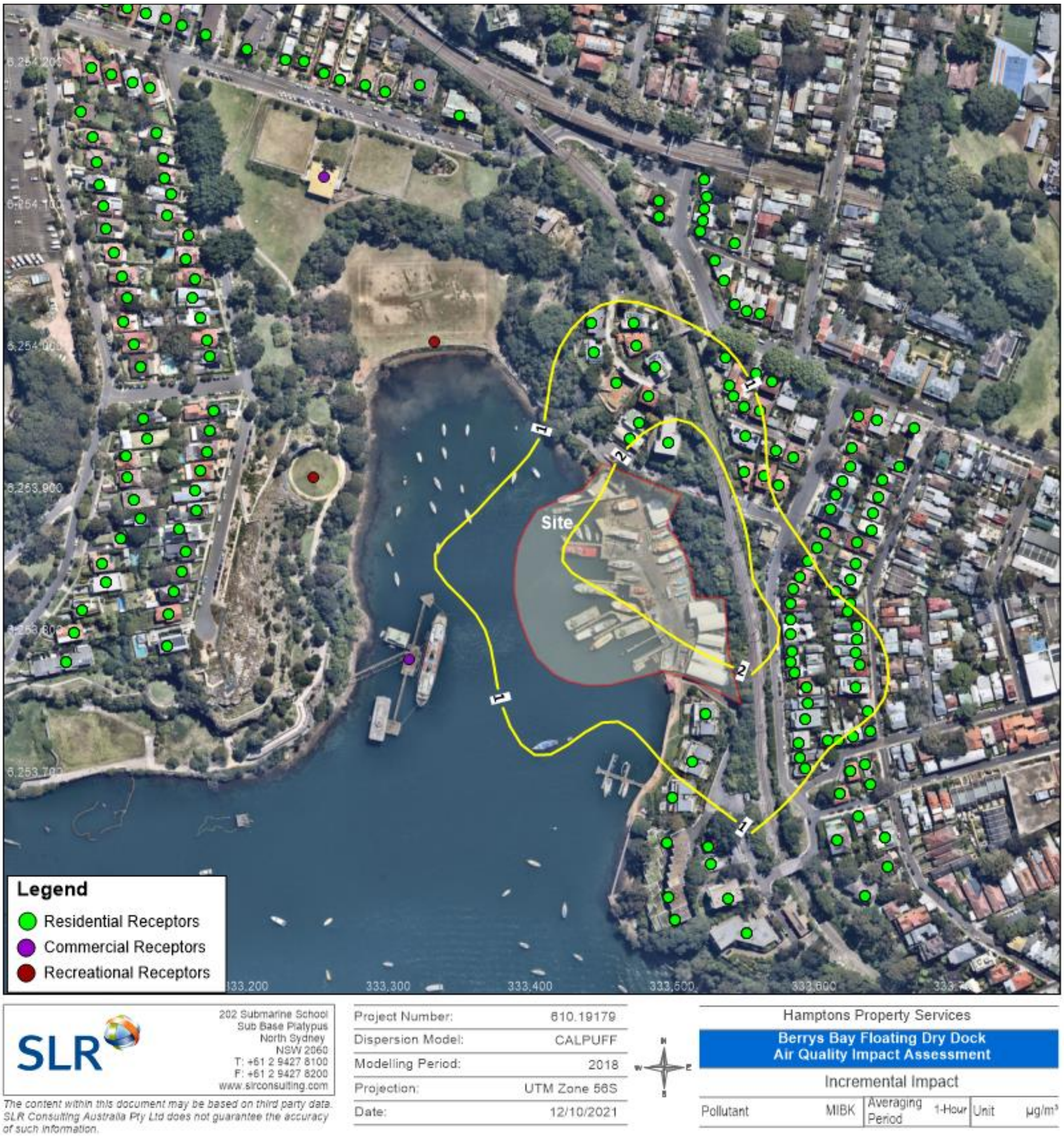
Hamptons Property Services

Berrys Bay Floating Dry Dock
Air Quality Impact Assessment

Incremental Impact

Pollutant	Nickel and compounds	Averaging Period	1-Hour	Unit	µg/m³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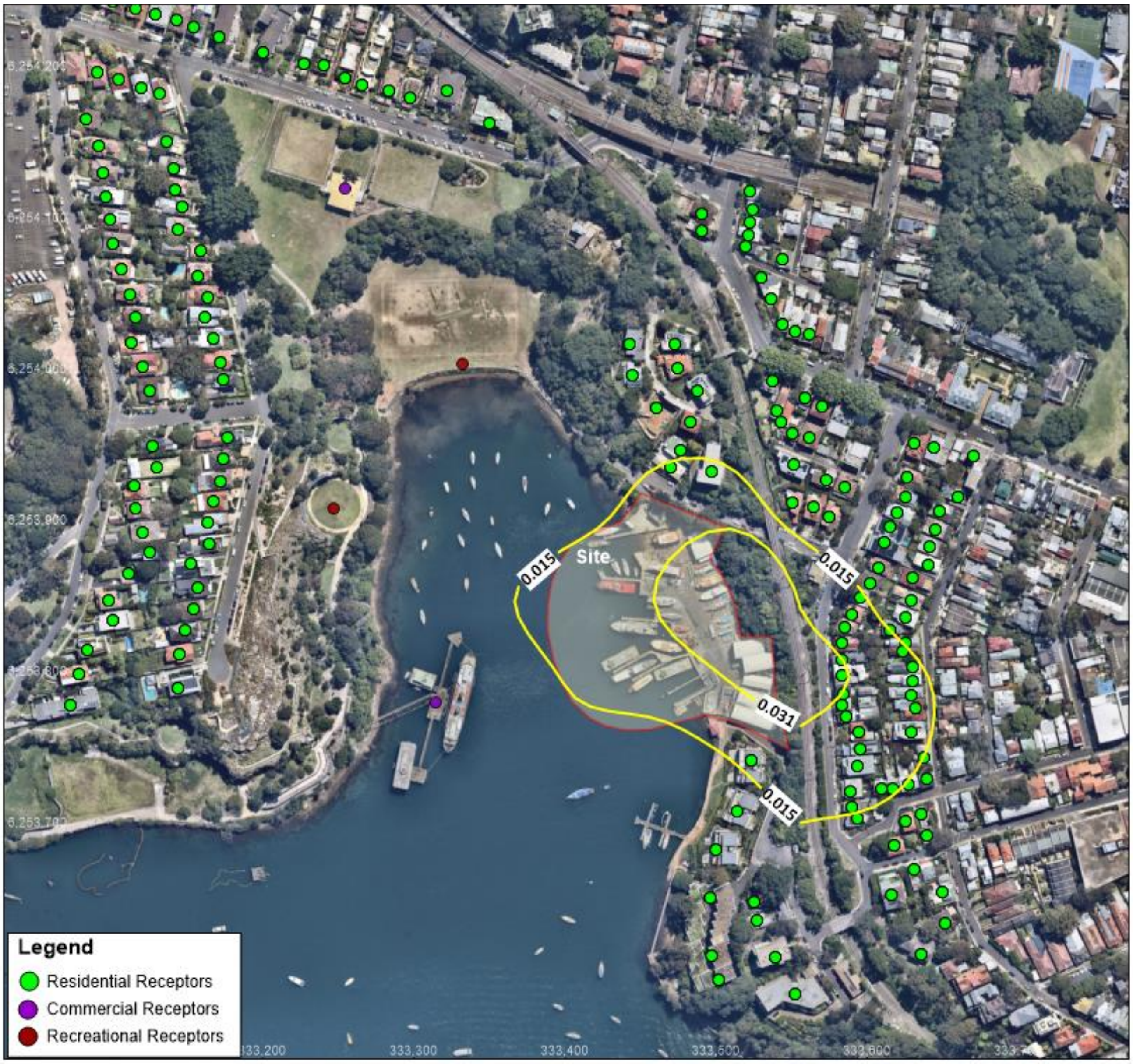
Hamptons Property Services
Berrys Bay Floating Dry Dock
Air Quality Impact Assessment
Incremental Impact
Pollutant MIBK
Averaging Period 1-Hour
Unit µg/m³



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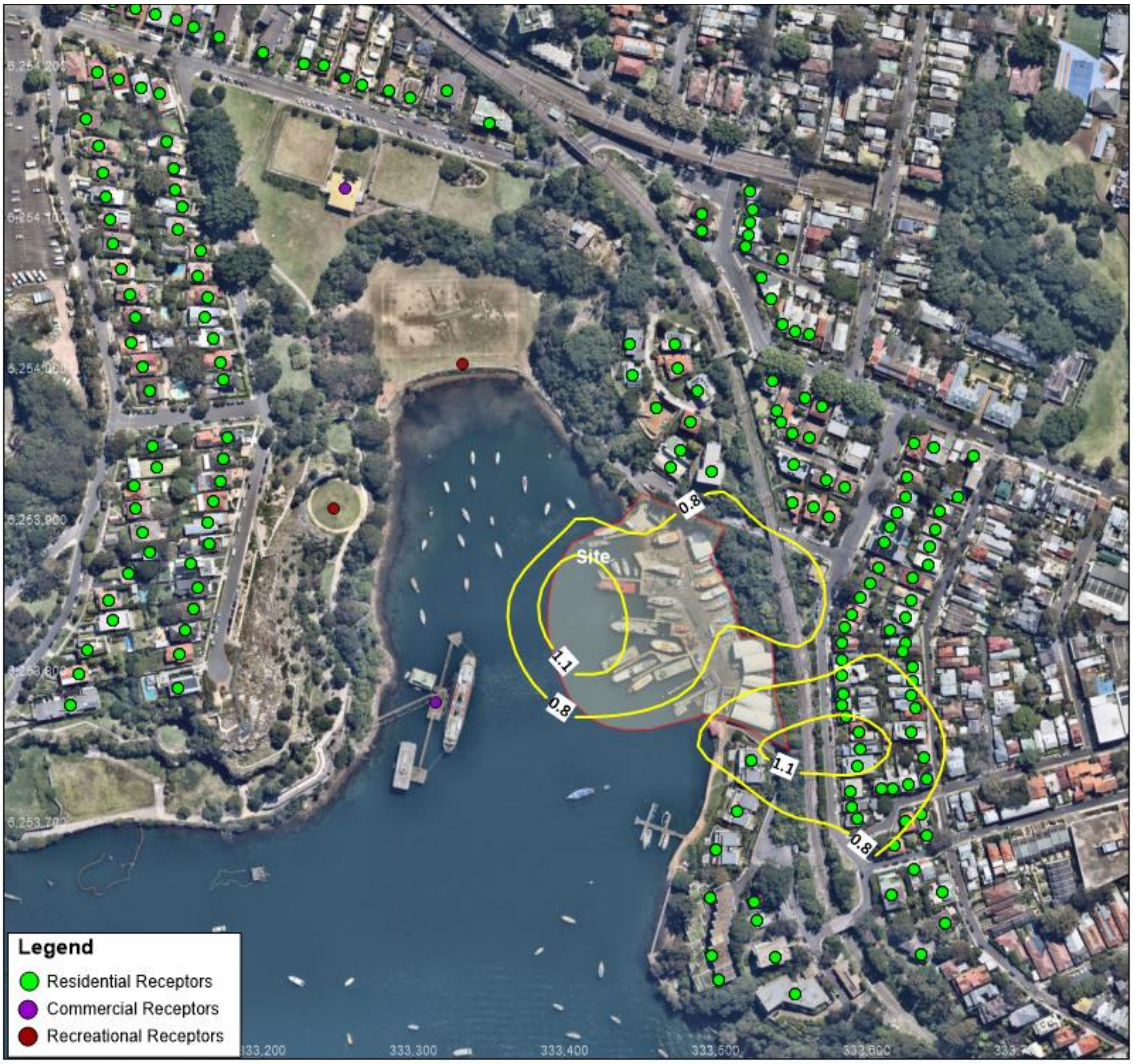
Hamptons Property Services

Berrys Bay Floating Dry Dock
Air Quality Impact Assessment

Incremental Impact

Pollutant	Manganese and compounds	Averaging Period	1-Hour	Unit	µg/m³



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Hamptons Property Services

Berrys Bay Floating Dry Dock
Air Quality Impact Assessment

Incremental Impact

Pollutant	Xylenes	Averaging Period	1-Hour	Unit	µg/m³

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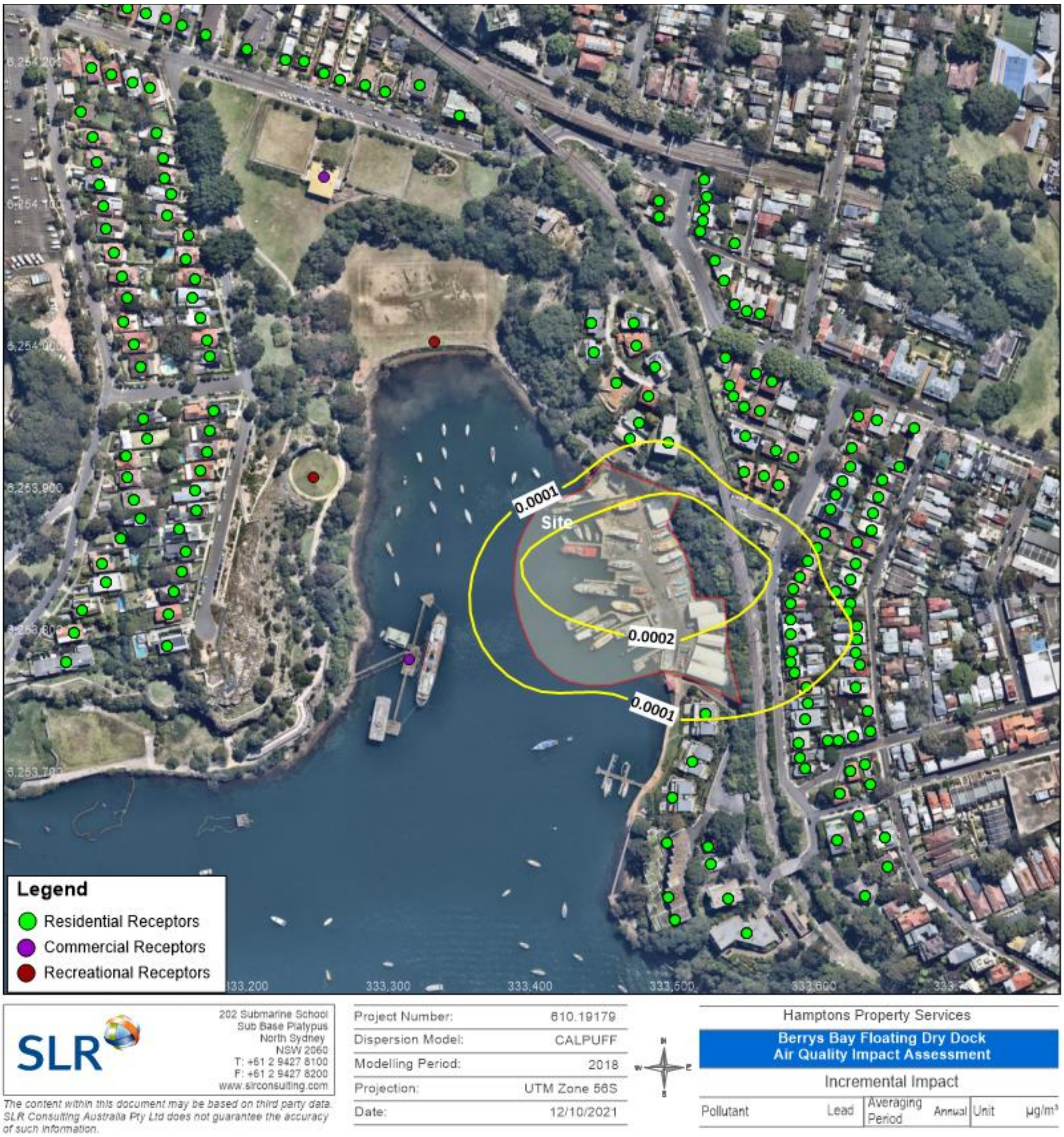
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Hamptons Property Services
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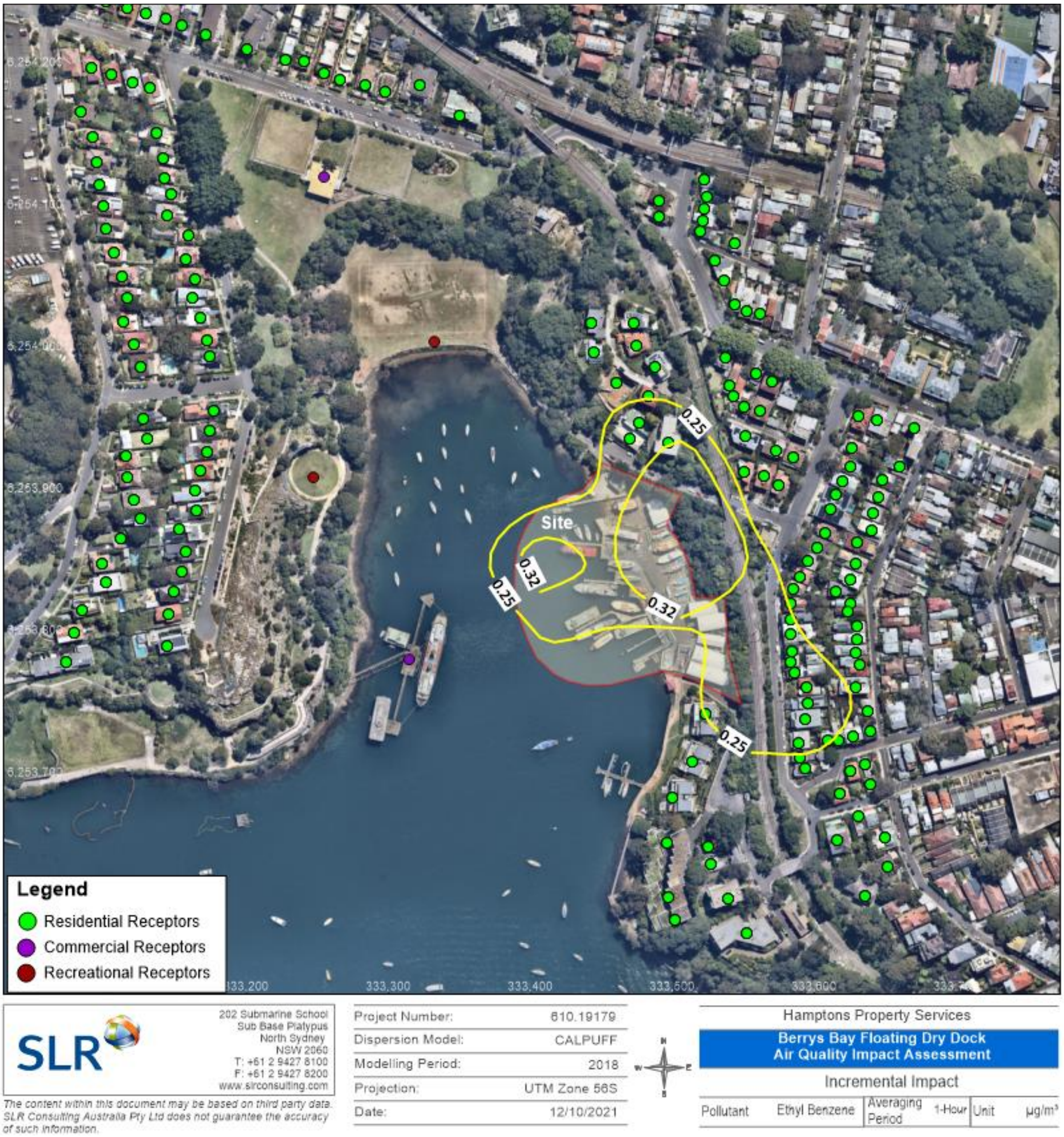
Air Quality Impact Assessment
Incremental Impact
Pollutant Lead
Averaging Period Annual
Unit µg/m³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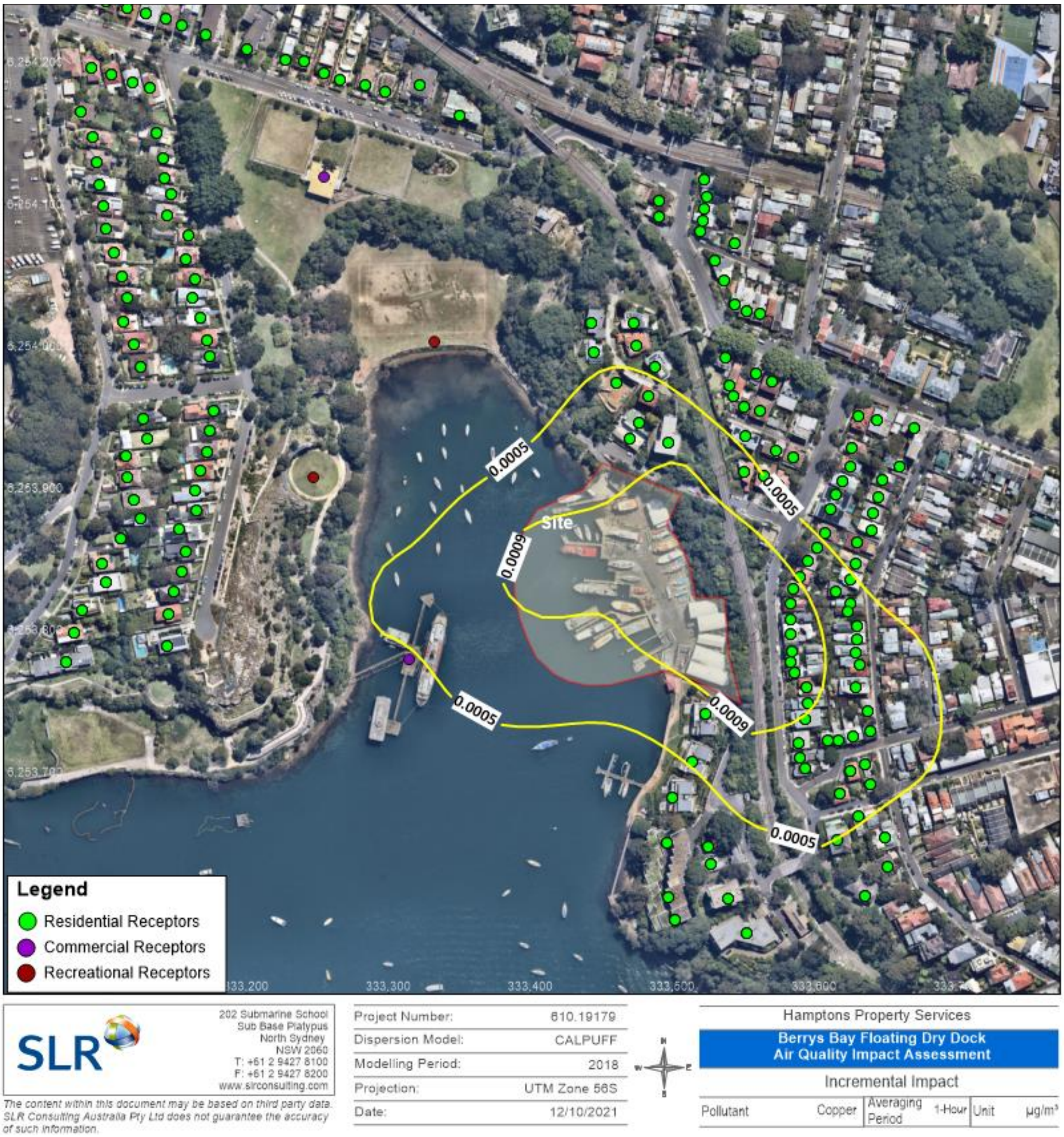
Incremental Impact
Pollutant Ethyl Benzene
Averaging Period 1-Hour
Unit µg/m³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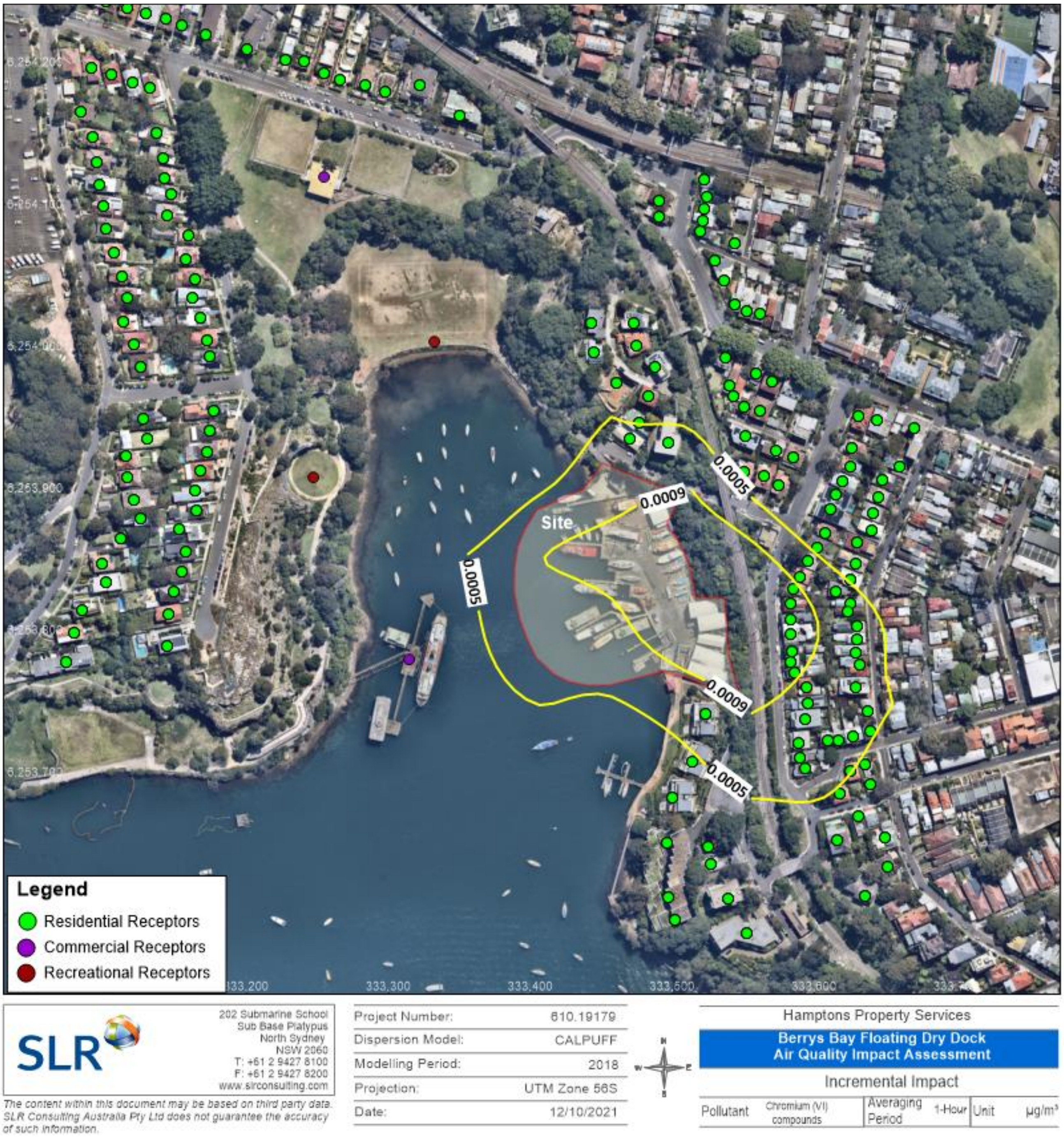
Incremental Impact
Pollutant Copper
Averaging Period 1-Hour
Unit µg/m³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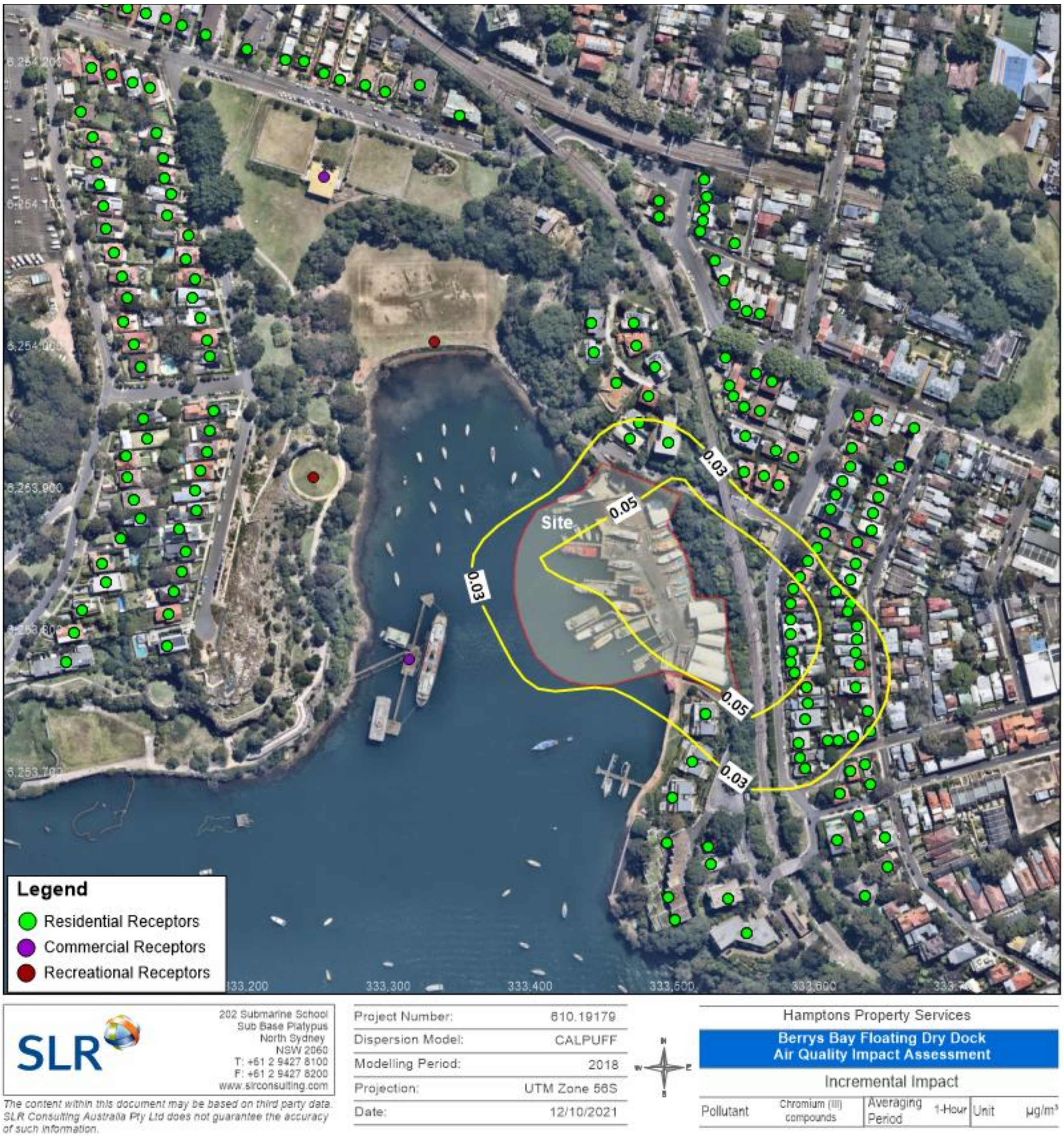
Berrys Bay Floating Dry Dock
Air Quality Impact Assessment
Incremental Impact
Pollutant
Chromium (VI) compounds
Averaging Period
1-Hour
Unit
µg/m³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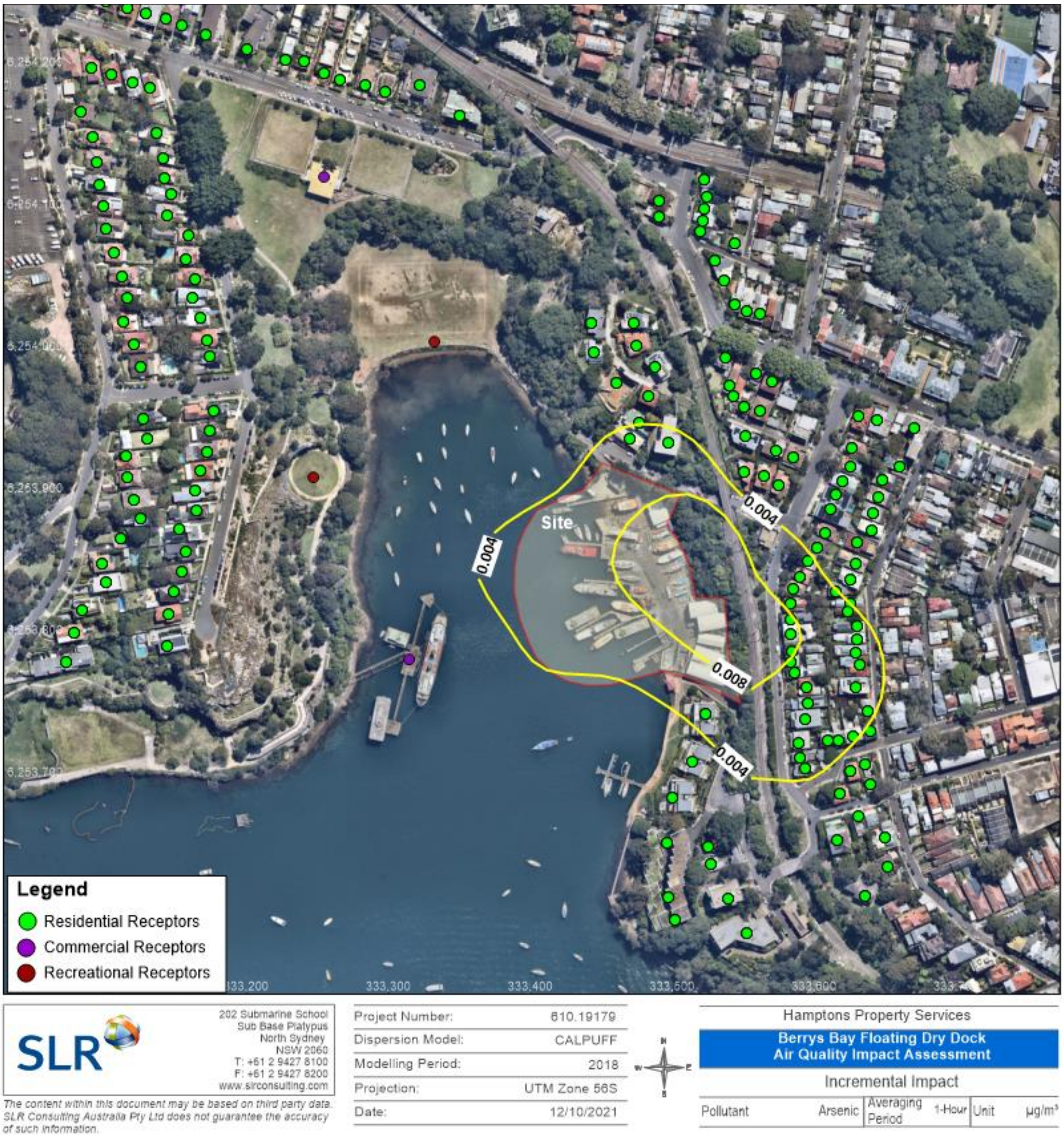
Hamptons Property Services
Berrys Bay Floating Dry Dock
Air Quality Impact Assessment
Incremental Impact
Pollutant
Chromium (III) compounds
Averaging Period
1-Hour
Unit
µg/m³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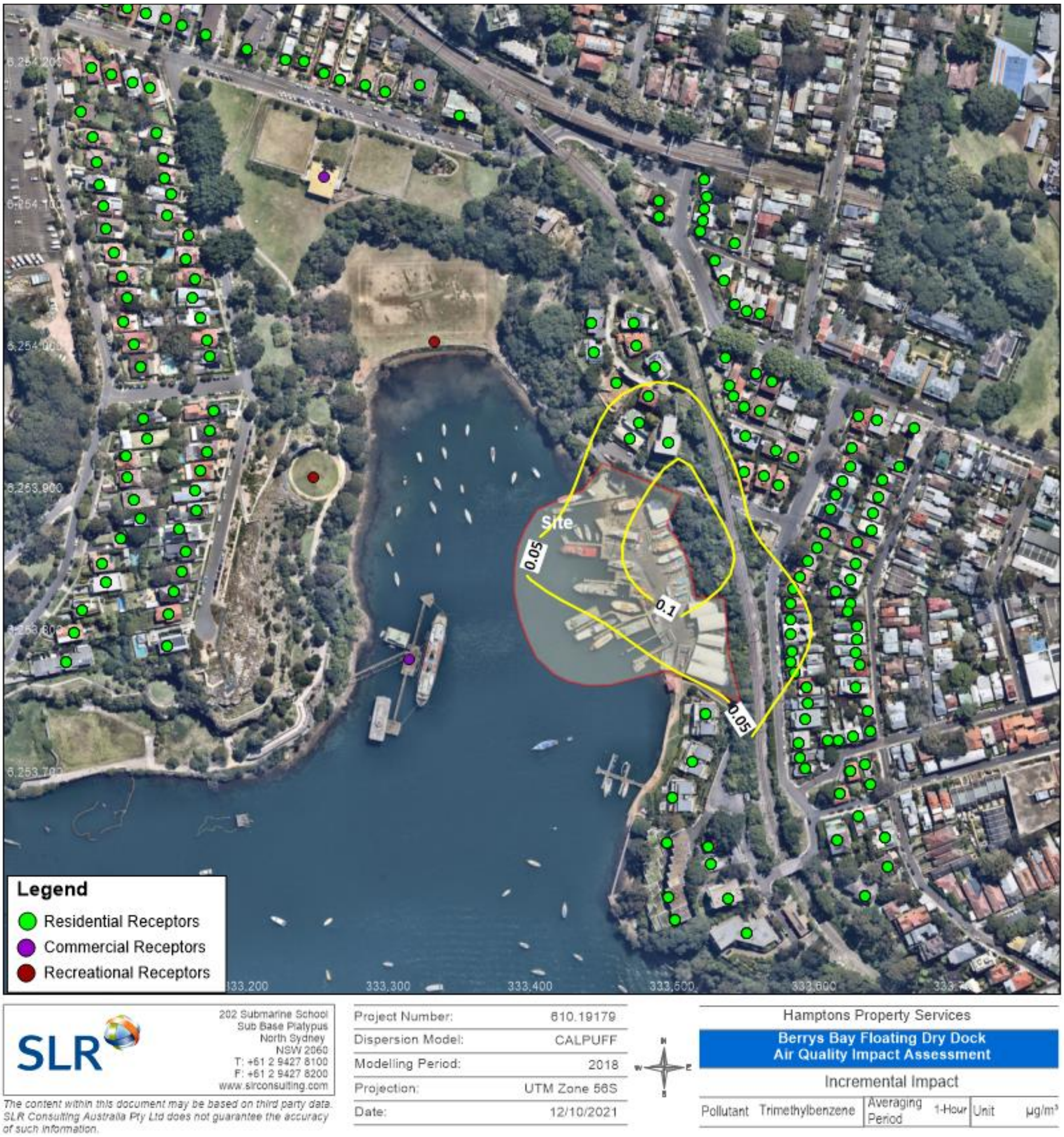
Incremental Impact
Pollutant Arsenic
Averaging Period 1-Hour
Unit µg/m³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Berrys Bay Floating Dry Dock
Air Quality Impact Assessment
Incremental Impact
Pollutant Trimethylbenzene
Averaging Period 1-Hour
Unit µg/m³

6 JOHN STREET, MCMAHONS POINT

Air Quality Risk Assessment

Prepared for:

Noakes Group Pty Ltd
6 John Street,
McMahons Point, NSW 2060

SLR Ref: 610.19179-R01
Version No: -v1.0
November 2021

PREPARED BY

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BASIS OF REPORT

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.19179-R01-v1.0	19 November 2021	Ali Naghizadeh	Graeme Starke	Ali Naghizadeh

CONTENTS

DOCUMENT REFERENCES

TABLES

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FIGURES

PHOTOS

APPENDICES

1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Noakes Group Pty Ltd (Noakes) to prepare an Air Quality Risk Assessment (AQRA) for the marine repair facility at 6 John Street, McMahons Point NSW (hereafter 'Site').

This AQRA has been prepared in response to condition U2 of Noakes's Environmental Protection Licence (EPL) 10893 which requires a Pollution Reduction Study to be prepared with the following objectives:

1. Understand the risk of air quality impacts from Site activities.
2. Determine if currently installed pollution controls remain fit-for-purpose.
3. Identify measures to minimise air quality impacts and ensure compliance with section 128 and section 129 of the Protection of the Environment Operations Act 1997 and Conditions O1-O4 and Condition L4 of the EPL.

This report presents the outcomes of *U2: Air Quality Risk Assessment*, the requirements of which are detailed below:

EPL Conditions	*Reference*
U2.1 The licensee must engage an independent and appropriately qualified consultant to undertake an Air Quality Risk Assessment. The Assessment must;	
1. Include a detailed description of all activities occurring on the site and include: *a) A process flow diagram clearly showing all activities/ operations carried out on the premises including, but not limited to;* *i. vessel spray painting* *ii. welding, and* *iii. surface preparation activities* *b) A detailed discussion of all activities carried out on the site, including frequency of occurrence and variability (i.e. seasonal, ad-hoc, routine)* *c) A comprehensive inventory of all materials/ products used for performing the identified activities such as paints, thinners, solvents, adhesives and surface coating materials. For each material/ product identified, the following must be included;* *i. details regarding the frequency of use and typical application rates* *ii. details of the volumes used (litre's per annum)* *iii. material Safety Data Sheet*	**Section 3**
2. Identify all potential sources of air pollutants (including dust, VOC's and odour) arising from activities undertaken and materials used on the site. Sources must be identified as point sources or fugitive sources.	**Section 3.3** **Section 4**

EPL Conditions	*Reference*
3. Include a detailed site plan clearly showing the layout of the site and; *a) locations where all activities/ operations occur* *b) all emission sources clearly identified* *c) plant boundary* *d) sensitive receptors (e.g. nearest residences)* *e) topography*	**Section 2** **Section 4**
4. Include a risk evaluation and assessment of each emission source and their potential impact on air quality. Methods for developing the risk classification must give consideration to, but not necessarily be limited to the: *a) type of material and specific material properties which may contribute to odour generation;* *b) quantity of individual material types used by the Premises;* *c) specific activities undertaken which utilise the material;* *d) odour emission intensity, including the results of any odour sampling where considered reasonable and practical to collect as part of the risk classification process*	**Section 7**
5. Identify and describe all currently installed emission controls including; *a) plans, process flow diagrams and descriptions that clearly identify and explain all pollution control equipment and control techniques for all activities occurring on the premises* *b) a description of all aspects of the air emission control systems, with particular regard to any fugitive emission capture systems (e.g. hooding, ducting), treatment systems (e.g. scrubbers, bag filters) and discharge systems (e.g. stacks)* *c) the operational parameters of all emission sources, including all operational variability, i.e. location, release type (stack, volume or area) and release parameters (e.g. stack height, stack diameter, exhaust velocity, temperature, emission concentration and rate)* *d) emission concentrations and rates must be determined;* *i. from all point sources during activities with high potential to cause air impacts* *ii. during peak operations, or at times representing worst case conditions* *iii. for pollutants including particles, odour and volatile organic compounds (VOC's)* *iv. in accordance with the approved methods for the sampling and analysis of air pollutants in NSW*	**Section 3.4**

EPL Conditions	*Reference*
6. Evaluate the effectiveness of currently installed controls at controlling pollutant emissions from all activities with a high potential to cause air quality impacts; *a) the effectiveness must be determined based on the achieved emission performance and removal efficiency of the installed controls, and* *b) must be determined based on the results of emission testing for pollutants including particles, odour and VOC's*	**Section 3.4**
7. Identify, evaluate and recommend options to reduce air quality impacts (including odour) from the premises. The proposal must specify: *a) how pollutant emissions will be mitigated for each material and activity identified and classified as having high emission potential* *b) how emission performance improvements will be implemented for each material and activity identified as having high emission potential* *c) a timeline for implementation of each odour performance improvement identified.* *d) each mitigation and improvement measure identified must:* *i. be tailored to the odour risk for each material and activity, and* *ii. include performance targets that are measurable, auditable and consistent with the Objective of the pollution reduction study.*	**Section 8**
U2.2 The works required by this Pollution Reduction Study must make reference to methodologies set out in the following documents: • *Technical Framework: Assessment and management of odour from stationary sources in NSW (NSW DEC, 2006);* • *Technical Notes: Assessment and management of odour from stationary sources in NSW (NSW DEC, 2006);* • *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (NSW DEC, 2005); and* • *Approved Methods for Sampling and Analysis of Air Pollutants in NSW (NSW DEC, 2006).*	This report

2 Site Overview and Setting

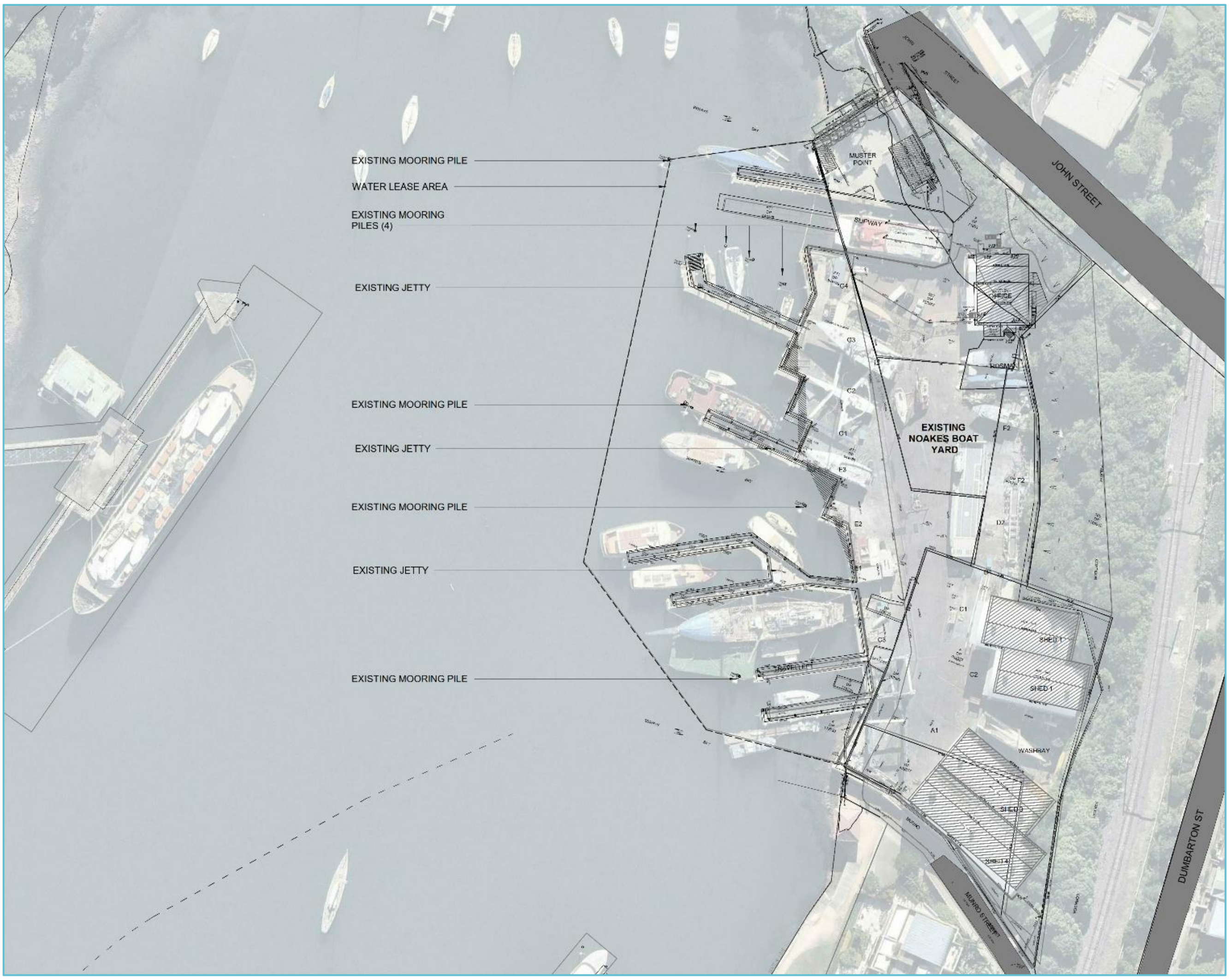
2.1 Site Overview

The Site has a total area of 6,403 square metres (m^2) and is occupied by a boat repair and maintenance facility which comprises both land and water-based infrastructure including:

- Car parking areas
- Hardstand to locate boats on when being repaired and maintained.
- Four enclosed buildings ('sheds') to undertake maintenance works.
- Northern Slipway
- A two storey office building
- Other marine repair infrastructure including wharfs and jetties.

A layout of the Site is presented in **Figure 1**.

Figure 1 Site Layout



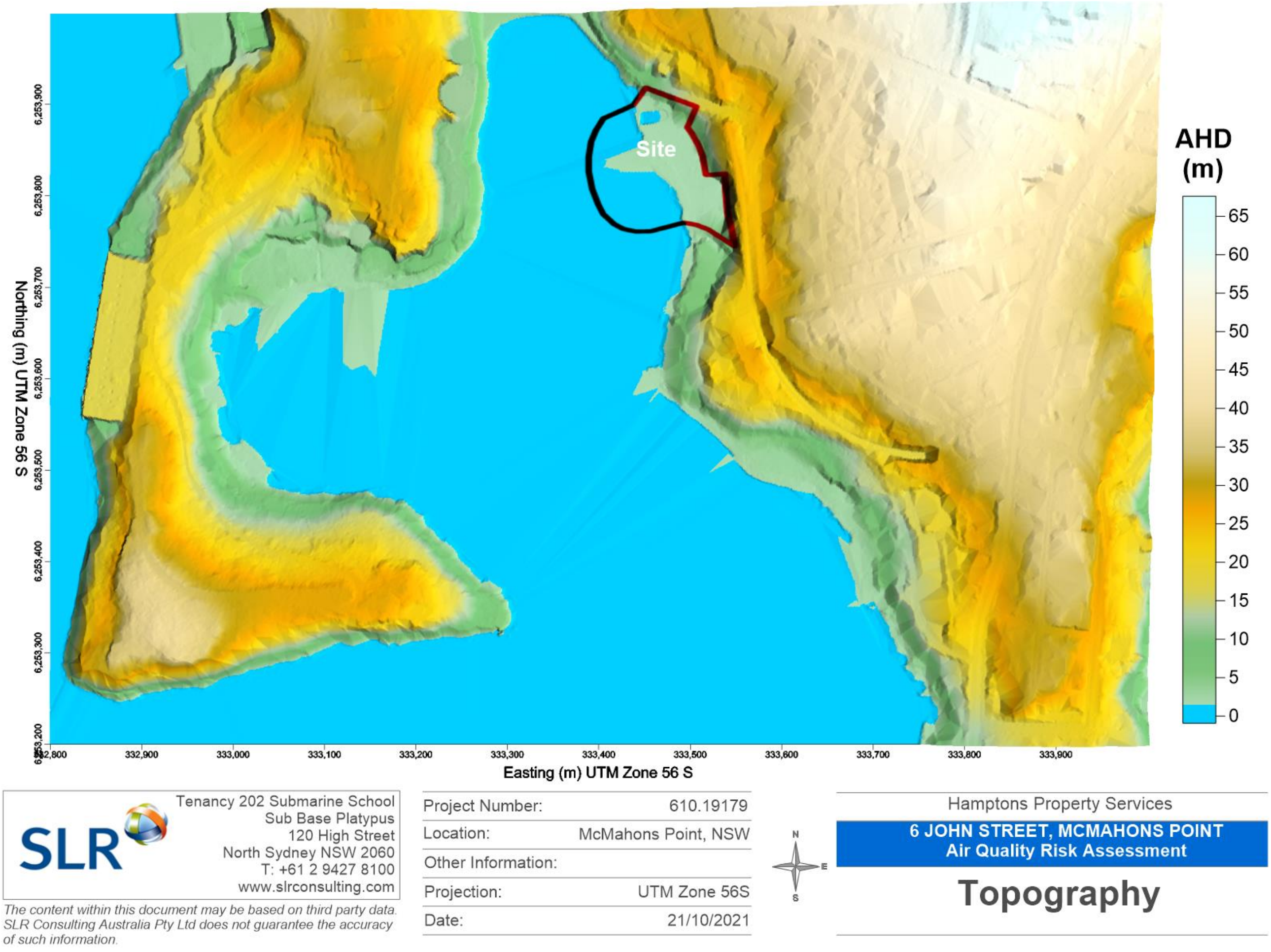
2.2 Local Topography

Topography is important in air quality studies as local atmospheric dispersion can be deflected by terrain and/or influenced by night-time katabatic (downhill) drainage flows from elevated terrain or channelling effects in valleys or gullies.

A three-dimensional representation of the area surrounding the Site is given in **Figure 2**. The topography within the illustrated area ranges from an approximate elevation of 0 metres (m) to 65 m Australian Height Datum (AHD).

The Site itself is reasonably flat with a gentle slope from east to west. The terrain steeply increases in elevation to the east up to a maximum elevation of approximately 65 m AHD. Ground elevations increase more gradually to the north and south.

Figure 2 Topography of Area Surrounding the Site



2.3 Surrounding Land Use and Sensitive Receptors

As illustrated in **Figure 3**, the Site is located within land predominantly zoned Working Waterfront (IN4). Local Centre (B2) and the surrounding locality generally consists of one to three storey buildings, containing residential accommodation and commercial uses.

The lots surrounding the Site are zoned High Density Residential (R4), Medium Density Residential (R3), Low Density Residential (R2), Infrastructure (SP2) and Public Recreation (RE1).

Generally, east of the Site are residential land uses, of low-medium density, including three storey apartment buildings. There is an SP2 buffer (in the form of the Lavender Bay Railway Line) between the Site and nearest residential buildings to the east. South of the Site are residential land uses of medium-high density and north of the site residential uses of low density as well as Waverton Park. To the west of the Site is Berrys Bay, with marine related uses.

Figure 4 illustrates receptors included in the assessment that was performed as part of this AQRA. As illustrated commercial and recreational receptors were included in addition to residential receptors. For each residential building four separate receptors were included at 0 m, 3 m, 6 m and 9 m elevations. It is noted that not all these buildings have residential areas at all these elevations (ie are this tall). In total, the modelling incorporates a total of 734 discrete receptors.

Figure 3 Surrounding Land Use

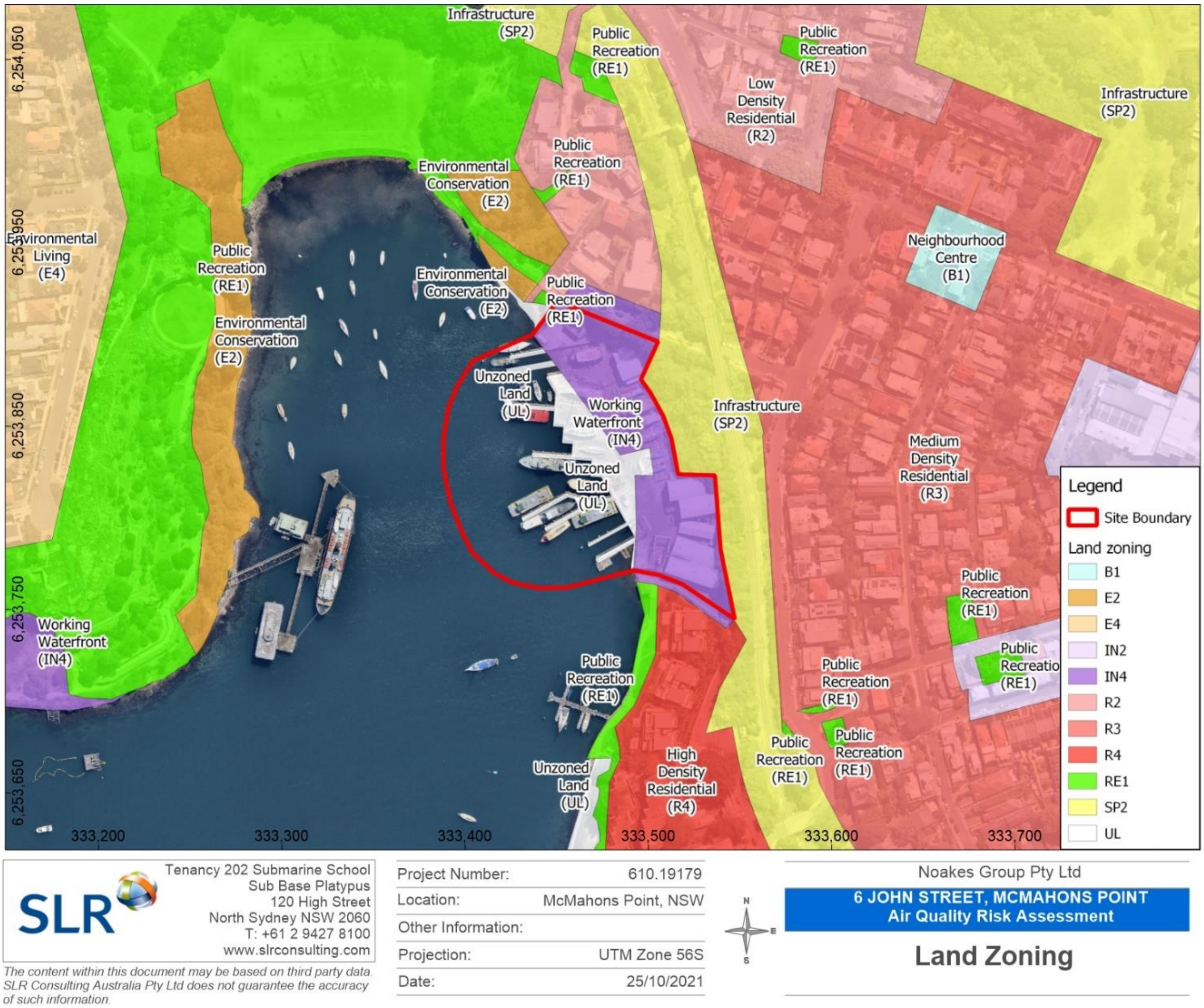
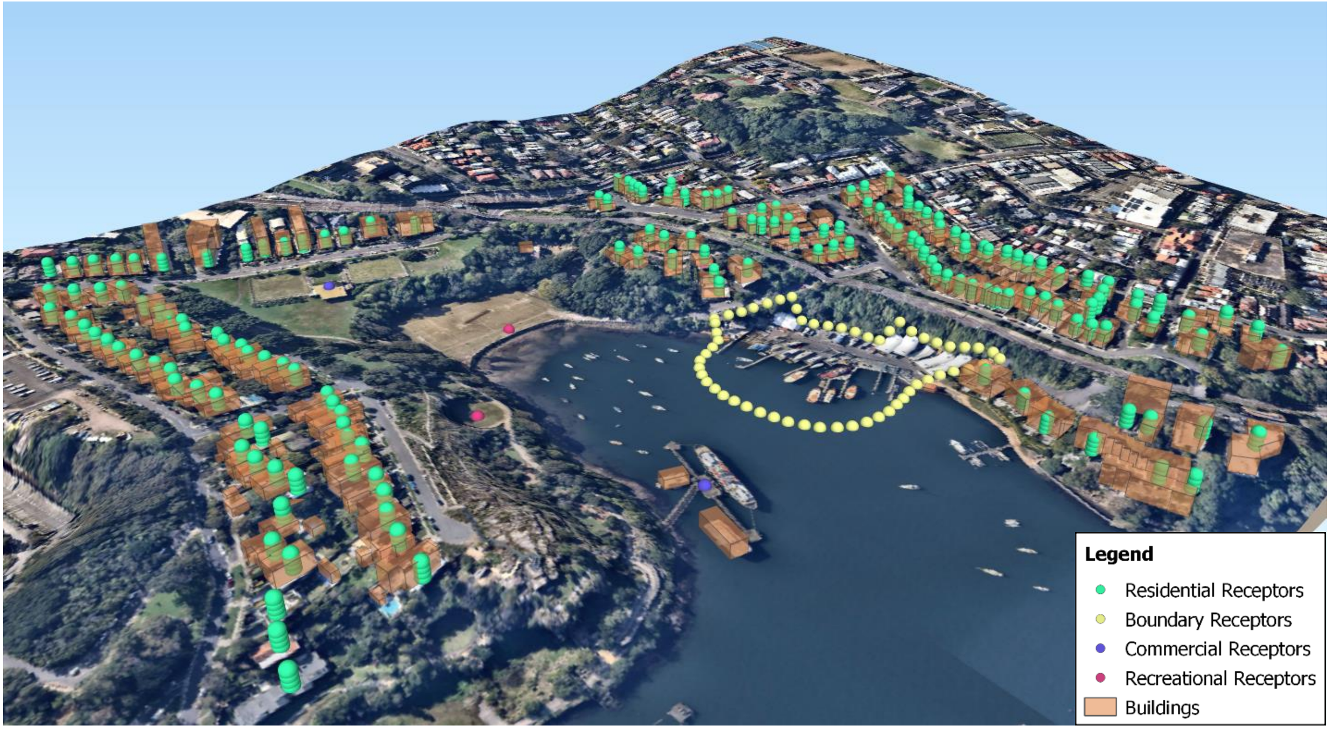


Figure 4 Modelled Sensitive Receptors



3 Site Operations

3.1 Overview of Site Activities

The operations at the Site include service, repair and maintenance of marine vessels. Typical service, repair and maintenance activities that are undertaken at the Site include:

- Electrical and mechanical works
- Fabrication;
- Surface preparation;
- Painting;
- Welding;
- Shipwrighting;
- Rigging; and
- Naval architecture services.

The clientele which utilises the services of the site includes naval services, public authorities, including NSW Water Police, Defence Maritime Services and historically, Roads and Maritime Services (RMS), as well as private individuals. The split is generally 60% for public work and 40% for private individuals

The Site operates in accordance with Development Consent (DC) No. 1164/90 and EPL 10893 which provide strict regulatory control over the operation of the site in relation to vessel accommodation, hours of operation and the nature of works permitted. In summary, key conditions are as follows:

- the office space is to be used for ancillary purposes only, or in conjunction with uses permitted by virtue of the zoning (Condition D.43 of DC)
- the maximum number of people permitted to be employed on the site at any one time is 120 (Condition D. 49 of DC)
- the maximum number of boat spaces shall not exceed 26, being spaces located in the hard stand area, worksheds, work berths, yard berths, home berths, northern slipway and the travel lift (Condition D.50 of DC). These may be configured as outlined in **Table 1.**
- limitation on where sand blasting and spray painting may occur (Condition 34B(i) of DC and O4.1 of EPL) and the duration of this (Condition 34B(i) of DC).
- limitation of antifoulant paint application type to roller, brush or airless spray only (Condition O4.5 of EPL)
- limitation on hours of operation for any process involving boat maintenance, repair or construction to 7.00 am to 6.00 pm, Monday to Saturday inclusive, with no work being undertaken on Sundays or Public Holidays with the exception of 90 minutes of travel lift movements on Sundays (Condition D32 of DC and L3.1 of EPL).

Table 1 Permitted Configuration of Vessels

Facility	
Hardstand	Boat to 25m in length, including 1 boat in wash bay
Worksheds	Boats to 30m in length in 10m wide bays, 10m in height
Workshops	9 workshops 12m x 5m for boat spaces. It is assumed that the workshop spaces is leased to skilled tenants for discretionary use, and fitted out accordingly.
Berths	
Work berths	Boats with direct access to wharf, bay width average 6m
Yard berths	Boats, associated with travel lift operation
Home berths	Ferry and charter boats for permanent berthing
Slipway	1 boat, to 9m beam
Travel lift	75 tonne (t), maximum beam 6.2 m, boat length to 25m, boat height to 7m.

Figure 5 illustrates a process flow diagram of typical activities carried out on the premises as well as approximate frequency of each activity per year. As illustrated, works at the Site are categorised into three main streams namely:

- Engine service
- Standard activities
- Restricted activities

Engine service includes mechanical repairs and maintenance of vessel engines which include, but are not limited to propellor repair and upgrades, engine maintenance, transmission service and replacement, engine rebuilds. This works is typically performed on the hardstand. Engine service activities are not deemed to have a significant potential for emissions to air.

Standard Activities are those activities not restricted by the facility's DA or EPL. These activities include welding, antifouling, topsides polishing, surface preparation works including wetrub and sanding as well as vessel detailing. Depending on the size of the vessels, these activities are either performed on the slipway (for vessels greater than 80 t) or the hardstand (for vessels less than 80 t). Areas on the hardstand where Standard Activities are performed are shown in **Figure 6**. It is noted that approximately 50% of all welding performed on site occurs in Shed 1 (see **Figure 6**), with the remainder performed on the hardstand or slipway. The maximum amount of welding electrode consumed per hour is approximately 0.1 kilograms (kg).

Restricted Activities are those activities restricted by the facility's DA or EPL due to potentially significant impacts (noise, air quality or other). These activities, which are performed infrequently, include blasting and spray painting (application of paint using conventional spray guns). In relation to blasting, depending on the type of abrasive material used size, these activities are either performed at the Eastern Hardstand (when sodium bicarbonate is used) or Shed 1, Shed 3 or Shed 4 (when sand is used). The maximum amount of abrasive material used per hour is approximately 250 kg. In relation to spray painting, depending on the size of the repair (and hence amount of paint required for the repair), these activities are either performed at the Eastern Hardstand (when repair area is less than 10 m^2) or Shed 1, Shed 3 or Shed 4 (when repair area is greater than 10 m^2, with a maximum of approximately 100 litres of paint used per job).

Standard hours of operation at the facility are 7 am to 6 pm Monday to Saturday, with no work on Sundays or public holidays with the exception of 90 minutes of travel lift movements on Sundays. Surface preparation activities are restricted to 9 am and 3 pm.

Figure 5 Noakes Process Flow Diagram

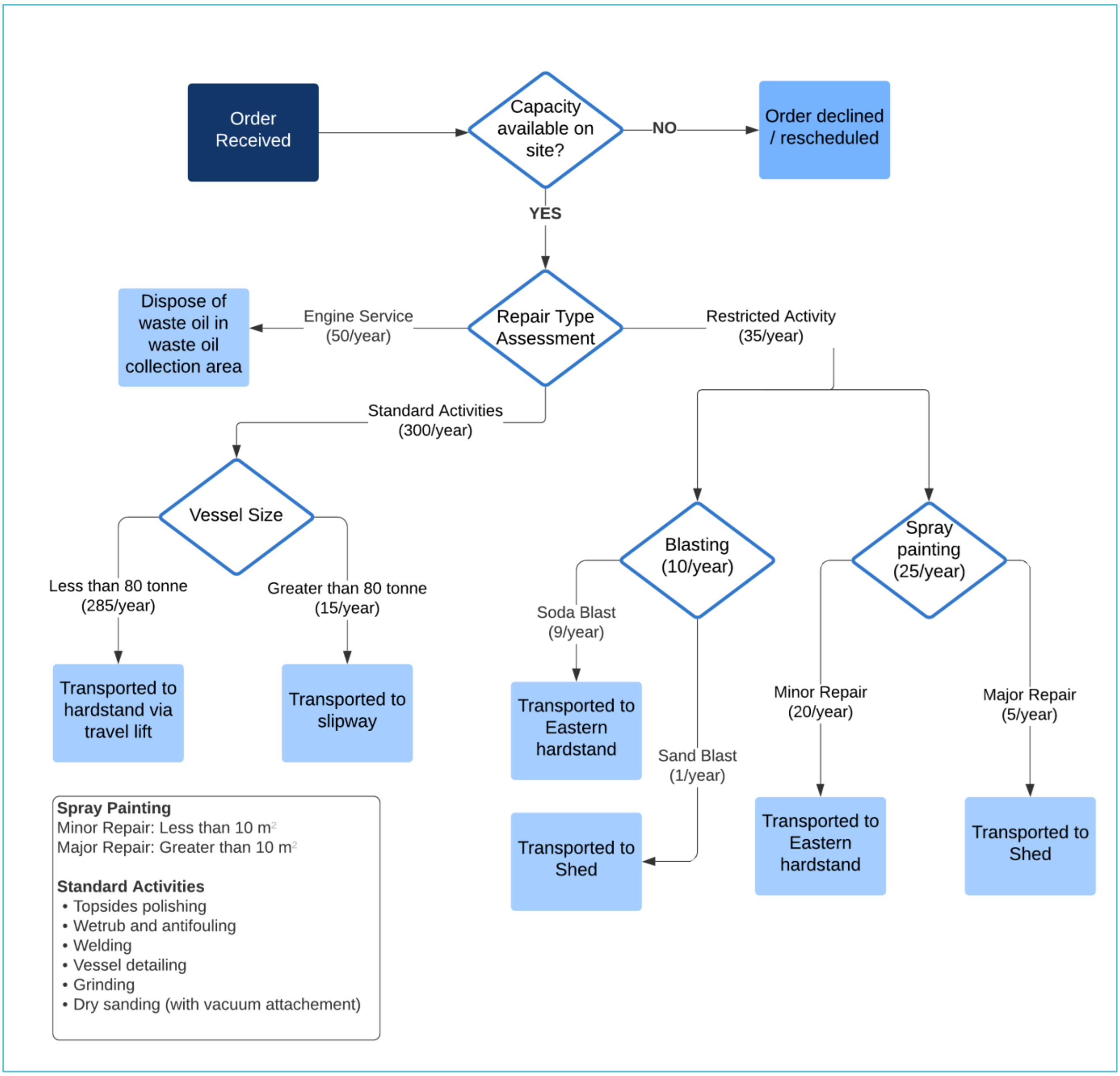


Figure 6 Site Layout

3.2 Audit of Site Activities

A site visit was completed on 6 August 2021 by Ali Naghizadeh, a Principal Consultant from SLR with the aim of identifying all sources of air emissions and pollution control measures implemented at the Site. During the site visit, the weather was characterised as mostly clear skies and with low to moderate speed west to west-northwesterly winds. The Facility was operational, with normal activities in progress. The following activities were being performed on site during the site visit:

- Wastewater pump out
- Roller brush painting on the slipway
- Antifoul application on the hardstand using airless sprayer
- Welding/fabrication in Shed 1
- Surface preparation, general repair works in Shed 3
- General repair works on hardstand

The following observations were made during the site visit:

- No odours were detected along John Street or Dumbarton Street. On Munro Street, 'weak' to 'distinct' odours with a 'sweet solvent' odour character were observed along the Site boundary. These odours could not be detected at locations within 5 m of the Site the boundary.
- No distinct odours were detectable downwind of the wastewater pump out. SLR was advised by Noakes staff that wastewater pump out of vessels using a land based vacuum tanker occurs on site very infrequently (less than once per year) and when required an external contractor is engaged for the work (see **Photo 1**). On the day of the site visit, the contractors left site promptly after wastewater pump out was complete. SLR was advised that waste water pump out is typically performed using a sealed plumbing system (ie a soft hose at berth is connected to fixed pluming) for charter and private vessels.
- Distinct odours with a 'paint/solvent' odour character were observed within an approximately 10 m radius of the slipways where roller brush painting of a vessel was in progress. These odours could not be detected at locations over 20 m from the slipway.
- Airless spraying of antifoul on the hardstand was carried out inside an encapsulated area. As shown in **Photo 2**, Noakes staff encapsulated the vessel hull using sections of plastic and tarpaulins. Weak odours with a 'sweet and pungent' character could be detected in very close proximity (less than 5 m) to the encapsulated vessel while the airless spraying was being performed.
- No visible dust emissions were observed from on-site activities.
- No odours were detected from the on-site wastewater treatment plant.
- The wet scrubber systems in Sheds 1, 3 and 4 were tested and were all operational.
- Sheds 1 and 4 are connected to a common duct which carries air treated by the wet scrubbers serving these sheds and releases the air at a location north of Shed 1 on the site boundary. The dust exhaust is located at an elevation of approximately 15 m (see **Photo 3**).
- The Shed 3 wet scrubber releases treated air directly behind Shed 3 and towards a paint storage shed. This is the most likely source of odours detected along the Munro Street boundary (cumulative emissions from the wet scrubber exhaust and to a lesser degree the paint storage shed).
- Sheds 3 and 4 were both under slight negative pressure when tested. This was determined by closing all operable doors and conducting smoke tests across the main access doors.
- All paints, antifouls and solvents are kept in one of three paint storage shed (see **Photo 3** and **Photo 5**). On the day of the site visit, all paints were stored in containers with lids securely sealed.
- On the day of the site visit welding activities were only being performed in Shed 1. Noakes staff advised that on average 50% of all welding occurs in Shed 1 with the remainder performed in either Shed 3, Shed 4 or on the hardstand.

During the site audit, SLR requested for Material Safety Data Sheets (MSDSs) of all materials used on site to be provided together with the following additional information for each material:

- Frequency of use (applications per year)
- Typical application rate (litres per job)
- Annual usage rate (litres per year)
- Application type (ie brush and roller, airless spray, conventional spray or other)

Table 2 Provides a summary of the above information. MSDSs are available upon request.

Photo 1 Waste Water Pump Out

Photo 2 Antifoul application on the hardstand

Photo 3 Duct Serving Shed 1 and Shed 4 Wet Scrubbers

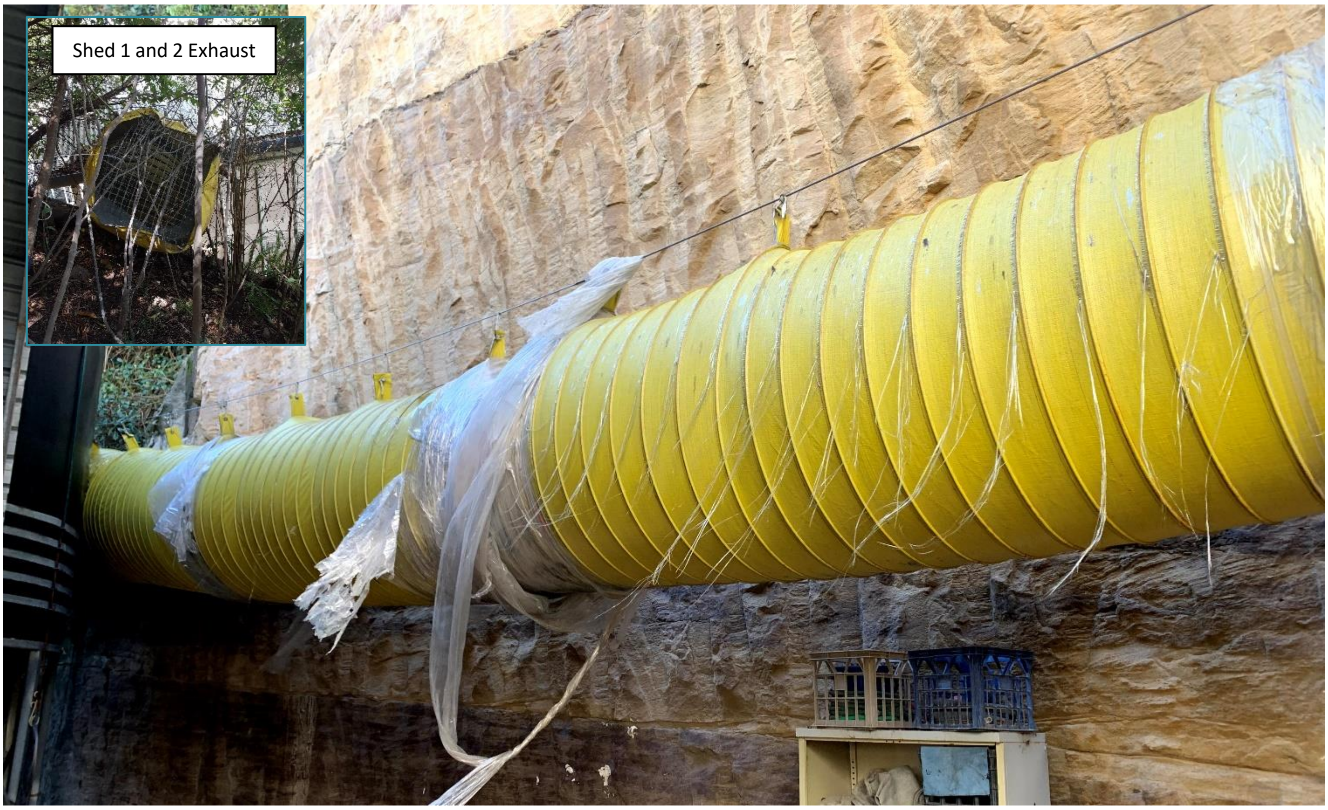


Photo 4 Shed 3 Wet Scrubber Exhaust and Paint Storage Shed 1

Photo 5 Paint Storage Sheds 2 and 3

Table 2 Material Used on Site

Material	Frequency of use (a/y)	Typical application rate (L/j)	Annual usage rate (L/y)	Usage by application (L/year)			
				Brush and roller	Spray (a)	Spray (c)	Other
545 Epoxy Primer Converter	24	15	350	0	0	350	0
545 Epoxy Primer Gray Base	24	15	350	0	0	350	0
Acetone	1000	1	500	0	0	0	500 (cleaner)
ITW Septone Alibrite	10	20	200	200	0	0	0
Awlcraft 2000 Oyster White	24	15	350	100	0	250	0
Oeseries Awlcraft Se Oe Series	10	20	200	0	0	200	0
Altex No.5 Antifouling	24	21	500	250	250	0	0
Altex Primashield Antifouling Sealer	24	21	500	500	0	0	0
Altex Chembar 3500 Primer	10	20	200	200	0	0	0
International Thinner-Eqpt Cleaner	50	2	100	0	0	0	100 (cleaner)
International Thinner-Eqpt Cleaner	50	2	100	0	0	0	100 (cleaner)
Gun Wash Solvent	125	2	250	0	100	100	50 (cleaner)

Material	Frequency of use (a/y)	Typical application rate (L/j)	Annual usage rate (L/y)	Usage by application (L/year)			
				Brush and roller	Spray (a)	Spray (c)	Other
Hydrochloric Acid	110	2	250	250	0	0	0
Interfine 878 Base Light Part A	24	8	200	200	0	0	0
Interfine 878 Part B	24	8	200	200	0	0	0
Intergard 263-162 Part B	20	15	300	300	0	0	0
Intergard 269 Red Part A	20	15	300	300	0	0	0
Intergard 269 Part B	20	15	300	300	0	0	0
Interline 704 Grey Part A	20	15	300	200	0	100	0
Interline 704 Part B	20	15	300	200	0	100	0
Interline 850 Buff Part A	20	15	300	200	0	100	0
Interline 850 Part B	20	15	300	200	0	100	0
Interprime 4198 Grey	20	15	300	200	0	100	0
Interprime 820 White Part A	20	15	300	200	0	100	0
Interprime 820 Part B	20	15	300	200	0	100	0
Interprotect Hardener	40	10	400	0	400	0	0
Interprotect High Build Part A	40	10	400	0	400	0	0
Interseal 670hs Golden Yellow Part A	20	10	200	0	200	0	0
Interseal 670hs Part B	20	10	200	0	200	0	0
Intershield 300 Bronze Part A	20	10	200	100	100	0	0
Intershield 300 Part B	20	10	200	100	100	0	0
Interspeed 376 Black	10	50	500	100	400	0	0
Interthane 863 Lsa Lp Deck Pewter Pt A	20	10	200	100	100	0	0
Interthane 864 Lsa-Nsp (Hp) Deck Pewter	20	10	200	100	100	0	0
Interthane 987 Lsac Lg N42 Storm Grey	20	10	200	100	100	0	0
Interthane 990 White Part A	20	10	200	100	100	0	0
Interthane 990 Golden Yellow Part A	20	10	200	100	100	0	0
Interzone 954 Black Part A	20	10	200	100	100	0	0
Interzone 954 Part B	20	10	200	100	100	0	0
Awlwood Ma Gloss	30	8	250	250	0	0	0
Methylated Spirits	600	1	400	0	0	0	400 (cleaner)
Micron Extra 2 Blue	50	20	1000	500	500	0	0
Mineral Turpentine	400	1	200	0	0	0	200 (cleaner)
Northane Hardener	10	10	100	100	0	0	0
Ogseries Awlgrip Topcoat	25	20	500	0	0	500	0

Material	Frequency of use (a/y)	Typical application rate (L/j)	Annual usage rate (L/y)	Usage by application (L/year)			
				Brush and roller	Spray (a)	Spray (c)	Other
Ypa984 Primocon Grey	100	5	500	500	0	0	0
A. Propspeed Etching Primer Base B. Propspeed Etching Primer Hardener	100	3	250	250	0	0	0
Captain Jack's Varnish	30	7	200	200	0	0	0
Tankguard Hb Classic Comp A	4	100	400	400	0	0	0
Tankguard Hb Classic Comp B	4	100	400	400	0	0	0
Jotun Thinner No. 17	120	2	250	0	250	0	0
Shipshape Primer Undercoat - Base	20	10	200	200	0	0	0
Shipshape Primer Undercoat - Base	20	10	200	200	0	0	0
Sikaflex-291	150	0	60	60	0	0	0
3m™ Stainless Steel Cleaner & Polish	100	1	60	60	0	0	0
Awlgrip Topcoat Flattening Agent	10	3	30	0	0	30	0
Trilux 33 Blue	150	2	250	0	250	0	0
Ultra 2 Black	10	20	200	0	200	0	0
Vc Offshore Hard Racing Antifouling Dover White	10	20	200	0	200	0	0
Yacht Primer Grey	20	8	150	150	0	0	0
Altex Epoxy High Build Surfacer	4	16	64	0	64	0	0

a/y = applications per year

L/j = litres per job

L/y = litres per year

Spray (c) = Spray using Conventional Gun

Spray (a) = Airless spraying

3.3 Identified Sources of Air Emissions and Pollutants of Concern

Based upon a review of the Site activities (presented in **Section 3.1**), and observations made during the site audit (presented in **Section 3.2**), potential air emission sources associated with the Site operations have been identified as follows:

- Odours and VOCs from application of paint and antifoul onto vessels (point and fugitive)
- Particulate matter and heavy metals from sand blasting and soda blasting (point and fugitive)
- Particulate matter and heavy metals from welding (point and fugitive)
- Odour and VOCs from solvents and adhesives (point and fugitive)

In addition to the above, there are a number of other activities that could lead to emission of pollutants to air, albeit at a much lower level. These are:

- Odours from wastewater pump out (fugitive)
- Odours and VOCs from paint/solvent storage sheds (fugitive)
- Products of combustion from vessels (mobile point)

- Products of combustion from vehicles visiting the Site (mobile point)

Given the scale and nature of these activities and ease of control through management measures, these lower impact potential activities have not been assessed further in this AQRA and the detailed assessment focuses on those activities with a high potential for impact.

3.4 Existing Emission Controls

As outlined in **Section 3.1**, the majority of Restricted Activities as well as 50% of all welding performed on site are performed in the three maintenance sheds (Shed 1, Shed 3 and Shed 4). Emissions from these sheds are treated using a wet scrubber system before discharge to atmosphere. When the wet scrubber systems are operational, the sheds are under a slight negative pressure which reduces the potential for fugitive emissions from the sheds.

All Restricted Activities and airless application of antifoul performed on the hardstand area are performed within areas encapsulated with plastic/tarpaulin sections which are taped together to form a seal (see **Photo 2**).

The pollutant removal efficiency of the wet scrubber system was calculated using the scrubber inlet and outlet pollutant concentrations as reported in the following NATA endorsed emission test reports:

- Stephenson Environmental Management Australia, Emission Test Report Number 5816, Dated 28 April 2017
- SLR Emission Test Report 610.19179-TR01R00, Dated 14 October 2021

These emission test reports, and all associated NATA endorsed Test Reports/Certificates of Analysis are provided in **Appendix A**.

The wet scrubber inlet and outlet concentrations as well as the calculated pollutant removal efficiencies are summarised in **Table 3**. As shown, the wet scrubbers efficiently remove particles and aerosols from the gas stream. However, these systems have a low VOC and odour removal efficiency. This is expected as impingement wet scrubbers are not designed to remove organic volatile compounds. Further, it is noted that the removal efficiency for each VOC compound is dependent on various factors including the compound's water solubility, temperature, etc.

In addition, and in order to determine the effectiveness of encapsulation in containing air emissions, SLR collected samples from inside and outside of encapsulated areas. The samples collected outside of the encapsulation were from a location downwind and in very close proximity to the encapsulated area. This sampling found that no significant fugitive emissions occur during spray painting in encapsulated areas. For all fugitive samples collected outside encapsulated areas, measured concentrations of all analysed VOC compounds were below the detection threshold of the analysis method with the exception of fugitive toluene concentrations at one location. The detected toluene concentrations at this location were less than 1% of what was measured inside the encapsulated area.

Given the effectiveness of the encapsulation in containing gaseous pollutants, it could be concluded that the encapsulation is also highly effective at containing particles.

It is noted that unless extracted, any gaseous pollutant built up within the encapsulated area would be released to the atmosphere as soon as the encapsulation seal is broken. Particles would deposit on the surfaces inside the encapsulated area and insignificant particle emissions are expected after the encapsulation seal is broken.

Table 3 Summary of Wet Scrubber Measured Concentrations and Pollutant Removal Efficiencies

Pollutant	Units	Wet Scrubber Inlet	Wet Scrubber Outlet	Removal Efficiency
Odour	ou	826[1]	664	20%
Ethylbenzene	mg/m^3	1.51	0.98	35%
Toluene	mg/m^3	0.04	0.04	0%
Xylene	mg/m^3	7.07[2]	4.61[2]	35%
Total VOCs	mg/m^3 (as n-propane)	95.2	47.8	50%
Total Solid Particulates	mg/m^3	6.58	<0.1	>98%

1 average of two samples

2 inclusive of p, m and o xylene

4 Emissions Inventory and Source Parameters

Emissions from the identified sources of air emissions were quantified using a combination of emission factors and emission monitoring results.

Table 4 presents a summary of source parameters and emission rates for the identified emission sources.

VOC and odour emissions from spray painting and application of antifoul in the sheds were quantified using the higher VOC concentrations between those measured by Stephenson Environmental in 2017 and by SLR in 2021 (refer to **Appendix A**). To estimate emission representative of peak shed operations from encapsulated area samples collected by SLR, concentrations were scaled up by multiplying the measured concentrations by the "maximum amount of paint used per job" (100 L) to "amount of paint used during the emission testing ratio"[1] and applying appropriate removal efficiencies (refer **Table 3**).

Particulate matter and heavy metal emissions from sand blasting in the sheds were estimated using Equation 2, Section 5.2.4 (Abrasive Blasting) of *Emission Estimation Technique Manual for Railway yard operations* (DEWHA, 2008) (hereafter the Railway Yard Operations EETM) with a maximum abrasive material usage rate of 250 kg per hour (refer **Section 3.1**). The Railway Yard Operations EETM does not provide control factors for sand blasting in enclosed areas treated with wet scrubbers. Therefore, to estimate emissions, the 99% control factor presented for 'enclosure and use of fabric filters' in Section 5.3 of the *Emission Estimation Technique Manual for Mining* (DSEWPC, 2012) was adopted. Given the high particle removal efficiency of the wet scrubber systems (refer **Section 3.4**), this control factor is deemed appropriate. It is noted that conservatively, the estimated emissions have been allocated to the shed exhausts as well as fugitive volume sources for each shed, effectively doubling the calculated emissions.

Particulate matter and heavy metal emissions from welding in the sheds were estimated using Equation 6, Section 3.3.7 (Welding) of *Emission Estimation Technique Manual for Fugitive Emissions* (DSEWPC, 2012)(hereafter the Fugitive Emissions EETM) with a maximum electrode (Type ER316) usage rate of 0.1 kg per hour (refer **Section 3.1**). Conservatively, a control factor of 20%, representative of particle removal efficiency of metal fabric filter screens, as presented in the Fugitive Emissions EETM was used. Further, similar to above, the estimated emissions have been allocated to the shed exhausts as well as fugitive volume sources for each shed, effectively doubling the calculated emissions.

VOC and odour emissions from spray painting and application of antifoul in encapsulated areas were quantified using the highest VOC concentrations measured by SLR for each individual compound identified by the monitoring (refer to **Appendix A**). Two separate volume sources were defined for each encapsulated area, namely, an 'instantaneous release source' emitting emissions over 1 minute each hour and a 'fugitive source' with emissions equivalent to 10% of total calculated emissions, emitting constantly during the site's operating hours. These collocated sources were modelled at various locations on the hardstand to enable assessment of risk based on location.

Particulate matter and heavy metal emissions from welding and soda blasting on the hardstand and slipway were estimated using the emission factors and methodology outlined above. As all soda blasting occurs in encapsulated areas a control factor of 99% was adopted for this activity. Conservatively, no control factor was adopted for welding.

[1] Ratios: International Awlcraft 2000: 100, International Interprotect: 5, Altex Epoxy primer:12.5, International Highbuild: 3.3 (Refer **Appendix C** for detailed VOC results)

VOC and odour emissions from roller brush application of antifoul/paint were conservatively assumed to be similar to those of the encapsulated area. However, as this activity is performed in the open air, all emissions were allocated to a single volume source releasing emissions constantly during operating hours.

The location of all modelled sources and buildings is presented in **Figure 7**. The existing 10 m high sheds were included in the modelling to account for potential building downwash effects. As illustrated the encapsulated area/hardstand fugitive emission sources have been modelled at 4 different locations (Hardstand 1, Hardstand 2, Hardstand 3 and Hardstand 4) in order to identify the level of risk associated with performing air emission generating activities at each of these locations.

The scenario modelled assumes all potential air emission generating activities (painting, welding and surface preparation) will be carried out at each location modelled simultaneously every hour of the year between 7 am and 6 pm (ie 365 days per year, 10 hours per day for all activities).

The dispersion modelling was performed for PM_{10}, $PM_{2.5}$, Odour, as well as VOCs and heavy metals with the highest total emission rate to impact assessment criteria ratios (ie Nickel, Xylene and Propylene Oxide). Impacts for other pollutants with lower total emission rate to impact assessment criteria ratios will be lower than those modelled.

Figure 7 Modelled Buildings and Point and Volume Sources

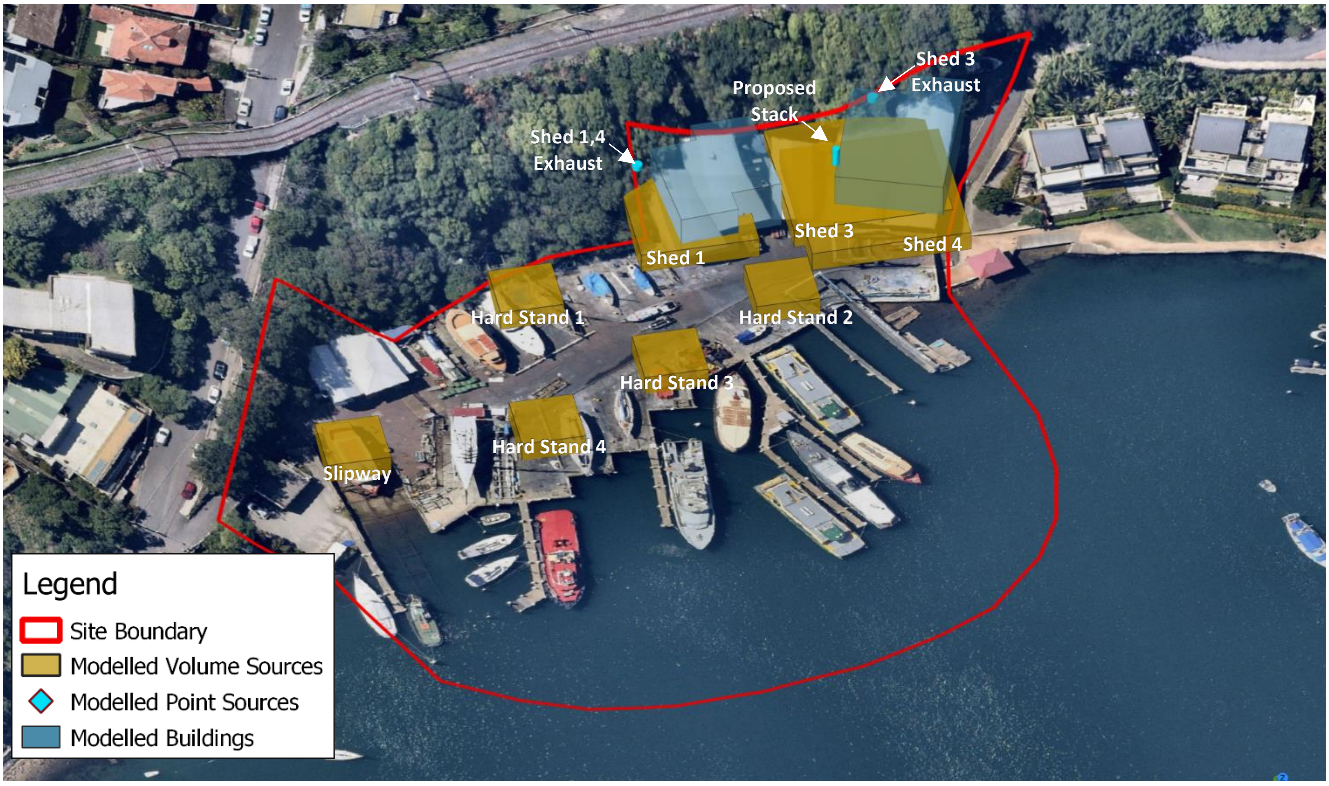


Table 4 Emission Rates and Source Parameters Adopted the AQRA

Parameter	Units	Shed 1 & 4 Exhaust	Shed 3 Exhaust	Sheds 4 Fugitive	Shed 3 Fugitive	Shed 1 Fugitive	Slipway	Encapsulated on Hardstand[1]	Hardstand Fugitive Emissions
Source type		Point[2]	Point[2]	Volume	Volume	Volume	Volume	Volume	Volume
Easting	m	333,530	333,543	333,524	333,517	333,519	333,461	various (refer **Figure 7)**	
Northing	m	6,253,822	6,253,764	6,253,782	6,253,780	6,253,815	6,253,887	various (refer **Figure 7)**	
Height	m	0.5	4	5	5	5	4	4	4
Stack diameter	m	1.03	1.03	-	-	-	-	-	-
Actual Flow Rate	m^3/s	6.4	6.4	-	-	-	-	-	-
Exit Velocity	m/s	7.7	7.7	-	-	-	-	-	-
Exit Temp	ºC	ambient	ambient	-	-	-	-	-	-
Base Elevation	m	14.7	10	6.6	5.11	5	4	5	5
Initial Horizontal Spread	m	-	-	6.98	6.98	5.2	5.8	2.79	2.79
Initial Vertical Spread	m	-	-	2.33	2.33	2.33	0.93	0.93	0.93
PM_{10}	g/s	0.00064	0.00064	0.00927[4]	0.00927[4]	0.00927[4]	0.009338[4]	-	0.009338[4]
$PM_{2.5}$	g/s	0.00064[3]	0.00064[3]	0.00117[4]	0.00117[4]	0.00117[4]	0.001238[4]	-	0.001238[4]
Arsenic & Compounds	g/s	0.0000069[6]	0.0000069[6]	0.0000069[6]	0.0000069[6]	0.0000069[6]	0.000007[6]	-	0.000007[6]
Chromium III & compounds	g/s	0.0000461[4]	0.0000461[4]	0.0000461[4]	0.0000461[4]	0.0000461[4]	0.000057[4]	-	0.000057[4]
Chromium IV & compounds	g/s	0.00000084[5]	0.00000084[5]	0.00000084[5]	0.00000084[5]	0.00000084[5]	0.000001[5]	-	0.000001[5]
Copper & compounds	g/s	0.0000014[6]	0.0000014[6]	0.0000014[6]	0.0000014[6]	0.0000014[6]	0.000001[6]	-	0.000001[6]
Lead & compounds	g/s	0.0000042[6]	0.0000042[6]	0.0000042[6]	0.0000042[6]	0.0000042[6]	0.000004[6]	-	0.000004[6]
Nickel & compounds	g/s	0.0000204[4]	0.0000204[4]	0.0000204[4]	0.0000204[4]	0.0000204[4]	0.000025[4]	-	0.000025[4]
Manganese & Compounds	g/s	0.000021[5]	0.000021[5]	0.000021[5]	0.000021[5]	0.000021[5]	0.000026[5]	-	0.000026[5]
Ethyl benzene		0.0063[7]	0.0063[7]	0.0010[7]	0.0010[7]	0.0010[7]	0.0002[7]	0.0119[7]	0.00002[7]

Parameter	Units	Shed 1 & 4 Exhaust	Shed 3 Exhaust	Sheds 4 Fugitive	Shed 3 Fugitive	Shed 1 Fugitive	Slipway	Encapsulated on Hardstand[1]	Hardstand Fugitive Emissions
Toluene	g/s	0.014[7]	0.0144[7]	0.0014[7]	0.0014[7]	0.0014[7]	0.0043[7]	0.2362[7]	0.00039[7]
Xylene	g/s	0.03[7]	0.0300[7]	0.0046[7]	0.0046[7]	0.0046[7]	0.0002[7]	0.0094[7]	0.00002[7]
Methylisobutylketone	g/s	0.0140[7]	0.0140[7]	0.0028[7]	0.0028[7]	0.0028[7]	0.0022[7]	0.1215[7]	0.00020[7]
Trimethylbenzene	g/s	0.0004[7]	0.0004[7]	0.0001[7]	0.0001[7]	0.0001[7]	0.0001[7]	0.0038[7]	0.00001[7]
Propylene Oxide	g/s	0.0033[7]	0.0033[7]	0.0007[7]	0.0007[7]	0.0007[7]	0.0020[7]	0.1090[7]	0.00018[7]
Odour	ou/s	4,260[7]	4,260[7]	848[7]	848[7]	848[7]	102[7]	5,561[7]	9.3[7]

1 instantaneous release over 60 seconds

2 horizontal release

3 conservatively assumed same as PM_{10}

4 inclusive of welding and abrasive blasting emissions

5 due to welding

6 due to abrasive blasting

7 due to application of paint/anti-foul

5 Relevant Air Quality Criteria

Ambient air quality criteria for the pollutants identified in **Table 4** are prescribed Section 7.1 of by the NSW Environment Protection Authority document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (hereafter 'the Approved Methods') (NSW EPA, 2017)

The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW, and are considered to be appropriate for the setting. Those relevant to the identified emission sources at the Site are discussed below.

The criteria specified within the Approved Methods for the pollutants of concern are provided in **Table 5**.

Table 5 Assessment Criteria for Pollutants of Concern

Pollutant	Criteria Basis	Averaging Period	Criterion
PM_{10}	health	1-hour	50 µg/m^3
	health	Annual	25 µg/m^3
$PM_{2.5}$	health	1-hour	25 µg/m^3
	health	Annual	8 µg/m^3.
Arsenic & compounds	health (Group 1 carcinogen[1])	1-hour	0.00009 mg/m$^{3\#}$
Chromium III & compounds	health (toxic)	1-hour	0.009 mg/m$^{3\#}$
Chromium VI & compounds	health (Group 1 carcinogen)	1-hour	0.00009 mg/m$^{3\#}$
Copper dust and mists	health (toxic)	1-hour	0.018 mg/m$^{3\#}$
Lead	health	Annual	0.05 µg/m^3
Manganese & compounds	health (toxic)	1-hour	0.018 mg/m$^{3\#}$
Nickel & compounds	Health (Group 1 carcinogen)	1-hour	0.00018 mg/m$^{3\#}$
Ethylbenzene	health (toxic)	1-hour	8 mg/m$^{3\#}$
Toluene	nuisance (odour)	1-hour	0.36 mg/m$^{3\#}$
Xylenes	nuisance (odour)	1-hour	0.19 mg/m$^{3\#}$
Methyl isobutyl ketone (MIBK)	nuisance (odour)	1-hour	0.23 mg/m$^{3\#}$
Trimethylbenzene	health (toxic)	1-hour	2.2 mg/m$^{3\#}$
Propylene Oxide	Health (Group B1 carcinogen[2])	1-hour	0.09 mg/m$^{3\#}$
Odour	nuisance	Nose response-time average	2 ou*

1 known human carcinogen

2 probable human carcinogen

99.9th percentile

* 99th percentile

6 Risk Assessment Methodology

6.1 Dispersion Modelling

Emissions from the identified sources at the site have been modelled using the US EPA's CALPUFF (Version 6) modelling system, as recommended by the NSW EPA. CALPUFF is a transport and dispersion model that ejects "puffs" of material emitted from modelled sources, simulating dispersion and transformation processes along the way. In doing so it typically uses the fields generated by a meteorological pre-processor CALMET, discussed further in **Appendix B**. Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period. The primary output files from CALPUFF contain either hourly concentration or hourly deposition fluxes evaluated at selected receptor locations. The CALPOST post-processor is then used to process these files, producing tabulations that summarise results of the simulation for user-selected averaging periods.

The advantages of using CALPUFF (rather than using a steady state Gaussian dispersion model such as AERMOD) is its ability to handle calm wind speeds (<0.5 m/s), complicated terrain and cumulative pollution impacts. Steady state models assume that meteorology is unchanged by topography over the modelling domain and may result in significant over or under estimation of air quality impacts.

More advanced dispersion models (such as CALPUFF) are approved for use by many regulatory authorities in situations where these models may be more appropriate than use of steady-state models and assumptions.

6.1.1 Accuracy of Air Dispersion Modelling

All atmospheric dispersion models, including CALPUFF, represent a simplification of the many complex processes involved in the dispersion of pollutants in the atmosphere. To obtain good quality results it is important that the most appropriate model is used and the quality of the input data (meteorological, terrain, source characteristics) is adequate.

The main sources of uncertainty in dispersion models, and their effects, are discussed below.

- **Oversimplification of physics:** This can lead to both under-prediction and over-prediction of ground level pollutant concentrations. Errors are greater in Gaussian plume models as they do not include the effects of non-steady-state meteorology (i.e., spatially- and temporally-varying meteorology).
- **Errors in emission rates:** Ground level concentrations are proportional to the pollutant emission rate. In addition, most modelling studies assume constant worst case emission levels or are based on the results of a small number of stack tests, however operations (and thus emissions) are often quite variable. Accurate measurement of emission rates and source parameters requires continuous monitoring.
- **Errors in source parameters:** Plume rise is affected by source dimensions, temperature and exit velocity. Inaccuracies in these values will contribute to errors in the predicted height of the plume centreline and thus ground level pollutant concentrations.
- **Errors in wind direction and wind speed**: Wind direction affects the direction of plume travel, while wind speed affects plume rise and dilution of plume. Errors in these parameters can result in errors in the predicted distance from the source of the plume impact, and magnitude of that impact. In addition, aloft wind directions commonly differ from surface wind directions. The preference to use rugged meteorological instruments to reduce maintenance requirements also means that light winds are often not well characterised.

- **Errors in mixing height:** If the plume elevation reaches 80% or more of the mixing height, more interaction will occur, and it becomes increasingly important to properly characterise the depth of the mixed layer as well as the strength of the upper air inversion.
- **Errors in temperature:** Ambient temperature affects plume buoyancy, so inaccuracies in the temperature data can result in potential errors in the predicted distance from the source of the plume impact, and magnitude of that impact.
- **Errors in stability estimates:** Gaussian plume models use estimates of stability class, and 3D models use explicit vertical profiles of temperature and wind (which are used directly or indirectly to estimate stability class for Gaussian models). In either case, errors in these parameters can cause either under-prediction or over-prediction of ground level concentrations. For example, if an error is made of one stability class, then the computed concentrations can be off by 50% or more.

The US EPA makes the following statement in its Modelling Guideline (USEPA 2005) on the relative accuracy of models:

> *"Models are more reliable for estimating longer time-averaged concentrations than for estimating short-term concentrations at specific locations; and the models are reasonably reliable in estimating the magnitude of highest concentrations occurring sometime, somewhere within an area. For example, errors in highest estimated concentrations of ±10 to 40% are found to be typical, i.e., certainly well within the often quoted factor-of-two accuracy that has long been recognised for these models. However estimates of concentrations that occur at a specific time and site, are poorly correlated with actually observed concentrations and are much less reliable."*

This AQRA utilises the CALPUFF dispersion model in full 3D mode, incorporating 3D meteorological output from TAPM and CALMET (refer **Appendix B**). The meteorological dataset has been compiled using observations from nearby automatic weather stations and air quality monitoring stations. Moreover, a five year period of meteorological data was reviewed to ensure that the year selected for use in the modelling is representative of long-term meteorological conditions.

Full details of the meteorological modelling methodology, selection of representative year for modelling, model data validation and meteorological data used in the dispersion modelling are presented in **Appendix B.**

6.2 Risk Categorisation of Modelled Emission Sources

The risk potential associated with each modelled source and for each pollutant modelled was determined based on the predicted incremental contribution from each source towards the relevant impact assessment criteria. **Table 6** outlines the criteria used for the risk categorisation.

Table 6 Source Risk Categorisation

Risk Potential	Criteria
Negligible	< 5% of criteria
Very Low	5% to 25% of criteria
Low	25% to 50% of criteria
Moderate	50% to 75% of criteria
High	75% to 95% of criteria
Very High	>95% of criteria

6.3 Risk Ranking of Material Used on Site

As a large variety of materials is used on site (refer **Table 2**), it is not practicable to conduct emission testing for all these materials. Further, given the application type and usage quantity of some products (eg Sikaflex-291 which is applied from caulking tube in very minimal quantities) collection of representative samples with concentrations high enough to ensure detection at the laboratory is not possible. Therefore, to identify those materials used on site with the highest potential odour and health impacts, the following methodology was developed:

a) MSDSs of all material used on site (see **Table 2**) were reviewed to identify material which contain toxic or odorous organic compounds (as defined by Section 7.2.1 and Section 7.4.1 of the Approved Methods. This was done through a global CAS Registry Number search. For each material used on site containing such compounds, the concentration of each compound was recorded.

   It is noted that some MSDSs included a concentration range. In such cases the mean of the maximum and minimum concentrations provided was used (eg 7.5% was used if MSDS reported a 5%-10% range). **Appendix C** presents a summary of the MSDS review.

b) For each material, 'individual organic compound scores' were calculated by dividing the compound concentrations (from Step a) by the corresponding impact assessment criteria.

c) Following calculating the individual organic compound scores, the following equation was used to calculate the material toxicity and odour scores (Refer to **Appendix C** for summary of odorous and toxic organic compounds). This equation considers the typical application rate and application type (refer **Table 2**). A higher score indicates higher risk of impact.

   It is noted that lower application rates would result in lower risk of impact. Further, different application types could potentially lead to significantly different organic compound emission rates. This is primarily due to difference in transfer efficiency[2] and evaporation rates. According to the NEWMOA Metal Painting and Coating Operations Manual[3] the transfer efficiency for conventional air spraying is only 30 to 60% while airless spraying typically achieves a 65 to 75% transfer efficiency. No transfer efficiency for roller application of paint is provided in the literature reviewed. However, given the small surface area of roller brushes and in the absence of material loss due to overspray, bounceback and fogging (which are issues associated with spray application of material), transfer efficiency is deemed to be very high.

[2] The term transfer efficiency refers to the amount of paint that is sprayed on the object compared to how much material is dispersed from the drawn from the paint reservoir. Transfer efficiency is expressed as a percentage. A 30% transfer efficiency means that 30% of the paint drawn reached the target and the balance (70%) was lost due to overspray, bounceback or fogging.

[3] https://www.ideals.illinois.edu/bitstream/handle/2142/2338/appltech.htm (accessed 30 October 2021)

$$Toxicity/Odour\ score = \frac{S\ \times T}{866} \times \frac{\sum X \times k}{A}$$

S = Sum of material individual scores

T = Typical application rate

866 = Sum of typical application rate of all material used on Site

A = Material annual usage rate

X = Annual material usage rate for application type

K = 1 for brush and roller application, 2 for airless application, 4 for conventional spray gun application and 0.5 for cleaning liquids

d) Overall material scores were calculated by adding the toxicity and odour score for each material.

7 Risk Assessment Results

7.1 Dispersion Modelling

Table 7 presents a summary of the risk potential predicted by the modelling at the modelled receptors. The air quality impact assessment criteria for toxic air pollutants (including nickel, xylene and propylene oxide) apply '*at and beyond the boundary of the facility*'. For these substances, risk potentials are reported at the site boundary, as well as the most impacted sensitive receptor.

As shown in **Table 7**:

- There is a Negligible to Low risk of impacts at modelled receptor locations due to activities on the Slipway.
- There is a Negligible to Very Low risk of impacts for all pollutants modelled at sensitive receptor locations due to activities on the hardstand. The risk potential is slightly higher (Negligible to Moderate) at Site boundary locations.
- There is a very low risk of nickel impacts at sensitive receptor locations modelled. However, impacts at boundary locations modelled range from Low to Very High.
- There is a Negligible to Very Low risk of impact due to activities in the sheds at modelled sensitive receptor locations for all pollutants except odour for which a Very High risk of Impact is predicted.
- There is a Moderate to Very High risk of nickel, xylene and propylene oxide impact due to activities in the sheds at boundary locations modelled.

It is noted that the modelled volume source for Hardstand Location 1 was conservatively placed on the eastern boundary of the Site (refer **Figure 7**). Therefore the predicted boundary concentrations are deemed to be very conservative.

In order to identify the emission source responsible for the Very High impact risk predicted for shed activities, additional post processing of model outputs was performed. **Table 8** present the risk potential for the shed point source and fugitive emissions separately. As shown, impacts due to fugitive shed emissions are predicted to have a Negligible to Low potential for impact and the Shed exhausts are the primary cause of the Very High risk potential predicted. This is expected as most shed emissions are emitted through the exhausts and the exhaust are situated in close proximity to the Site Boundary.

Table 7 Risk Assessment of Identified Emission Sources

Source	Pollutant	PM_{10}		$PM_{2.5}$		Nickel	Xylene	Odour	Propylene Oxide
	Averaging Period	24-hour	Annual	24-hour	Annual	1-hour	1-hour	1-hour	1-hour
Slipway	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Negligible	Negligible	Negligible
	Boundary					Low	Negligible		Very Low
Hardstand - Location 1*	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Negligible	Negligible	Negligible
	Boundary					Moderate	Negligible		Very Low
Hardstand - Location 2*	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Negligible	Negligible	Negligible
	Boundary					Low	Negligible		Negligible
Hardstand - Location 3*	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Negligible	Negligible	Negligible
	Boundary					Low	Negligible		Negligible
Hardstand - Location 4*	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Negligible	Negligible	Negligible
	Boundary					Low	Negligible		Negligible
Shed 1#	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Very Low	Very High	Negligible
	Boundary					Very High	Very High		Very High
Shed 3#	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Very Low	Very High	Negligible
	Boundary					Very High	Very High		Very High
Shed 4#	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Very Low	Very High	Negligible
	Boundary					Very High	Very High		Moderate

* Fugitive plus instantaneous release sources

Fugitive plus stack exhaust

Table 8 Risk Assessment of Shed Emissions

Source	Pollutant	PM_{10}		$PM_{2.5}$		Nickel	Xylene	Odour	Propylene Oxide
	Averaging Period	24-hour	Annual	24-hour	Annual	1-hour	1-hour	1-hour	1-hour
Shed 1 - Fugitive	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Negligible	Low	Negligible
	Boundary					Low	Very Low		Negligible
Shed 3 - Fugitive	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Negligible	Low	Negligible
	Boundary					Low	Very Low		Negligible
Shed 4 - Fugitive	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Negligible	Low	Negligible
	Boundary					Low	Very Low		Negligible
Shed 3 - Exhaust	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Very Low	Very High	Negligible
	Boundary					Very High	Very High		Very High
Shed 1,4 - Exhaust	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Very Low	Very High	Negligible
	Boundary					Very High	Very High		Moderate

7.2 Material Risk Assessment

Table 9 presents the risk ranking of material used on site. As shown, apart from Sikaflex-291, the calculated toxicity scores are very low relative to overall scores indicating the material used on Site are much more likely to cause nuisance issues than health impacts.

Table 10 provides an overview of the highest risk material identified. As shown, many of these products are primarily used in sheds and the usage of some of these materials has reduced in recent times as low VOC alternatives have become available in the market.

Material which were in use when emission testing was performed by SLR (refer **Appendix A**) are highlighted green in **Table 9.** The highest risk material used on site during the emission testing were:

- Interprotect Hardener, with an overall score of 27 (3.2 times lower than the rank 1 material); and
- Altex Epoxy High Build Surfacer, with an overall score of 15 (5.8 times lower than the rank 1 material).

Given the negligible to very low risk of VOC and odour impacts associated with activities on the hardstand and slipway (see **Section 7.1**), the use of even the highest risk material is unlikely to lead to significant impacts. However, as the potential for risk of odour impacts due to spray painting and antifoul application inside the sheds is predicted to be very high the use of material with a higher risk than those in use when the emission testing was performed (Interprotect Hardener) may potentially lead to exceedances of relevant impact assessment criteria at boundary/sensitive receptor locations without further mitigation.

Table 9 Risk Ranking of Material Used on Site

Product	Overall Score	Overall Rank	Tox Score	Tox Rank	Odour Score	Odour Rank
VC Offshore Hard Racing Antifouling Dover White	87	1	0.2	15	87	1
Tankguard Hb Classic Comp B	67	2	0.6	3	66	2
Sikaflex-291	65	3	64.8	1	0	52
Oeseries Awlcraft Se Oe Series	61	4	0.6	4	61	3
Interspeed 376 Black	46	5	0.4	8	45	4
Interline 704 Part B	41	6	0.1	17	41	5
Tankguard Hb Classic Comp A	40	7	0.3	10	40	6
Interprime 4198 Grey	33	8	0.3	11	32	7
Interprotect Hardener	27	9	0.1	19	27	8
Interprime 820 Part B	23	10	0.5	6	22	9
Intergard 269 Part B	20	11	0.1	21	20	10
Interline 704 Grey Part A	20	12	0.1	18	20	11
Intershield 300 Part B	18	13	0.1	22	18	12
Altex No.5 Antifouling	17	14	0.000	41	17	13
Altex Epoxy High Build Surfacer	15	15	0.02	30	15	14
Interprime 820 White Part A	15	16	0.000	42	15	15
Ogseries Awlgrip Topcoat	14	17	0.000	43	14	16
Intergard 263-162 Part B	13	18	0.000	44	13	17
Interprotect High Build Part A	13	19	0.1	20	13	18

Product	Overall Score	Overall Rank	Tox Score	Tox Rank	Odour Score	Odour Rank
Altex Primashield Antifouling Sealer	12	20	0.4	7	12	19
Altex Chembar 3500 Primer	12	21	0.3	9	12	20
Intergard 269 Red Part A	9	22	0.02	32	9	21
Intershield 300 Bronze Part A	8	23	0.02	33	8	23
Awlcraft 2000 Oyster White	8	24	0.000	45	8	22
Interzone 954 Part B	8	25	0.000	46	8	24
545 Epoxy Primer Gray Base	8	26	0.2	12	8	25
Interthane 990 Golden Yellow Part A	8	27	0.1	23	8	26
Interthane 990 White Part A	8	28	0.1	24	8	27
Interthane 987 Lsac Lg N42 Storm Grey	8	29	0.1	25	8	28
Ultra 2 Black	7	30	0.2	13	7	29
Interseal 670hs Part B	6	31	0.000	47	6	30
Micron Extra 2 Blue	6	32	0.5	5	5	32
Northane Hardener	6	33	0.02	31	6	31
Shipshape Primer Undercoat - Base	5	34	0.04	27	5	33
Interline 850 Part B	4	35	0.000	48	4	34
Interseal 670hs Golden Yellow Part A	4	36	0.04	26	4	35
Trilux 33 Blue	4	37	0.000	49	4	36
Interzone 954 Black Part A	3	38	0.02	34	3	37
Gun Wash Solvent	3	39	0.03	28	3	38
Gta713 International Thinner-Eqpt Cleaner	2	40	0.01	37	2	39
Jotun Thinner No. 17	2	41	0.03	29	2	40
Shipshape Primer Undercoat - Base	2	42	0.000	50	2	41
Interthane 864 Lsa-Nsp (Hp) Deck Pewter	2	43	0.000	51	2	42
Interthane 863 Lsa Lp Deck Pewter Pt A	2	44	0.000	52	2	43
Ypa315 Yacht Primer Grey	1	45	0.000	53	1	44
Hydrochloric Acid	1	46	1.3	2	0	56
Gta220 International Thinner-Eqpt Cleaner	1	47	0.004	39	1	45
Od3001 545 Epoxy Prmer Converter	1	48	0.000	54	1	46
A. Propspeed Etching Primer Base B. Propspeed Etching Primer Hardener	0.5	49	0.000	55	0.5	47
Mineral Turpentine	0.5	50	0.02	36	0.5	48
Interfine 878 Base Light Part A	0.4	51	0.000	56	0.4	49
Awlwood Ma Gloss	0.3	52	0.000	57	0.3	50
Primocon Grey	0.2	53	0.2	14	0.0	57
Interline 850 Buff Part A	0.1	54	0.1	16	0.0	58
Captain Jack's Varnish	0.1	55	0.02	35	0.1	51
Awlgrip Topcoat Flattening Agent	0.1	56	0.000	58	0.1	53
Methylated Spirits	0.0	57	0.000	59	0.0	54
3m™ Stainless Steel Cleaner & Polish	0.0	58	0.01	38	0.0	59
Interfine 878 Part B	0.0	59	0.000	60	0.0	55
Acetone	0.0	60	0.003	40	0.0	60

Table 10 Overview Highest Risk Ranking Material

Product	Comment
VC Offshore Hard Racing Antifouling Dover White	Primarily used on yachts – applied on hardstand. Not commercially feasible to remove masts and spray in sheds
Tankguard Hb Classic Comp B	Only applied inside vessels tanks
Sikaflex-291	Viscous material applied from caulking tube. Applied in very minimal quantities but in all locations.
Oeseries Awlcraft SE OE Series	Primarily applied in sheds
Interspeed 376 Black	Primarily applied to police vessels inside Shed 3. Very rare to apply on hardstand by airless application
Interline 704 Part B	Primarily applied in sheds. Usage has reduced in recent times.
Tankguard Hb Classic Comp A	Only applied inside vessel tanks.
Interprime 4198 Grey	Primarily applied in sheds. Usage has reduced in recent times.
Interprotect Hardener	Applied in sheds and on hardstand. Not feasible to reduce usage or restrict to sheds
Interprime 820 Part B	Primarily applied in sheds. Usage has reduced in recent times. Primarily defence product

8 Air Emission Mitigation and Management Options

In order to further reduce the potential air quality risk associated with site activities, additional mitigation measures are proposed to be put in place. The following sections outlines the mitigation measures currently being considered by Noakes.

8.1 Physical Controls

As outlined in **Section 7.1**, the emission sources with the highest potential for air quality risk at sensitive receptor locations are expected to be the sheds. The sheds are currently equipped with wet scrubber systems which efficiently remove particles and aerosols from the gas stream. However, these systems have a low VOC and odour removal efficiency (see **Section 3.4**). Further, the sheds exhaust gas treated by the wet scrubbers horizontally at locations very close to the site boundary.

The following additional physical control are being considered by Noakes in order to reduce the air quality risk associated with operations inside the sheds:

- Relocation of the exhasuts to a more central location at the Site (see **Figure 7**). The increased distance between the emission release point and Site boundary and sensitive receptors will provide an opportunity for emissions to be further dispersed prior to reaching the site boundary.
- Vertically releasing treated emissions to atmosphere at an increased velocity. Gas momentum (a function of vertical gas velocity) is a significant influencing factor on plume dispersion. Vertical release of treated gases at high velocities can significantly enhance dispersion of pollutants.
- Further treatment of shed emissions using activated carbon adsorption (carbon filtration). Carbon filtration works by adsorbing odorous and toxic VOC compounds into the pores of the carbon. The filters need to be replaced at appropriate intervals before they become saturated and their control efficiency begins to be compromised.
- Upgrading Shed 1, 3 and 4 cladding and sealing roof vents to ensure openings into the sheds are between a maximum of 4 m^2 and a minimum of 2 m^2. This will maintain a negative pressure in the ventilated space and ensure an ingress of air through the openings effectively removing the potential for fugitive emissions.

Noakes have engaged a pollution control provider (Fowlerex) to design the above mentioned carbon filtration system and associated stack. The design criteria for the proposed system iss as follows:

- VOC/Odour removal efficiency: 95%
- Nominal velocity through the filter: 0.35 m/s
- Bed thickness of the activated carbon: 0.6 m
- Contact time: 1.7 seconds
- Activated carbon load: 5,000 kg.
- Predicted time between carbon changes: greater than 12 months
- Stack air flow: m^3/s
- Stack Height: 8.0 m
- Stack exit diameter: 0.71 m

Detailed drawings of the proposed carbon filtration system are provided in **Appendix D**.

Emissions from activities on the hardstand are not expected to have a high potential for air quality risk at and beyond the Site boundary (see **Section 7.1**). However, in order to further reduce potential for air quality impacts, Noakes is considering using an enclosable mobile shed connected to the fixed shed pollution control system. The mobile shed is a substantial steel enclosure structure that can be put in place over whole jobs that have not been put into the sheds.

The solution being considered (designed by Fowlerex) for the treatment of mobile shed emissions involves extraction of contaminated air from the mobile shed at a flow rate of 3.2 m^3/s which would ensure negative pressure in the mobile shed (and no fugitive emissions) and releasing the air into a fixed shed with the wet scrubber system running. It is noted that the destination fixed shed will not be able to operate simultaneous with the relocatable shed.

Use of the mobile shed for all works on the hardstand is not feasible (due to size restrictions, impact on work in sheds, etc.). Therefore, the mobile shed would be only used for certain jobs (depending on type of repair, duration of repair, type of material used, vessel size and operations in the fixed sheds) but would result in a reduction in the frequency of odour emissions (reducing the likelihood of odour nuisance).

8.2 Potential Reduction in Risk Due to the Proposed Mitigation Measures

In order to assess the change in risk associated with the above mentioned physical controls, three additional air dispersion modelling scenarios where performed as per the methodology outlined in **Section 5**. A description of the three scenarios is provided in **Table 11**.

Table 11 Scenarios Modelled to Assess Potential Reduction in Risk Due to the Proposed Mitigation Options

Scenario	Shed Exhaust Locations	Stack Height (m)	Stack Velocity (m/s)	Stack Temperature (°C)	VOC/Odour Control (%)	PM Control (%)	Fugitive emissions
1	North of Shed 3*	8	16.2	nc	nc	nc	Nil
2	nc	nc	nc	nc	95%	nc	Nil
3	North of Shed 3*	8	16.2	nc	95%	nc	Nil

nc = no change from existing (refer **Section 4**)

PM = particulate matter

* x coordinate: 333,525 mE, y coordinate: 6,253,788 mS (see **Figure 7**)

Table 12 presents the findings of the additional air dispersion modelling. In summary, the modelling found that:

- Relocation of the shed exhausts alone (Scenario 1) without additional treatment of exhaust gases would reduce the nickel, xylene and propylene oxide risk at boundary receptors from Very High/Moderate to Very Low/Negligible. However, risk of odour impacts at Sensitive receptors remains Very High.
- Treatment of exhaust gases using the Fowlerex designed carbon filtration system alone (Scenario2) would reduce the odour, xylene and propylene oxide risk at modelled receptors from Very High/Moderate to Very Low/Negligible. However, given no additional particulate matter control is proposed, the potential nickel risk at boundary receptors remains Very High.

- Treatment of exhaust gases using the Fowlerex designed carbon filtration system and relocation of the shed exhausts (Scenario 3) would reduce the air quality impact risk for all pollutants and at all locations modelled to Very Low/Negligible.

Further, according to the modelling results, with the proposed stack and carbon filtration systems in place, an odour risk of Moderate (ie 50% to 75% of the criterion) would be achieved with odour emission rates of up to 8.3 times higher than those concentrations modelled (2,300 ou/s). Considering the material with the highest odour risk has an odour score 3.2 times higher than the material which was in use when odour samples were collected from the shed, the odour risk even for the highest odour risk material used on site is expected to be Low as a result of the proposed mitigation measures.

Given the above, and considering the odour risk associated with hardstand and slipway odour sources is predicted to be Negligible (possibly Very Low/Low if higher risk material is used), it is expected that cumulative odour concentrations would be well below the odour impact assessment criterion (2 ou) at sensitive receptor locations.

Table 12 Risk Assessment with Proposed Physical Controls in Place

Scenario	Pollutant	PM_{10}		$PM_{2.5}$		Nickel	Xylene	Odour	Propylene Oxide
	Averaging Period	24-hour	Annual	24-hour	Annual	1-hour	1-hour	1-hour	1-hour
Scenario 1	Boundary					Very Low	Very Low		Negligible
	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Very Low	Very High	Negligible
Scenario 2 - Shed 1,4 Exhaust	Boundary					Very High	Very Low		Negligible
	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Negligible	Very Low	Negligible
Scenario 2 - Shed 3 Exhaust	Boundary					Very High	Very Low		Very Low
	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Negligible	Very Low	Negligible
Scenario 3	Boundary					Very Low	Negligible		Negligible
	Sensitive Receptor	Negligible	Negligible	Negligible	Negligible	Very Low	Negligible	Very Low	Negligible

8.3 Management Measures to Reduce Risk of Impact

In addition to the physical controls outlines above, the following proactive/predictive air quality management measures will be implemented at the Site.

- Regular equipment cleaning and maintenance of all air emission control systems will be performed in accordance with the manufacturers' recommendations for cleaning and maintenance.
- An awareness and understanding of air quality issues will be included in site inductions for all staff, and contractors. Specific mention of the following items will be included:
  - Site specific air quality management measures to be followed.
  - Locations of nearby air quality sensitive receivers.
  - Potential air quality and odour impacts which may be caused by activity during normal and abnormal circumstances;
  - Prevention of accidental air emissions and actions to be taken when accidental emissions occur;
  - Procedures for complaint handling.
- The simultaneous use of multiple high odour risk material will be avoided wherever possible, scheduling operations so they are used separately rather than concurrently.
- Ensure that air quality mitigation is appropriately implemented and that shed/encapsulated area openings are closed while works being undertaken.
- All vehicles and vessels will be switched off when not in use and avoid excessive idling emissions.
- An awareness of industry developments will be maintained in relation to low VOC alternatives of material currently used on site in order to assess cost and practicality with a view of continuously improving air quality performance.
- Daily site inspections will be undertaken in order to identify and mitigate offensive odours and visible dust from the Site before the emissions can lead to impact at sensitive receptor locations.

9 Statement of Commitments

Noakes' physical air quality controls proposed for implementation at the Site are provided in **Table 13.**

Table 13 Air quality Management Commitments

Objective	Action	Timeframe
Minimise air quality impact on surrounding residential receivers.	Installation of carbon filtration system serving the sheds and associated stack and ductwork	To be implemented with other site upgrades to improve environmental performance and subject to Council approval. Expected to be completed within 12 months of obtaining any required approval.
	Sealing Shed 4 roof vents and limiting openings into the shed to 2 to 4 m^2	Fully implemented
	Sealing Shed 1 and 3 roof vents and limiting openings into the shed to 2 to 4 m^2	Prior to any sandblasting works being undertaken within these sheds.
	Mobile Enclosure	It is understood that the use of a mobile enclosure onsite would be subject to Council approval. The mobile enclosure is expected to be set up within one week of obtaining any required approval. Extraction and treatment of mobile enclosure emissions will be completed within 12 months of obtaining any required approvals for the carbon filtration system and associated stack.

10 References

DEWHA. (2008). *National Pollutant Inventory Emission Estimation Technique Manual for Railway Yard Operations.* Department of Environment, Water, Heritage and Arts.

DSEWPC. (2012). *Emission Estimation Technique Manual for Fugitive Emissions.* Commonwealth of Australia .

DSEWPC. (2012). NPI Emission Estimation Technique Manual for Mining. *Version 3.1*. Australia: Department of Sustainability, Environment, Water, Population and Communities.

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NSW EPA. (2017, January). Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales. Prepared by NSW Environment Protection Authority, which is part of the NSW Office of Environment and Heritage (OEH). Retrieved from http://www.environment.nsw.gov.au/resources/air/ammodelling05361.pdf

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APPENDIX A

Emission Test Reports

NOAKES BERRYS BAY BOATYARD

Odour and VOC Emissions

Prepared for:

Noakes Group Ptd Ltd
6 John St
McMahons Point
Sydney NSW 2060

SLR Ref: 610.19179-TR01R01
November 2021

PREPARED BY

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Noakes Group Ptd Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.19179-TR01R00	19 November 2021	Danny Echeverri	Graeme Starke	Graeme Starke

CONTENTS

DOCUMENT REFERENCES

TABLES

APPENDICES

1 NOMENCLATURE

o	degrees
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to
%	percentage
#	denotes reporting conditions not specified in EPL and therefore adopted from POEO Schedule 5 Test methods, averaging periods and reference conditions for scheduled premises – Group 5
§	denotes concentration limit not specified in EPL and therefore adopted from POEO Schedule 4 Standards of concentration for scheduled premises: general activities and plant – Group 5
^	denotes Special Condition in EPL No. 10000 Condition L3.4 - Oxygen correction is not required for Nitrogen Oxides for emission Points 12 and 13
AESTD	Australian Eastern Standard Time Daylight Savings
AEST	Australian Eastern Standard Time
ALS	Australian Laboratory Services
AM	ambient method
Am^3/s	actual cubic metres of air per second
Avg	average
AS	Australian Standard
AS/NZS	Australian Standards/New Zealand Standards
CO^2	carbon dioxide
CO	carbon monoxide
CSC	certified span concentration
Conc.	concentration
^{o}C	degrees Celsius
D	duct diameter
EPA	Environment Protection Agency / Environment Protection Authority
EPL	Environment Protection Licence
F	fluoride
g/g mole	grams per gram mole
GC/MS	Gas Chromatography/Mass Spectrometry
HCl	hydrogen chloride
hr	Hours
ID	identification
K	kelvin
kg/m^3	kilograms per cubic metre
kPa	kilopascals
LOR	limit of reporting

l/min	litres per minute
Max	maximum
m	metres
m/s	metres per second
m^2	square metres
m^3	cubic metres
m^3/s	cubic metres of air per second
$\mu g/m^3$	micrograms per cubic metre of air
mg/m^3	milligrams per cubic metre of air
Min	minimum
min	minutes
NA	not applicable
NATA	National Association of Testing Authorities
NSW	New South Wales
NM	not measured
No.	number
NO_x	oxides of nitrogen
OEH	Office of Environment and Heritage
OM	other method
O_2	oxygen
PM_{10}	particulate matter less than 10 microns
$PM_{2.5}$	particulate matter less than 2.5 microns
Ppb	parts per billion
ppm	parts per million
POEO	Protection of the Environment and Operations (Clean Air) Regulations 2010
Qld	Queensland
SLR	SLR Consulting Australia Pty Ltd
SO_2	sulphur dioxide
SO_3/H_2SO_4	sulphur trioxide / sulphuric acid mist
TM	Test Method
TSP	total suspended particulate
UNSW	University of New South Wales
USEPA M	United States Environment Protection Agency Method
UTM	Universal Transverse Mercator

2 Introduction

SLR Consulting Australia Pty Ltd (SLR Consulting) was commissioned by Noakes Group Pty Ltd (Noakes) to undertake odour and volatile organic compounds (VOC) emission monitoring at their Berrys Bay Shipyard located at 6 John Street, McMahons Point NSW (the Site).

The objective of the testing was to obtain data to be used as input to the air quality impact modelling assessment for the site.

The following tables describes the scope of work performed at each location:

Table 1 Monitoring locations

Location Name	Location Specific	Air Quality Parameters	Number of Samples	Method
Axopar 37	Encapsulated Area	Odour	2	NSW OEH OM-7 (AS4323.3)
		VOC	1	TO-15[a]
	Fugitive (immediately outside Encapsulated Area)	VOC	1	NSW OEH TM-34 (USEPA M18)
Hardstand - Eastern Boundary	Encapsulated	Odour	2	NSW OEH OM-7 (AS4323.3)
		VOC	1	TO-15 [a]
	Fugitive (immediately outside Encapsulated Area)	VOC	1	NSW OEH TM-34 (USEPA M18
Marloo	Encapsulated	Odour	2	NSW OEH OM-7 (AS4323.3)
		VOC	1	NSW OEH TM-34 (USEPA M18)
	Fugitive	VOC	1	
Wet Scrubber	Inlet	Odour	2	NSW OEH OM-7 (AS4323.3)
	Outlet		1	

[a] US EPA Method TO-15 not covered under SLR's NATA accreditation.

Where appropriate, monitor airflow, temperature and moisture and calculate mass odour emission rates.

This letter report outlines the sampling methodologies, the odour monitoring results, and includes the calculations of odour emission rates for each source, where appropriate.

2.1 Operating Conditions

On the day of testing, the plant operating procedures and production rates were considered normal by Noakes. The paints and antifoul products used on the day were considered by Noakes to be representative of material with high VOC content. The Duration of spray painting and antifoul applications were considered by Noakes to be representative of peak operations.

3 Process Emissions Monitoring

3.1 Test Methods and Analysis References

All sampling and monitoring were performed by SLR unless otherwise specified. The following sections outline for each parameter requested to be tested, a brief description of the relevant test method for sampling and analysis and the NATA Accredited Laboratory that completed the analysis.

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Appendix A

3.1.1 Flow and Temperature Sampling and Analysis

Flow and temperature sampling and analysis was performed in accordance with NSW OEH TM-1 and TM-2 (USEPA M2 *Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)*). Where possible, a velocity profile was obtained utilising an S-Type pitot tube and manometer.

Temperatures were measured using a digital thermometer connected to a Type K chromel/alumel thermocouple probe.

3.1.2 Odour Sampling and Analysis

All Odour sampling and analysis was performed in accordance with NSW OEH OM-7 (AS/NZS 4323.3-2001 "*Stationary source emissions Part 3: Determination of odour concentration by dynamic olfactometry"*).

Odorous gas was drawn through a clean Teflon (PTFE) sample probe connected to a single use, odour-free Nalophan sampling bag. The sampling pump was connected to the airtight plastic container to provide a sample gas flow-rate of approximately 2 l/min. After the required volume has been sampled, the pump was stopped, and the bag was sealed.

All collected samples were labelled with reference number, location, sampling date and times, kept under dark conditions. Samples were handled in accordance with SLR's QA/QC procedures and delivered to The Odour Unit, NATA accreditation number 14974, for analysis in accordance with AS/NZS 4323.3.

As required by the Australian Standard, all samples were analysed within 30 hours of sampling using dynamic olfactometry. Laboratory certificates of analysis are presented in **Appendix A.**

3.1.3 VOC Sampling and Analysis

VOC samples were collected in accordance with the following methods:

- NSW OEH TM-34 (USEPA M18 "*Measurement of Gaseous Organic Compound Emissions By Gas Chromatography*")
- US EPA Method TO-15 "*Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) Determination of Volatile Organic Compounds (VOCs) in Air"*

NSW OEH TM-34 VOC samples were collected by drawing air at a rate of approximately 100 ml/min through an activated carbon tube using a sampling pump. All collected samples were labelled with reference number, location, sampling date and times, and kept out of direct sunlight. Samples were handled in accordance with SLR's QA/QC procedures and delivered to Envirolab Australia, NATA accreditation number 2901, for analysis using GC/GC-MS. Laboratory certificates of analysis are presented in **Appendix C.** This sampling method was used for locations where a low concentration of VOCs was expected (with the exception of Marloo Encapsulated Area).

US EPA Method TO-15 samples were collected using SUMMA cannisters. Each sample was taken over a 1-hour period. Samples were processed using the company's quality assurance and quality control (QA/QC) checks to ensure all samples were labelled and handled correctly. As required by AS/NZS 4323.3: 2001 and USEPA Method 15, all odour samples were delivered to Envirolab for analysis within 30 hours of sample collection. Laboratory certificates of analysis are presented in **Appendix B**. This sampling method was used for locations where a high concentration of VOCs was expected as USEPA M18 could lead to breakthrough of VOCs on the sorbent tube invalidating the results.

SLR's NATA accreditation does not cover US EPA method TO-15. However, all canisters used were prepared by NATA accredited Envirolab in accordance with TO-15 requirements.

3.2 Deviations from Test Methods

There were deviations to the specified test reference methodologies, and these are specified below:

Sample Location – AS/NZS 4323.1:

- Wet Scrubber Inlet - The sample location for the Wet Scrubber Inlet was deemed non-ideal in accordance with AS/NZS 4323.1. The sample location consisted of a rectangular air wet scrubber inlet with an approximate effective opening width estimated at 0.14 m x 5.4. SLR therefore adopted additional sampling points in accordance with AS/NZS 4323.1 to improve the accuracy of the measurement. However, it is noted that the Wet Scrubber Inlet location does not meet the minimum criteria set out in AS/NZS 4323.1. Refer to **Table 5** for detailed summary of the sample location recordings and illustrative representation of each location.
- Wet Scrubber Outlet - The sample location for the Wet Scrubber Outlet did not meet ideal sampling plane requirements for downstream distance requirements. Refer to **Table 6** for detailed summary of the sample location recordings and illustrative representation of each location.

3.3 Reference Conditions

Reference conditions for all reported concentrations and flow rates are at measured temperature, pressure, moisture, and oxygen concentration.

4 Results

SLR Consulting completed all the sampling as per the relevant standards, methods and analysis of flow and temperature. Results are presented in the following tables.

Table 2 Emissions Monitoring: Axopar 37

Test Details			
Sample date	04 March 2021		
Conditions	Normal		
Sampling plane description	Trapezoidal prism vessel encapsulation using plastic tarps to cover all areas of the boat. Total area measured to be 4.275 m^2. Air space within the area was estimated to be approximately 33 m^3. Volume was calculated to be approximately 66 m^3		
Sample plane compliance	N/A		
Additional Notes	The paint used during the sample period was Altex Epoxy primer (8 litres). Easterly winds		
Testing officer(s)	Danny Echeverri and Ali Naghizadeh		
Source Conditions			
Approximate Volume (m^3)	66		
Temperature Inside (°C)	Not measured		
Temperature outside (°C)	23.3		
Barometric pressure (kPa)	101.22		
Average velocity measured outside (m/sec)	0.18		
Odour			
Run No.	1	2	
SLR Sample ID No.	10694	10695	
Sample Period (hrs)	1200 – 1210	1203 – 1213	
Odour Concentration (OU)	790	664	
Mass Odour Emission Rate (OU/s)	7.3[a]	6.1[a]	

[a] Results not covered by SLR's NATA accreditation as emissions are based on calculations from estimated volume.

Table 2 Emissions Monitoring: Axopar 37 continued

VOC Fugitive	
SLR Sample ID No.	10718
Sample Period	1143 - 1243
	Concentration (mg/m³)
Total VOCs (as propane)	< 4.0
Benzene	< 0.3
Toluene	< 7.3
Ethylbenzene	< 7.3
p-Xylene & m-xylene	< 1.5
o-Xylene	< 7.3

VOC Encapsulated Area		
SLR Sample ID No.	10714	
Sample Period	1200-1300	
	Concentration (mg/m³)	**Emission Rate (g/s)**
Total VOCs (as toluene)	261[a]	NA
Toluene	0.2	0.000002
Ethylbenzene	4.5	0.000041
Xylene	17.1	0.000157
Isopropyl Alcohol	2.5	0.000023
MIBK	220	0.002025
4-ethyl toluene	7.8	0.000072
1,3,5-Trimethylbenzene	6.9	0.000064
1,2,4-Trimethylbenzene	23	0.000212

Note: Instantaneous release assumed for encapsulated areas.
[a] Results not covered by Envirolab NATA accreditation.

Table 3 Emissions Monitoring: Hardstand - Eastern Boundary

Test Details	
Sample date	04 March 2021
Conditions	Normal
Sampling plane description	Encapsulated area using plastic tarps with total areas measured to be 3.9 m^2. Volume was calculated to be approximately 14 m^3.
Sample plane compliance	N/A
Additional Notes	The paint used during the sample period was International Awlcraft 2000 (1 litre).
Testing officer(s)	Danny Echeverri and Ali Naghizadeh
Source Conditions	
Approximate Volume (m^3)	14
Temperature Inside (°C)	Not measured
Temperature outside (°C)	23.3
Barometric pressure (kPa)	101.22
Average velocity outside (m/sec)	Not measured

Odour		
Run No.	1	2
SLR Sample ID No.	10700	10701
Sample Period (hrs)	1429 – 1439	1419 – 1429
Odour Concentration (OU)	790	431
Mass Odour Emission Rate (OU/s)	3.1 [a]	1.7 [a]

[a] Results not covered by SLR's NATA accreditation as emissions are based on calculations from estimated volume.

Table 3 Emissions Monitoring: Hardstand - Eastern Boundary continued

VOC Fugitive		
SLR Sample ID No.	10719	
Sample Period	1424 – 1524	
	Concentration (mg/m³)	
Total VOCs (as propane)	< 4	
Benzene	< 0.3	
Toluene	< 7.4	
Ethylbenzene	< 7.4	
p-Xylene & m-xylene	< 1.5	
o-Xylene	< 7.4	

VOC Encapsulated Area			
SLR Sample ID No.	10716		
Sample Period	1419-1519		
	Concentration (mg/m³)	**Emission Rate (g/s)**	
Total VOCs (toluene)	48.9 [a]	NA	
Toluene	6.9	0.00003	
Ethylbenzene	1.1	0.000004	
Xylene	6.5	0.000025	
Ethanol	0.18	0.000001	
Acetone	0.57	0.000002	
Ethyl acetate	10	0.000039	
Methyl methacrylate	0.1	0.000000	
MIBK	0.32	0.000000	
4-ethyl toluene	0.14	0.000001	
1,3,5- Trimethylbenzene	0.1	0.000000	
1,2,4 - Trimethylbenzene	0.47	0.000002	

Note: Instantaneous release assumed for encapsulated areas.
[a] Results not covered by Envirolab NATA accreditation.

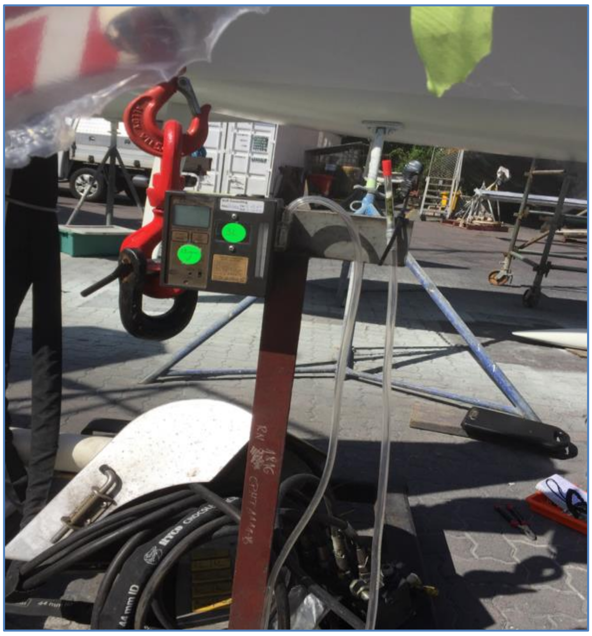
Table 4 Emissions Monitoring: Marloo

Test Details			
Sample date	04 March 2021		
Conditions	Normal		
Sampling plane description	Trapezoidal prism vessel encapsulation using plastic tarps to cover lower area of the boat. Total area measured to be 7.875 m^2. Air space within the area was estimated to be approximately 81 m^3. Volume was calculated to be approximately 122 m^3.		
Sample plane compliance	N/A		
Additional Notes	The paint used during the sample period was International Highbuild (30 litres).		
Testing officer(s)	Danny Echeverri and Ali Naghizadeh		
Source Conditions			
Approximate Volume (m^3)	122		
Ambient Temperature Inside (°C)	No measured		
Ambient Temperature outside (°C)	23.3		
Barometric pressure (kPa)	101.22		
Average velocity outside (m/sec)	Not measured		
Odour			
Run No.	1	2	
SLR Sample ID No.	10697	10717	
Sample Period (hrs)	1601 – 1611	1601 – 1611	
Odour Concentration (OU)	3760	4100	
Mass Odour Emission Rate (OU/s)	85 [a]	93 [a]	

[a] Results not covered by SLR's NATA accreditation as emissions are based on calculations from estimated volume.

Table 4 Emissions Monitoring: Marloo continued

VOC Fugitive	
SLR Sample ID No.	10721
Sample Period	1546 – 1632
	Concentration (mg/m³)
Total VOCs (as propane)	< 0.9
Benzene	< 0.4
Toluene	1.73
Ethylbenzene	< 1
p-Xylene & m-xylene	< 2
o-Xylene	< 1



VOC Encapsulated Area		
SLR Sample ID No.	10720	
Sample Period	1546 – 1632	
	Concentration (mg/m³)	**Emission Rate (g/s)**
Total VOCs (as propane)	174	NA
Toluene	174.1	0.004
Ethylbenzene	8.8	0.000199
Xylene	6.1	0.000138
Propylene oxide	80.4	0.001817
MIBK	22.9	0.001

Note: Instantaneous release assumed for encapsulated areas.

Table 5 Emissions Monitoring: Wet Scrubber Inlet

Test Details	
Sample date	04 March 2021
Conditions	Normal
Sampling plane description	5.4 m x 0.42 m rectangular air wet scrubber inlet. The approximate effective opening width was estimated to be approximately 0.14 m x 5.4 to make up for water over the surface.
Sample plane compliance	Not in compliance
Additional Notes	The paint used during the sample period was International Interprotect (20 litres).
Testing officer(s)	Danny Echeverri and Ali Naghizadeh

Source Conditions		
Source dimensions (m)	5.4 m x 0.42 m	
Temperature Inside (°C)	25	
Temperature outside (°C)	25	
Barometric pressure (kPa)	101.22	
Average velocity (m/sec)	8.7	

Inlet				
Run No.	1	2		
SLR Sample ID No.	10698	10699		
Sample Period (hrs)	1310 – 1320	1328 – 1338		
Odour Concentration (OU)	861	790		
Mass Odour Emission Rate (Actual) ($OU.m^3/s$)	5.6	5.2		

Table 6 Emissions Monitoring: Wet Scrubber outlet

Test Details		
Sample date	04 March 2021	
Conditions	Normal	
Sampling plane description	1.03 diameter circular vent.	
Sample plane compliance	Not in compliance	
Additional Notes	The paint used during the sample period was International Interprotect (20 litres).	
Testing officer(s)	Danny Echeverri and Ali Naghizadeh	
Source Conditions		
Source dimensions (m)	1.03	
Temperature Inside (°C)	No measured	
Temperature outside (°C)	25	
Barometric pressure (kPa)	101.22	
Average velocity (m/sec)	7.7	
Outlet		
Run No.	1	
SLR Sample ID No.	10696	
Sample Period (hrs)	1310 – 1320	
Odour Concentration (OU)	664	
Mass Odour Emission Rate (OU.m³/s)	4.3	

5 Monitoring Instrument Calibration

Details of the most recent calibration of each instrument used to take the measurements are provided in **Table 7**.

Table 7 Equipment Calibration Details

Asset Number	Name	Next Calibration / Due Date
2004	Pump	21-04-2021
2005	Pump	21-04-2021
N299	Pump	01-02-2022
2006	Pump	02-02-2022
Drum-001	Drum	NA
Drum-002	Drum	NA
2076	Tetracal	04-04-2021
3110	Anemometer	12-01-2022

6 Measurement Uncertainty

The estimated measurement uncertainty associated with the monitoring methods are provided in **Table 8.**

Table 8 Measurement Uncertainty

Parameter	Associated Test Method	Uncertainty
Velocity	TM-2, AS 4323.1, USEPA M2A, 2C	±5%
Temperature	TM-2, USEPA M2C	±2°C
Odour	OM-7, AS4323.3	± 50 - 124% (based upon a single determination)
VOCs (adsorption tube)	NSW TM-34, USEPA M 18	25%

7 References

AS/NZS. (n.d.). *4323.3:2001 - Stationary source emissions Part 3: Determination of odour concentration by dynamic olfactometry.*

NSW DEC. (2007). *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW.*

USEPA. (2019, January 14). Measurement of Gaseous Organic Compound Emission By Gas Chromatography.

APPENDIX A

Odour Laboratory Analysis Report

THE ODOUR UNIT PTY LTD

THE ODOUR UNIT

12/56 Church Ave
Mascot, NSW 2020

Phone: +61 2 9209 4420
Email: info@odourunit.com.au
Internet: www.odourunit.com.au
ABN: 53 091 163 061

NATA
Accreditation Number: 14974

Odour Concentration Measurement Report

The measurement was commissioned by:

Organisation	SLR Consulting	Telephone	+61 2 9424 2210
Contact	Danny Echeverri	Facsimile	--
Sampling Site	Not disclosed	Email	decheverri@slrconsulting.com
Sampling Method	Not disclosed	Sampling Team	SLR Consulting

Order details:

Order requested by	Danny Echeverri	Order accepted by	A. Schulz
Date of order	14/02/2021	TOU Project #	N1869R
Order number	PO 30054	Project Manager	A. Schulz
Signed by	Danny Echeverri	Panel Operator	A. Schulz

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian/New Zealand Standard: Stationary source emissions – *Part 3: 'Determination of odour concentration by dynamic olfactometry* (AS/NZS4323.3). The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 22 °C ±3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: TOU-OLF-001.
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the AS/NZS 4323.3. $r = 0.280$ (October 2019) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the AS/NZS 4323.3. $A = 0.076$ (October 2019) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou, which is 4 times the lowest dilution setting.
Traceability	The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen. Note Disclaimers on last page of this document.

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced, except in full.

Date: 17th March 2021

Panel Roster Number: SYD20210305_018

A. Schulz
Authorised Signatory

The Odour Unit Pty Ltd
ABN 53 091 165 061
Form 06B – Odour Concentration Results Sheet

Issue Date: 13.11.2003
Issued By: SB
Last printed 3/17/2021 2:35:00 PM

Revision: 13
Revision Date: 10.08.2020
Approved By: TJS

1

THE ODOUR UNIT PTY LTD

NATA
Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20200101_001

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Dilution Equipment ID	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)
Axopar 37 (R1) 10694	SC21112	04/03/2021 1210 hrs	05/03/2021 1040 hrs	4	8	-	-	-	790	790
Axopar 37 (R2) 10695	SC21113	04/03/2021 1213 hrs	05/03/2021 1113 hrs	4	8	-	-	-	664	664
Wet scrubber outlet Shed 4 (R1) 10696	SC21114	04/03/2021 1320 hrs	05/03/2021 1151 hrs	4	8	-	-	-	664	664
Death Row (R1) 10700	SC21115	04/03/2021 1439 hrs	05/03/2021 1315 hrs	4	8	-	-	-	790	790
Death Row (R2) 10701	SC21116	04/03/2021 1429 hrs	05/03/2021 1350 hrs	4	8	-	-	-	431	431
Marloo (R1) 10697	SC21117	04/03/2021 1611 hrs	05/03/2021 1426 hrs	4	8	-	-	-	3760	3760
Marloo (R2) 10717	SC21118	04/03/2021 1611 hrs	05/03/2021 1457 hrs	4	8	-	-	-	4100	4100

Samples Received in Laboratory – From: SLR Consulting Date: 05/03/2021 Time: 09:00 am

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

NATA
Accreditation Number: 14974

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Dilution Equipment ID	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)
Wet scrubber inlet Shed 4 (R1) 10698	SC21119	04/03/2021 1320 hrs	05/03/2021 1534 hrs	4	8	-	-	-	861	861
Wet scrubber inlet Shed 4 (R2) 10699	SC21120	04/03/2021 1338 hrs	05/03/2021 1621 hrs	4	8	-	-	-	790	790

Samples Received in Laboratory – From: SLR Consulting Date: 05/03/2021 Time: 09:00 am

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

NATA
Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS 4323.3 (Yes / No)
n-butanol	SYD20210305_018	51,400	$20 \le \chi \le 80$	861	60	Yes

Comments

Odour characters (non-NATA accredited) as determined by odour laboratory panel:

SC21112	paint, sweet
SC21113	paint, sweet
SC21114	paint, sweet
SC21115	sour, paint
SC21116	sour, paint
SC21117	paint, sweet
SC21118	paint, sour
SC21119	paint, sour
SC21120	paint, sour

Disclaimers

1. Parties, other than The Odour Unit Pty Ltd, responsible for collecting odour samples have advised that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing.
2. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.
3. Any comments included in, or attachments to, this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.
4. This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd.

Report Status

Status	Version	Date	Prepared by	Checked by	Change	Reason
Draft	0.1	17/03/21	Isaac Farrugia	-	-	-
Final	1.0	17/03/20	Isaac Farrugia	Alex Schulz	-	-
Revised	-	-	-	-	-	-

END OF DOCUMENT

APPENDIX B

VOC Canisters Laboratory Analysis Report

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 263601

Client Details

Client	SLR Consulting Aust. Pty Ltd (Sydney)
Attention	D. Echeverri
Address	PO Box 2003, NORTH SYDNEY, NSW, 2059

Sample Details

Your Reference	**610.19179**
Number of Samples	2xCanisters
Date samples received	08/03/2021
Date completed instructions received	08/03/2021

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	15/03/2021
Date of Issue	15/03/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Giovanni Agosti, Group Technical Manager

Authorised By

Nancy Zhang, Laboratory Manager

Client Reference: 610.19179

TO15 in Canisters/Bags			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Vacuum before Shipment	Hg"	-30	-30
Vacuum before Analysis	Hg"	-7	-7
Date prepared	-	08/03/2021	08/03/2021
Date analysed	-	08/03/2021	08/03/2021
Propylene	ppbv	<50	<5
Dichlorodifluoromethane	ppbv	<50	<5
Chloromethane	ppbv	<50	<5
1,2-Dichlorotetrafluoroethane	ppbv	<50	<5
Vinyl chloride	ppbv	<50	<5
1,3-Butadiene	ppbv	<50	<5
Bromomethane	ppbv	<50	<5
Chloroethane	ppbv	<50	<5
Ethanol	ppbv	<500	95
Acrolein	ppbv	<500	<50
Trichlorofluoromethane (Freon 11)	ppbv	<50	<5
Acetone	ppbv	<500	240
Isopropyl Alcohol	ppbv	1,000	<50
1,1-Dichloroethene	ppbv	<50	<5
1,1,2-Trichlorotrifluoroethane	ppbv	<50	<5
Methylene chloride (Dichloromethane)	ppbv	<500	<50
Carbon Disulfide	ppbv	<500	<50
trans-1,2-dichloroethene	ppbv	<50	<5
MTBE	ppbv	<50	<5
1,1- Dichloroethane	ppbv	<50	<5
Vinyl Acetate	ppbv	<50	<5
MEK	ppbv	<500	<50
Hexane	ppbv	<50	<5
cis-1,2-Dichloroethene	ppbv	<50	<5
Ethyl Acetate	ppbv	<50	2,800
Chloroform	ppbv	<50	<5
Tetrahydrofuran	ppbv	<50	<5
1,1,1-Trichloroethane	ppbv	<50	<5
1,2-Dichloroethane	ppbv	<50	<5
Benzene	ppbv	<50	<5
Carbon tetrachloride	ppbv	<50	<5

Client Reference: 610.19179

TO15 in Canisters/Bags			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Cyclohexane	ppbv	<50	<5
Heptane	ppbv	<50	<5
Trichloroethene	ppbv	<50	<5
1,2-Dichloropropane	ppbv	<50	<5
1,4-Dioxane	ppbv	<50	<5
Bromodichloromethane	ppbv	<50	<5
Methyl Methacrylate	ppbv	<50	25
MIBK	ppbv	54,000	78
cis-1,3-Dichloropropene	ppbv	<50	<5
trans-1,3-Dichloropropene	ppbv	<50	<5
Toluene	ppbv	53	1,800
1,1,2-Trichloroethane	ppbv	<50	<5
Methyl Butyl Ketone	ppbv	<50	<5
Dibromochloromethane	ppbv	<50	<5
Tetrachloroethene	ppbv	<50	<5
1,2-Dibromoethane	ppbv	<50	<5
Chlorobenzene	ppbv	<50	<5
Ethylbenzene	ppbv	1,000	260
m-& p-Xylene	ppbv	3,000	1,100
Styrene	ppbv	<50	<5
o-Xylene	ppbv	940	380
Bromoform	ppbv	<50	<5
1,1,2,2-Tetrachloroethane	ppbv	<50	<5
4-ethyl toluene	ppbv	1,600	29
1,3,5-Trimethylbenzene	ppbv	1,400	20
1,2,4-Trimethylbenzene	ppbv	4,800	96
1,3-Dichlorobenzene	ppbv	<50	<5
Benzyl chloride	ppbv	<50	<5
1,4-Dichlorobenzene	ppbv	<50	<5
1,2-Dichlorobenzene	ppbv	<50	<5
1,2,4-Trichlorobenzene	ppbv	<50	<5
Naphthalene	ppbv	<50	<5
Hexachloro- 1,3-butadiene	ppbv	<50	<5
TVOC's as toluene*	$\mu g/m^3$	69,200	13,000
Surrogate-Bromochloromethane	% rec	104	100
Surrogate -1,4-Difluorobenzene	% rec	100	99

Envirolab Reference: 263601
Revision No: R00

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Client Reference: 610.19179

TO15 in Canisters/Bags			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Surrogate-Chlorobenzene-D5	% rec	101	98

Client Reference: 610.19179

TO15 in Canisters ug/m3			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Vacuum before Shipment	Hg"	-30	-30
Vacuum before Analysis	Hg"	-7	-7
Date prepared	-	08/03/2021	08/03/2021
Date analysed	-	08/03/2021	08/03/2021
Propylene	µg/m³	<90	<9
Dichlorodifluoromethane	µg/m³	<250	<25
Chloromethane	µg/m³	<100	<10
1,2-Dichlorotetrafluoroethane	µg/m³	<250	<25
Vinyl chloride	µg/m³	<130	<13
1,3-Butadiene	µg/m³	<110	<11
Bromomethane	µg/m³	<190	<19
Chloroethane	µg/m³	<130	<13
Ethanol	µg/m³	<900	180
Acrolein	µg/m³	<1100	<110
Trichlorofluoromethane (Freon 11)	µg/m³	<280	<28
Acetone	µg/m³	<1190	570
Isopropyl Alcohol	µg/m³	2,500	<120
1,1-Dichloroethene	µg/m³	<200	<20
1,1,2-Trichlorotrifluoroethane	µg/m³	<380	<38
Methylene chloride (Dichloromethane)	µg/m³	<1700	<170
Carbon Disulfide	µg/m³	<1600	<160
trans-1,2-dichloroethene	µg/m³	<200	<20
MTBE	µg/m³	<180	<18
1,1- Dichloroethane	µg/m³	<200	<20
Vinyl Acetate	µg/m³	<180	<18
MEK	µg/m³	<1500	<150
Hexane	µg/m³	<180	<18
cis-1,2-Dichloroethene	µg/m³	<200	<20
Ethyl Acetate	µg/m³	<180	10,000
Chloroform	µg/m³	<240	<24
Tetrahydrofuran	µg/m³	<150	<15
1,1,1-Trichloroethane	µg/m³	<270	<27
1,2-Dichloroethane	µg/m³	<200	<20
Benzene	µg/m³	<160	<16
Carbon tetrachloride	µg/m³	<310	<31

Client Reference: 610.19179

TO15 in Canisters ug/m3			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Cyclohexane	μg/m³	<170	<17
Heptane	μg/m³	<200	<20
Trichloroethene	μg/m³	<270	<27
1,2-Dichloropropane	μg/m³	<230	<23
1,4-Dioxane	μg/m³	<180	<18
Bromodichloromethane	μg/m³	<340	<34
Methyl Methacrylate	μg/m³	<200	100
MIBK	μg/m³	220,000	320
cis-1,3-Dichloropropene	μg/m³	<230	<23
trans-1,3-Dichloropropene	μg/m³	<230	<23
Toluene	μg/m³	200	6,900
1,1,2-Trichloroethane	μg/m³	<270	<27
Methyl Butyl Ketone	μg/m³	<200	<20
Dibromochloromethane	μg/m³	<160	<16
Tetrachloroethene	μg/m³	<340	<34
1,2-Dibromoethane	μg/m³	<380	<38
Chlorobenzene	μg/m³	<230	<23
Ethylbenzene	μg/m³	4,500	1,100
m-& p-Xylene	μg/m³	13,000	4,900
Styrene	μg/m³	<210	<21
o-Xylene	μg/m³	4,100	1,600
Bromoform	μg/m³	<520	<52
1,1,2,2-Tetrachloroethane	μg/m³	<340	<34
4-ethyl toluene	μg/m³	7,800	140
1,3,5-Trimethylbenzene	μg/m³	6,900	100
1,2,4-Trimethylbenzene	μg/m³	23,000	470
1,3-Dichlorobenzene	μg/m³	<300	<30
Benzyl chloride	μg/m³	<260	<26
1,4-Dichlorobenzene	μg/m³	<300	<30
1,2-Dichlorobenzene	μg/m³	<300	<30
1,2,4-Trichlorobenzene	μg/m³	<370	<37
Naphthalene	μg/m³	<260	<26
Hexachloro- 1,3-butadiene	μg/m³	<530	<53
TVOC's as toluene*	μg/m³	261,000	48,900
Surrogate-Bromochloromethane	% rec	104	100
Surrogate -1,4-Difluorobenzene	% rec	100	99

Envirolab Reference: 263601
Revision No: R00

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Client Reference: 610.19179

TO15 in Canisters ug/m3			
Our Reference		263601-1	263601-2
Your Reference	UNITS	10714	10716
Date Sampled		04/03/2021	04/03/2021
Type of sample		Air	Air
Air Kit Security No.		3524	1698
Surrogate-Chlorobenzene-D5	% rec	101	98

Client Reference: 610.19179

Method ID	Methodology Summary
TO15	USEPA TO15 - Analysis of VOC's in air using USEPA TO15 and in house method AT-002. Note, longer term stability of some oxygenated compounds is questionable where significant humidity is present.
USEPA 18	Measurement of Gaseous Organic Compound Emissions by Gas Chromatography using USEPA m18.

Client Reference: 610.19179

QUALITY CONTROL: TO15 in Canisters/Bags						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Vacuum before Shipment	Hg"			[NT]	2	-30	-30	0	[NT]	[NT]
Vacuum before Analysis	Hg"			[NT]	2	-7	-7	0	[NT]	[NT]
Date prepared	-			08/03/2021	2	08/03/2021	08/03/2021		08/03/2021	[NT]
Date analysed	-			08/03/2021	2	08/03/2021	08/03/2021		08/03/2021	[NT]
Propylene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	99	[NT]
Dichlorodifluoromethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Chloromethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2-Dichlorotetrafluoroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Vinyl chloride	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,3-Butadiene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Bromomethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Chloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Ethanol	ppbv	5	TO15	<5	2	95	95	0	[NT]	[NT]
Acrolein	ppbv	5	TO15	<5	2	<50	<50	0	[NT]	[NT]
Trichlorofluoromethane (Freon 11)	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Acetone	ppbv	5	TO15	<5	2	240	220	9	[NT]	[NT]
Isopropyl Alcohol	ppbv	5	TO15	<5	2	<50	<50	0	[NT]	[NT]
1,1-Dichloroethene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,1,2-Trichlorotrifluoroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Methylene chloride (Dichloromethane)	ppbv	5	TO15	<5	2	<50	<50	0	[NT]	[NT]
Carbon Disulfide	ppbv	5	TO15	<5	2	<50	<50	0	[NT]	[NT]
trans-1,2-dichloroethene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
MTBE	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,1- Dichloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Vinyl Acetate	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
MEK	ppbv	5	TO15	<5	2	<50	<50	0	[NT]	[NT]
Hexane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	86	[NT]
cis-1,2-Dichloroethene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Ethyl Acetate	ppbv	0.5	TO15	<0.5	2	2800	2700	4	[NT]	[NT]
Chloroform	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Tetrahydrofuran	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,1,1-Trichloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2-Dichloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Benzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	82	[NT]
Carbon tetrachloride	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Cyclohexane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Heptane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	92	[NT]

Client Reference: 610.19179

QUALITY CONTROL: TO15 in Canisters/Bags						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Trichloroethene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2-Dichloropropane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,4-Dioxane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Bromodichloromethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Methyl Methacrylate	ppbv	0.5	TO15	<0.5	2	25	24	4	[NT]	[NT]
MIBK	ppbv	5	TO15	<5	2	78	75	4	[NT]	[NT]
cis-1,3-Dichloropropene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
trans-1,3-Dichloropropene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Toluene	ppbv	0.5	TO15	<0.5	2	1800	1700	6	90	[NT]
1,1,2-Trichloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Methyl Butyl Ketone	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Dibromochloromethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Tetrachloroethene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2-Dibromoethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Chlorobenzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Ethylbenzene	ppbv	0.5	TO15	<0.5	2	260	250	4	92	[NT]
m-& p-Xylene	ppbv	1	TO15	<1	2	1100	1100	0	93	[NT]
Styrene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	100	[NT]
o-Xylene	ppbv	0.5	TO15	<0.5	2	380	360	5	96	[NT]
Bromoform	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,1,2,2-Tetrachloroethane	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
4-ethyl toluene	ppbv	0.5	TO15	<0.5	2	29	28	4	99	[NT]
1,3,5-Trimethylbenzene	ppbv	0.5	TO15	<0.5	2	20	19	5	99	[NT]
1,2,4-Trimethylbenzene	ppbv	0.5	TO15	<0.5	2	96	91	5	102	[NT]
1,3-Dichlorobenzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Benzyl chloride	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,4-Dichlorobenzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2-Dichlorobenzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
1,2,4-Trichlorobenzene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Naphthalene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
Hexachloro- 1,3-butadiene	ppbv	0.5	TO15	<0.5	2	<5	<5	0	[NT]	[NT]
TVOC's as toluene*	µg/m³	188	TO15	<188	2	13000	12900	1	[NT]	[NT]
Surrogate-Bromochloromethane	% rec		TO15	88	2	100	100	0	89	[NT]
Surrogate -1,4-Difluorobenzene	% rec		TO15	77	2	99	100	1	80	[NT]
Surrogate-Chlorobenzene-D5	% rec		TO15	77	2	98	99	1	79	[NT]

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Client Reference: 610.19179

QUALITY CONTROL: TO15 in Canisters ug/m3					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Vacuum before Shipment	Hg"			[NT]	2	-30	-30	0	[NT]	[NT]
Vacuum before Analysis	Hg"			[NT]	2	-7	-7	0	[NT]	[NT]
Date prepared	-			08/03/2021	2	08/03/2021	08/03/2021		[NT]	[NT]
Date analysed	-			08/03/2021	2	08/03/2021	08/03/2021		[NT]	[NT]
Propylene	µg/m³	0.9	TO15	<0.9	2	<9	<9	0	[NT]	[NT]
Dichlorodifluoromethane	µg/m³	2.5	TO15	<2.5	2	<25	<25	0	[NT]	[NT]
Chloromethane	µg/m³	1.0	TO15	<1.0	2	<10	<10	0	[NT]	[NT]
1,2-Dichlorotetrafluoroethane	µg/m³	2.5	TO15	<2.5	2	<25	<25	0	[NT]	[NT]
Vinyl chloride	µg/m³	1.3	TO15	<1.3	2	<13	<13	0	[NT]	[NT]
1,3-Butadiene	µg/m³	1.1	TO15	<1.1	2	<11	<11	0	[NT]	[NT]
Bromomethane	µg/m³	1.9	TO15	<1.9	2	<19	<19	0	[NT]	[NT]
Chloroethane	µg/m³	1.3	TO15	<1.3	2	<13	<13	0	[NT]	[NT]
Ethanol	µg/m³	9	TO15	<9	2	180	180	0	[NT]	[NT]
Acrolein	µg/m³	11	TO15	<11	2	<110	<110	0	[NT]	[NT]
Trichlorofluoromethane (Freon 11)	µg/m³	2.8	TO15	<2.8	2	<28	<28	0	[NT]	[NT]
Acetone	µg/m³	11.9	TO15	<11.9	2	570	520	9	[NT]	[NT]
Isopropyl Alcohol	µg/m³	12	TO15	<12	2	<120	<120	0	[NT]	[NT]
1,1-Dichloroethene	µg/m³	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]
1,1,2-Trichlorotrifluoroethane	µg/m³	3.8	TO15	<3.8	2	<38	<38	0	[NT]	[NT]
Methylene chloride (Dichloromethane)	µg/m³	17	USEPA 18	<17	2	<170	<170	0	[NT]	[NT]
Carbon Disulfide	µg/m³	16	TO15	<16	2	<160	<160	0	[NT]	[NT]
trans-1,2-dichloroethene	µg/m³	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]
MTBE	µg/m³	1.8	TO15	<1.8	2	<18	<18	0	[NT]	[NT]
1,1- Dichloroethane	µg/m³	2.0	TO15	<2.0	2	<20	<2.0	164	[NT]	[NT]
Vinyl Acetate	µg/m³	1.8	TO15	<1.8	2	<18	<18	0	[NT]	[NT]
MEK	µg/m³	15	TO15	<15	2	<150	<150	0	[NT]	[NT]
Hexane	µg/m³	1.8	TO15	<1.8	2	<18	<18	0	[NT]	[NT]
cis-1,2-Dichloroethene	µg/m³	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]
Ethyl Acetate	µg/m³	1.8	TO15	<1.8	2	10000	9700	3	[NT]	[NT]
Chloroform	µg/m³	2.4	TO15	<2.4	2	<24	<24	0	[NT]	[NT]
Tetrahydrofuran	µg/m³	1.5	TO15	<1.5	2	<15	<15	0	[NT]	[NT]
1,1,1-Trichloroethane	µg/m³	2.7	TO15	<2.7	2	<27	<27	0	[NT]	[NT]
1,2-Dichloroethane	µg/m³	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]
Benzene	µg/m³	1.6	TO15	<1.6	2	<16	<16	0	[NT]	[NT]
Carbon tetrachloride	µg/m³	3.1	TO15	<3.1	2	<31	<31	0	[NT]	[NT]
Cyclohexane	µg/m³	1.7	TO15	<1.7	2	<17	<17	0	[NT]	[NT]
Heptane	µg/m³	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]

Client Reference: 610.19179

QUALITY CONTROL: TO15 in Canisters ug/m3						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Trichloroethene	µg/m³	2.7	TO15	<2.7	2	<27	<27	0	[NT]	[NT]
1,2-Dichloropropane	µg/m³	2.3	TO15	<2.3	2	<23	<23	0	[NT]	[NT]
1,4-Dioxane	µg/m³	1.8	TO15	<1.8	2	<18	<18	0	[NT]	[NT]
Bromodichloromethane	µg/m³	3.4	TO15	<3.4	2	<34	<34	0	[NT]	[NT]
Methyl Methacrylate	µg/m³	2.0	TO15	<2.0	2	100	100	0	[NT]	[NT]
MIBK	µg/m³	20	TO15	<20	2	320	310	3	[NT]	[NT]
cis-1,3-Dichloropropene	µg/m³	2.3	TO15	<2.3	2	<23	<23	0	[NT]	[NT]
trans-1,3-Dichloropropene	µg/m³	2.3	TO15	<2.3	2	<23	<23	0	[NT]	[NT]
Toluene	µg/m³	1.9	TO15	<1.9	2	6900	6500	6	[NT]	[NT]
1,1,2-Trichloroethane	µg/m³	2.7	TO15	<2.7	2	<27	<27	0	[NT]	[NT]
Methyl Butyl Ketone	µg/m³	2.0	TO15	<2.0	2	<20	<20	0	[NT]	[NT]
Dibromochloromethane	µg/m³	1.6	TO15	<1.6	2	<16	<16	0	[NT]	[NT]
Tetrachloroethene	µg/m³	3.4	TO15	<3.4	2	<34	<34	0	[NT]	[NT]
1,2-Dibromoethane	µg/m³	3.8	TO15	<3.8	2	<38	<38	0	[NT]	[NT]
Chlorobenzene	µg/m³	2.3	TO15	<2.3	2	<23	<23	0	[NT]	[NT]
Ethylbenzene	µg/m³	2.2	TO15	<2.2	2	1100	1100	0	[NT]	[NT]
m-& p-Xylene	µg/m³	4.3	TO15	<4.3	2	4900	4600	6	[NT]	[NT]
Styrene	µg/m³	2.1	TO15	<2.1	2	<21	<21	0	[NT]	[NT]
o-Xylene	µg/m³	2.2	TO15	<2.2	2	1600	1600	0	[NT]	[NT]
Bromoform	µg/m³	5.2	TO15	<5.2	2	<52	<52	0	[NT]	[NT]
1,1,2,2-Tetrachloroethane	µg/m³	3.4	TO15	<3.4	2	<34	<34	0	[NT]	[NT]
4-ethyl toluene	µg/m³	2.5	TO15	<2.5	2	140	140	0	[NT]	[NT]
1,3,5-Trimethylbenzene	µg/m³	2.5	TO15	<2.5	2	100	95	5	[NT]	[NT]
1,2,4-Trimethylbenzene	µg/m³	2.5	TO15	<2.5	2	470	450	4	[NT]	[NT]
1,3-Dichlorobenzene	µg/m³	3.0	TO15	<3.0	2	<30	<30	0	[NT]	[NT]
Benzyl chloride	µg/m³	2.6	TO15	<2.6	2	<26	<26	0	[NT]	[NT]
1,4-Dichlorobenzene	µg/m³	3.0	TO15	<3.0	2	<30	<30	0	[NT]	[NT]
1,2-Dichlorobenzene	µg/m³	3.0	TO15	<3.0	2	<30	<30	0	[NT]	[NT]
1,2,4-Trichlorobenzene	µg/m³	3.7	TO15	<3.7	2	<37	<37	0	[NT]	[NT]
Naphthalene	µg/m³	2.6	TO15	<2.6	2	<26	<26	0	[NT]	[NT]
Hexachloro- 1,3-butadiene	µg/m³	5.3	TO15	<5.3	2	<53	<53	0	[NT]	[NT]
TVOC's as toluene*	µg/m³	188	TO15	<188	2	48900	48600	1	[NT]	[NT]
Surrogate-Bromochloromethane	% rec		TO15	88	2	100	100	0	[NT]	[NT]
Surrogate -1,4-Difluorobenzene	% rec		TO15	77	2	99	100	1	[NT]	[NT]
Surrogate-Chlorobenzene-D5	% rec		TO15	77	2	98	99	1	[NT]	[NT]

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Client Reference: 610.19179

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

Client Reference: 610.19179

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.

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.

Client Reference: 610.19179

Report Comments

AIR_TO-15

PQL has been raised due to the high level of analytes present in the samples #1,#2.

TVOC is reported as C3 to Naphthalene (propylene to naphthalene)

APPENDIX C

VOC Carbon Tubes Laboratory Analysis Report

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
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CERTIFICATE OF ANALYSIS 264084

Client Details	
Client	SLR Consulting Aust. Pty Ltd (Sydney)
Attention	D. Echeverri
Address	PO Box 2003, NORTH SYDNEY, NSW, 2059

Sample Details	
Your Reference	610.19179
Number of Samples	4 carbon tube
Date samples received	11/03/2021
Date completed instructions received	11/03/2021

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.

Report Details	
Date results requested by	18/03/2021
Date of Issue	18/03/2021

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Results Approved By
Dragana Tomas, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Envirolab Reference: 264084
Revision No: R00

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Client Reference: 610.19179

VOC in Carbon tubes					
Our Reference		264084-1	264084-2	264084-3	264084-4
Your Reference	UNITS	10718	10719	10720	10721
Type of sample		carbon tube	carbon tube	carbon tube	carbon tube
Date Sampled		4/03/2021	4/03/2021	4/03/2021	4/03/2021
Date extracted	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Acetone	µg/tube	<5	<5	<5	<5
Acrylonitrile	µg/tube	<5	<5	<5	<5
Methylethylketone (MEK)	µg/tube	<5	<5	<5	<5
Hexane	µg/tube	<5	<5	<5	<5
Ethylacetate	µg/tube	<5	<5	<5	<5
1,2-Dichloroethane	µg/tube	<5	<5	<5	<5
Benzene	µg/tube	<2	<2	<2	<2
Carbon Tetrachloride	µg/tube	<5	<5	<5	<5
Cyclohexane	µg/tube	<5	<5	<5	<5
Ethylacrylate	µg/tube	<5	<5	<5	<5
Trichloroethene	µg/tube	<5	<5	<5	<5
1,4-Dioxane	µg/tube	<5	<5	<5	<5
Propylene Oxide	µg/tube	<10	<10	420	<10
Epichlorohydrin	µg/tube	<5	<5	<5	<5
Methylisobutylketone (MIBK)	µg/tube	<5	<5	120	<5
Toluene	µg/tube	<5	<5	910	9
Tetrachloroethene	µg/tube	<5	<5	<5	<5
n-Butylacetate	µg/tube	<5	<5	<5	<5
Chlorobenzene	µg/tube	<5	<5	<5	<5
Ethylbenzene	µg/tube	<5	<5	46	<5
m+p-Xylene	µg/tube	<10	<10	32	<10
Styrene	µg/tube	<5	<5	<5	<5
o-Xylene	µg/tube	<5	<5	<5	<5
Cyclohexanone	µg/tube	<5	<5	<5	<5
Nonane	µg/tube	<5	<5	<5	<5
Isopropylbenzene	µg/tube	<5	<5	<5	<5
Diisobutylketone (DIBK)	µg/tube	<5	<5	<5	<5
a-Methylstyrene	µg/tube	<5	<5	<5	<5
Decane	µg/tube	<5	<5	<5	<5
Benzylchloride	µg/tube	<5	<5	<5	<5
Naphthalene	µg/tube	<5	<5	<5	<5
Dodecane	µg/tube	<5	<5	<5	<5
TVOC's as hexane in tubes*	µg/tube	<50	<50	3,000	<50
Surrogate Toluene-d8	%	73	72	75	74

Envirolab Reference: 264084
Revision No: R00

Client Reference: 610.19179

VOC in Carbon tubes					
Our Reference		264084-1	264084-2	264084-3	264084-4
Your Reference	UNITS	10718	10719	10720	10721
Type of sample		carbon tube	carbon tube	carbon tube	carbon tube
Date Sampled		4/03/2021	4/03/2021	4/03/2021	4/03/2021
Surrogate 4-Bromofluorobenzene	%	75	82	80	73

Client Reference: 610.19179

Method ID	Methodology Summary
ORG-022	Determination of volatile organic compounds in charcoal tubes/badges/sorbents using CS2 extraction, based on NIOSH methods using GC/GC-MS. Desorption efficiencies are not applied to results in ug/tube. Note where μg/m^3 results are supplied for SKC badges, the factors used are for 575-001, if 575-001 data is unavailable for an analyte then use 575-002 then 575-003 (exposure time must be supplied).

Client Reference: 610.19179

QUALITY CONTROL: VOC in Carbon tubes						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			17/03/2021	[NT]	[NT]	[NT]	[NT]	17/03/2021	[NT]
Date analysed	-			17/03/2021	[NT]	[NT]	[NT]	[NT]	17/03/2021	[NT]
Acetone	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	106	[NT]
Acrylonitrile	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Methylethylketone (MEK)	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Hexane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	101	[NT]
Ethylacetate	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	102	[NT]
1,2-Dichloroethane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	101	[NT]
Benzene	µg/tube	2	ORG-022	<2	[NT]	[NT]	[NT]	[NT]	100	[NT]
Carbon Tetrachloride	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	100	[NT]
Cyclohexane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	99	[NT]
Ethylacrylate	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Trichloroethene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	100	[NT]
1,4-Dioxane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	99	[NT]
Propylene Oxide	µg/tube	10	ORG-022	<10	[NT]	[NT]	[NT]	[NT]	118	[NT]
Epichlorohydrin	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	99	[NT]
Methylisobutylketone (MIBK)	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Toluene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Tetrachloroethene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	98	[NT]
n-Butylacetate	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	94	[NT]
Chlorobenzene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Ethylbenzene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
m+p-Xylene	µg/tube	10	ORG-022	<10	[NT]	[NT]	[NT]	[NT]	97	[NT]
Styrene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
o-Xylene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Cyclohexanone	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Nonane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Isopropylbenzene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Diisobutylketone (DIBK)	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	94	[NT]
a-Methylstyrene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Decane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	94	[NT]
Benzylchloride	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Naphthalene	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Dodecane	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	103	[NT]
TVOC's as hexane in tubes*	µg/tube	50	ORG-022	<50	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate Toluene-d8	%		ORG-022	75	[NT]	[NT]	[NT]	[NT]	97	[NT]
Surrogate 4-Bromofluorobenzene	%		ORG-022	83	[NT]	[NT]	[NT]	[NT]	95	[NT]

Client Reference: 610.19179

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

Client Reference: 610.19179

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.

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.

Stephenson

Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd
ACN 002 600 526 (Incorporated in NSW)
ABN 75 002 600 526

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EMISSION TEST REPORT (ETR) NO. 5816

SCRUBBER STACK EMISSIONS AND BOUNDARY AIR QUALITY MONITORING

NOAKES GROUP PTY LIMITED

MCMAHONS POINT, NSW

PROJECT NO.: **5816/S24645A/17**

DATE OF SURVEY: **13 APRIL 2017**

DATE OF ISSUE: **28 APRIL 2017**

NATA accredited laboratory number 15043.
Accredited for Compliance with ISO/IEC 17025

EMISSION TEST REPORT NO. 5816

	The sampling and analysis was commissioned by:	
Client	Organisation:	Noakes Group Pty Limited
	Contact:	Matthew Millington
	Address:	6 John Street, McMahons Point, NSW 2059
	Telephone:	02 9925 0306
	Email:	matthew@noakes.net.au
	Project Number:	5803/S24632/17
	Test Date:	10 April 2017
	Production Conditions:	Normal painting operating conditions during testing.
	Analysis Requested:	Flow, temperature, moisture, oxygen, Total Solid Particulates and Volatile Organic Compounds.
	Sample Locations:	Spray booth filter and scrubber inlet, Scrubber outlet stack, and Southern boundary
	Sample ID Nos.:	726195 to 726200 inclusive
	Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Test Method Number for Sampling & Analysis*	*NATA Laboratory Analysis By: NATA Accreditation No. & Report No.*
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, ETR No. 5816
Flow	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 5816
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, ETR No. 5816
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, ETR No. 5816
Oxygen	NSW TM-25, USEPA M3A	SEMA, Accreditation No. 15043, ETR No. 5816
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 5816
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 5816
Total Solid Particulates	NSW TM-15, AS4323.2	SEMA, Accreditation No. 15043, PTR No. 2036
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 5816
Volatile Organic Compounds	NSW TM-34, USEPA M18	TestSafe Australia, Accreditation No. 3726, Report No. 2017-1676

Deviations from Test Methods	Nil
Sampling Times	NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2, except for OM-6.
Reference Conditions	NSW – As per (1) Environment Protection Licence conditions, or (2) Part 3 of the Protection of the Environment Operations (Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date: 27 April 2017

P W Stephenson
Managing Director

1.1 SCOPE OF WORK

The scope of work undertaken at Noakes, McMahons Point on April 13, 2017 is tabled below.

Parameter	Stack Locations			Test Method
	Spray booth filter & scrubber inlet	Scrubber outlet stack	Southern boundary ambient	
Flow	✓	✓	--	TM-2
Moisture	✓	✓	--	TM-22
Oxygen	✓	✓	--	TM-25
Volatile Organic Compounds	Single	Single	Single	TM-34
Total Solid Particles	Single	Single	--	TM-15
Inhalable particles	--	--	1 x 4-5 hr sample	AS 3640
Temperature	--	--	✓	TM-2
Wind speed	--	--	✓	
Relative humidity	--	--	✓	TM-2

Key:

TM = test method

AS = Australian Standard

hr = hour

1.2 Production and Monitoring Conditions

Noakes Group personnel considered the boatyard and spray booth were operating under typical conditions on the day of testing. Details of production conditions and surface coatings being used are available from Noakes Group on request.

Emissions from the spray painting activities being conducted on a vessel in the spray booth were measured at:

- the inlet of the extraction system collecting dust, fume and gases which are then processed through a filter bank and wet scrubber installed within the spray booth; and,
- at the scrubber outlet duct discharging gases from the extraction system.

Boundary monitoring was also conducted on the southern side of the spray booth opposite the nearest residence.

During the monitoring survey the following meteorology prevailed:

- Temperature 19.3 – 20.4 degrees celsius
- Relative Humidity 78 – 61 percentage
- Wind Direction South to south-south-west
- Wind Speed 10 – 15 kilometres per hour
- Barometric Pressure 1023 – 1021 hectopascals

1.3 Summary of Emission Test Results – 13 April 2017

Parameter	Unit of measure	Monitoring Location		
		Spray booth filter and scrubber INLET	**Scrubber OUTLET stack**	**Southern boundary**
Stack Temperature	°C	19	19	22
Velocity	m/s	--	7.7	NA
Volumetric Flow	m^3/s	6.4	6.4	NA
Moisture	%	1.3	1.3	NA
Molecular Weight Dry Stack Gas	g/g mole	28.8	28.8	NA
Gas Density	kg/m^3	1.29	1.29	NA
Stack pressure	kPa	101.8	101.8	NA
Oxygen (Average)	%	20.9	20.9	20.9
Total Solid Particulates (TSP)	mg/m^3	**6.58**	**<0.1**	**<0.01**
TSP sample numbers		726198	726199	726200
Volatile Organic Compounds (as n-propane equivalent) (VOC)	mg/m^3	95.2	47.8	1.13
VOC sample numbers		726196	726195	726197
Volatile Organic Compounds (actual uncorrected)	mg/m^3	227	116	2.74

Key:			
	°C	=	degrees Celsius
	%	=	percentage
	<	=	less than
	kg/m^3	=	Kilograms per cubic metre
	kPa	=	Kilo Pascals
	g/g mole	=	grams per gram mole
	m/s	=	metres per second
	m^3/min	=	dry cubic metre per minute 0°C and 101.3 kilopascals (kPa)
	mg/m^3	=	milligrams per cubic metre at 0°C and 101.3 kilopascals (kPa)

1.4 DETAILED SCRUBBER EMISSION TEST RESULTS – TSP

Emission Test Results Project Number & Name Test Location Date	**TSP** 5816 Noakes Scrubber Inlet 13/04/2017	**TSP** 5816 Noakes Scrubber Outlet Stack 13/04/2017
RUN	1	2
Sample Start Time (hrs)	13:30	13:30
Sample Finish Time (hrs)	14:50	14:50
Sample Location (Inlet/Exhaust)	Exhaust	Exhaust
Stack Temperature (^{o}C)	19	19
Stack Cross-Sectional area (m^2)	0.894	0.894
Average Stack Gas Velocity (m/s)	--	8
Actual Gas Flow Volume (am^3/min)	410	410
Total Normal Gas Flow Volume (m^3/min)	380	380
Total Normal Gas Flow Volume (m^3/sec)	6.4	6.4
Total Stack Pressure (kPa)	101.8	101.8
Analysis	TSP	TSP
Method	TM-15	TM-15
SEMA Lab Number	726198	726199
Mass In Sample (mg)	6.93	< 0.1
Air Volume Sampled (am^3)	1.140	1.150
Normal Sample Volume (m^3)	1.05	1.06
Concentration at Stack O_2 (mg/m^3)	**6.58**	**< 0.1**
Mass Emission Rate (g/s)	**0.0422**	**< 0.0006**
Moisture Content (% by volume)	1.3	1.3
Molecular Weight Dry Stack Gas (g/g-mole)	28.8	28.8
Dry Gas Density (kg/m^3)	1.29	1.29
Isokinetic Sampling Rate (%)	97.6	98.5
Sample Storage Period	3 months	3 months
Sampling Performed by	JW, PWS	JW, PWS
Sample Analysed by (Laboratory)	SEMA	SEMA
Calculations Entered by	JW	JW
Calculations Checked by	PWS	PWS

Abbreviations of Personnel:
PWS = Peter Stephenson
JW = Jay Weber

1.5 VOC (SPECIATION DETECTS) EMISSION TEST RESULTS – 13 APRIL 2017

Volatile Organic Compound	Concentration (mg/m³)						Impact Assessment Criteria mg/m³
	Inlet		Outlet		Boundary		
	Normal	n-Propane equiv.	Normal	n-Propane equiv.	Normal	n-Propane equiv.	
Aromatic Hydrocarbons							
Ethylbenzene	1.51	0.62	0.98	0.41	0.08	0.03	8.00
Isopropylbenzene	0.02	0.01	0.01	0.00	ND	ND	--
1,2,3-Trimethylbenzene	0.01	0.00	0.01	0.00	ND	ND	--
1,2,4-Trimethylbenzene	0.09	0.03	0.07	0.03	0.04	0.01	--
1,3,5-Trimethylbenzene	0.02	0.01	0.02	0.01	0.01	0.00	--
Toluene	0.04	0.02	0.04	0.02	0.01	0.00	0.36
p-Xylene & /or m-Xylene	5.70	2.36	3.74	1.55	0.23	0.09	0.19
o-Xylene	1.37	0.57	0.87	0.36	0.06	0.02	0.19
Ketones							
Acetone	0.03	0.02	ND	ND	ND	ND	--
n-Butyl alcohol	0.21	0.12	ND	ND	ND	ND	--

1.6 ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, NSW TM-22, USEPA 4	25%
Oxygen	NSW TM-24, USEPA 3A	1% actual
Particulate > 20 mg/m^3	NSW TM-15, AS4323.2	15%
Particulate < 20 mg/m^3	NSW TM-15, AS4323.2	50%
Velocity	AS4323.1, NSW TM-2, USEPA 2	5%
Volatile Organic Compounds (adsorption tube)	NSW TM-34, USEPA 18	25%

Key:

Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96) (Source – Measurement Uncertainty)

Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK*

Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

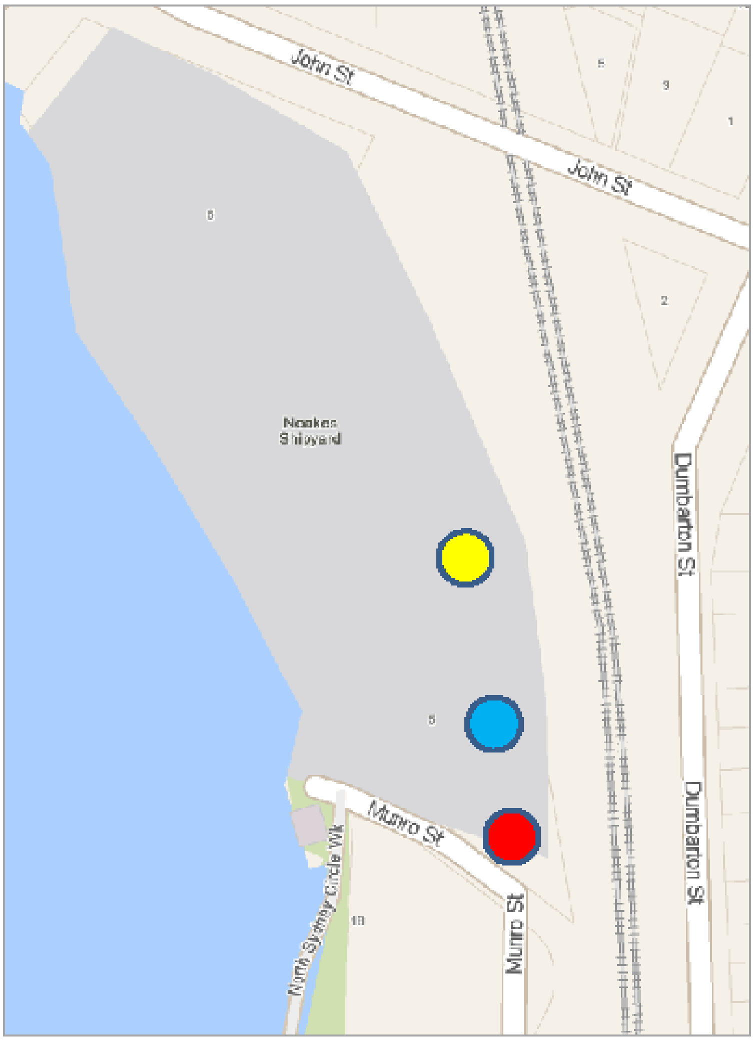
Note: ISO 9096 is for 20-1000 mg/m^{3}- which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m^3 correlates to 5 mg/m^3 with most quoted uncertainties of $\pm$ 5.3 mg/m^3 @ 6.4 mg/m^3. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m^3 under lab conditions.

1.7 Monitoring Locations

Photographs 1-1 to 1-3 show the duct system installed to facilitate collecting a representative sample of the emissions on the exhaust or outlet side of the wet scrubber. Without this duct it would not have been possible to collect a representative sample from the exit of the scrubber.

Refer Figure 1 for a schematic of the monitoring locations.

Figure 1 Monitoring Locations



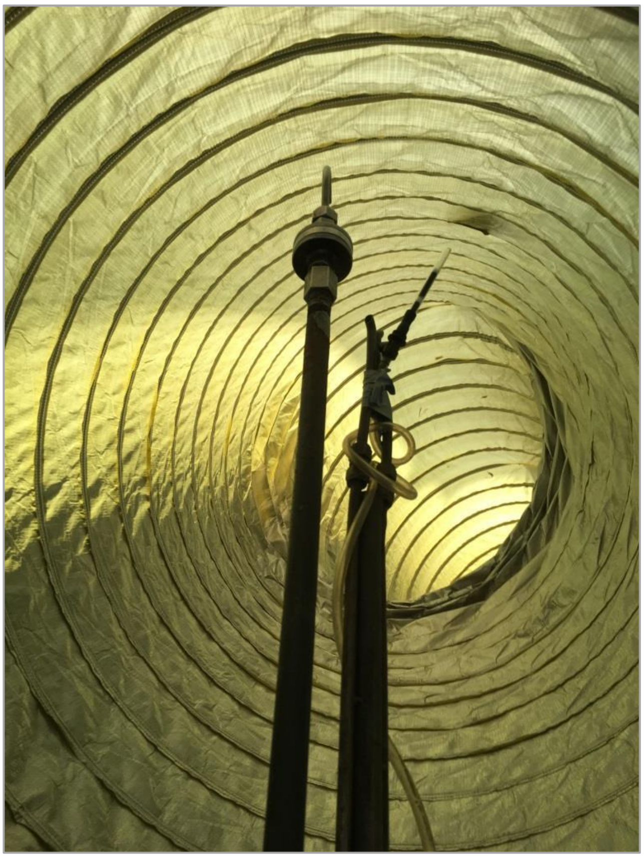
Key:

Inlet monitoring location

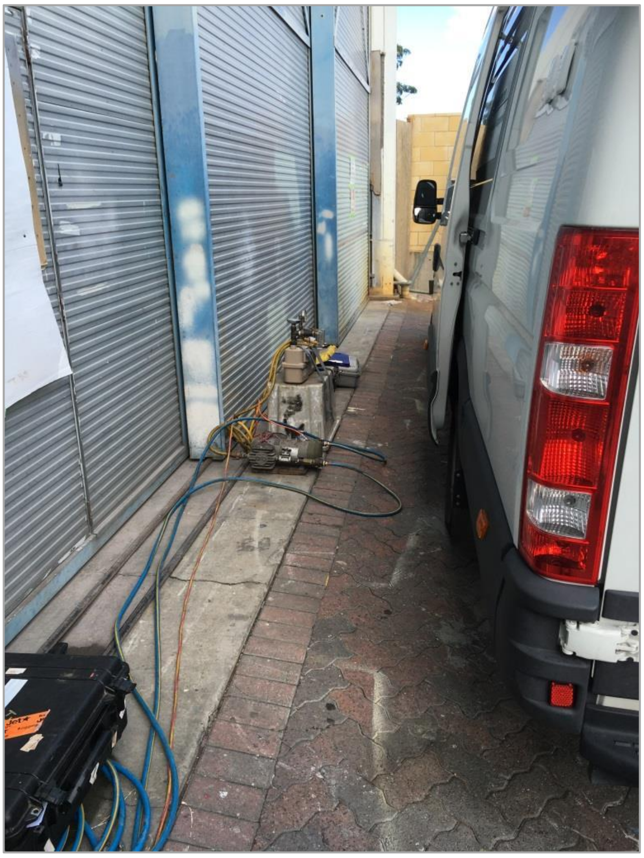
Outlet monitoring location

Boundary monitoring location

Photograph 0-1 Sampling Probes Inside Scrubber Discharge Duct



Photograph 0-2 Emission Monitoring Controls Outside Spray Booth



Photograph 0-3 Showing Duct Conveying Emission from Scrubber Body to Sampling Point to Enable Representative Sample to be Collected

1.8 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
647	Stopwatch	18-Jan-17	18-Jul-17
872	Gas Meter	21-Mar-17	21-Mar-18
904	Gas Meter	06-Jun-16	06-Jun-17
858	Digital Temperature Reader	17-Jan-17	17-Jul-17
894	Thermocouple	17-Jan-17	17-Jul-17
427	Nozzle TSP Swagelok 2	09-Mar-17	09-Mar-18
428	Nozzle TSP Swagelok 3	09-Mar-17	09-Mar-18
815	Digital Manometer	23-Feb-17	23-Feb-18
613	Barometer	23-Feb-17	23-Feb-18
726	Pitot	03-Jun-16	03-Jun-2017 Visually inspected On-Site before use
926	Balance		Response Check with SEMA Site Mass
946	combustion analyzer	17-Feb-17	17-Aug-17
934	Personal Sampler	06-Oct-16	06-Oct-17
834	Personal Sampler	22-Mar-17	22-Mar-18
11	Personal Sampler	05-Aug-16	06-Aug-17
835	Personal Sampler	22-Mar-17	22-Mar-18
531	Calibrator	20-Jan-17	20-Jul-17
927	Balance		Response Check with SEMA Site Mass
Gas Mixtures used for Analyser Span Response			
Conc.	**Mixture**	**Cylinder No.**	**Expiry Date**
902 ppm 9.8% 10.4%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALSB 4980	07-Feb-18

1.9 CONCLUSIONS

During this emission monitoring and boundary ambient air quality monitoring the following conclusions have been drawn:-

- Normal painting processes were being conducted in the spray booth;
- Extraction system and wet scrubber was operating as designed;
- Scrubber was removing particles and paint aerosols efficiently;
- Measured concentrations were:

Inlet

- TSP 6.58 mg/m^3
- VOC 95.2 mg/m^3 (as n-propane)

Outlet

- TSP < 0.1 mg/m^3
- VOC 47.8 mg/m^3 (as n-propane)

Boundary

- TSP < 0.01 mg/m^3
- VOC 1.13 mg/m^3 (as n-propane)

The measured outlet VOC emission concentration exceeded the VOC emission limit of 40 mg/m^3 (as n-propane) for Scheduled Premises as per the Clean Air Regulation under the POEO Act. However, this site may NOT be a Scheduled Premise under the Act, in which case, there is not an emission limit for VOCs. Local Council Nuisance By-Laws will take precedence if this is the case.

The measured boundary ground level speciated VOC concentrations were in compliance with Approved Methods Impact Assessment Criteria with the exception of p-Xylene &/or m-Xylene which marginally exceeded the relevant IAC.

However, although particles and aerosols were being removed efficiently, the VOCs and paint solvent vapours were not being removed effectively by the wet scrubber. This would be expected because impingement wet scrubbers are not designed to remove organic compounds.

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS

Stephenson
Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd
ACN 002 600 526 (Incorporated in NSW)
ABN 75 002 600 526

52A Hampstead Road
Auburn NSW 2144 Australia
Tel: (02) 9737 9991
E-Mail: info@stephensonenv.com.au

Particle Test Report No. 2036

The analysis was commissioned by SEMA on behalf of:

Client	Organisation:	Noakes Group Pty Limited
	Contact:	Matthew Millington
	Address:	6 John street, McMahons Point, NSW 2059
	Telephone:	02 9925 0306
	Email:	matthew@noakes.net.au
	Project Number:	5816/S24645A/17
	Analysis Requested:	Gravimetric – TM-15
	Chain of Custody Number	S24689
	Date Analysis Completed:	18 April 2017
	No. of Samples Tested:	3
	Sample Locations:	Spray booth filter and scrubber inlet, Scrubber outlet stack, and Southern boundary
	Sample ID Nos.:	726198, 726199, 726200
	Filter ID Nos.:	14853, 14852, 14834

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Accredited for Compliance with ISO/IEC 17025.

Identification	The filters are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Analysis Test Method*
TSP	AS4323.2-1995 (R2014)
Total Inspirable Dust	AS3640-2009*

Deviations from Test Methods	Nil

Issue Date

21 April 2017

Jay Weber
Testing Supervisor

Gravimetric Results – Test Report No. 2036

Sample Location	Sample ID No.	Filter ID No	Sampling Date	Analysis Date (Completed)	Sample Mass (g)
Inlet	726198	14853	13/04/2017	18/04/2017	0.00693
Outlet	726199	14852	13/04/2017	18/04/2017	<0.0001
Boundary	726200	14834	13/04/2017	18/04/2017	<0.0001

Key:

g = grams

SafeWork NSW

Test Safe AUSTRALIA

Ali Naghizadeh
Stephenson Environmental Management Australia
PO Box 6398
SILVERWATER NSW 1811

Lab. Reference: 2017-1676

SAMPLE ORIGIN: Project No. 5816

DATE OF INVESTIGATION: 13/04/2017 **DATE RECEIVED:** 18/04/17

ANALYSIS REQUIRED: Volatile Organic Compounds Screen

REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.

Increment and total pagination can be seen on the following pages.

G O'Donnell

Greg O'Donnell

Date: 21/04/17

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ilac-MRA NATA
Accreditation No. 3726
Accredited for compliance with ISO/IEC 17025

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Jay Weber

Sample ID : 726195 **Sample : 2017-1676-1**

No	Compounds	CAS No	Front (µg/section)	Back (µg/section)	No	Compounds	CAS No	Front (µg/section)	Back (µg/section)
	Aliphatic hydrocarbons (LOD = 5µg/compound/section)					**Aromatic hydrocarbons** (LOD = 1µg/compound/section)			
1	2-Methylbutane	78-78-4	ND	ND	39	Benzene	71-43-2	ND	ND
2	n-Pentane	109-66-0	ND	ND	40	Ethylbenzene	100-41-4	167	ND
3	2-Methylpentane	107-83-5	ND	ND	41	Isopropylbenzene	98-82-8	2	ND
4	3-Methylpentane	96-14-0	ND	ND	42	1,2,3-Trimethylbenzene	526-73-8	2	ND
5	Cyclopentane	287-92-3	ND	ND	43	1,2,4-Trimethylbenzene	95-63-6	12	ND
6	Methylcyclopentane	96-37-7	ND	ND	44	1,3,5-Trimethylbenzene	108-67-8	3	ND
7	2,3-Dimethylpentane	565-59-3	ND	ND	45	Styrene	100-42-5	ND	ND
8	n-Hexane	110-54-3	ND	ND	46	Toluene	108-88-3	6	ND
9	3-Methylhexane	589-34-4	ND	ND	47	p-Xylene &/or m-Xylene	106-42-3 & 108-38-3	637	ND
10	Cyclohexane	110-82-7	ND	ND	48	o-Xylene	95-47-6	148	ND
11	Methylcyclohexane	108-87-2	ND	ND		**Ketones** (LOD #49, #54 & #55 =5µg/c/s; #50, #51, #52 & #53 =25µg/c/s)			
12	2,2,4-Trimethylpentane	540-84-1	ND	ND	49	Acetone	67-64-1	ND	ND
13	n-Heptane	142-82-5	ND	ND	50	Acetoin	513-86-0	ND	ND
14	n-Octane	111-65-9	ND	ND	51	Diacetone alcohol	123-42-2	ND	ND
15	n-Nonane	111-84-2	ND	ND	52	Cyclohexanone	108-94-1	ND	ND
16	n-Decane	124-18-5	ND	ND	53	Isophorone	78-59-1	ND	ND
17	n-Undecane	1120-21-4	ND	ND	54	Methyl ethyl ketone (MEK)	78-93-3	ND	ND
18	n-Dodecane	112-40-3	ND	ND	55	Methyl isobutyl ketone (MIBK)	108-10-1	ND	ND
19	n-Tridecane	629-50-5	ND	ND		**Alcohols** (LOD = 25µg/compound/section)			
20	n-Tetradecane	629-59-4	ND	ND	56	Ethyl alcohol	64-17-5	ND	ND
21	α-Pinene	80-56-8	ND	ND	57	n-Butyl alcohol	71-36-3	ND	ND
22	β-Pinene	127-91-3	ND	ND	58	Isobutyl alcohol	78-83-1	ND	ND
23	D-Limonene	138-86-3	ND	ND	59	Isopropyl alcohol	67-63-0	ND	ND
	Chlorinated hydrocarbons (LOD = 5µg/compound/section)				60	2-Ethyl hexanol	104-76-7	ND	ND
24	Dichloromethane	75-09-2	ND	ND	61	Cyclohexanol	108-93-0	ND	ND
25	1,1-Dichloroethane	75-34-3	ND	ND		**Acetates** (LOD = 25µg/compound/section)			
26	1,2-Dichloroethane	107-06-2	ND	ND	62	Ethyl acetate	141-78-6	ND	ND
27	Chloroform	67-66-3	ND	ND	63	n-Propyl acetate	109-60-4	ND	ND
28	1,1,1-Trichloroethane	71-55-6	ND	ND	64	n-Butyl acetate	123-86-4	ND	ND
29	1,1,2-Trichloroethane	79-00-5	ND	ND	65	Isobutyl acetate	110-19-0	ND	ND
30	Trichloroethylene	79-01-6	ND	ND		**Ethers** (LOD = 25µg/compound/section)			
31	Carbon tetrachloride	56-23-5	ND	ND	66	Ethyl ether	60-29-7	ND	ND
32	Perchloroethylene	127-18-4	ND	ND	67	*tert*-Butyl methyl ether (MTBE)	1634-04-4	ND	ND
33	1,1,2,2-Tetrachloroethane	79-34-5	ND	ND	68	Tetrahydrofuran (THF)	109-99-9	ND	ND
34	Chlorobenzene	108-90-7	ND	ND		**Glycols** (LOD = 25µg/compound/section)			
35	1,2-Dichlorobenzene	95-50-1	ND	ND	69	PGME	107-98-2	ND	ND
36	1,4-Dichlorobenzene	106-46-7	ND	ND	70	Ethylene glycol diethyl ether	629-14-1	ND	ND
	Miscellaneous (LOD #37= 5µg & #38=25µg/compound/section)				71	PGMEA	108-65-6	ND	ND
37	Acetonitrile	75-05-8	ND	ND	72	Cellosolve acetate	111-15-9	ND	ND
38	n-Vinyl-2-pyrrolidinone	88-12-0	ND	ND	73	DGMEA	112-15-2	ND	ND
	Total VOCs (LOD =50µg/compound/section)		1441	ND		Worksheet check		YES	YES

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Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Jay Weber
Sample ID : 726196 **Sample : 2017-1676-2**

No	Compounds	CAS No	Front (µg/section)	Back (µg/section)	No	Compounds	CAS No	Front (µg/section)	Back (µg/section)
	Aliphatic hydrocarbons (LOD = 5µg/compound/section)					**Aromatic hydrocarbons** (LOD = 1µg/compound/section)			
1	2-Methylbutane	*78-78-4*	ND	ND	39	Benzene	*71-43-2*	ND	ND
2	n-Pentane	*109-66-0*	ND	ND	40	Ethylbenzene	*100-41-4*	257	ND
3	2-Methylpentane	*107-83-5*	ND	ND	41	Isopropylbenzene	*98-82-8*	3	ND
4	3-Methylpentane	*96-14-0*	ND	ND	42	1,2,3-Trimethylbenzene	*526-73-8*	2	ND
5	Cyclopentane	*287-92-3*	ND	ND	43	1,2,4-Trimethylbenzene	*95-63-6*	16	ND
6	Methylcyclopentane	*96-37-7*	ND	ND	44	1,3,5-Trimethylbenzene	*108-67-8*	4	ND
7	2,3-Dimethylpentane	*565-59-3*	ND	ND	45	Styrene	*100-42-5*	ND	ND
8	n-Hexane	*110-54-3*	ND	ND	46	Toluene	*108-88-3*	6	ND
9	3-Methylhexane	*589-34-4*	ND	ND	47	p-Xylene &/or m-Xylene	*106-42-3 & 108-38-3*	972	ND
10	Cyclohexane	*110-82-7*	ND	ND	48	o-Xylene	*95-47-6*	234	Below
11	Methylcyclohexane	*108-87-2*	ND	ND		**Ketones** (LOD #49, #54 & #55 =5µg/c/s; #50, #51, #52 & #53 =25µg/c/s)			
12	2,2,4-Trimethylpentane	*540-84-1*	ND	ND	49	Acetone	*67-64-1*	5	ND
13	n-Heptane	*142-82-5*	ND	ND	50	Acetoin	*513-86-0*	ND	ND
14	n-Octane	*111-65-9*	ND	ND	51	Diacetone alcohol	*123-42-2*	ND	ND
15	n-Nonane	*111-84-2*	ND	ND	52	Cyclohexanone	*108-94-1*	ND	ND
16	n-Decane	*124-18-5*	ND	ND	53	Isophorone	*78-59-1*	ND	ND
17	n-Undecane	*1120-21-4*	ND	ND	54	Methyl ethyl ketone (MEK)	*78-93-3*	ND	ND
18	n-Dodecane	*112-40-3*	ND	ND	55	Methyl isobutyl ketone (MIBK)	*108-10-1*	ND	ND
19	n-Tridecane	*629-50-5*	ND	ND		**Alcohols** (LOD = 25µg/compound/section)			
20	n-Tetradecane	*629-59-4*	ND	ND	56	Ethyl alcohol	*64-17-5*	ND	ND
21	α-Pinene	*80-56-8*	ND	ND	57	n-Butyl alcohol	*71-36-3*	35	ND
22	β-Pinene	*127-91-3*	ND	ND	58	Isobutyl alcohol	*78-83-1*	ND	ND
23	D-Limonene	*138-86-3*	ND	ND	59	Isopropyl alcohol	*67-63-0*	ND	ND
	Chlorinated hydrocarbons (LOD = 5µg/compound/section)				60	2-Ethyl hexanol	*104-76-7*	ND	ND
24	Dichloromethane	*75-09-2*	ND	ND	61	Cyclohexanol	*108-93-0*	ND	ND
25	1,1-Dichloroethane	*75-34-3*	ND	ND		**Acetates** (LOD = 25µg/compound/section)			
26	1,2-Dichloroethane	*107-06-2*	ND	ND	62	Ethyl acetate	*141-78-6*	ND	ND
27	Chloroform	*67-66-3*	ND	ND	63	n-Propyl acetate	*109-60-4*	ND	ND
28	1,1,1-Trichloroethane	*71-55-6*	ND	ND	64	n-Butyl acetate	*123-86-4*	ND	ND
29	1,1,2-Trichloroethane	*79-00-5*	ND	ND	65	Isobutyl acetate	*110-19-0*	ND	ND
30	Trichloroethylene	*79-01-6*	ND	ND		**Ethers** (LOD = 25µg/compound/section)			
31	Carbon tetrachloride	*56-23-5*	ND	ND	66	Ethyl ether	*60-29-7*	ND	ND
32	Perchloroethylene	*127-18-4*	ND	ND	67	*tert*-Butyl methyl ether (MTBE)	*1634-04-4*	ND	ND
33	1,1,2,2-Tetrachloroethane	*79-34-5*	ND	ND	68	Tetrahydrofuran (THF)	*109-99-9*	ND	ND
34	Chlorobenzene	*108-90-7*	ND	ND		**Glycols** (LOD = 25µg/compound/section)			
35	1,2-Dichlorobenzene	*95-50-1*	ND	ND	69	PGME	*107-98-2*	ND	ND
36	1,4-Dichlorobenzene	*106-46-7*	ND	ND	70	Ethylene glycol diethyl ether	*629-14-1*	ND	ND
	Miscellaneous (LOD #37= 5µg & #38=25µg/compound/section)				71	PGMEA	*108-65-6*	ND	ND
37	Acetonitrile	*75-05-8*	ND	ND	72	Cellosolve acetate	*111-15-9*	ND	ND
38	n-Vinyl-2-pyrrolidinone	*88-12-0*	ND	ND	73	DGMEA	*112-15-2*	ND	ND
	Total VOCs (LOD =50µg/compound/section)		2260	ND		Worksheet check		YES	YES

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Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Jay Weber

Sample ID : 726197 **Sample : 2017-1676-3**

No	Compounds	CAS No	Front	Back	No	Compounds	CAS No	Front	Back
			µg/section					µg/section	
	Aliphatic hydrocarbons (LOD = 5µg/compound/section)					**Aromatic hydrocarbons** (LOD = 1µg/compound/section)			
1	2-Methylbutane	*78-78-4*	ND	ND	39	Benzene	*71-43-2*	ND	ND
2	n-Pentane	*109-66-0*	ND	ND	40	Ethylbenzene	*100-41-4*	14	ND
3	2-Methylpentane	*107-83-5*	ND	ND	41	Isopropylbenzene	*98-82-8*	ND	ND
4	3-Methylpentane	*96-14-0*	ND	ND	42	1,2,3-Trimethylbenzene	*526-73-8*	ND	ND
5	Cyclopentane	*287-92-3*	ND	ND	43	1,2,4-Trimethylbenzene	*95-63-6*	6	ND
6	Methylcyclopentane	*96-37-7*	ND	ND	44	1,3,5-Trimethylbenzene	*108-67-8*	1	ND
7	2,3-Dimethylpentane	*565-59-3*	ND	ND	45	Styrene	*100-42-5*	ND	ND
8	n-Hexane	*110-54-3*	ND	ND	46	Toluene	*108-88-3*	1	ND
9	3-Methylhexane	*589-34-4*	ND	ND	47	p-Xylene &/or m-Xylene	*106-42-3 & 108-38-3*	39	ND
10	Cyclohexane	*110-82-7*	ND	ND	48	o-Xylene	*95-47-6*	10	ND
11	Methylcyclohexane	*108-87-2*	ND	ND		**Ketones** (LOD #49, #54 & #55 =5µg/c/s; #50, #51, #52 & #53 =25µg/c/s)			
12	2,2,4-Trimethylpentane	*540-84-1*	ND	ND	49	Acetone	*67-64-1*	ND	ND
13	n-Heptane	*142-82-5*	ND	ND	50	Acetoin	*513-86-0*	ND	ND
14	n-Octane	*111-65-9*	ND	ND	51	Diacetone alcohol	*123-42-2*	ND	ND
15	n-Nonane	*111-84-2*	ND	ND	52	Cyclohexanone	*108-94-1*	ND	ND
16	n-Decane	*124-18-5*	ND	ND	53	Isophorone	*78-59-1*	ND	ND
17	n-Undecane	*1120-21-4*	ND	ND	54	Methyl ethyl ketone (MEK)	*78-93-3*	ND	ND
18	n-Dodecane	*112-40-3*	ND	ND	55	Methyl isobutyl ketone (MIBK)	*108-10-1*	ND	ND
19	n-Tridecane	*629-50-5*	ND	ND		**Alcohols** (LOD = 25µg/compound/section)			
20	n-Tetradecane	*629-59-4*	ND	ND	56	Ethyl alcohol	*64-17-5*	ND	ND
21	α-Pinene	*80-56-8*	ND	ND	57	n-Butyl alcohol	*71-36-3*	ND	ND
22	β-Pinene	*127-91-3*	ND	ND	58	Isobutyl alcohol	*78-83-1*	ND	ND
23	D-Limonene	*138-86-3*	ND	ND	59	Isopropyl alcohol	*67-63-0*	ND	ND
	Chlorinated hydrocarbons (LOD = 5µg/compound/section)				60	2-Ethyl hexanol	*104-76-7*	ND	ND
24	Dichloromethane	*75-09-2*	ND	ND	61	Cyclohexanol	*108-93-0*	ND	ND
25	1,1-Dichloroethane	*75-34-3*	ND	ND		**Acetates** (LOD = 25µg/compound/section)			
26	1,2-Dichloroethane	*107-06-2*	ND	ND	62	Ethyl acetate	*141-78-6*	ND	ND
27	Chloroform	*67-66-3*	ND	ND	63	n-Propyl acetate	*109-60-4*	ND	ND
28	1,1,1-Trichloroethane	*71-55-6*	ND	ND	64	n-Butyl acetate	*123-86-4*	ND	ND
29	1,1,2-Trichloroethane	*79-00-5*	ND	ND	65	Isobutyl acetate	*110-19-0*	ND	ND
30	Trichloroethylene	*79-01-6*	ND	ND		**Ethers** (LOD = 25µg/compound/section)			
31	Carbon tetrachloride	*56-23-5*	ND	ND	66	Ethyl ether	*60-29-7*	ND	ND
32	Perchloroethylene	*127-18-4*	ND	ND	67	*tert*-Butyl methyl ether (MTBE)	*1634-04-4*	ND	ND
33	1,1,2,2-Tetrachloroethane	*79-34-5*	ND	ND	68	Tetrahydrofuran (THF)	*109-99-9*	ND	ND
34	Chlorobenzene	*108-90-7*	ND	ND		**Glycols** (LOD = 25µg/compound/section)			
35	1,2-Dichlorobenzene	*95-50-1*	ND	ND	69	PGME	*107-98-2*	ND	ND
36	1,4-Dichlorobenzene	*106-46-7*	ND	ND	70	Ethylene glycol diethyl ether	*629-14-1*	ND	ND
	Miscellaneous (LOD #37= 5µg & #38=25µg/compound/section)				71	PGMEA	*108-65-6*	ND	ND
37	Acetonitrile	*75-05-8*	ND	ND	72	Cellosolve acetate	*111-15-9*	ND	ND
38	n-Vinyl-2-pyrrolidinone	*88-12-0*	ND	ND	73	DGMEA	*112-15-2*	ND	ND
	Total VOCs (LOD =50µg/compound/section)		93	ND		Worksheet check		YES	YES

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SafeWork NSW

Test Safe AUSTRALIA

Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Jay Weber

Stephenson Environmental Management Australia

ND = Not Detected
VOCs = Volatile Organic Compounds
All compounds numbered 1-73 are included of this analysis in the scope of NATA accreditation. Any additional compounds attonated with * are not covered by NATA accreditation.

Method : Analysis of Volatile Organic Compounds in Workplace Air by Gas Chromatography/Mass Spectrometry
Method Number : WCA.207
Detection Limit : 5µg/section; 25µg/section for oxygenated hydrocarbons except acetone, MEK and MIBK at 5µg/section and aromatic hydrocarbon at 1µg/section.
Brief Description : Volatile organic compounds are trapped from the workplace air onto charcoal tubes by the use of a personal air monitoring pump. The volatile organic compounds are then desorbed from the charcoal in the laboratory with CS_2. An aliquot of the desorbant is analysed by capillary gas chromatography with mass spectrometry detection.

Total Volatile Organic Compounds (TVOC) test result in µg/section is calculated by comparison to the average mass detector response of the 73 quantified compounds. The response of a mass detector is dependent on the fragmentation of the molecule. Therefore, the TVOC test result should be interpreted as a semi-quantitative guide to the amount of VOCs present. If the TVOC test result is less than the addition of the total amount of the 73 quantified compounds then the TVOC result is of little value other than for comparative purposes. If the TVOC test result is greater than the addition of all the compounds quantified then this can indicate that there are additional compounds present other than the 73 quantified compounds reported.

PGME : Propylene Glycol Monomethyl Ether
PGMEA : Propylene Glycol Monomethyl Ether Acetate
DGMEA : Diethylene Glycol Monoethyl Ether Acetate

Measurement Uncertainty
The measurement uncertainty is an estimate that characterises the range of values within which the true value is asserted to lie. The uncertainty estimate is an expanded uncertainty using a coverage factor of 2, which gives a level of confidence of approximately 95%. The estimate is compliant with the "ISO Guide to the Expression of Uncertainty in Measurement" and is a full estimate based on in-house method validation and quality control data.

Quality Assurance
In order to ensure the highest degree of accuracy and precision in our analytical results, we undertake extensive intra- and inter-laboratory quality assurance (QA) activities. Within our own laboratory, we analyse laboratory and field blanks and perform duplicate and repeat analysis of samples. Spiked QA samples are also included routinely in each run to ensure the accuracy of the analyses. WorkCover Laboratory Services has participated for many years in several national and international inter-laboratory comparison programs listed below:-

- Workplace Analysis Scheme for Proficiency (WASP) conducted by the Health & Safety Executive UK;
- Quality Management in Occupational and Environmental Medicine QA Program, conducted by the Institute for Occupational, Social and Environmental Medicine, University of Erlangen – Nuremberg, Germany;
- Quality Control Technologies QA Program, Australia;
- Royal College of Pathologists QA Program, Australia.

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APPENDIX B

Meteorological Modelling

Selection of Representative Year for Meteorological Modelling

Meteorological data collected over the period 2015-2019 at Sydney Olympic Park AWS (Station #66212) and Sydney Airport AWS (Station #66037), located 12 kilometres (km) to the west-northwest and south-southwest respectively, were analysed to select a representative year for dispersion modelling. The analysis showed that data collected during the 2018 calendar year are in reasonably good agreement with 5-year averages and was therefore selected for use in this assessment.

It is noted that meteorological monitoring is also performed by the NSW Department of Planning, Industry and Environment's Environment (DPIE), Environment, Energy and Science group (EES) at a number of the Air Quality Monitoring Stations (AQMSs) they operate. Rozelle AQMS is located in close proximity to the site (approximately 4 km southwest). However, meteorological data from this station was not used in the assessment as the station does not comply with the relevant siting Standards due to the presence of trees within 10 m of the AQMS.

Data collected by the Sydney Olympic Park AWS and Sydney Airport AWS from 2015-2019 is summarised in **Figure B1** to **Figure B3**. Examination of the data indicates the following:

- **Figure B1** indicates relatively similar wind direction frequencies for all years analysed;
- **Figure B2** indicates that 2018 and 2019 exhibit wind speeds that are closest to the 5-year average; and
- **Figure B3** shows that temperatures in 2017 and 2018 most closely reflect the 5-year average.

Figure B1 Frequency of Winds at Sydney Olympic Park AWS and Sydney Airport AWS for 2015-2019

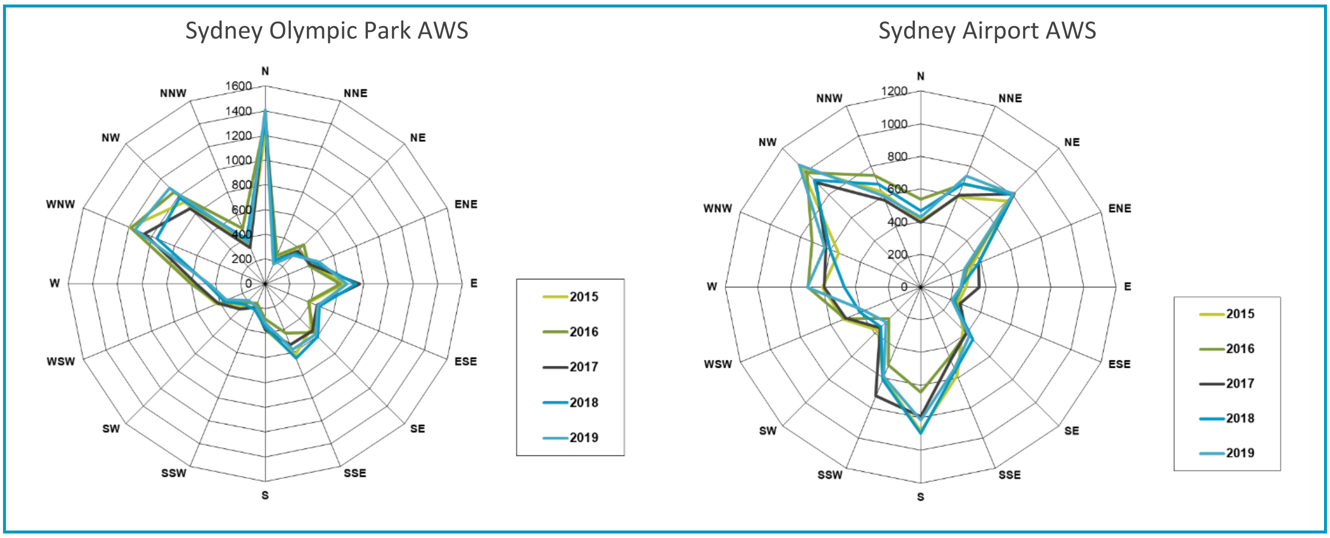


Figure B2 Monthly Average Wind Speed at Sydney Olympic Park AWS and Sydney Airport AWS for 2015-2019

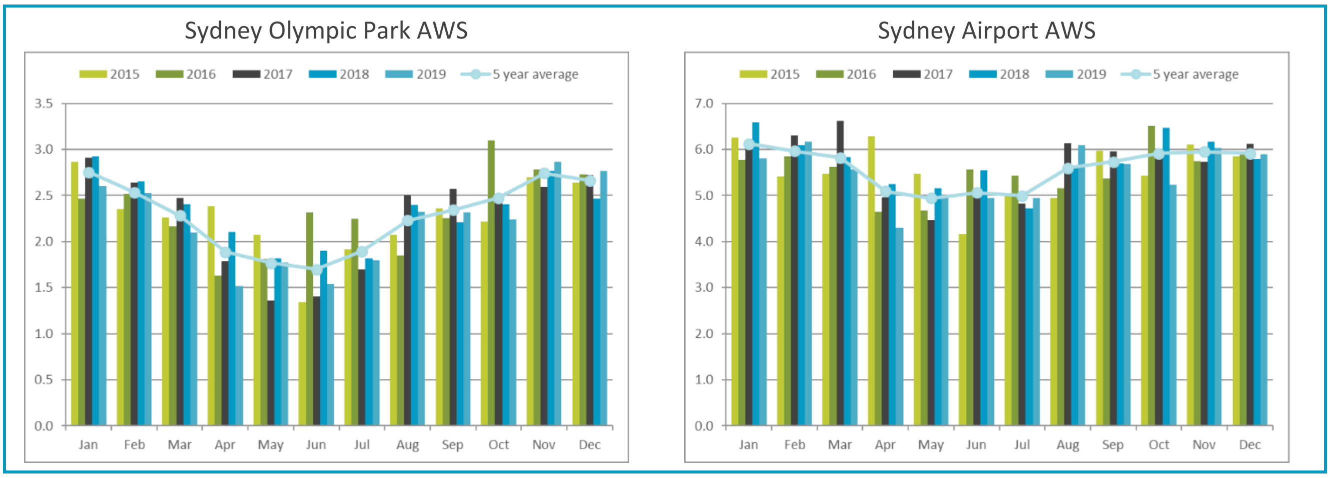
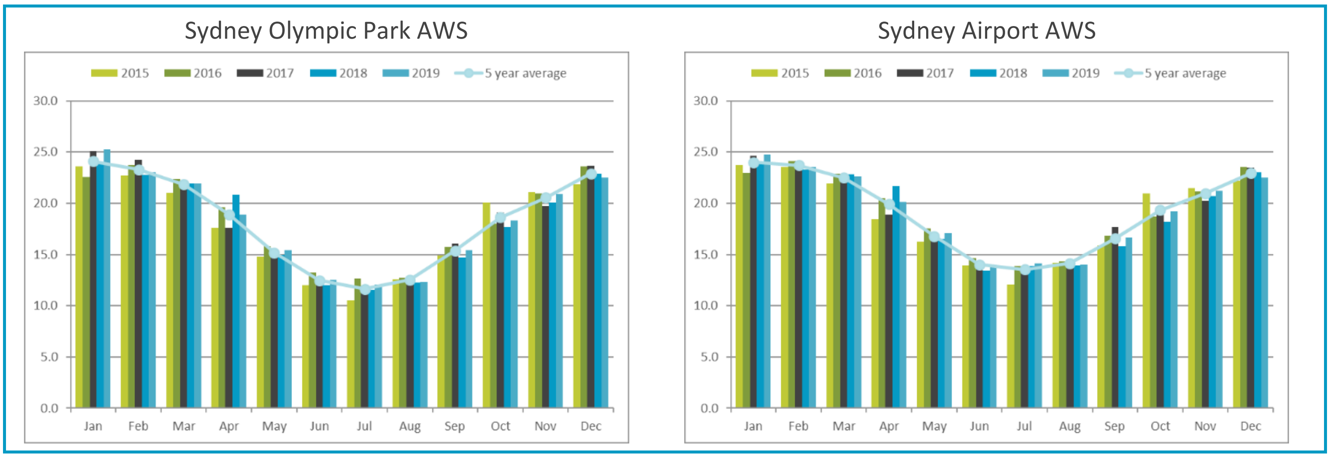


Figure B3 Monthly Average Temperature at Sydney Olympic Park AWS and Sydney Airport AWS for 2015-2019



Meteorological Modelling - TAPM

In order to calculate all required meteorological parameters required by the dispersion modelling process, meteorological modelling using The Air Pollution Model (TAPM, v 4.0.4) has been performed. TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model that may be used to predict three-dimensional meteorological data and air pollution concentrations.

TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

TAPM may assimilate actual local wind observations so that they can optionally be included in a model solution. Given that TAPM is known to underpredict calm wind conditions, the wind speed and direction observations obtained from the nearest BoM and EES AQMS stations have also been used in the subsequent CALMET component of the modelling.

The three dimensional output data from TAPM was used as input for the diagnostic meteorological model (CALMET).

Table B1 Meteorological Parameters used for this Study (TAPM v 4.0.4)

Modelling Period	31 December 2017 to 1 January 2019
Centre of analysis	331,175 mE 6,252,053 mS (UTM Coordinates)
Number of grid points	42 × 42 × 35
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Data assimilation	Fort Denison AWS (#66022), Sydney Olympic Park AWS (#66212), Manly AWS (#66197), Sydney Airport AWS (#66037), Kurnell AWS (#66043), Little Bay AWS (#66051), Terrey Hills AWS (#66059), Bankstown AWS (#66137), Randwick AQMS, Lindfield AQMS, Macquarie Park AQMS
Terrain	AUSLIG 9 second DEM

Meteorological Modelling - CALMET

In the simplest terms, CALMET is a meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field. The final wind field thus reflects the influences of local topography and current land uses.

CALMET modelling was conducted using a nested approach to generate 30 m resolution wind fields across the innermost grid to ensure that the complex topography and land use of the area surrounding the site is appropriately accounted for. Surface observations from surrounding meteorological stations located within the modelling domain were incorporated in the model, together with data extracted from the innermost TAPM grid. **Table B2** details the parameters used in the CALMET meteorological modelling.

Table B2 CALMET Configuration Used for this Study

Modelling Period	1 January 2018 to 31 December 2018
Nest 1	
Centre of analysis	330,000 mE, 6,251,100 mS (UTM Coordinates)
Meteorological grid domain (Meteorological grid resolution)	20 km x 20 km (0.4 km)
Vertical Resolution (Cell Heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)

Modelling Period	1 January 2018 to 31 December 2018
Data Assimilation	Sydney Olympic Park AWS (66212), Sydney Airport AWS (66037), Fort Denison AWS (66022), gap filled with TAPM[4]
Nest 2	
Centre of analysis	332,540 mE, 6,252,830 mS (UTM Coordinates)
Meteorological grid domain (Meteorological grid resolution)	10 km x 10 km (0.2 km)
Vertical Resolution (Cell Heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data Assimilation	Nest 1 outputs
Nest 3	
Centre of analysis	333,530 mE, 6,253,825 mS (UTM Coordinates)
Meteorological grid domain (Meteorological grid resolution)	5 km x 5 km (0.1 km)
Vertical Resolution (Cell Heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data Assimilation	Nest 2 outputs
Nest 4	
Centre of analysis	333,495 mE, 6,253,795 mS (UTM Coordinates)
Meteorological grid domain (Meteorological grid resolution)	0.9 km x 0.9 km (0.03 km)
Vertical Resolution (Cell Heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data Assimilation	Nest 3 outputs

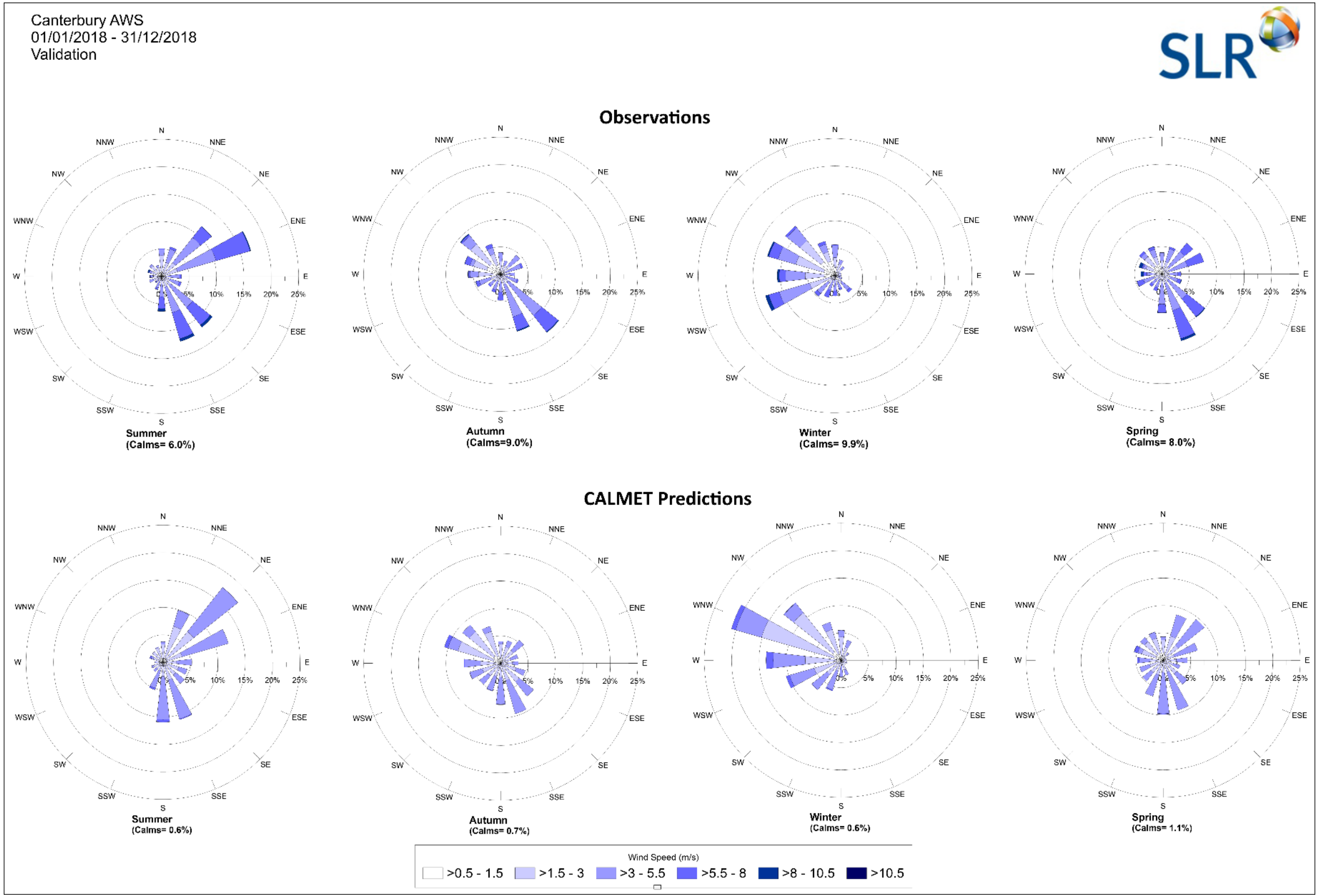
Meteorological Data Validation

To provide confidence in the site-representative meteorological dataset generated using TAPM and CALMET, a meteorological data representative of the Canterbury Racecourse AWS (Station #66194) was extracted from the model output using the methodology used for generating site representative meteorological data outlined in above. These predicted data were than compared against the observational data recorded at Canterbury Racecourse for validation. Observational data from Canterbury Racecourse AWS was not assimilated into the TAPM and CALMET runs to ensure a robust validation.

A comparison of the modelled and observed wind data at Canterbury Racecourse AWS is presented as seasonal wind roses in **Figure B4**. As illustrated, predicted wind directions are in reasonably good agreement with the observational data for all seasons. The wind speeds predicted by the model are noticeably lower than those recorded by the Canterbury Racecourse AWS. As low wind speed conditions are associated with poor dispersion of air pollutants, this will lead to overestimation of pollutant concentrations for near-field receptors.

[4] Data predicted by TAPM (extracted at 337,925 mE, 6260.303 mS) was used to complete the surface meteorology dataset. TAPM data was only used for hours that data was missing from all three included BoM weather stations. In total, between 1 to 10 hours of missing data were identified for the various parameters required by CALMET.

Figure B4 Comparison of Modelled and Observed Wind Data – Canterbury Racecourse AWS



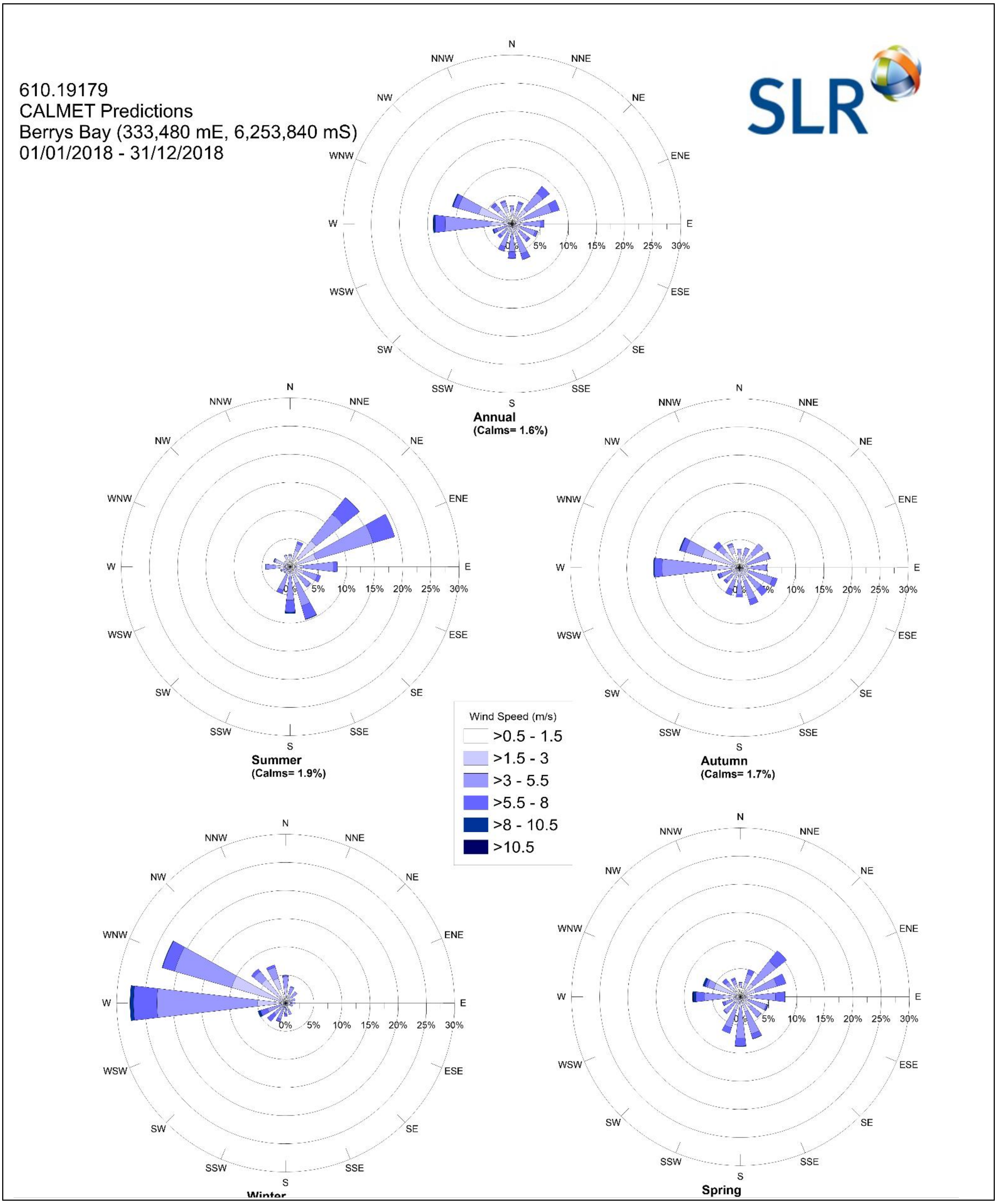
Meteorological Data Used in Modelling

Wind Speed and Direction

A summary of the annual wind behaviour predicted by CALMET at the site is presented as wind roses in **Figure B5**. A review of the wind roses indicates that, on an annual basis, dominant winds are light (between 3 m/s and 5.3 m/s) and blow from the west and west-northwest. Calm wind conditions (wind speed less than 0.5 m/s) were predicted to occur only 1.6% of the time throughout the modelling period.

The seasonal wind roses indicate that in summer, the winds blow predominantly from the northeast and east-northeast, with a very low frequency of winds from the southwest and northwest quadrants In autumn, winds from the west and west-northwest are predominant, with a relatively similar frequency of winds from all other directions. The frequency of winds from the west and west-northwest increase further in winter, with very few winds from other directions. In spring, winds blow from all directions, with the highest frequency of winds from the east-northeast quadrant and the lowest frequency of winds from the north-northwest quadrant. The predicted occurrence of calm conditions is relatively similar for all seasons, ranging from 1.1% in winter to 1.9% in summer.

Figure B5 Predicted Seasonal Wind Roses for the Site (CALMET, 2018)



Atmospheric Stability

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Gifford-Turner (PGT) assignment scheme identifies six stability classes, A to F, to categorise the degree of atmospheric stability as follows:

- A = Extremely unstable conditions
- B = Moderately unstable conditions
- C = Slightly unstable conditions
- D = Neutral conditions
- E = Slightly stable conditions
- F = Moderately stable conditions

The meteorological conditions defining each PGT stability class are shown in **Table B3**.

Table B3 Meteorological Conditions Defining PGT Stability Classes

Surface Wind Speed (m/s)	Daytime Insolation			Night-Time Conditions	
	Strong	**Moderate**	**Slight**	**Thin overcast or > 4/8 low cloud**	**<= 4/8 cloudiness**
< 2	A	A - B	B	E	F
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	C	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D

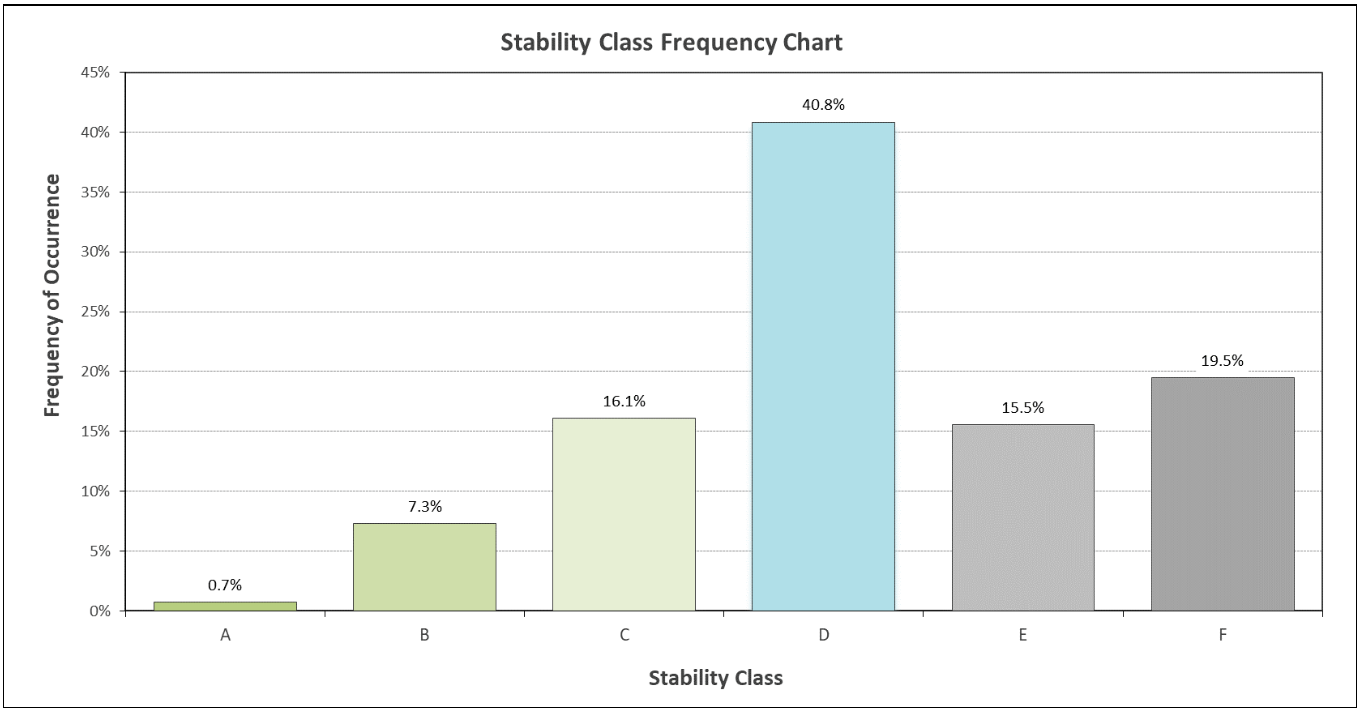
Source: (NOAA, 2018)

Notes:

1. Strong insolation corresponds to sunny midday in midsummer in England; slight insolation to similar conditions in midwinter.
2. Night refers to the period from 1 hour before sunset to 1 hour after sunrise.
3. The neutral category D should also be used, regardless of wind speed, for overcast conditions during day or night and for any sky conditions during the hour preceding or following night as defined above.

The frequency of each stability class predicted by CALMET at the site over the modelling period is presented in **Figure B6**. The results indicate a high frequency of conditions typical to Stability Class D. The predominance of Stability Class D is associated with the relatively high frequency of high wind speed conditions, which limit the formation of very stable conditions.

Figure B6 Predicted Stability Class Frequencies at the Site (CALMET predictions, 2018)

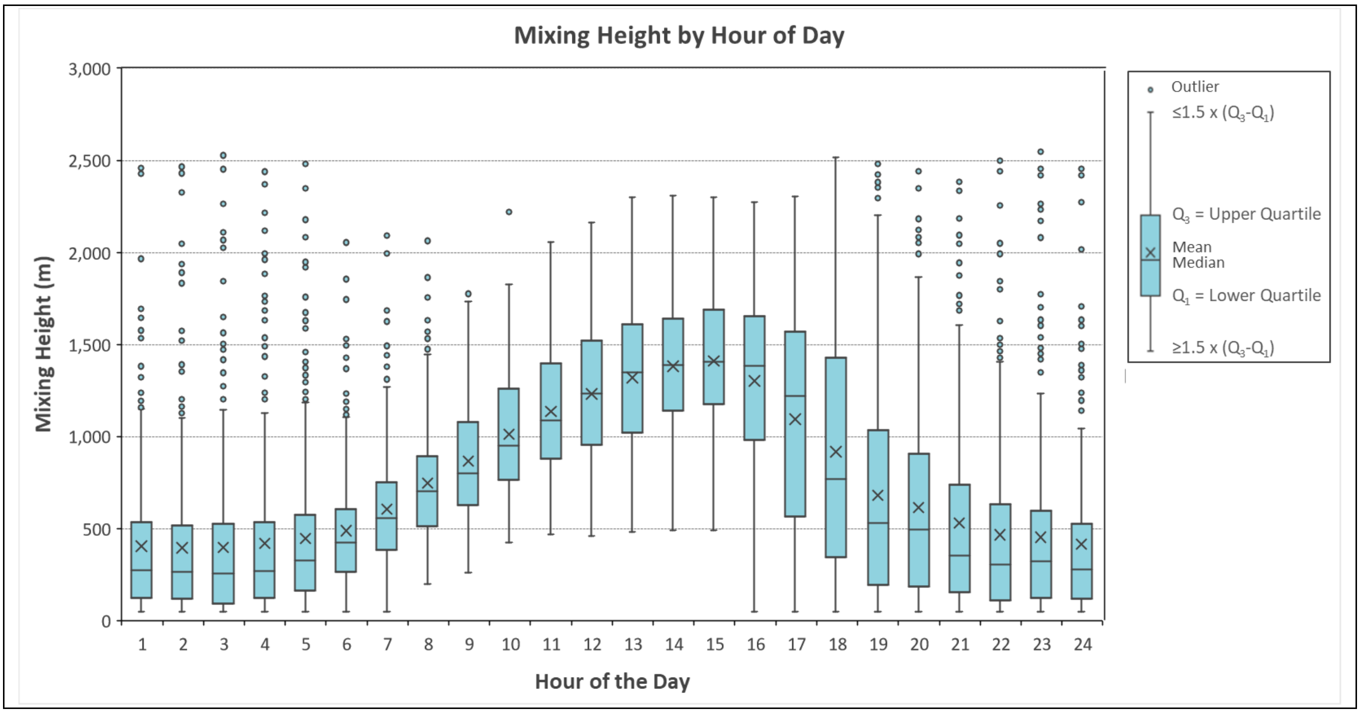


Mixing Heights

Diurnal variations in maximum and average mixing heights predicted by CALMET at the Site during the 2015 modelling period are illustrated in **Figure B7**.

As would be expected, an increase in mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground based temperature inversions and growth of the convective mixing layer.

Figure B7 Predicted Mixing Heights at the Site (CALMET predictions, 2018)



APPENDIX C

MSDS Review

Table D1 Materials Used on Site Containing Toxic Organic Compounds

Substance	Acetone	Benzene	Ethanolamine	Ethylbenzene	MDI (diphenylmethane diisocyanate)	Propylene glycol monomethyl ether	Trimethylbenzene (mixed isomers)
CAS #	67-64-1	71-43-2	141-43-5	100-41-4	101-68-8	107-98-2	95-63-6
Number Of Material Containing Substance	2	1	1	30	1	4	10
Impact Assessment Criteria (mg/m^3)	22	0.029	0.14	8	0.00004	6.6	2.2
Impact Assessment Criteria (ppm)	9.2	0.009	0.05	1.8	0.000004	1.8	0.46
Criteria Basis	Toxics						
545 Epoxy Primer Gray Base						6.25	
Acetone	100						
Oeseries Awlcraft Se Oe Series				6.25		6.25	
Altex Primashield Antifouling Sealer				5.5			5.5
Altex Chembar 3500 Primer				5.5			5.5
International Thinner-Eqpt Cleaner				6.25			
International Thinner-Eqpt Cleaner				17.5			
Gun Wash Solvent	35			1.7			
Intergard 269 Red Part A				1.75			
Intergard 269 Part B				6.25			
Interline 704 Grey Part A				6.25			
Interline 704 Part B				6.25			
Interline 850 Buff Part A							1.75
Interprime 4198 Grey				6.25			1.75
Interprime 820 Part B							6.25
Interprotect Hardener				6.25			
Interprotect High Build Part A				6.25			

Substance	Acetone	Benzene	Ethanolamine	Ethylbenzene	MDI (diphenylmethane diisocyanate)	Propylene glycol monomethyl ether	Trimethylbenzene (mixed isomers)
Interseal 670Hs Golden Yellow Part A				1.75		1.75	
Intershield 300 Bronze Part A				1.75			
Intershield 300 Part B				6.25			
Interspeed 376 Black				6.25			
Interthane 987 Lsac Lg N42 Storm Grey				6.25			
Interthane 990 White Part A				6.25			
Interthane 990 Golden Yellow Part A				6.25			
Interzone 954 Black Part A				1.75			
Micron Extra 2 Blue				1.75			6.25
Mineral Turpentine		0.1					20
Northane Hardener				3			
Primocon Grey							17.5
Captain Jack'S Varnish							1
Tankguard Hb Classic Comp A				5			
Tankguard Hb Classic Comp B				10			
Jotun Thinner No. 17				10			
Shipshape Primer Undercoat - Base						5.9	
Sikaflex-291				0.625	0.55		
3M™ Stainless Steel Cleaner & Polish			0.55				
Ultra 2 Black				1.75			1.75
Vc Offshore Hard Racing Antifouling Dover White				6.25			
Altex Epoxy High Build Surfacer				1			

Table D2 Materials Used on Site Containing Odorous Organic Compounds

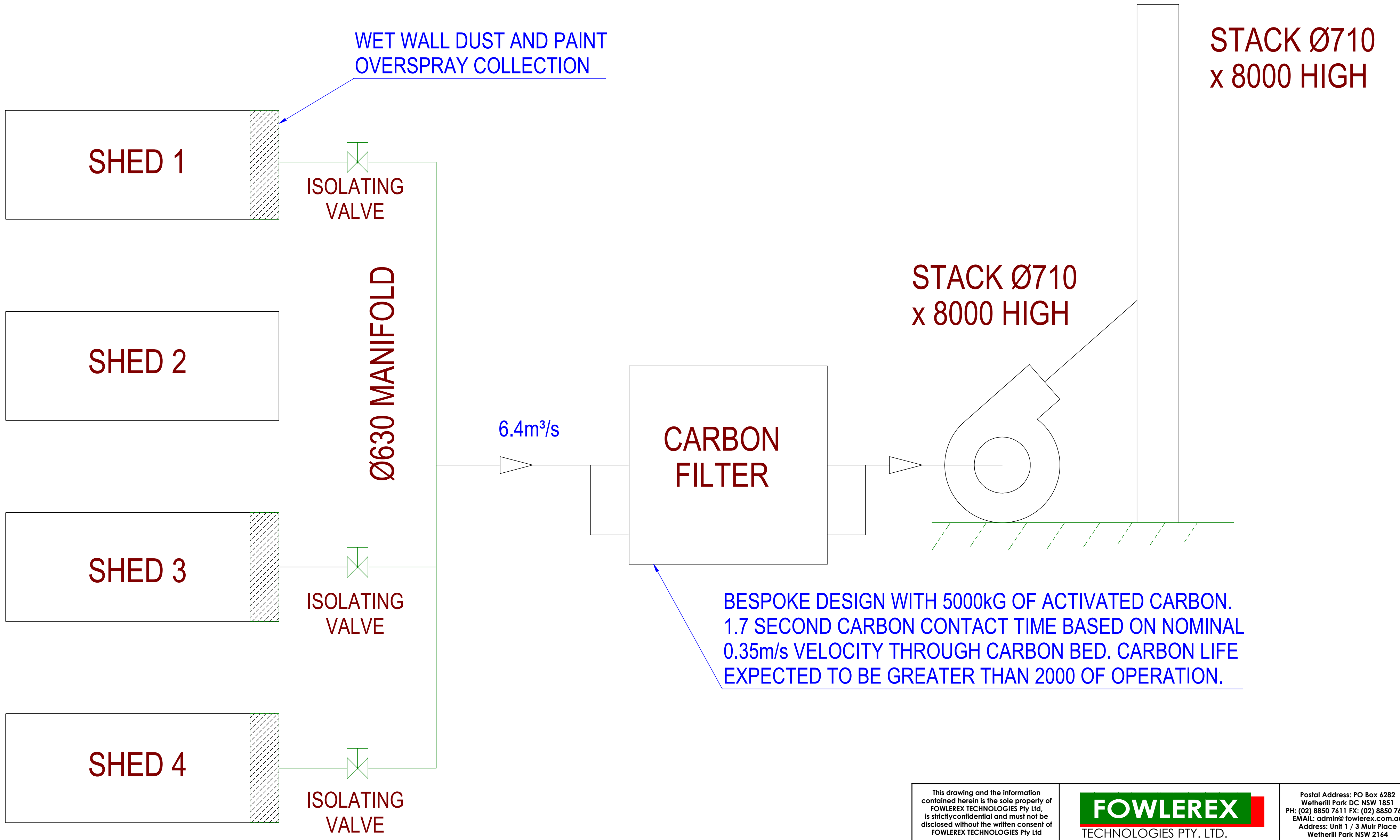
Substance	Cumene	Cyclohexanone	Ethanol	Ethyl acetate	Methanol	Methyl ethyl ketone	Methyl isobutyl ketone	n-butanol	n-butyl acetate	Toluene	Xylenes
CAS #	98-82-8	108-94-1	64-17-5	141-78-6	67-56-1	78-93-3	108-10-1	71-36-3	123-86-4	108-88-3	1330-20-7
Number Of Material Containing Substance	1	4	1	1	2	2	5	19	4	4	44
Impact Assessment Criteria (mg/m3)	0.021	0.26	2.1	12.1	3	3.2	0.23	0.5	1.02	0.36	0.19
Impact Assessment Criteria (ppm)	0.004	0.07	1.1	3.5	2.4	1.1	0.05	0.16	0.21	0.09	0.04
Criteria Basis	Odour										
545 Epoxy Prmer Converter						17.5					
545 Epoxy Primer Gray Base						6.25		6.25	6.25		1.75
Awlcraft 2000 Oyster White											6.25
Oeseries Awlcraft Se Oe Series								6.25	37.5		17.5
Altex No.5 Antifouling								15			15
Altex Primashield Antifouling Sealer											20
Altex Chembar 3500 Primer											20
International Thinner-Eqpt Cleaner								17.5			37.5
International Thinner-Eqpt Cleaner											75
Gun Wash Solvent					2.1		6.8		15	7.5	7.45
Interfine 878 Base Light Part A											1.75
Interfine 878 Part B					1						
Intergard 263-162 Part B							37.5				
Intergard 269 Red Part A								17.5			17.5
Intergard 269 Part B								37.5			37.5
Interline 704 Grey Part A		6.25						6.25			17.5
Interline 704 Part B								37.5			37.5
Interline 850 Part B								17.5			

Substance	Cumene	Cyclohexanone	Ethanol	Ethyl acetate	Methanol	Methyl ethyl ketone	Methyl isobutyl ketone	n-butanol	n-butyl acetate	Toluene	Xylenes
Interprime 4198 Grey											37.5
Interprime 820 White Part A							17.5			6.25	
Interprime 820 Part B		6.25						17.5			17.5
Interprotect Hardener								37.5			37.5
Interprotect High Build Part A								17.5			17.5
Interseal 670Hs Golden Yellow Part A											6.25
Interseal 670Hs Part B								17.5			6.25
Intershield 300 Bronze Part A								6.25			17.5
Intershield 300 Part B								17.5			37.5
Interspeed 376 Black											17.5
Interthane 863 Lsa Lp Deck Pewter Pt A		6.25									
Interthane 864 Lsa-Nsp (Hp) Deck Pewter		6.25									
Interthane 987 Lsac Lg N42 Storm Grey											17.5
Interthane 990 White Part A											17.5
Interthane 990 Golden Yellow Part A											17.5
Interzone 954 Black Part A							1.75				6.25
Interzone 954 Part B								6.25			17.5
Awlwood Ma Gloss									6.25		
Methylated Spirits			100								
Micron Extra 2 Blue											6.25
Mineral Turpentine	5										15
Northane Hardener											20
Ogseries Awlgrip Topcoat											6.25
A. Propspeed Etching Primer Base B. Propspeed Etching Primer Hardener											7.5

Substance	Cumene	Cyclohex anone	Ethanol	Ethyl acetate	Methanol	Methyl ethyl ketone	Methyl isobutyl ketone	n-butanol	n-butyl acetate	Toluene	Xylenes
Captain Jack'S Varnish										1	
Tankguard Hb Classic Comp A								7.1			12
Tankguard Hb Classic Comp B								12			20
Jotun Thinner No. 17								13			13
Shipshape Primer Undercoat - Base											15.7
Shipshape Primer Undercoat - Base											5.5
Sikaflex-291											6.25
Awlgrip Topcoat Flattening Agent				17.5							
Trilux 33 Blue											37.5
Ultra 2 Black											6.25
VC Offshore Hard Racing Antifouling Dover White											75
Yacht Primer Grey											6.25
Altex Epoxy High Build Surfacer							5.5			15	5.5

APPENDIX D

Pollution Control System Design



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A.B.N. 76 100 555 904

NOAKES

FILTRATION SYSTEM
SHED EXTRACTION FLOW DIAGRAM

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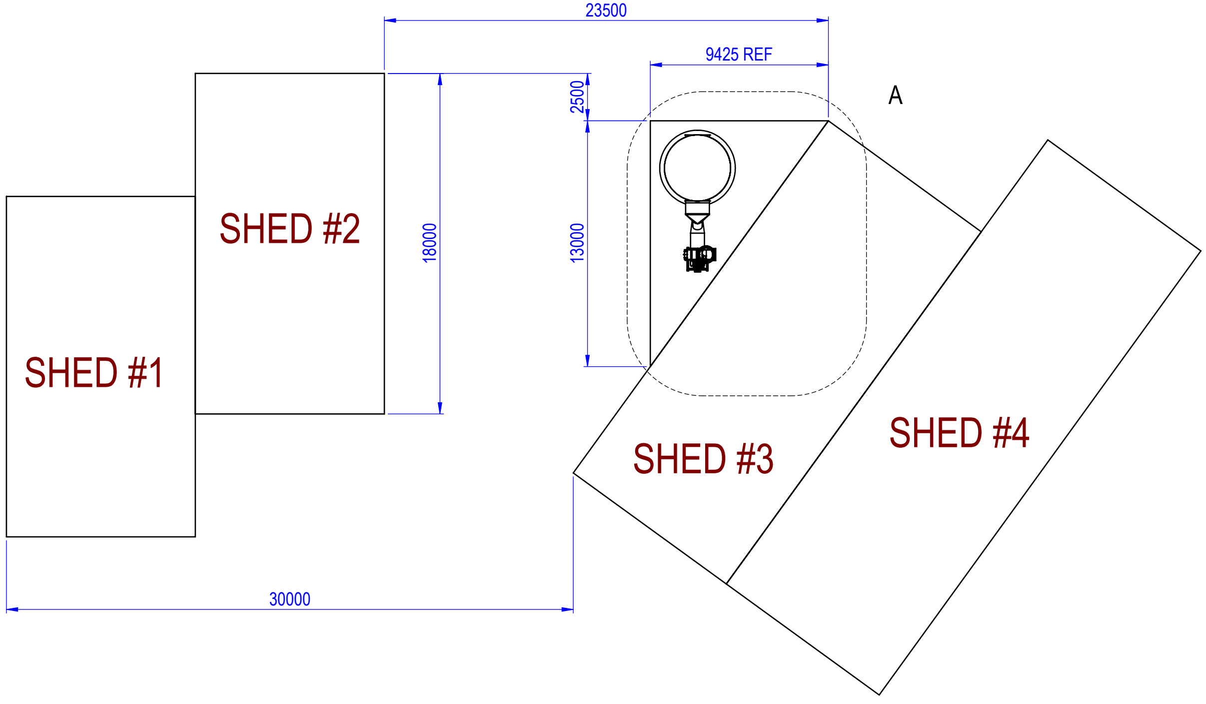

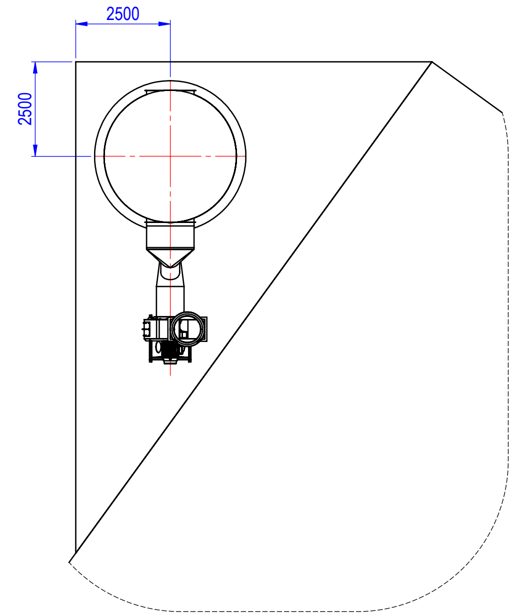

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PRELIMINARY GA
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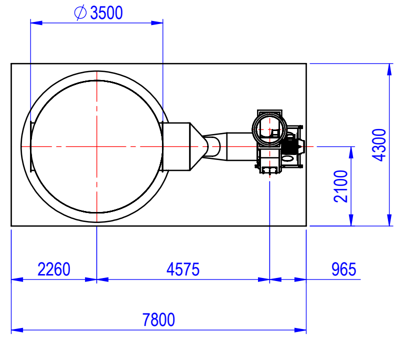

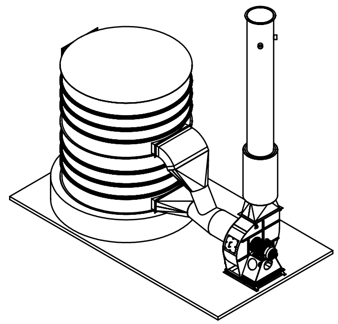

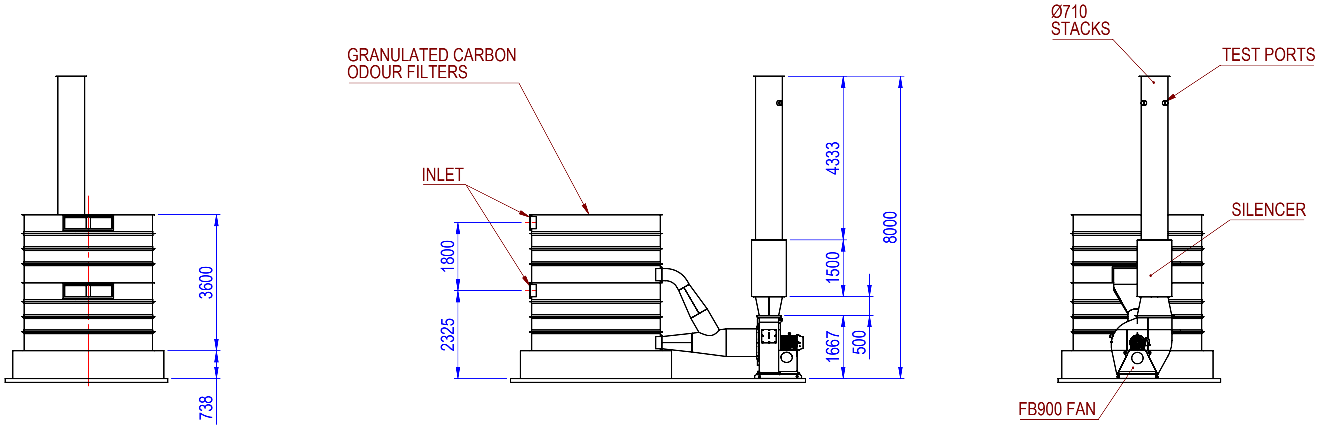

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ISSUE **1**

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STANNARDS MARINE PTY LTD vs NORTH SYDNEY COUNCIL L&E 63136/2021

Responses to Contamination Issues

Stage 2 Report

Geosyntec Consultants Pty Ltd
ABN 23 154 745 525
www.geosyntec.com.au

1 Request for Expert Opinion

I have been retained by Noakes Group Ltd. to provide an opinion on matters concerning possible sediment contamination issues in relation to an appeal in the Land and Environment Court relating to the refusal by North Sydney Council (NSC) for the Stannards Marine Pty Ltd (Stannards) Development Application to use a floating dry dock (FDD) in Berrys Bay as part of Noakes Boat Repair Yard.

I have been provided with an electronic file that contains the Class 1 application with DA and reports, the Council Assessment Report, the NSC Statement of Facts and Contentions (SOFACs), the SOFAC in reply and SOFAC filed by the Objector parties.

I have specifically been asked to address the Council's contention that insufficient data has been presented with the DA (and subsequently for the s34 Hearing) to allow for a decision on consent, as well as the reporting standards of the submissions containing the data.

I have read Division 2, Part 31 of the Uniform Civil Procedure Rules 2005 and the Expert Witness Code of Conduct in Schedule 7. This report is prepared in accordance with these documents and I agree to be bound by their terms.

2 Qualifications

My name is David Andrew Reynolds, I am a Senior Principal and Director of Geosyntec Consultants Australia Pty. Ltd. (Geosyntec). The address of Geosyntec Consultants is 189 Kent St., Sydney, NSW, 2000.

I have approximately 28 years of experience in contaminant hydrogeology and geological engineering. I was the leader of the Hydrogeology Research Group at the University of Western Australia and the Research Director of the Centre for Groundwater Studies. I am a contaminated sites auditor in Western Australia and Queensland. I was a member of the National Academies of Science, Engineering and Medicine Committee on Subsurface Characterization, Modeling, Monitoring, and Remediation of Fractured Rocks and author of the publication of the same name. I have more than 30 technical publications in peer reviewed journals. I am currently Project Director for more than 30 projects within Geosyntec. My CV is included as Appendix D.

Summary of Opinions

1. Sufficient information in the form of Jacobs (2018) and MPR (2021) has been provided to allow adequate consideration of the contamination status of the Site.

2. The data provided in Jacobs (2018) and MPR (2021) are suitable for a decision on consent.

3. The reporting in Jacobs (2018) is well aligned with NSW EPA (2020) for a PSI also noting that it was issued prior to the guidance being issued.

4. The Site History requirements of NSW EPA (2020) have been met through previous reporting

5. The Site Identification and Description requirements of NSW EPA (2020) have been met through previous reporting

6. Remediation is not practicable

7. MPR (2021) is not well aligned with NSW EPA (2020) however it was not issued as a DSI.

8. Based on a detailed assessment of sediment sample data in Jacobs (2018) and MPR (2021) the site is suitable for the intended purpose in its current contaminated state.

9. Suspension and transport of sediment will not impact the contamination status of Berry Bay.

10. Suspension and transport of sediment will not lead to unacceptable contamination risks to human health and the environment.

Table of Contents

Appendices

3 Introduction

Stannards Marine Pty Ltd (Stannards) submitted a Development Application (DA 57/2019) to operate a Floating Dry Dock (FDD) in Berrys Bay as part of the Noakes Boat Repair Yard. The DA was denied by North Sydney Council (NSC) and the denial is currently being appealed in the Land and Environment Court of New South Wales.

A joint report of contamination experts (Andrew Norris, Jeremy Colville, David Reynolds) was prepared, dated 14 April 2022, responding to the contentions raised in the Statement of Facts and Contentions for the FDD matter, Statement of Facts and Contentions for the Relocatable Shed (RS) matter and Objectors Statement of Facts and Contentions for the FDD matter.

The joint expert report noted that analysis of sediments within Berrys Bay had been undertaken by several parties, however the experts agreed that not all reporting is in alignment with Chapter 4 of the Resilience and Hazards SEPP (former SEPP 55) and the NSW EPA Consultants Reporting on Contaminated Land, Contaminated Land Guidelines (2020). Andrew Norris, Contamination expert for NSC, opined that the limitations to the reporting result in the data being unsuitable for a decision on consent to be made.

It is unclear that the FDD DA would trigger the need for reporting as per the SEPP and NSW EPA (2020) given there is no change to land use. However, many aspects of the SEPP and NSW EPA (2020 reporting framework and requirements have already been completed in existing reports.

According to NSW EPA (2020), "*the process of contaminated land management can be broadly divided into the following stages:*

1. Preliminary site investigation (PSI)

2. Sampling and analysis quality plan (SAQP)

3. Detailed site investigation (DSI)

4. Site specific risk assessment and modelling

5. Remedial action plan (RAP)

6. Site remediation and validation

7. Environmental management plan

8. Ongoing monitoring

Consultants' reports most often address one or more of these stages. Reports may be presented separately or combined (for example preliminary and detailed site investigations can sometimes be combined into a single document). Each report must stand alone, containing enough information to be readily understood. A summary of certain information can be provided, if relevant information has been included in a previous report prepared by a consultant (unless that information has since been superseded). Final documents should be submitted to regulatory authorities to support decision-making relating to contaminated land."

Jacobs (2018) completed a desktop Preliminary Contamination Assessment (PCA) – analogous to a Preliminary Site Investigation (PSI). An Addendum to the PCA contained the results of sediment sampling, which is consistent with the concept of a Detailed Site Investigation (DSI). MPR (2021) reported the results of additional sediment sampling as part of an expert report, not a traditional DSI.

Opinion: The reporting in Jacobs (2018) is well aligned with NSW EPA (2020) for a PSI.

Opinion: MPR (2021) is not well aligned with NSW EPA (2020).

Geosyntec consultants

Additional reporting could be beneficial to the court to assist in the decision on consent. This Stage 2 report compiles sediment data from previous sediment assessments completed within Berrys Bay (Jacobs (2018) and MPR (2021) for the Noakes Boat Yard and one for another portion of the Bay), addresses aspects of reporting in accordance with Chapter 4 of the Resilience and Hazards SEPP that have not been previously addressed, and evaluates its reliability for a decision on the suitability of the site for the proposed use.

4 Requirements of NSW EPA (2020) Already Reported

4.1 Site Identification and Description

Site location details (a reporting requirement under NSW EPA (2020)) have been provided in Section 3 of the Environmental Impact Statement (EIS, Hamptons Property Services, 2019) as well as in Jacobs PCA (2018). Figure 1 in Appendix A of this report shows the general location of Berrys Bay within Sydney Harbour.

Drawing 1 (provided below) shows the location of the existing boat repair and maintenance facility on the eastern foreshore of Berrys Bay. The water lease area is indicated by the black and blue dotted line extending out into Berrys Bay. Figure 3 in Appendix A shows the proposed location of the FDD in the outer (loading) position and the inner (working) position. This is discussed further in Section 5.1 of this report.

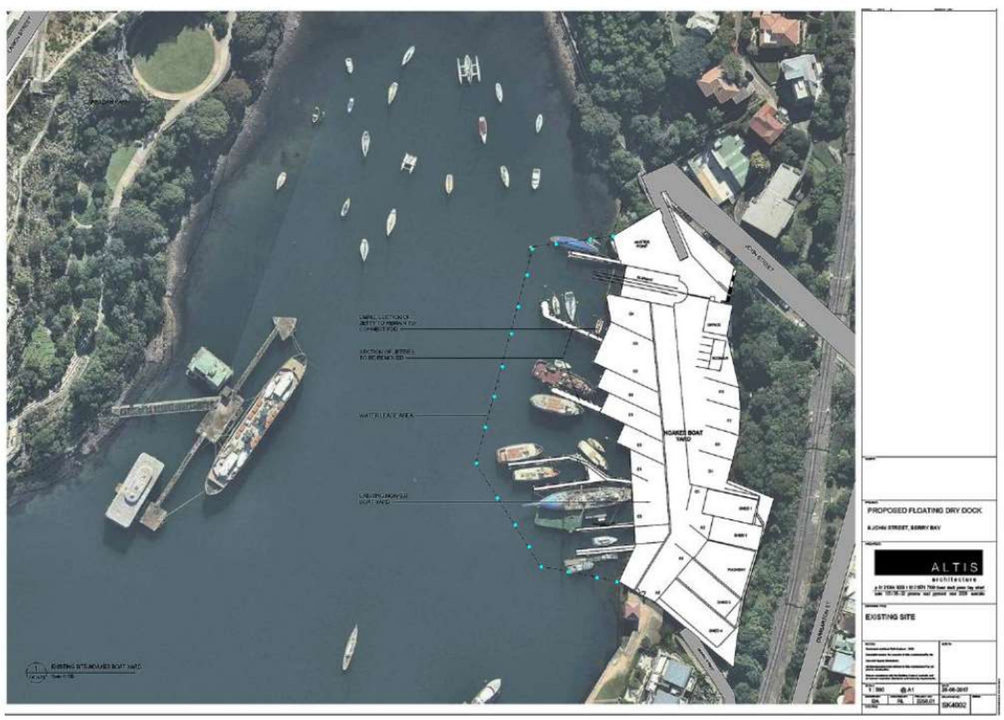

Figure 2: General Arrangement Plan (Existing)

Source: Altis Architects

Drawing 1: General Arrangement Plan (Source: EIS, Hamptons Property Services, 2019)

Opinion: The Site Identification and Description requirements of NSW EPA (2020) have been met through previous reporting.

4.2 Site History

Site history has been previously presented in Jacobs (2018) Preliminary Contamination Assessment (PCA), as would be expected in a PSI-level report.

The Noakes boatyard is situated on land and within the Berrys Bay area that has historically been used for ship building, maintenance and associated maritime activities for over 150 years. The site continues to operate as a boat repair and maintenance facility. Berrys Bay has supported a variety of industrial and maritime operations, including the former BP Terminal, the former Coal Loader and Caltex leases. Historical aerial imagery reviewed by Jacobs as part of the PCA indicated progressive expansion and modification to the existing Noakes Boatyard site.

Further detail of the site history is provided in Section 2 and 3 of Jacobs (2018) and Section 3 of the EIS.

Opinion: The Site History requirements of NSW EPA (2020) have been met through previous reporting.

5 Previous Results

Sediment chemistry data from previous investigations within Berrys Bay is presented in the following reports;

- Jacobs (2018), PCA – Berrys Bay EIS for Floating Dry Dock, Addendum to PCA – Sediment Contamination Analytical Results.
- Marine Pollution Research (2021), Marine Ecology Impact Assessment, Stannards Marine Pty Ltd Vs North Sydney Council L&E 63136/2021.
- Douglas Partners/Golder Associates (2018), Contamination Factual Report- Marine Investigations, Western Harbour Tunnel and Beaches Link Geotechnical Investigation (Report Number 1666099-001-R-Rev C).

The Jacobs and Marine Pollution Research (MPR) reports were prepared specifically for the Noakes Site and have been provided with the DA or as part of the court proceedings. The Douglas Partners/Golder Associates report was prepared for Roads & Maritime Services (RMS) for the proposed Western Harbour Tunnel and Beaches Link (WHTBL) project and contains results of sediment sampling completed within the western arm of Berrys Bay that will be used to demonstrate the overall contamination status of Berry Bay.

5.1 Jacobs (2018)

A targeted sediment sampling event was undertaken by Jacobs within Berrys Bay on 29 November 2017. The sampling was targeted to sediment locations in Berrys Bay associated with potential demolition and construction phases of the proposed areas to be disturbed.

The scope of work included collection of nine shallow sediment samples (1 – 9, with sample 10 a duplicate sample collected at location 6). The location of the sediment samples within Berrys Bay is shown in Figure 2, Appendix A.

The following laboratory analysis was performed on the sediment samples collected:

- Total metals and metalloids: arsenic, cadmium, cobalt, copper, chromium, lead, nickel, silver, zinc and mercury;
- BTEXN - benzene, toluene, ethylbenzene, xylene and naphthalene;
- Tributyltin (TBT);
- Total petroleum hydrocarbons (measured as TRH);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Organochlorine Pesticides (OCPs);
- Total Polychlorinated Biphenyls (PCBs);
- Per- and poly-fluoroalkyl substances (PFAS).
- Particle size distribution (2-200 µm)
- Total organic carbon (TOC)
- Moisture content

The analytical results were compared against recommended sediment quality guideline values contained in the ANZECC/ARMCANZ Sediment Quality Guidelines (CSIRO Land and Water Science Report 08/07 May 2013).

Elevated concentrations of copper, lead, Tributyltin (TBT), zinc and mercury were reported at all locations. Jacobs concluded that the source of the identified contamination was considered to be associated with historical fill and historical industrial/commercial marine operations.

Bioavailability testing of sediment was not undertaken, however, in the PCA they consider that the fraction of a contaminant in sediment that is available for uptake by aquatic biota is likely to be a small component of total contaminant load, with the majority of contaminants in sediment likely to remain bound to particulates rather than be released to (bioavailable) dissolved phase(s) if sediment is remobilised.

Jacobs note that the Navigation Impact Assessment (NIA - Haskoning Australia P/L, 18 December 2017) indicates that at least 300 mm minimum under keel clearance for the FDD must be maintained at all tides, specifically that the FDD will be at least 300mm above the seabed at all times (Section 5.1.5 and 4.3.2 of the NIA). Jacobs conclude that operation of the FDD will not result in mobilisation of potentially contaminated sediment from the bed of Berrys Bay.

5.2 Marine Pollution Research (2021)

The report was prepared by MPR to provide an opinion on matters concerning possible marine ecological environmental harm from use of the FDD in Berrys Bay, specifically arising from disturbance of marine sediments due to FDD operation and not as a DSI.

The report contains the sediment chemistry data from the Jacobs (2018) sampling event and presents the results of additional sediment sampling completed by MPR on 9 September 2021. MPR collected a total of 10 sediment grab samples (Referred to as locations 11 – 20). Surface samples were collected at all locations and deeper samples also collected at locations 16-20.

The location of the sediment samples within Berrys Bay is shown in Figure 2, Appendix A (the location of the Jacobs samples are also included for reference).

The following laboratory analysis was performed on the sediment samples collected;

- Total metals: antimony, arsenic, cadmium, chromium, copper, lead, nickel, silver, zinc and mercury;
- BTEXN;
- Organotin compounds- monobutyltin, dibutyltin and tributyltin;
- TRH;
- PAHs;
- OCPs;
- PCBs;
- Particle size distribution
- TOC
- Moisture content

MPR considered the combined sediment chemistry data (Jacobs & MPR) available was adequate for assessment of project impacts on marine ecology arising from potential disturbance of contaminated sediment.

The combined data set was compared against the Australia/New Zealand Guidelines (ANZG 2018) Default Guideline Values (DGV) for protection of marine aquatic life.

MPR made the following conclusions based on their assessment:

- Given that the FDD will be operated by surface winches with no underwater propulsion the risk of sediment disturbance due to FDD operations must be considered low.
- Disturbed surface sediments would not be mobilised for sufficient time to increase dissolved contaminants in the water column.
- Sufficient sediment samples were collected to demonstrate seabed sediments are similar to other seabed sediments in the Parramatta River in terms of overall metal and organic contamination.
- The risk of the FDD physically impacting seabed and creating resuspension is adequately addressed by Management System.
- Any plumes from the FDD bottoming out would rapidly re-settle close to FDD footprint. Mean concentrations of contaminants in the FDD footprint are less than means in surrounding areas.
- Sediments potentially mobilised by bottoming-out or listing have similar or less contaminant levels to surrounding areas which, when settled, would not result in any measurable change in the overall surface sediment contamination status of the surrounding seabed.

Overall, MPR concluded that the project has no meaningful possibility of impact for seabed sediment marine vegetation by virtue of the lack of marine vegetation on the seabed in the study area, particularly at the depth under the FDD.

Opinion: Sufficient information in the form of Jacobs (2018) and MPR (2021) has been provided to allow adequate consideration of the contamination status of the Site.

5.3 Douglas Partners/Golder Associates (2018)

Douglas Partners/Golder Associates prepared a geotechnical investigation report for the proposed Western Harbour Tunnel and Beaches Link (WHTBL) project. In addition to geotechnical investigations the report also includes assessment of contamination and investigation of groundwater conditions. The report is publicly available online and contains analytical results from sediment sampling completed within a portion (western arm) of Berrys Bay.

The samples were collected to better understand the contamination status of the sediments and assess whether dredging and offsite disposal are feasible options as part of WHTBL construction.

Surficial sediment samples (top ~0.2m) were collected from 28 locations within Berrys Bay on 23 May 2017 using gab sampling methods. Sample locations were named B426W to B451W, B768W and B769W.

The location of the sediment samples within Berrys Bay are shown in Figure 2, Appendix A.

Analytical results were presented in the report in Table A8 for samples from Berrys Bay and The Spit. An extract of the Table containing the results for Berrys Bay is provided in Appendix B.

6 Compliance with SEPP

Geosyntec undertook a review of the previous sediment investigations general compliance with guidance provided in Chapter 4 of the Resilience and Hazards SEPP (Former SEPP 55-Remedaition of Land).

Chapter 4 of the Resilience and Hazards SEPP refers to the Managing Land Contamination, Planning Guidelines SEPP- Remediation of Land. The Planning Guidelines provide "*Issues to consider*" for a Stage 2- Detailed Investigation. The "*Issues to consider*" are listed as follows;

1. *Is the sampling program that has been undertaken by the consultant adequate to identify hot spots of contamination on the site? Does it conform with the relevant EPA guidelines? Check the sampling program against the EPA's guidelines or consult a site auditor if necessary.*

2. *Have appropriate thresholds and criteria been used for the assessment? Compare with appropriate criteria or consult a site auditor if necessary.*

3. *Do the levels of contamination on the site need to be reduced in order for the site to be suitable for the proposed use? If so, progress to Stage 3—Site Remedial Action Plan.*

4. *Does this site pose a significant threat to human health or the environment? If so, refer to the CLM Act in relation to duty to notify the EPA.*

5. *Is a site audit of the detailed investigation necessary, or required under the CLM Act? See section 3.6.1.*

Each of the issues listed above is discussed in Sections 5.1 to 5.5 below, respectively.

6.1 Sampling Program

Samples were collected from a total of 19 locations across Berrys Bay by Jacobs and MPR to assess surficial sediment quality.

Sediment sampling by Jacobs and MPR has been undertaken within the following broad areas;

- Area 1: Eastern shoreline and adjacent to boat slip- Samples 5, 7, 8, 9
- Area 2: Inner (working) FDD footprint- Samples 1, 2, 3, 4, 6 (Duplicate 10)
- Area 3: Outer (loading) FDD footprint- Samples 16, 17, 18, 19, 20
- Area 4: Outer sampling within broader Berrys Bay area- 11, 12, 13, 14, 15

The spread of the Jacobs and MPR sampling enables assessment of potential differences in sediment chemistry within different portions of the FDD operation and across the eastern arm of Berrys Bay. Furthermore, the sampling completed by Douglas Partners/Golder Associates provides valuable sediment chemistry data from the western arm of Berrys Bay away from the Noakes boatyard and proposed FDD.

The 14 primary samples collected within Area 1-3 above cover an area of approximately 3,400m^2. For general comparison, the NSW EPA Sampling Design Guidelines (NSW EPA, 1998) Table A recommends a minimum of 11 sampling points for site characterisation of a site of 4,000m^2 based on detecting circular hot spots (by systematic sampling pattern).

The overall sampling density and locations of samples is considered appropriate for understanding the sediment chemistry in the vicinity of the proposed FDD and further out (west) into Berrys Bay.

Jacobs (2018) reviewed potential sources of contamination to sediment within the Bay and based on this prepared a list of COPC. The list of COPC identified is considered appropriate. The MPR analytical suite is generally consistent with that undertaken by Jacobs, with the exception of PFAS which was analysed by Jacobs and reported non-detect for all samples.

The sediment analysis completed by Jacobs (2018) and MPR (2021) are considered to cover the expected COPC in surficial sediment of Berrys Bay.

6.2 Adoption of Appropriate Criteria

The analytical results obtained by Jacobs (2018) were compared against recommended sediment quality guideline values contained in the ANZECC/ARMCANZ Sediment Quality Guidelines (CSIRO Land and Water Science Report 08/07 May 2013).

MPR undertook additional desk-top analysis of the Jacobs sampling results and noted the following items (MPR, 2021, Section 24b-f):

- Limits of Reporting (LORs) orders of magnitude greater than relevant default guideline values (DGVs).
- Normalising total sediment organic contaminant results against TOC is required. MPR note that Jacobs did not normalise TRH results and TRH C10-C40 results were compared to TRH C6-C36 DGV.
- Breakdown of TBT compounds were not reported.
- PAH compounds were not assessed against DGVs.

Increasing organic content favours partitioning of both metals and organics to sediment particles. For hydrophobic organic contaminants the DGVs are normalised to 1% organic content and therefore the analytical result for these contaminants must also be normalised to 1% organic content.

Geosyntec note that Appendix A5 of ANZECC/ARMCANZ Sediment Quality Guidelines discusses the derivation of the TPH guideline and states the following:

"Note that while TPHs will also partition strongly to sediment organic carbon, insufficient information is available to derive a SQGV that is modified using the TOC concentration of the sediments (as is done for other hydrophobic organic substances such as PAHs)".

Douglas Partners/Golder Associates state in Section 6.1 that the analytical results for organotins, PFAS, TPH and PAHs have been normalised (to 1% TOC), however review of laboratory certificates and the results presented in Table A8 for Berrys Bay do not indicate normalisation of data for these analytes.

Geosyntec note the points raised by MPR regarding the Jacobs data and the inconsistency with normalisation of data, however the quality of the analytical data is not considered to have been impacted and the data is considered appropriate for assessment of sediment quality.

The combined data set prepared by MPR (comprising Jacobs and MPR analytical results) was compared against the Australia/New Zealand Guidelines (ANZG 2018) Default Guideline Values (DGV) for protection of marine aquatic life.

Appropriate default guideline values have been adopted by Jacobs and MPR, with some relevant corrections and observations made by MPR to the Jacobs data.

Appendix B contains tables of results from the previous sediment investigations within Berrys Bay. Table 1 and Table 2 present the Jacobs and MPR data, respectively, with the data now consistently presented against the adopted DGVs (1% TOC normalisation for TBT, PAHs and PCBs).

Comparison of Jacobs and MPR analytical results to the adopted criteria shows exceedances in all areas sampled in the eastern arm of Berrys Bay, in particular for metals, organotins, Polycyclic

Aromatic Hydrocarbons (PAHs) and Total Petroleum Hydrocarbons (TPH). Similar exceedances are observed in the analytical data from Douglas Partners/Golder Associates collected from the western arm of Berrys Bay (distant from the Noakes site and unlikely to be impacted by boatyard operations).

6.3 Is Remediation Required

The analytical results in Appendix B indicate that sediment chemistry within Berrys Bay is similar to other seabed sediments in the Parramatta River in terms of overall metal and organic contamination. The sediment contamination in Berrys Bay is in line with the general levels of sediment contamination known to be widespread in the Parramatta River and Port Jackson (Birch and Taylor, 2004).

Furthermore, based on the sediment chemistry results, Geosyntec agree with the MPR (2021) conclusions that generally the mean concentrations of contaminants in the FDD footprint are less than the means in surrounding areas and sediment. Bottoming-out of the FDD (or other shear stresses on the bottom sediments as a result of the FDD) may move contaminants to surrounding areas, however this would not result in any measurable change in the overall sediment contamination status of the surrounding seabed.

Remediation within the footprint of the FDD would provide little to no benefit as the sediment quality surrounding this area is of similar (or worse) sediment quality and therefore the remediated area would become re-contaminated soon after the remediation due to natural processes. Birch & Taylor (2004) note natural processes such as bottom currents/wind induced wave action occur that move readily resuspended fine sediment material within shallow bays.

The concept of remediation of sediment offering little value if the surrounding areas are of similar sediment quality is further supported by the Jemena Kendall Bay Sediment Remediation Project. The recently completed remediation works were State Significant Development (SSD 6701) and involved large-scale remediation of contaminated sediment within Kendall Bay, Parramatta River. Further details are provided below (Source: Jemena, Kendall Bay EIS, Appendix 4 Ecological Risk Assessment):

- The contaminants of potential concern stated in Jemena's Voluntary Management Proposal (VMP, Approval No.: 20171703) for sediments in Kendall Bay were PAHs & TRHs, related to the former Mortlake Gasworks.
- Investigations identified acute toxicity to benthic organisms in two areas of Kendall Bay where oily gasworks sediment are present near the surface. Additionally, chronic toxicity was reported in sediment samples from the outer portions of Kendall Bay and from other reference bays, considered to be beyond the influence of the former Mortlake Gasworks.
- Studies undertaken by CSIRO found elevated mixed-metal burden in some Kendall Bay sediment was likely to cause chronic toxicity, however similar metal burden are known to occur throughout Sydney Harbour due to historic pollution from industrial and urban sources.
- CSIRO attributed chronic toxicity to a combination of metals, plus PAHs and other contaminants of widespread distribution in the Parramatta River. The heads of other bays in this part of the Parramatta River, where stormwater contributes contaminants, particularly metals such as copper and zinc, also showed high to very high chronic toxicity.
- An Ecological Risk Assessment (ERA) concluded that "*remediation targeting areas where chronic toxicity is observed may be ineffective at eliminating chronic toxicity of the sediments in the longer term because remediated areas within the bay will be expected to become re-contaminated as sediment from the surrounding environment is redeposited, and also from future stormwater inputs, particularly from the large stormwater drain at the southern end of Kendall Bay. It is not recommended that such areas be remediated*".
- The remediation areas were selected and agreed on by the EPA accredited Site Auditor and NSW EPA, based on addressing areas which pose a potential human health risk and/or where acute toxicity was reported.

- Areas of chronic toxicity were not targeted during the remediation given the acknowledgement that chronic toxicity is present in sediment across large portions of the Parramatta River and it Bays related to historic pollution from a range of industrial and urban sources.

Opinion: Remediation is not practicable

6.4 Risk to Environment or Human Health

The report prepared by MPR assesses possible marine ecological environmental harm from use of the FDD in Berrys Bay, specifically arising from disturbance of marine sediments due to FDD operation.

MPR conclude that the project has no meaningful possibility of impact on seabed sediment marine vegetation by virtue of the lack of marine vegetation on the seabed in the study area, particularly at the depths under the FDD. Therefore, the risk to aquatic marine biota is low and would not be measurable.

Geosyntec 2021 concludes resuspension of the sediments presents a very low risk to human health due to a low probability of completed Source – Pathway – Receptor linkages. The review by Geosyntec 2021 is provided below:

In terms of human health impacts:

i. For a risk to be present a completed pathway from a source to a receptor must be present. In this case the source is well characterised by the sediment samples taken and the receptor under consideration is human.
ii. Potential pathways between the source and the human receptor are incomplete, unlikely, or managed via existing orders and actions.
iii. A potential pathway exists through consumption of fish or other seafood sourced from Berry's Bay. This potential pathway is currently managed by the Department of Primary Industries who have decreed that no fish or crustaceans caught west of the Sydney Harbour Bridge should be eaten.
iv. A potential pathway exists for recreational activities. To complete the pathway a recreational user would need to interact with suspended sediment. It is considered unlikely that recreational swimmers would be present in the Bay in the vicinity of the FDD at the depth of the suspended sediments, particularly during load/unload operations which is (to my understanding) the most likely time that sediment resuspension could occur.
v. A second potential recreational pathway exists for surface recreation (boats, kayaks, etc.). To complete this pathway a recreational user would need to interact with suspended sediment. Such interaction is considered unlikely.

Opinion: Suspension and transport of sediment will not lead to unacceptable contamination risks to human health and the environment

6.5 Site Audit Requirement

A site audit of the investigation (conducted by MPR) is not considered necessary or required under the CLM Act.

7 Suitability of Data for a Decision on Consent

7.1 Data Quality Objectives

The data quality objectives (DQO) process is a systematic planning tool based on the scientific method for establishing criteria for data quality and for developing data collection designs. The DQO defines the experimental process required to test a hypothesis. Using the DQO process to plan the investigation effort, the relevant parties can improve the effectiveness, efficiency and defensibility of a decision in a resource and cost-effective manner.

The DQO process consists of seven steps, which are designed to clarify the study objectives, define the appropriate type of data and specify tolerable levels of potential decision errors. The seven-step DQO process adopted for the works was as follows:

- Step 1 – Defining the Problem. The first step in the DQO process is to 'define the problem' that has initiated the investigation;
- Step 2 – Identify the Decision. The second step in the process is to define the decision statement that the study will attempt to resolve;
- Step 3 – Identify Inputs to the Decision. In this step, the different types of information needed to resolve the decision statement are identified;
- Step 4 – Define the Study Boundaries;
- Step 5 – Develop a Decision Rule;
- Step 6 – Specify Limits on Decision Errors; and
- Step 7 – Optimise the Design for obtaining the Data.

In Section 6.1 to 6.3 below Geosyntec have completed a high-level review to assess if the previous investigations within Berrys Bay have followed the DQO process.

7.1.1 Jacobs (2018)

The Jacobs PCA and PCA Addendum (2018) reports did not present a defined DQO process, however the investigations were completed in general accordance with the process as outlined below.

- Step 1- the “problem” is defined in the PCA Addendum as the demolition works and FDD operations have the potential to disturb/mobilise bed sediments and therefore the contamination status of the sediment must be confirmed to assess potential risks.
- Step 2- the decision is: do concentrations of COPC in sediment exceed adopted criteria and does potential disturbance of this sediment from FDD present an increased risk.
- Step 3- the input to the decision included observations in the field, analytical data for the COPC determined in the PCA and adopted site criteria.
- Step 4- the lateral study boundary is shown in Figure 1 of the PCA Addendum. The vertical study boundary is considered to be the top layer of sediment (~0.1m) given the use of Ponar grab sampler.
- Step 5- Analytical concentrations were compared against DGVs to determine contamination status of sediment.
- Step 6- Specific limits on decision errors were not provided in the report, noting QAQC was completed by the laboratory and is discussed further in Section 7.
- Step 7- No optimisation of design for obtaining the data was discussed in the report.

7.1.2 Marine Pollution Research (2021)

The MPR (2021) report did not present a defined DQO process, however the investigation was completed in general accordance with the process as outlined below.

- Step 1- the “problem” is to assess potential marine ecological harm arising from disturbance of marine sediment due to the FDD operations.
- Step 2- the decision is: do concentrations of COPC in sediment exceed adopted criteria and does potential disturbance of this sediment from FDD present an increased risk to marine ecology.
- Step 3- the input to the decision included relevant historical data/investigations, observations in the field, analytical data for the COPC and adopted site criteria.
- Step 4- the lateral study boundary is shown in Figure 1 of the MRP report. The vertical study boundary is considered to be the depth of sediment core samples collected which based on Annexure B.2 of the MPR report is between ~40-50cm into the sediment. “Surface” samples (0 to 0.25m) were analysed at each location and deeper “Bottom” samples (>0.25m) analysed for locations 16-20.
- Step 5- Analytical concentrations were compared against DGVs to determine contamination status of sediment. The expect disturbance of sediment from FDD operations and the presence (or lack) of ecological communities was reviewed.
- Step 6- Specific limits on decision errors were not provided in the report. QAQC has been completed by the laboratory.
- Step 7- No optimisation of design for obtaining the data was discussed in the report.

7.1.3 Douglas Partners/Golder Associates (2018)

The Douglas Partners/Golder Associates (2018) report did not present a defined DQO process, however detailed Quality Control and Data Validation reviews are provided in Sections 4 and 5 of the report, respectively (discussed further in Section 7.3, below).

The Douglas Partners/Golder Associates sediment analytical data is being utilised in the current assessment to provide a general comparison of sediment quality in a portion of Berrys Bay distant from the FDD and Noakes boat yard operations. The review completed in Section 7 of this report is considered appropriate for assessing the data quality and validity for this purpose.

7.2 Evaluation of QA/QC

A general review of field and laboratory Quality Assurance and Quality Control (QA/QC) measures undertaken for the previous investigation is provided below.

7.2.1 Jacobs (2018)

Field QAQC

The following is noted in relation to field QA/QC:

- Appropriate sampling equipment was utilised with samples collected using a stainless steel Ponar grab sampler and decontaminated prior to sampling (Decon 90 and water).
- Sample handling was undertaken to minimise potential for cross contamination (washing down work areas on vessel and wearing of nitrile gloves).
- Chain-of-custody (COC) used to record sample information and manage dispatch of samples to the laboratory.
- Samples were stored in eskies with ice and delivered to laboratory for analysis.

Laboratory QAQC

The laboratory QA/QC provided in the laboratory certificates reports the following (Appendix A of Jacobs 2018):

- No value outliers occur for method blanks, duplicates, laboratory control, matrix spikes or regular samples matrices surrogate recovery.
- No analysis holding time outliers.
- Quality control parameter frequency compliance met targets with the exception of no laboratory duplicates or matrix samples were completed for organotin (expected rate 10% and 5%, respectively).

Overall, the field and laboratory QA/QC processes and results appear appropriate for the works completed.

7.2.2 Marine Pollution Research (2021)

Field QAQC

The following is noted in relation to field QA/QC:

- Appropriate sampling equipment appears to have been utilised with reference to sample collection from a sample corer.
- Photographs and detailed descriptions of each sample (including location, date & time, core depth, Easting & Northing) is provided in Annexure B.2 of the MPR report.
- Sample handling and decontaminated prior to and between sampling locations is not discussed in the report. Nitrile gloves and labelled sample jars are visible in photographs in Annexure B.2.
- Sample storage prior to laboratory analysis is not discussed in the MPR report. COC documentation is contained with the laboratory certificates providing a record of sample information and management of dispatch of samples to the laboratory. The laboratory note on the COC that the samples were received on the same day as sampling (9 September 2021), the custody seal was intact and ice was present upon receipt of samples.
-

Laboratory QAQC

The laboratory QA/QC provided in the laboratory certificates reports the following (Appendix C):

- No value outliers occur for method blanks, duplicates and laboratory control
- No analysis holding time outliers.
- Several matrix spike recoveries (PAHs, zinc and TBT) were not determined due to elevated background levels (>4 times spike level) and one matrix spike recovery for TBT was less than the lower data quality objective.
- Several sample surrogates (TPH/BTEX and organotin) were less than the lower data quality objective.
- Quality control parameter frequency compliance met targets with the exception of laboratory duplicates for mercury and moisture content below the expected rate of 10% (actual rates of 6.7% and 9.5%, respectively).

Limited information on the field and laboratory QA/QC process and results is available in the MPR report. However, the extensive experience of the sampling team that oversaw/undertook the works is noted and the review above indicates the QA/QC processes and results are generally appropriate for the works completed.

7.2.3 Douglas Partners/Golder Associates (2018)

Field QA/QC

The field QA/QC completed comprised collection of blind replicates, split replicates, rinsate, trip blank and trip spike samples, with field triplicates and batch duplicates also obtained. Data acceptance criteria (DAC) was set in Section 4.2 of the report for QAQC compliance.

The Data Validation of the report, Section 5.1, states the following for field QA/QC:

- Samples were collected by experienced Golder-Douglas staff, under established sampling protocols
- Samples were received by the laboratory in correctly preserved and chilled containers
- Overall, the repeatability of the analytical data met the objectives of the project
- Overall rate of QA/QC sampling met the 5% target for primary and secondary samples
- Rinsate results were either non-detect or low and considered unlikely to impact validity of data
- Trip blank and spikes data within acceptable range

Laboratory QA/QC

The Data Validation of the report, Section 5.2, states the following for laboratory QA/QC:

- Analysis was undertaken by NATA accredited laboratories using NATA accredited analytical methods (excluding HBCDs and Radionuclides).
- Some non-conformance of the laboratory duplicates and laboratory control samples was reported but not expected to compromise the integrity of the data.
- Method blank results indicated satisfactory hygiene in samples preparation and analysis.
- Matrix spikes generally within control limits.
- Some holding time breaches were reported, however this did not appear to be related to analysis of samples from Berrys Bay.

Douglas Partners/Golder Associates concluded based on the QA/QC assessment that the analytical data are acceptable and valid for use. The QA/QC and data validation indicated that the quality of the data was acceptable for environmental interpretative purposes.

Geosyntec consider the Douglas Partners/Golder Associates data for Berrys Bay acceptable for its intended use in the current assessment (to provide a general comparison of sediment quality in a portion of Berrys Bay distant from the FDD and Noakes boat yard operations).

Opinion: The data provided in Jacobs (2018) and MPR (2021) are suitable for a decision on consent

Geosyntec consultants

8 Suitability of Site for Intended Purpose

Tables of the sediment chemistry data from previous investigation are provided in Tables 1 to 3 in Appendix B.

Table 4 compares the mean concentrations of key COPC by area within Berrys Bay. The mean concentrations have been assessed across the following broad areas;

- Area 1: Eastern shoreline and adjacent to boat slip- Samples 5, 7, 8, 9 (Jacobs 2018)
- Area 2: Inner (working) FDD footprint- Samples 1, 2, 3, 4, 6 (Jacobs 2018)
- Area 3: Outer (loading) FDD footprint- Samples 16, 17, 18, 19, 20 (MPR 2021)
- Area 4: Outer sampling within broader Berrys Bay area- Samples 11, 12, 13, 14, 15 (MPR 2021)
- Area 5: Western arm of Berrys Bay- Samples B426W to B451W, B768W and B769W (Douglas/Golder 20178)

Areas 1 to 5 generally progressively work out into Berrys Bay away from the eastern shoreline of the Noakes shipyard, with Area 5 located in the western arm of Berrys Bay distant from the Noakes operations (Refer to Figures in Appendix A for samples locations).

The mean concentrations of metals, TBT, sum of PAHs and sum of TRH (C10-C36) by the areas defined above were assessed in Table 4 and general trends are summarised below:

- Similar concentrations of copper, lead and reported across Areas 2 to 5. For lead and zinc the mean concentrations in Area 4 are higher than Area 2 or 3. For copper the mean concentration in Area 4 is higher than Areas 2 and 3.
- The mean TBT concentration at Area 5 is higher (approximately double) than reported for Areas 2 and 3. TBT analyses were not performed for Area 4.
- The mean sum of PAH concentrations are generally similar across each of the areas assessed. PAH analyses were not performed for Area 4.
- The mean sum of TPH concentrations are generally similar across each of the areas assessed. TPH analyses were not performed for Area 4.

The data in Table 4 and the general trends summarised above indicate that the sediment across much of Berrys Bay has a similar contamination status. The area where the FDD will be used (Area 2 and 3) generally has similar or lower contaminant concentrations than surrounding areas outside the lease, including the Western arm of Berrys Bay.

The analytical results in Appendix B indicate that sediment chemistry within Areas 2 to 5 of Berrys Bay is similar to other seabed sediments in the Parramatta River in terms of overall metal and organic contamination. The sediment contamination in Berrys Bay is in line with the general levels of sediment contamination known to be widespread in the Parramatta River and Port Jackson (Birch and Taylor, 2004).

Any sediment disturbance due to activities associated with the FDD would not result in a change in the contamination status of sediments within the Bay. Natural high energy processes such as storm events can result in sediment migration within the Bay, which is indicated by the uniformity of contamination levels not only in the immediate vicinity of Noakes boatyard but in distal western regions of the Bay.

Opinion: Suspension and transport of sediment will not impact the contamination status of Berrys Bay

Opinion: The site is suitable for the intended purpose in its current contaminated state

9 References

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Appendix A Figures

LEGEND

Area of Interest

This product has been created to support the main report and is not suitable for other purposes. Image courtesy of SixMaps

200 m

Datum: GDA 1994 MGA Zone 56 - AHD

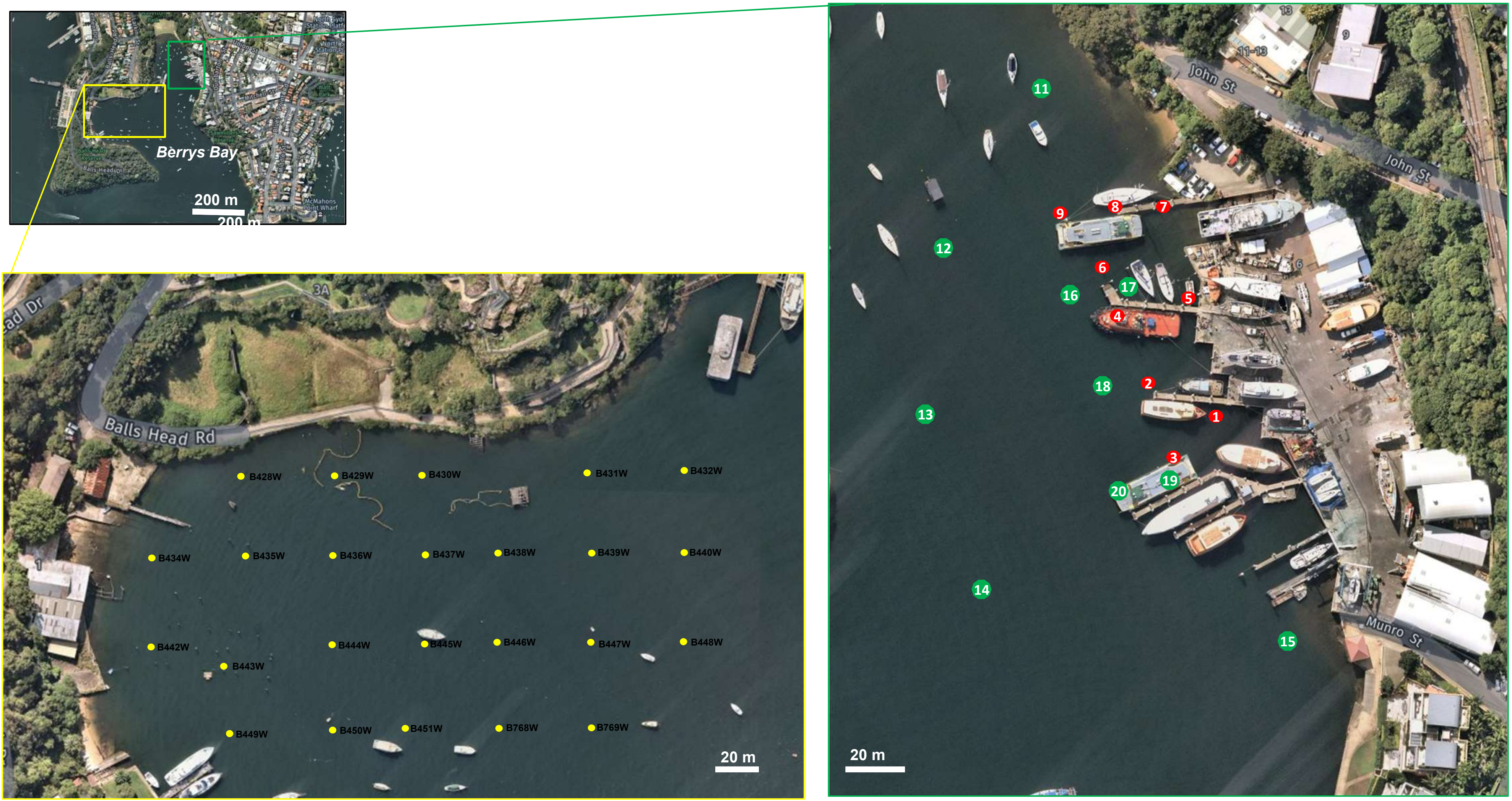
Figure 1: Site Location

Site Address: Berrys Bay, Sydney

Client: Stannards Marine Pty Ltd

Job Number: GSY0171 | Date: April 2022

Geosyntec consultants



LEGEND

- Sampling Location Jacobs (2017)
- Sampling Location MPR (2021)
- Sampling Location Golder (2021)

This product has been created to support the main report and is not suitable for other purposes. Image NearMaps

Datum: GDA 1994 MGA Zone 56 - AHD

Figure 2: Sampling Location

Site Address: Berrys Bay, Sydney

Client: Stannards Marine Pty Ltd

Job Number: GSY0171

Date: April 2022

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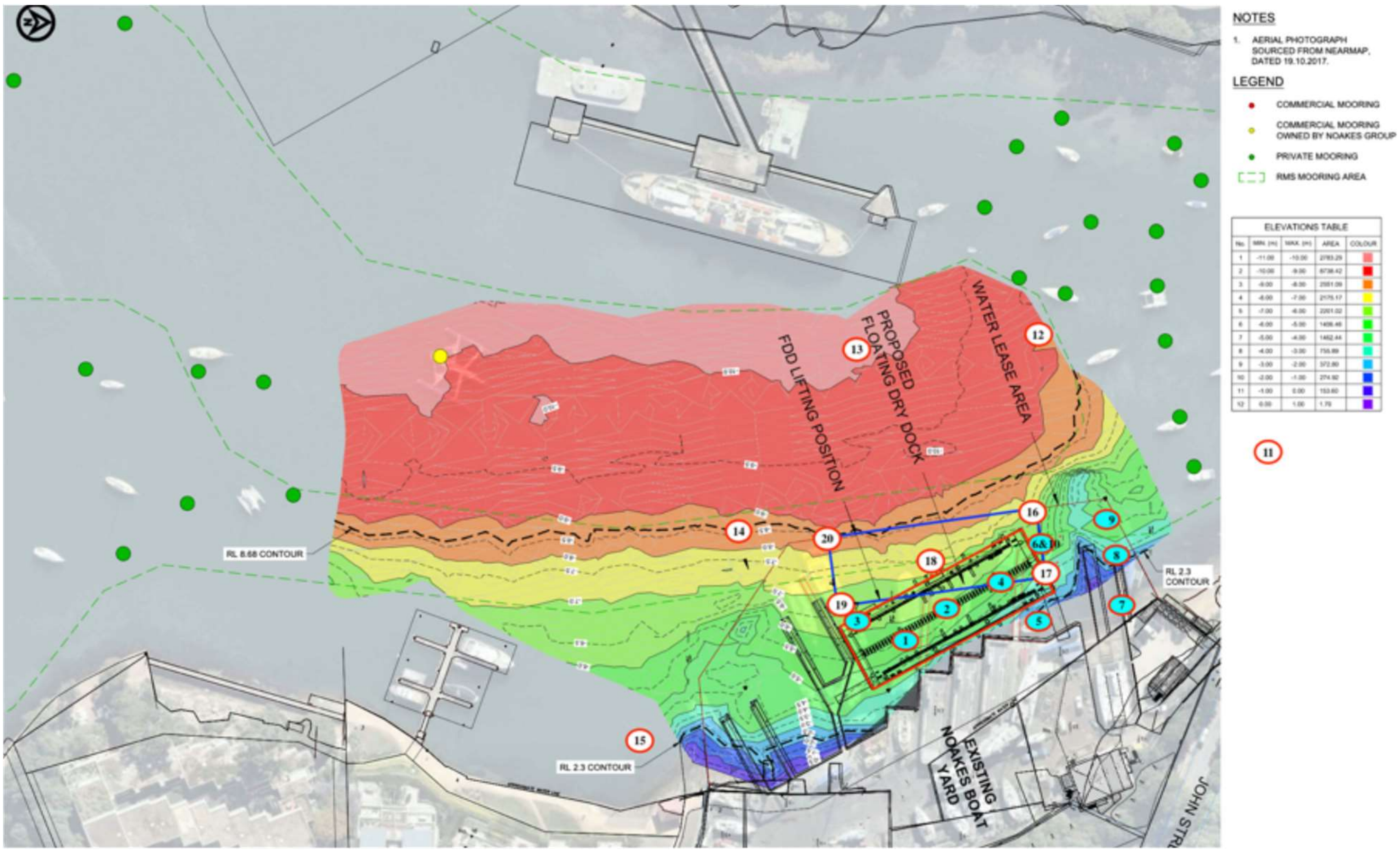
2017 and 2121 sediment sampling locations superimposed onto the Royal Haskoning (Navigation report Map 3

Samples 1 to 10 in 2017 and samples 11 to 20 in 2121



LEGEND

Source: MPR (2021) - Adapted

This product has been created to support the main report and is not suitable for other purposes. I

1:1000 (A3) 1:500 (A1)

Datum: GDA 1994 MGA Zone 56 - AHD

Figure 3: Footprint of FDD

Site Address: Berrys Bay, Sydney

Client: Stannards Marine Pty Ltd

Job Number: GSY0171

Date: April 2022

Geosyntec consultants

Appendix B Analytical Summary Tables

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Table 1. Jacobs 2017 Sediment Analytical Results

	Moisture Content	Organic Matter	Total Metals										Organotin Compounds				Polychlorinated Biphenyls (PCB)	
	Moisture	Total Organic Carbon	Cobalt 7440-48-4	Selenium 7782-49-2	Arsenic 7440-38-2	Cadmium 7440-43-9	Chromium 7440-47-3	Copper 7440-50-8	Lead 7439-92-1	Nickel 7440-02-0	Zinc 7440-66-6	Mercury 7439-97-6	Tributyltin	TBT Normalised	Dibutyltin	Monobutyltin	PCB	Total PCB Normalised
	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µgSn/kg	µgSn/kg	µgSn/kg	µgSn/kg	mg/kg	mg/kg
Limit of reporting	1	0.5	2	5	5	1	2	5	5	2	5	0.1	0.5	0.5	1.0	1.0	0.1	0.1
ANZG18 Default Guideline Value					20	1.5	80	65	50	21	200	0.15		9				0.034
ANZG18 Additional Upper Guideline Value					70	10	370	270	220	52	410	1		70				0.08
Field ID																		
1	39.1	1.7	4	<5	15	<1	35	296	243	7	595	1.6	118	69.4	40	20	0.1	<0.1
2	41.2	2.4	4	<5	13	<1	39	263	245	8	479	2.0	142	59.2	40	21	<0.1	<0.1
3	38.2	1.6	4	<5	14	<1	38	194	186	7	505	1.5	41	25.6	13	6	<0.1	<0.1
4	48.5	2.6	8	<5	22	<1	50	384	332	15	796	2.6	329	126.5	86	26	<0.1	<0.1
5	50.6	3.9	8	<5	30	<1	61	2240	874	20	1320	13.6	1860	476.9	344	78	<0.1	<0.1
6	40	2.6	10	<5	62	<1	36	363	228	13	531	3.0	265	101.9	72	18	<0.1	<0.1
6dup (10)	41.3	2.4	6	<5	19	<1	43	427	271	14	561	3.7	251	104.6	53	9	<0.1	<0.1
7	32.3	1.3	4	<5	14	<1	27	1600	290	9	844	3.5	1020	784.6	170	37	<0.1	<0.1
8	42.7	2.9	5	<5	20	<1	47	1340	374	13	751	9.2	1670	575.9	378	75	0.8	0.3
9	28.2	1.3	4	<5	12	<1	24	369	167	9	322	3.3	164	126.2	49	17	<0.1	<0.1

	Organochlorine Pesticides (OCPs) *Note that ANZG limits are shown as µg/kg																								
	alpha-BHC	Hexachlorobenzene	beta-BHC	gamma-BHC	delta-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Sum Chlordane	trans-Chlordane	alpha-Endosulfan	cis-Chlordane	Dieldrin	4,4`-DDE	Endrin 7	beta-Endosulfan	Endosulfan (sum)	4,4`-DDD	Endrin aldehyde	Endosulfan sulfate	4,4`-DDT	Endrin ketone	Methoxychlor	Aldrin + Dieldrin	DDD+DDE+DDT
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Limit of reporting	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.2	0.05	0.2	0.05	0.05
ANZG18 Default Guideline Value									0.00045				0.0028	0.0014	0.0027			0.0035			0.0012				
ANZG18 Additional Upper Guideline Value									0.009				0.007	0.007	0.06			0.009			0.005				
Field ID																									
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05
6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05
6dup (10)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05
7	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05
8	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05
9	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05

* Normalised results shown in red text

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Table 2. MPR 2021 Sediment Analytical Results

GSY0171

	Moisture Content	Organic Matter	Total Metals										Organotin Compounds				Polychlorinated Biphenyls (PCB)
	Moisture	Total Organic Carbon	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Silver	Zinc	Total Recoverable Mercury	Tributyltin	TBT @ 1%TOC	Dibutyltin	Monobutyltin	PCB
	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µgSn/kg	µgSn/kg	µgSn/kg	µgSn/kg	µg/kg
Limit of reporting	1%	0.02%	1	1	0.1	1	1	1	1	1	1	0.1	0.5	0.5	1.0	1.0	5.0
ANZG18 Default Guideline Value				20	1.5	80	65	50	21		200	0.15		9			
ANZG18 Additional Upper Guideline Value				70	10	370	270	220	52		410	1		70			
Field ID																	
11 Surf	47.9	3.53	<1.0	3.7	0.2	30.1	94.5	251	5	<1.0	461	<0.1	-	-	-	-	-
12 Surf	64	3.61	<1.0	6.4	0.1	42	140	310	8.2	<1.0	614	<0.1	-	-	-	-	-
13 Surf	66.2	3.2	<1.0	3.8	<0.1	37.1	82	242	5.4	<1.0	520	<0.1	-	-	-	-	-
14 Surf	61.1	3.28	<1.0	3.8	<0.1	38.9	72.1	274	5.7	<1.0	599	<0.1	-	-	-	-	-
15 Surf	45.8	4.12	<1.0	4.6	0.3	36.2	204	564	7.1	<1.0	1720	<0.1	-	-	-	-	-
16 Surf	29	2.16	<1.0	3.2	<0.1	25.8	81.1	128	2.2	<1.0	225	<0.1	43.6	20.2	11	5	<15.6
16 Bot	32.5	1.6	<1.0	2.8	<0.1	9	43.6	122	2.2	<1.0	190	<0.1	10.1	3.6	4	2	<15.6
17 Surf	51.3	5.02	<1.0	4.6	0.1	32.2	230	366	6.9	<1.0	800	<0.1	453	90.2	94	16	<31.2
17 Bot	52	5.32	<1.0	4.6	0.2	39.6	194	443	8.7	<1.0	923	<0.1	892	167.7	421	81	<31.2
18 Surf	54.7	2.66	<1.0	4.6	<0.1	24.6	120	200	3.9	<1.0	411	<0.1	11.1	4.2	6	2	<31.2
18 Bot	44.2	1.5	<1.0	3.6	<0.1	15.9	59.3	130	3.2	<1.0	316	<0.1	6.4	4.3	6	3	<15.6
19 Surf	35.4	1.9	<1.0	3.8	<0.1	16.4	113	175	2.8	<1.0	407	<0.1	12.2	6.4	6	2	<15.6
19 Bot	32.9	1.9	<1.0	2.9	0.1	15.6	61.5	180	3	<1.0	335	<0.1	5.2	2.7	3	<1	<15.6
20 Surf	63.6	3.26	<1.0	5.1	<0.1	41.9	128	316	6.5	<1.0	690	<0.1	17.8	5.5	5	2	<31.2
20 Bot	57.4	3.1	<1.0	4.5	<0.1	30.4	97.4	304	5.2	<1.0	628	<0.1	17.3	5.6	10	3	<31.2

	Organochlorine Pesticides (OCPs)																								
	alpha-BHC	beta-BHC	delta-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Sum Chlordane	trans-Chlordane	alpha-Endosulfan	cis-Chlordane	Dieldrin	4.4`-DDE	4.4`-DDE Normalised	Endrin 7	beta-Endosulfan	Endosulfan (sum)	4.4`-DDD	4.4`-DDD Normalised	Endrin aldehyde	Endosulfan sulfate	4.4`-DDT	Endrin ketone	Methoxychlor	Aldrin + Dieldrin	DDD+DDE+DDT
	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg		µg/kg	µg/kg	µg/kg	µg/kg		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Limit of reporting	0.5	0.50	0.50	0.50	0.50	0.50	0.25	0.25	0.50	0.50	0.50	0.50		0.50	0.50	0.50	0.50		0.50	0.50	0.5	0.50	0.25	0.50	0.50
ANZG18 Default Guideline Value							0.45				2.8		1.4	2.7				3.5			1.2				
ANZG18 Additional Upper Guideline Value							9				7		7	60				9			5				
Field ID																									
11 Surf	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-		-	-	-	-	-	-	-
12 Surf	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-		-	-	-	-	-	-	-
13 Surf	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-		-	-	-	-	-	-	-
14 Surf	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-		-	-	-	-	-	-	-
15 Surf	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-		-	-	-	-	-	-	-
16 Surf	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<0.5	<0.5
16 Bot	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<0.25	<0.5	<0.5	<0.5	1.56	0.975	<0.5	<0.5	<0.5	3.29	2.056	<0.5	<0.5	<0.5	<0.5	<0.25	<0.5	4.85
17 Surf	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<0.25	<0.5	<0.5	<0.5	9.34	1.861	<0.5	<0.5	<0.5	12	2.39	<0.5	<0.5	<0.5	<0.5	<0.25	<0.5	21.3
17 Bot	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<0.25	<0.5	<0.5	<0.5	9.29	1.746	<0.5	<0.5	<0.5	11.2	2.105	<0.5	<0.5	<0.5	<0.5	<0.25	<0.5	20.3
18 Surf	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<0.25	<0.5	<0.5	<0.5	3.51	1.32	<0.5	<0.5	<0.5	2.86	1.075	<0.5	<0.5	<0.5	<0.5	<0.25	<0.5	6.37
18 Bot	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<0.25	<0.5	<0.5	<0.5	1.52	1.013	<0.5	<0.5	<0.5	2.66	1.773	<0.5	<0.5	<0.5	<0.5	<0.25	<0.5	4.18
19 Surf	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<0.25	<0.5	<0.5	<0.5	3.84	2.021	<0.5	<0.5	<0.5	6.37	3.353	<0.5	<0.5	<0.5	<0.5	<0.25	<0.5	10.2
19 Bot	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<0.25	<0.5	<0.5	<0.5	2.62	1.379	<0.5	<0.5	<0.5	4.08	2.147	<0.5	<0.5	<0.5	<0.5	<0.25	<0.5	6.7
20 Surf	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<0.25	<0.5	<0.5	<0.5	4.87	1.494	<0.5	<0.5	<0.5	7.63	2.34	<0.5	<0.5	<0.5	<0.5	<0.25	<0.5	12.5
20 Bot	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.25	<0.25	<0.5	<0.5	<0.5	5.13	1.655	<0.5	<0.5	<0.5	6.26	2.019	<0.5	<0.5	<0.5	<0.5	<0.25	<0.5	11.4

* Normalised results shown in red text

				ANZECC 2000 Sediment ISGC-High	ANZECC 2000 Sediment ISGC-Low	B426W	B427W	B428W	B429W	B430W	B431W	B432W	QC201A	QC201B
		Sample Depth				23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17
		Lab Report and Sample #				ES1712748001	ES1712748002	ES1712748003	ES1712748004	ES1712748005	ES1712748006	ES1712748007	ES1712748030	A17/2048-A-2
		Units	LOR			Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay
Organotins	Dibutyltin	mg/kg	0.001			<0.001	0.003	0.181	0.091	0.008	0.001	0.003	0.010	0.036
	Monobutyltin	mg/kg	0.001			<0.001	<0.001	0.015	0.022	0.003	<0.001	<0.001	0.002	0.058
	Tributyltin	mg/kg	0.0005	0.07	0.005	0.001	0.022	0.688	0.248	0.019	0.007	0.023	0.038	0.038
Heavy Metals	Aluminium	mg/kg	50			2350.0	19200.0	11400.0	12800.0	8970.0	9160.0	15600.0	15700.0	13000.0
	Antimony	mg/kg	0.5	25	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Arsenic	mg/kg	1	70	20	5.8	22.0	31.5	27.4	22.1	16.3	18.8	17.0	21.0
	Cadmium	mg/kg	0.1	10	1.5	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5
	Chromium	mg/kg	1	370	80	7.5	77.3	56.0	60.5	35.0	35.1	61.5	55.0	54.0
	Cobalt	mg/kg	0.5			1.1	7.7	6.1	6.2	3.6	4.1	6.4	5.6	5.5
	Copper	mg/kg	1	270	65	12.1	211.0	484.0	342.0	145.0	93.6	170.0	156.0	170.0
	Iron	mg/kg	50			5520.0	33600.0	27800.0	26700.0	19300.0	19300.0	27100.0	26900.0	27000.0
	Lead	mg/kg	1	220	50	46.0	299.0	323.0	289.0	168.0	163.0	249.0	238.0	210.0
	Manganese	mg/kg	10			45.0	166.0	102.0	119.0	89.0	174.0	125.0	112.0	120.0
	Mercury	mg/kg	0.01	1	0.15	0.2	2.5	4.3	4.6	1.5	1.5	2.3	2.5	4.0
	Nickel	mg/kg	1	52	21	1.4	16.4	24.1	15.6	8.0	7.0	13.4	12.2	11.0
	Selenium	mg/kg	0.1			0.2	1.9	1.0	1.2	0.6	0.6	1.4	1.4	<0.1
	Silver	mg/kg	0.1	3.7	1	0.1	1.9	1.6	2.0	1.4	0.9	2.0	1.7	1.0
	Vanadium	mg/kg	2			10.4	61.8	41.8	47.1	33.4	32.9	51.7	46.3	50.0
	Zinc	mg/kg	1	410	200	51.6	614.0	942.0	735.0	400.0	294.0	504.0	457.0	400.0
PAHs	Acenaphthene	mg/kg	0.004	0.5	0.016	<0.004	0.041	0.277	0.195	0.065	0.059	0.056	<0.05	0.039
	Acenaphthylene	mg/kg	0.004	0.64	0.044	0.025	0.547	1.240	0.584	0.254	0.406	0.506	0.226	0.320
	Anthracene	mg/kg	0.004	1.1	0.085	0.018	0.348	1.130	0.667	0.246	0.427	0.490	0.252	0.270
	Benz(a)anthracene	mg/kg	0.004	1.6	0.261	0.061	1.220	5.100	2.260	1.010	1.030	1.080	0.916	1.470
	Benzo(a)pyrene	mg/kg	0.004	1.6	0.43	0.083	2.000	6.640	2.670	1.300	1.710	1.320	1.340	2.390
	Benzo(a)pyrene TEQ (lower bound)*	mg/kg	0.5			-	-	-	-	-	-	-	-	-
	Benzo(a)pyrene TEQ (medium bound)*	mg/kg	0.5			-	-	-	-	-	-	-	-	-
	Benzo(a)pyrene TEQ (upper bound)*	mg/kg	0.5			-	-	-	-	-	-	-	-	-
	Benzo(b)&(k)fluoranthene	mg/kg	0.01			-	-	-	-	-	-	-	-	4.100
	Benzo(b)&(j)fluoranthene	mg/kg	0.004			0.077	1.540	5.810	2.570	0.694	1.490	1.120	1.430	-
	Benzo(g,h,i)perylene	mg/kg	0.004			0.076	1.480	5.240	2.570	1.180	0.992	1.220	0.697	1.920
	Benzo(k)fluoranthene	mg/kg	0.004			0.036	0.952	2.500	0.833	0.473	0.518	0.622	0.850	-
	Chrysene	mg/kg	0.004	2.8	0.384	0.044	0.904	3.860	1.630	0.805	0.638	0.643	1.110	1.610
	Dibenz(a,h)anthracene	mg/kg	0.004	0.26	0.063	0.013	0.240	1.020	0.449	0.220	0.215	0.301	0.120	0.430
	Fluoranthene	mg/kg	0.004	5.1	0.6	0.110	2.300	8.380	3.770	1.630	2.080	2.410	1.670	2.930
	Fluorene	mg/kg	0.004	0.54	0.019	<0.004	0.095	0.304	0.187	0.064	0.091	0.102	<0.05	0.090
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.004			0.057	1.020	3.930	1.750	0.872	0.830	1.230	0.464	2.490
	Naphthalene	mg/kg	0.005	2.1	0.16	0.006	0.139	0.503	0.213	0.190	0.092	0.126	0.078	0.180
	Phenanthrene	mg/kg	0.004	1.5	0.24	0.038	0.844	3.370	1.600	0.661	1.040	0.937	0.686	0.920
	Perylene	mg/kg	0.004			0.017	0.337	1.280	0.532	0.264	0.302	0.326	0.291	0.360
	Pyrene	mg/kg	0.004	2.6	0.665	0.114	2.420	7.420	3.900	1.590	0.224	2.450	1.730	3.070
	PAH (Sum of Common 16 PAHs - Lab Reported)	mg/kg	0.004	45	4	0.866	18.100	64.400	29.600	12.800	13.500	16.500	13.000	24.600
	1-Methylnaphthalene	mg/kg	0.005			-	-	-	-	-	-	-	-	0.062
	2-Methylnaphthalene	mg/kg	0.005			<0.005	0.064	0.289	0.116	0.056	0.054	0.058	<0.05	0.094
	Benzo(e)pyrene	mg/kg	0.004			0.053	1.070	3.990	1.680	0.828	0.934	1.050	0.899	1.440
	Coronene	mg/kg	0.005			0.038	0.544	2.100	1.380	0.418	0.335	0.431	0.292	0.450
PCBs	Aroclor 1016	mg/kg	0.005			<0.005	<0.0062	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	-
	Aroclor 1232	mg/kg	0.005			<0.005	<0.0062	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	-
	Aroclor 1242	mg/kg	0.005			<0.005	<0.0062	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	-
	Aroclor 1248	mg/kg	0.005			<0.005	<0.0062	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	-
	Aroclor 1254	mg/kg	0.005			<0.005	<0.0062	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	-
	Aroclor 1260	mg/kg	0.005			<0.005	<0.0062	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	-
	Aroclor 1221	mg/kg	0.005			<0.005	<0.0062	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	-
	PCB (Sum of Total-Lab Reported)	mg/kg	0.005		0.023	<0.005	<0.0062	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	-
BTEXN	Benzene	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-
	Toluene	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-
	Ethylbenzene	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-
	Xylenes (m & p)	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-
	Xylene (o)	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-
	Xylenes (Sum of total) (Lab Reported)	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
	Total BTEX	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-
	Naphthalene	mg/kg	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.180
TRHs	TRH C6 - C9 Fraction	mg/kg	3			<3	<3	<3	<3	<3	<3	<3	<3	<10
	TRH C10 - C14 Fraction	mg/kg	3			<3	<3	12.0	11.0	4.0	<3	4.0	6.0	<10
	TRH C15 - C28 Fraction	mg/kg	3			23.0	80.0	432.0	596.0	232.0	156.0	214.0	305.0	260.0
	TRH C29 - C36 Fraction	mg/kg	5			20.0	86.0	445.0	577.0	280.0	176.0	202.0	308.0	370.0
	TRH+C10 - C36 (Sum of total) (Lab Reported)	mg/kg	3		550	43.0	166.0	889.0	1180.0	516.0	332.0	420.0	619.0	-
	TRH+C10 - C40 (Sum of total) (Lab Reported)	mg/kg	3		550	49.0	203.0	1020.0	1410.0	611.0	406.0	476.0	732.0	-
	TRH C6 - C10 Fraction F1	mg/kg	3			<3	<3	<3	<3	<3	<3	<3	<3	<10
	TRH C6 - C10 Fraction Less BTEX F1	mg/kg	3			<3	<3	<3	<3	<3	<3	<3	<3	-
	TRH >C10 - C16 Fraction F2	mg/kg	3			<3	4.0	32.0	32.0	12.0	6.0	11.0	14.0	<20
	TRH >C10 - C16 Fraction Less Naphthalene F2	mg/kg	3			<3	4.0	32.0	32.0	12.0	6.0	11.0	14.0	-
	TRH >C16 - C34 Fraction F3	mg/kg	3			37.0	138.0	706.0	987.0	411.0	277.0	341.0	515.0	640.0
	TRH >C34 - C40 Fraction F4	mg/kg	5			12.0	61.0	287.0	392.0	188.0	123.0	124.0	203.0	220.0
Pesticides	a-BHC	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	Aldrin	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	Aldrin & Dieldrin (Sum of total) (Lab Reported)	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
	b-BHC	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	Chlordane (Sum of total)	mg/kg	0.00025	0.006	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
	cis-Chlordane	mg/kg	0.00025			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	trans-Chlordane	mg/kg	0.00025			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.001
	d-BHC	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	DDD	mg/kg	0.0005	0.02	0.002	<0.0005	<0.0005	0.011	0.010	0.004	0.002	0.002	0.002	0.018
	DDE	mg/kg	0.0005	0.027	0.0022	<0.0005	0.001	0.007	0.009	0.002	0.001	0.002	0.001	0.009
	DDT	mg/kg	0.0005	0.046	0.0016	<0.0005	<0.0005	0.009	0.011	0.004	0.003	0.004	0.003	<0.002
	DDT+DDE+DDD (Sum of total) (Lab Reported)	mg/kg	0.0005			<0.0005	0.001	0.026	0.030	0.010	0.006	0.008	0.006	-
	Dieldrin	mg/kg	0.0005	0.008	0.00002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	Endosulfan	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
	Endosulfan I	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	Endosulfan II	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	Endosulfan sulphate	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	Endrin	mg/kg	0.0005	0.008	0.00002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	Endrin aldehyde	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
	Endrin ketone	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	g-BHC	mg/kg	0.00025	0.001	0.00032	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.001
	Heptachlor	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	Heptachlor epoxide	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
	Hexachlorobenzene	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.004
	Methoxychlor	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
	Oxychlordane	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
Moisture	Moisture Content	%	1			23.700	64.500	50.400	56.300	45.400	50.700	62.100	63.000	60.700

Analyte	B433W	B434W	B435W	B436W	B437W	B438W	B439W	B440W	B441W	B442W	B443W	B444W	QC202A	QC202B	B445W	B446W
Sample Depth	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17
Lab Report and Sample #	ES1712748008	ES1712748009	ES1712748010	ES1712748011	ES1712748012	ES1712748013	ES1712748014	ES1712748015	ES1712748016	ES1712748017	ES1712748018	ES1712748019	ES1712748031	A17/2048-A-3	ES1712748020	ES1712748021
Units / LOR	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay
Dibutyltin	0.003	1.160	0.022	0.055	0.013	0.012	0.006	0.009	0.006	0.050	0.039	0.013	0.040	0.092	0.006	0.017
Monobutyltin	<0.001	0.134	0.004	0.013	0.002	0.003	0.001	0.002	0.002	0.012	0.012	0.002	0.013	0.100	0.001	0.002
Tributyltin	0.024	5.150	0.097	0.118	0.078	0.058	0.036	0.031	0.011	0.113	0.084	0.068	0.073	0.100	0.043	0.052
Aluminium	19700.0	12500.0	8290.0	19300.0	19300.0	18500.0	18700.0	17400.0	19500.0	8260.0	7590.0	16400.0	15800.0	11000.0	17300.0	16400.0
Antimony	<0.5	4.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	20.9	139.0	16.8	23.3	21.6	21.8	19.6	18.8	19.2	20.7	14.2	18.8	18.9	18.0	21.0	17.7
Cadmium	<0.1	0.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1
Chromium	75.2	178.0	29.5	73.7	73.8	66.9	67.4	63.5	64.8	37.4	30.1	59.7	54.7	50.0	66.2	58.3
Cobalt	7.6	32.0	3.5	7.8	7.7	7.0	6.8	6.6	6.4	3.6	2.8	6.4	5.8	5.0	6.9	6.2
Copper	197.0	2360.0	145.0	277.0	244.0	209.0	194.0	172.0	162.0	319.0	161.0	210.0	198.0	190.0	202.0	183.0
Iron	32400.0	130000.0	16900.0	33000.0	32800.0	31600.0	30300.0	28400.0	30600.0	20500.0	16000.0	29000.0	26800.0	24000.0	30700.0	27500.0
Lead	281.0	1600.0	150.0	304.0	306.0	281.0	270.0	246.0	258.0	209.0	150.0	263.0	247.0	200.0	283.0	260.0
Manganese	157.0	652.0	71.0	140.0	137.0	148.0	129.0	139.0	144.0	65.0	60.0	116.0	121.0	110.0	133.0	123.0
Mercury	2.3	4.8	1.5	2.8	2.8	2.4	2.4	2.1	2.6	1.7	1.6	3.7	3.0	4.8	2.7	2.8
Nickel	14.6	46.2	7.3	15.1	15.9	14.2	13.8	12.7	14.1	6.8	5.6	13.2	12.0	10.0	14.4	12.7
Selenium	1.2	2.7	0.9	0.9	1.8	1.6	1.2	1.4	1.5	0.7	0.6	1.5	1.6	<0.1	1.2	1.7
Silver	2.5	2.6	1.4	2.9	2.8	2.2	2.6	2.4	2.8	1.3	1.2	2.6	2.4	1.0	2.4	2.5
Vanadium	59.3	60.7	28.6	60.1	63.0	56.4	53.0	50.0	52.1	29.8	26.8	49.0	45.0	44.0	53.3	48.3
Zinc	573.0	7690.0	400.0	700.0	658.0	571.0	564.0	510.0	513.0	554.0	314.0	546.0	508.0	420.0	572.0	504.0
Acenaphthene	0.039	0.862	0.175	0.052	0.073	0.053	0.049	0.044	0.063	0.424	0.106	0.076	0.062	0.070	0.062	<0.05
Acenaphthylene	0.606	1.680	0.408	0.556	0.945	0.601	0.611	0.527	0.734	0.480	0.329	0.748	0.336	0.470	0.728	0.506
Anthracene	0.503	1.930	0.936	0.444	0.754	0.479	0.564	0.406	0.641	1.380	0.364	0.795	0.343	0.350	0.641	0.449
Benz(a)anthracene	1.210	7.920	1.560	1.280	1.360	0.889	1.330	0.969	1.420	4.190	1.280	1.560	1.180	1.770	1.410	1.850
Benzo(a)pyrene	2.210	27.800	2.110	2.060	2.160	2.290	2.660	1.620	2.430	4.230	1.790	2.040	1.860	3.170	2.610	2.100
Benzo(a)pyrene TEQ (lower bound)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene TEQ (medium bound)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene TEQ (upper bound)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)&(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	5.300	-	-
Benzo(b)&(j)fluoranthene	1.380	28.600	2.400	1.700	1.780	1.410	1.530	1.600	2.090	3.080	1.730	1.650	2.040	-	1.920	1.890
Benzo(g,h,i)perylene	1.680	21.600	1.090	1.350	1.590	1.540	1.700	1.100	1.460	3.830	1.450	1.990	1.650	2.490	1.570	0.779
Benzo(k)fluoranthene	0.918	6.880	0.724	1.090	1.160	1.120	0.983	0.803	1.030	0.927	0.934	0.881	1.150	-	1.470	1.070
Chrysene	0.989	8.210	1.300	0.838	0.904	0.738	0.845	0.632	0.961	3.040	1.100	0.927	1.450	1.960	0.913	1.500
Dibenz(a,h)anthracene	0.344	3.920	0.308	0.274	0.392	0.333	0.334	0.239	0.355	0.662	0.270	0.414	0.263	0.530	0.391	0.300
Fluoranthene	1.860	18.700	2.830	2.630	2.500	2.440	2.310	1.790	2.750	8.860	2.260	3.080	2.180	3.350	2.040	2.940
Fluorene	0.081	0.675	0.189	0.088	0.121	0.098	0.094	0.078	0.111	0.348	0.140	0.110	0.067	0.110	0.108	0.096
Indeno(1,2,3-c,d)pyrene	1.410	14.700	0.940	1.120	1.370	1.320	1.190	0.947	1.280	2.740	1.090	1.390	1.000	3.150	1.320	1.240
Naphthalene	0.143	0.643	0.093	0.137	0.177	0.130	0.160	0.115	0.155	0.165	0.110	0.183	0.115	0.200	0.192	0.135
Phenanthrene	0.827	6.460	2.720	0.849	0.957	0.653	0.895	0.708	1.000	4.150	0.926	1.310	0.840	1.150	0.993	1.030
Perylene	0.389	4.540	0.466	0.360	0.502	0.344	0.373	0.280	0.422	0.934	0.361	0.586	0.398	0.510	0.505	0.410
Pyrene	2.000	29.000	3.130	2.600	2.640	2.420	2.480	1.630	2.980	8.900	2.410	3.680	2.240	3.540	2.200	3.160
PAH (Sum of Common 16 PAHs - Lab Reported)	18.500	206.000	23.000	19.200	21.000	18.700	19.900	14.800	21.700	52.700	18.400	23.200	19.200	30.700	20.900	21.200
1-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	0.082	-	-
2-Methylnaphthalene	0.074	0.386	0.060	0.065	0.093	0.069	0.079	0.072	0.105	0.104	0.070	0.122	0.056	0.110	0.116	0.065
Benzo(e)pyrene	1.220	14.500	1.260	1.200	1.150	1.360	1.260	0.914	1.390	2.800	1.130	1.280	1.350	1.830	1.320	1.300
Coronene	0.626	7.280	0.306	0.540	0.404	0.438	0.492	0.359	0.302	1.420	0.606	0.370	0.670	0.520	0.359	0.345
Aroclor 1016	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	-	<0.0062	<0.0062
Aroclor 1232	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	-	<0.0062	<0.0062
Aroclor 1242	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	-	<0.0062	<0.0062
Aroclor 1248	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	-	<0.0062	<0.0062
Aroclor 1254	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	-	<0.0062	<0.0062
Aroclor 1260	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	-	<0.0062	<0.0062
Aroclor 1221	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	-	<0.0062	<0.0062
PCB (Sum of Total-Lab Reported)	<0.0062	<0.0062	<0.005	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	-	<0.0062	<0.0062
Benzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2
Toluene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2
Ethylbenzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2
Xylenes (m & p)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2
Xylene (o)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2
Xylenes (Sum of total) (Lab Reported)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
Total BTEX	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2
Naphthalene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.200	<0.005	<0.005
TRH C6 - C9 Fraction	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<10	<3	<3
TRH C10 - C14 Fraction	20.0	46.0	3.0	8.0	3.0	8.0	8.0	3.0	3.0	6.0	5.0	6.0	8.0	<10	4.0	3.0
TRH C15 - C28 Fraction	179.0	1110.0	213.0	430.0	227.0	279.0	508.0	199.0	204.0	262.0	214.0	292.0	375.0	340.0	210.0	181.0
TRH C29 - C36 Fraction	200.0	1130.0	220.0	453.0	242.0	308.0	497.0	216.0	309.0	260.0	230.0	307.0	378.0	430.0	294.0	189.0
TRH+C10 - C36 (Sum of total) (Lab Reported)	399.0	2290.0	436.0	891.0	472.0	595.0	1010.0	418.0	516.0	528.0	449.0	605.0	761.0	-	508.0	373.0
TRH+C10 - C40 (Sum of total) (Lab Reported)	479.0	2750.0	515.0	948.0	565.0	709.0	1170.0	502.0	615.0	626.0	518.0	723.0	911.0	-	601.0	443.0
TRH C6 - C10 Fraction F1	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<10	<3	<3
TRH C6 - C10 Fraction Less BTEX F1	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	-	<3	<3
TRH >C10 - C16 Fraction F2	26.0	86.0	9.0	20.0	9.0	14.0	23.0	8.0	9.0	14.0	12.0	14.0	20.0	14.0	12.0	8.0
TRH >C10 - C16 Fraction Less Naphthalene F2	26.0	86.0	9.0	20.0	9.0	14.0	23.0	8.0	9.0	14.0	12.0	14.0	20.0	-	12.0	8.0
TRH >C16 - C34 Fraction F3	313.0	1860.0	363.0	707.0	396.0	491.0	825.0	346.0	400.0	436.0	356.0	503.0	631.0	780.0	393.0	310.0
TRH >C34 - C40 Fraction F4	140.0	805.0	143.0	221.0	160.0	204.0	324.0	148.0	206.0	176.0	150.0	206.0	260.0	250.0	196.0	125.0
a-BHC	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
Aldrin	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
Aldrin & Dieldrin (Sum of total) (Lab Reported)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005
b-BHC	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
Chlordane (Sum of total)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005
cis-Chlordane	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
trans-Chlordane	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.002	<0.0005	<0.0005
d-BHC	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
DDD	<0.0005	0.029	<0.0005	0.003	0.002	0.001	0.001	<0.0005	0.001	0.005	0.002	0.002	0.003	<0.001	0.002	0.003
DDE	<0.0005	0.022	<0.0005	0.005	0.004	0.002	0.002	0.001	0.001	0.003	0.001	0.002	0.001	0.007	0.002	0.003
DDT	<0.0005	0.071	<0.0005	0.006	0.005	<0.0005	<0.0005	<0.0005	<0.0005	0.010	0.003	0.005	0.003	<0.002	<0.0005	0.003
DDT+DDE+DDD (Sum of total) (Lab Reported)	<0.0005	0.122	<0.0005	0.015	0.011	0.003	0.004	0.001	0.003	0.019	0.006	0.009	0.008	-	0.003	0.009
Dieldrin	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
Endosulfan	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005
Endosulfan I	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
Endosulfan II	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
Endosulfan sulphate	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
Endrin	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
Endrin aldehyde	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005
Endrin ketone	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
g-BHC	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.001	<0.00025	<0.00025
Heptachlor	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
Heptachlor epoxide	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
Hexachlorobenzene	<0.0005	<0.0005	<0.0005	<0.0005	0.001	<0.0005	<0.0005	0.001	<0.0005	<0.0005	<0.0005	0.001	0.001	0.002	<0.0005	<0.0005
Methoxychlor	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005
Oxychlordane	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005
Moisture Content	67.300	52.900	43.500	70.000	64.500	65.400	63.600	64.600	67.700	43.300	43.000	59.200	61.100	57.800	61.100	63.000

				ANZECC 2000 Sediment ISGC-High	ANZECC 2000 Sediment ISGC-Low	B447W	B448W	B449W	B450W	B451W	B768W	B769W	QC102 (method blank)
		Sample Depth				23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17	23/05/17
		Lab Report and Sample #				ES1712748022	ES1712748023	ES1712748024	ES1712748025	ES1712748026	ES1712748027	ES1712748028	ES1712748029
		Units	LOR			Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay	Berrys Bay
Organotins	Dibutyltin	mg/kg	0.001			0.005	0.014	0.002	0.004	0.039	0.015	0.007	<0.001
	Monobutyltin	mg/kg	0.001			0.001	0.002	<0.001	0.002	0.002	0.003	0.001	<0.001
	Tributyltin	mg/kg	0.0005	**0.07**	**0.005**	0.024	0.042	0.021	0.012	0.251	0.048	0.047	<0.0005
Heavy Metals	Aluminium	mg/kg	50			18800.0	19400.0	4680.0	5880.0	14700.0	18400.0	22400.0	<50
	Antimony	mg/kg	0.5	**25**	**2**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Arsenic	mg/kg	1	**70**	**20**	18.9	19.9	11.0	9.9	18.1	19.7	24.2	<1
	Cadmium	mg/kg	0.1	**10**	**1.5**	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1
	Chromium	mg/kg	1	**370**	**80**	64.7	66.3	17.2	14.8	52.6	64.9	80.5	<1
	Cobalt	mg/kg	0.5			6.6	7.0	1.7	1.8	5.6	7.0	8.5	<0.5
	Copper	mg/kg	1	**270**	**65**	178.0	191.0	70.8	43.4	176.0	198.0	238.0	<1
	Iron	mg/kg	50			30800.0	31200.0	10100.0	10100.0	25500.0	31300.0	38800.0	<50
	Lead	mg/kg	1	**220**	**50**	299.0	274.0	116.0	75.2	238.0	284.0	335.0	<1
	Manganese	mg/kg	10			134.0	140.0	42.0	60.0	112.0	130.0	150.0	<10
	Mercury	mg/kg	0.01	**1**	**0.15**	2.8	2.8	1.2	0.8	3.4	3.9	4.9	<0.01
	Nickel	mg/kg	1	**52**	**21**	13.8	12.7	3.6	3.4	13.0	15.6	17.4	<1
	Selenium	mg/kg	0.1			1.6	1.7	0.4	0.6	1.3	1.2	1.9	<0.1
	Silver	mg/kg	0.1	**3.7**	**1**	2.6	2.0	0.8	0.5	2.0	2.6	3.0	<0.1
	Vanadium	mg/kg	2			50.6	55.6	17.0	19.4	43.2	55.3	62.1	<2
	Zinc	mg/kg	1	**410**	**200**	510.0	546.0	152.0	129.0	467.0	554.0	659.0	<1
PAHs	Acenaphthene	mg/kg	0.004	**0.5**	**0.016**	<0.05	<0.05	0.082	<0.025	0.074	<0.05	0.057	<0.004
	Acenaphthylene	mg/kg	0.004	**0.64**	**0.044**	0.494	0.528	0.251	0.103	0.659	0.551	0.393	0.006
	Anthracene	mg/kg	0.004	**1.1**	**0.085**	0.408	0.438	0.452	0.109	0.571	0.487	0.379	<0.004
	Benz(a)anthracene	mg/kg	0.004	**1.6**	**0.261**	1.640	1.750	1.390	0.470	2.430	2.060	1.270	<0.004
	Benzo(a)pyrene	mg/kg	0.004	**1.6**	**0.43**	1.840	1.960	1.420	0.489	2.870	2.380	1.900	0.005
	Benzo(a)pyrene TEQ (lower bound)*	mg/kg	0.5			-	-	-	-	-	-	-	-
	Benzo(a)pyrene TEQ (medium bound)*	mg/kg	0.5			-	-	-	-	-	-	-	-
	Benzo(a)pyrene TEQ (upper bound)*	mg/kg	0.5			-	-	-	-	-	-	-	-
	Benzo(b)&(k)fluoranthene	mg/kg	0.01			-	-	-	-	-	-	-	-
	Benzo(b)&(j)fluoranthene	mg/kg	0.004			1.740	1.980	1.340	0.497	2.480	2.130	1.930	0.005
	Benzo(g,h,i)perylene	mg/kg	0.004			0.712	1.570	0.515	0.388	1.060	0.621	1.770	0.008
	Benzo(k)fluoranthene	mg/kg	0.004			0.826	0.975	0.594	0.244	1.510	1.200	1.280	<0.004
	Chrysene	mg/kg	0.004	**2.8**	**0.384**	1.270	1.390	1.020	0.348	1.930	1.620	1.540	<0.004
	Dibenz(a,h)anthracene	mg/kg	0.004	**0.26**	**0.063**	0.179	0.291	0.200	0.080	0.215	0.164	0.307	<0.004
	Fluoranthene	mg/kg	0.004	**5.1**	**0.6**	2.640	2.970	2.500	0.749	3.870	3.310	2.440	<0.004
	Fluorene	mg/kg	0.004	**0.54**	**0.019**	0.086	0.106	0.142	<0.025	0.128	0.124	0.099	<0.004
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.004			0.574	1.200	0.740	0.303	0.819	0.630	1.160	0.005
	Naphthalene	mg/kg	0.005	**2.1**	**0.16**	0.124	0.126	0.090	0.032	0.166	0.172	0.190	<0.005
	Phenanthrene	mg/kg	0.004	**1.5**	**0.24**	0.935	0.994	1.270	0.277	1.390	1.220	0.984	<0.004
	Perylene	mg/kg	0.004			0.360	0.376	0.297	0.098	0.564	0.471	0.407	<0.004
	Pyrene	mg/kg	0.004	**2.6**	**0.665**	2.720	3.100	2.470	0.763	4.290	3.510	2.550	<0.004
	PAH (Sum of Common 16 PAHs - Lab Reported)	mg/kg	0.004	**45**	**4**	18.000	21.600	16.000	5.490	27.400	22.400	20.800	0.034
	1-Methylnaphthalene	mg/kg	0.005			-	-	-	-	-	-	-	-
	2-Methylnaphthalene	mg/kg	0.005			<0.05	0.059	0.050	<0.025	0.086	0.086	0.072	<0.005
	Benzo(e)pyrene	mg/kg	0.004			1.150	1.150	0.870	0.284	1.780	1.370	1.320	<0.004
	Coronene	mg/kg	0.005			0.351	0.695	0.281	0.259	0.513	0.244	0.785	0.005
PCBs	Aroclor 1016	mg/kg	0.005			<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	<0.0062	<0.005
	Aroclor 1232	mg/kg	0.005			<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	<0.0062	<0.005
	Aroclor 1242	mg/kg	0.005			<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	<0.0062	<0.005
	Aroclor 1248	mg/kg	0.005			<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	<0.0062	<0.005
	Aroclor 1254	mg/kg	0.005			<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	<0.0062	<0.005
	Aroclor 1260	mg/kg	0.005			<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	<0.0062	<0.005
	Aroclor 1221	mg/kg	0.005			<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	<0.0062	<0.005
	PCB (Sum of Total-Lab Reported)	mg/kg	0.005		**0.023**	<0.0062	<0.0062	<0.005	<0.005	<0.0062	<0.0062	<0.0062	<0.005
BTEXN	Benzene	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Toluene	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Xylenes (m & p)	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Xylene (o)	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Xylenes (Sum of total) (Lab Reported)	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Total BTEX	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Naphthalene	mg/kg	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
TRHs	TRH C6 - C9 Fraction	mg/kg	3			<3	<3	<3	<3	<3	<3	<3	<3
	TRH C10 - C14 Fraction	mg/kg	3			6.0	4.0	<3	<3	6.0	6.0	7.0	<3
	TRH C15 - C28 Fraction	mg/kg	3			252.0	246.0	74.0	47.0	359.0	283.0	333.0	<3
	TRH C29 - C36 Fraction	mg/kg	5			267.0	262.0	70.0	53.0	393.0	303.0	371.0	<5
	TRH+C10 - C36 (Sum of total) (Lab Reported)	mg/kg	3		**550**	525.0	512.0	144.0	100.0	758.0	592.0	711.0	<3
	TRH+C10 - C40 (Sum of total) (Lab Reported)	mg/kg	3		**550**	607.0	614.0	168.0	122.0	941.0	704.0	838.0	<3
	TRH C6 - C10 Fraction F1	mg/kg	3			<3	<3	<3	<3	<3	<3	<3	<3
	TRH C6 - C10 Fraction Less BTEX F1	mg/kg	3			<3	<3	<3	<3	<3	<3	<3	<3
	TRH >C10 - C16 Fraction F2	mg/kg	3			16.0	11.0	4.0	<3	18.0	14.0	22.0	<3
	TRH >C10 - C16 Fraction Less Naphthalene F2	mg/kg	3			16.0	11.0	4.0	<3	18.0	14.0	22.0	<3
	TRH >C16 - C34 Fraction F3	mg/kg	3			415.0	425.0	118.0	84.0	625.0	490.0	566.0	<3
	TRH >C34 - C40 Fraction F4	mg/kg	5			176.0	178.0	46.0	38.0	298.0	200.0	250.0	<5
Pesticides	a-BHC	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Aldrin	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Aldrin & Dieldrin (Sum of total) (Lab Reported)	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	b-BHC	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Chlordane (Sum of total)	mg/kg	0.00025	**0.006**	**0.0005**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	cis-Chlordane	mg/kg	0.00025			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	trans-Chlordane	mg/kg	0.00025			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	d-BHC	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	DDD	mg/kg	0.0005	**0.02**	**0.002**	0.005	0.004	0.001	<0.0005	0.004	0.003	0.003	<0.0005
	DDE	mg/kg	0.0005	**0.027**	**0.0022**	0.003	0.002	0.001	<0.0005	0.003	0.003	0.001	<0.0005
	DDT	mg/kg	0.0005	**0.046**	**0.0016**	0.006	0.004	0.001	<0.0005	0.004	0.004	0.003	<0.0005
	DDT+DDE+DDD (Sum of total) (Lab Reported)	mg/kg	0.0005			0.013	0.011	0.003	<0.0005	0.010	0.011	0.007	<0.0005
	Dieldrin	mg/kg	0.0005	**0.008**	**0.00002**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Endosulfan	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Endosulfan I	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Endosulfan II	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Endosulfan sulphate	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Endrin	mg/kg	0.0005	**0.008**	**0.00002**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Endrin aldehyde	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Endrin ketone	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	g-BHC	mg/kg	0.00025	**0.001**	**0.00032**	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Heptachlor	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Heptachlor epoxide	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Hexachlorobenzene	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.001	0.001	<0.0005
	Methoxychlor	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Oxychlordane	mg/kg	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Moisture	Moisture Content	%	1			64.600	68.400	31.500	38.300	57.600	61.800	62.600	23.600

Table 4. Sediment Analytical Results by Area

GSY0171

Geosyntec consultants

engineers | scientists | innovators

		Organic Matter	Total Metals								Organotin Compounds		PAH		TPH
		Total Organic Carbon	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	Mercury	Tributyltin	TBT @ 1%TOC	Sum of PAHs	Sum of PAHs @1%	C10 - C36 (sum)
		%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µgSn/kg	µgSn/kg	mg/kg	mg/kg	mg/kg
	Limit of reporting	0.02%	1	0.1	1	1	1	1	1	0.1	0.5	0.5	0.5	0.5	3.0
	ANZG18 Default Guideline Value		20	1.5	80	65	50	21	200	0.15		9		10	280
	ANZG18 Additional Upper Guideline Value		70	10	370	270	220	52	410	1		70		50	550
	Field ID														
Jacobs 2017 Data	**1**	1.7	15	<1	35	296	243	7	595	1.6	118	69.4	21.2	12.5	100
	2	2.4	13	<1	39	263	245	8	479	2.0	142	59.2	24.7	10.3	330
	3	1.6	14	<1	38	194	186	7	505	1.5	41	25.6	18.8	11.8	<50
	4	2.6	22	<1	50	384	332	15	796	2.6	329	126.5	49.5	19	530
	5	3.9	30	<1	61	2240	874	20	1320	13.6	1860	476.9	29.4	7.5	600
	6	2.6	62	<1	36	363	228	13	531	3.0	265	101.9	22.4	8.6	380
	6dup (10)	2.4	19	<1	43	427	271	14	561	3.7	251	104.6	18.9	7.9	150
	7	1.3	14	<1	27	1600	290	9	844	3.5	1020	784.6	33.3	25.6	400
	8	2.9	20	<1	47	1340	374	13	751	9.2	1670	575.9	54.3	18.7	820
	9	1.3	12	<1	24	369	167	9	322	3.3	164	126.2	7.8	6	<50
MPR 2021 Data	**11 Surf**	3.53	3.7	0.2	30.1	94.5	251	5	461	<0.1	-	-	-	-	-
	12 Surf	3.61	6.4	0.1	42	140	310	8.2	614	<0.1	-	-	-	-	-
	13 Surf	3.2	3.8	<0.1	37.1	82	242	5.4	520	<0.1	-	-	-	-	-
	14 Surf	3.28	3.8	<0.1	38.9	72.1	274	5.7	599	<0.1	-	-	-	-	-
	15 Surf	4.12	4.6	0.3	36.2	204	564	7.1	1720	<0.1	-	-	-	-	-
	16 Surf	2.16	3.2	<0.1	25.8	81.1	128	2.2	225	<0.1	43.6	20.2	21.4	9.907	387
	16 Bot	1.6	2.8	<0.1	9	43.6	122	2.2	190	<0.1	10.1	3.6	40.5	8.068	236
	17 Surf	5.02	4.6	0.1	32.2	230	366	6.9	800	<0.1	453	90.2	23.8	8.947	637
	17 Bot	5.32	4.6	0.2	39.6	194	443	8.7	923	<0.1	892	167.7	23.8	12.526	945
	18 Surf	2.66	4.6	<0.1	24.6	120	200	3.9	411	<0.1	11.1	4.2	25.0	7.669	655
	18 Bot	1.5	3.6	<0.1	15.9	59.3	130	3.2	316	<0.1	6.4	4.3	15.4	9.625	257
	19 Surf	1.9	3.8	<0.1	16.4	113	175	2.8	407	<0.1	12.2	6.4	79.5	14.944	524
	19 Bot	1.9	2.9	0.1	15.6	61.5	180	3	335	<0.1	5.2	2.7	11.3	7.355	669
	20 Surf	3.26	5.1	<0.1	41.9	128	316	6.5	690	<0.1	17.8	5.5	35.1	18.474	784
	20 Bot	3.1	4.5	<0.1	30.4	97.4	304	5.2	628	<0.1	17.3	5.6	32.6	10.516	789
Area Means	**AREA1**: Adjacent to slip (5,7,8,9)	Mean	19.0	<1	39.8	1387.3	426.3	12.8	809.3	7.4	1178.5	490.9	31.2	14.5	606.7
	AREA 2: Inner FDD footprint (1,2,3,4)	Mean	16.0	<1	40.5	284.3	251.5	9.3	593.8	1.9	157.5	70.2	28.6	13.4	320.0
	AREA 3: Outer FDD (16,17,18,19,20)	Mean	4.3	0.1	28.2	134.4	237.0	4.5	506.6	<0.1	107.5	25.3	37.0	12.0	597.4
	AREA 4: Distant (11,12,13,14,15)	Mean	4.5	0.2	36.9	118.5	328.2	6.3	782.8	<0.1	-	-	-	-	-
	AREA 5: Western arm of Berrys Bay*	Mean	NC	NC	NC	271.0	286.4	NC	758.1	NC	264.9	NC	28.1	NC	584.9

Normalised results shown in red text

* Sediment data for Western Arm of Berrys Bay taken from Table 3 (Douglas Partners/Golder Associates).

NC= Not Calculated

Appendix C Laboratory Certificates

Appendix C Jacobs 2017 Laboratory Certificates

CERTIFICATE OF ANALYSIS

Work Order	: **ES1730018**	Page	: 1 of 15
Client	: **JACOBS GROUP (AUSTRALIA) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: ROBERT GAUTHIER	Contact	: Marnie Thomsett
Address	: 100 CHRISTIE STREET P O BOX 164 ST LEONARDS NSW, AUSTRALIA 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9928 2100	Telephone	: +61-2-8784 8555
Project	: Berry's Bay Sediments	Date Samples Received	: 29-Nov-2017 13:00
Order number	: IA171000.70	Date Analysis Commenced	: 01-Dec-2017
C-O-C number	: 233457	Issue Date	: 20-Dec-2017 10:46
Sampler	: ROBERT GAUTHIER		
Site	: ----		
Quote number	: EN/003/17 Primary Work Only		
No. of samples received	: 10		
No. of samples analysed	: 10		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ashesh Patel	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- samples were resubmitted as results were quite high, dilutions were done on these samples accordingly.
- EP066 : Positive PCB result is confirmed by re-extraction and re-analysis.
- EP090 Organotin: Sample '2' showed poor matrix spike recovery. Insufficient sample remaining for re-extraction and re-analysis.
- EP090 Organotin: Sample '1' showed poor duplicate results. Insufficient sample remaining for re-extraction and re-analysis.
- EP090 Organotin: Particular samples required dilution due to the presence of high level contaminants. LOR values have been adjusted accordingly and surrogate recovery has not been determined.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	1	2	3	4	5
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-001	ES1730018-002	ES1730018-003	ES1730018-004	ES1730018-005
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	39.1	41.2	38.2	48.5	50.6
EA150: Particle Sizing								
+75µm	----	1	%	67	54	61	51	55
+150µm	----	1	%	58	47	52	38	42
+300µm	----	1	%	35	25	24	19	21
+425µm	----	1	%	17	12	9	10	13
+600µm	----	1	%	6	5	2	7	8
+1180µm	----	1	%	2	2	<1	4	5
+2.36mm	----	1	%	<1	2	<1	2	4
+4.75mm	----	1	%	<1	<1	<1	<1	2
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	33	46	39	49	45
Sand (>75 µm)	----	1	%	66	52	61	48	51
Gravel (>2mm)	----	1	%	1	2	<1	3	4
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EG005T: Total Metals by ICP-AES								
Cobalt	7440-48-4	2	mg/kg	4	4	4	8	8
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg	15	13	14	22	30
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	35	39	38	50	61
Copper	7440-50-8	5	mg/kg	296	263	194	384	2240
Lead	7439-92-1	5	mg/kg	243	245	186	332	874
Nickel	7440-02-0	2	mg/kg	7	8	7	15	20
Zinc	7440-66-6	5	mg/kg	595	479	505	796	1320
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	1.6	2.0	1.5	2.6	13.6
EP004: Organic Matter								
Total Organic Carbon	----	0.5	%	1.7	2.4	1.6	2.6	3.9
EP066: Polychlorinated Biphenyls (PCB)								

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

			Client sample ID	1	2	3	4	5
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-001	ES1730018-002	ES1730018-003	ES1730018-004	ES1730018-005
				Result	Result	Result	Result	Result
EP066: Polychlorinated Biphenyls (PCB) - Continued								
Total Polychlorinated biphenyls	----	0.1	mg/kg	**0.1**	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	**0.8**	<0.8
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	**0.5**	<0.8
Phenanthrene	85-01-8	0.5	mg/kg	**2.3**	**2.2**	**1.7**	**4.2**	**1.9**
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	**0.9**	<0.8

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	1	2	3	4	5
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-001	ES1730018-002	ES1730018-003	ES1730018-004	ES1730018-005
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Fluoranthene	206-44-0	0.5	mg/kg	4.0	4.5	3.5	8.5	4.3
Pyrene	129-00-0	0.5	mg/kg	4.0	4.7	3.6	8.8	5.0
Benz(a)anthracene	56-55-3	0.5	mg/kg	1.5	1.8	1.4	3.7	2.3
Chrysene	218-01-9	0.5	mg/kg	1.6	1.8	1.4	3.7	2.3
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	2.2	2.9	2.2	5.7	4.1
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	1.1	1.1	0.8	2.1	1.7
Benzo(a)pyrene	50-32-8	0.5	mg/kg	2.0	2.5	1.9	4.8	3.7
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	1.1	1.4	1.0	2.3	1.8
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	0.6	<0.8
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	1.4	1.8	1.3	2.9	2.3
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	21.2	24.7	18.8	49.5	29.4
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	2.6	3.2	2.5	6.8	4.7
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	2.9	3.5	2.7	6.8	5.0
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	3.1	3.8	3.0	6.8	5.2
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	100	170	<100	280	290
C29 - C36 Fraction	----	100	mg/kg	<100	160	<100	250	310
^ C10 - C36 Fraction (sum)	----	50	mg/kg	100	330	<50	530	600
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	170	290	110	460	550
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	140	210
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	170	290	110	600	760
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	1	2	3	4	5
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-001	ES1730018-002	ES1730018-003	ES1730018-004	ES1730018-005
				Result	Result	Result	Result	Result
EP080: BTEXN - Continued								
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	**118**	**142**	**41.0**	**329**	**1860**
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	1	2	3	4	5
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-001	ES1730018-002	ES1730018-003	ES1730018-004	ES1730018-005
				Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued								
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums								
Sum of PFAS	----	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**125**	**99.5**	**126**	**108**	**104**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	1	2	3	4	5
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-001	ES1730018-002	ES1730018-003	ES1730018-004	ES1730018-005
				Result	Result	Result	Result	Result
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	131	106	78.5	122	126
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	128	101	71.0	120	127
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	93.3	95.8	90.6	92.6	94.4
2-Chlorophenol-D4	93951-73-6	0.5	%	96.7	98.9	92.9	95.4	97.0
2.4.6-Tribromophenol	118-79-6	0.5	%	81.6	86.1	78.3	81.9	87.0
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	101	102	94.8	97.8	99.9
Anthracene-d10	1719-06-8	0.5	%	101	103	96.8	99.4	100
4-Terphenyl-d14	1718-51-0	0.5	%	90.5	91.0	87.9	89.4	90.5
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	87.8	93.8	98.3	89.4	74.9
Toluene-D8	2037-26-5	0.2	%	92.9	99.9	104	92.4	76.3
4-Bromofluorobenzene	460-00-4	0.2	%	94.6	99.5	106	93.5	79.9
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	104	83.4	92.8	Not Determined	Not Determined
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	116	99.0	111	122	66.0
13C8-PFOA	----	0.0002	%	95.0	66.0	104	94.0	66.0

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	6	7	8	9	10
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-006	ES1730018-007	ES1730018-008	ES1730018-009	ES1730018-010
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	40.0	32.3	42.7	28.2	41.3
EA150: Particle Sizing								
+75µm	----	1	%	59	91	69	80	59
+150µm	----	1	%	47	84	48	75	46
+300µm	----	1	%	26	50	16	58	26
+425µm	----	1	%	19	28	6	50	19
+600µm	----	1	%	15	16	3	46	14
+1180µm	----	1	%	8	9	1	38	8
+2.36mm	----	1	%	4	6	<1	27	4
+4.75mm	----	1	%	2	3	<1	6	1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	41	9	31	20	41
Sand (>75 µm)	----	1	%	54	84	68	50	54
Gravel (>2mm)	----	1	%	5	7	1	30	5
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EG005T: Total Metals by ICP-AES								
Cobalt	7440-48-4	2	mg/kg	10	4	5	4	6
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg	62	14	20	12	19
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	36	27	47	24	43
Copper	7440-50-8	5	mg/kg	363	1600	1340	369	427
Lead	7439-92-1	5	mg/kg	228	290	374	167	271
Nickel	7440-02-0	2	mg/kg	13	9	13	9	14
Zinc	7440-66-6	5	mg/kg	531	844	751	322	561
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	3.0	3.5	9.2	3.3	3.7
EP004: Organic Matter								
Total Organic Carbon	----	0.5	%	2.6	1.3	2.9	1.3	2.4
EP066: Polychlorinated Biphenyls (PCB)								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	6	7	8	9	10
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-006	ES1730018-007	ES1730018-008	ES1730018-009	ES1730018-010
				Result	Result	Result	Result	Result
EP066: Polychlorinated Biphenyls (PCB) - Continued								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	**0.8**	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	**0.6**	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	**1.6**	**3.6**	**4.9**	**0.9**	**1.5**
Anthracene	120-12-7	0.5	mg/kg	<0.5	**0.6**	**1.0**	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	6	7	8	9	10
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-006	ES1730018-007	ES1730018-008	ES1730018-009	ES1730018-010
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Fluoranthene	206-44-0	0.5	mg/kg	3.8	5.3	9.4	1.6	3.3
Pyrene	129-00-0	0.5	mg/kg	4.0	6.7	9.3	1.6	3.3
Benz(a)anthracene	56-55-3	0.5	mg/kg	1.7	2.2	4.3	0.8	1.5
Chrysene	218-01-9	0.5	mg/kg	1.9	2.2	4.2	0.8	1.6
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	3.0	4.2	6.3	1.1	1.6
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	1.1	1.7	2.5	<0.5	0.7
Benzo(a)pyrene	50-32-8	0.5	mg/kg	2.5	3.5	5.9	1.0	2.2
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	1.2	1.5	2.4	<0.5	1.3
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.6	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	1.6	1.8	2.9	<0.5	1.9
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	22.4	33.3	54.3	7.8	18.9
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	3.2	4.5	8.1	1.2	2.7
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	3.5	4.8	8.1	1.5	3.0
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	3.7	5.0	8.1	1.8	3.2
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	190	190	420	<100	<100
C29 - C36 Fraction	----	100	mg/kg	190	210	400	<100	150
^ C10 - C36 Fraction (sum)	----	50	mg/kg	380	400	820	<50	150
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	320	370	700	130	240
>C34 - C40 Fraction	----	100	mg/kg	110	160	250	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	430	530	950	130	240
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	6	7	8	9	10
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-006	ES1730018-007	ES1730018-008	ES1730018-009	ES1730018-010
				Result	Result	Result	Result	Result
EP080: BTEXN - Continued								
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	μgSn/kg	**265**	**1020**	**1670**	**164**	**251**
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	6	7	8	9	10
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-006	ES1730018-007	ES1730018-008	ES1730018-009	ES1730018-010
				Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued								
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums								
Sum of PFAS	----	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**103**	**105**	**90.4**	**114**	**116**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	6	7	8	9	10
			Client sampling date / time	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00	29-Nov-2017 00:00
Compound	CAS Number	LOR	Unit	ES1730018-006	ES1730018-007	ES1730018-008	ES1730018-009	ES1730018-010
				Result	Result	Result	Result	Result
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	124	135	125	130	126
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	128	123	86.3	128	131
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	97.6	98.0	94.7	98.3	75.2
2-Chlorophenol-D4	93951-73-6	0.5	%	100	101	97.4	101	72.5
2.4.6-Tribromophenol	118-79-6	0.5	%	88.0	89.3	87.8	86.3	55.2
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	103	103	99.9	102	76.8
Anthracene-d10	1719-06-8	0.5	%	104	104	101	104	79.4
4-Terphenyl-d14	1718-51-0	0.5	%	93.6	92.2	89.7	93.7	102
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	96.0	88.7	94.2	94.0	89.9
Toluene-D8	2037-26-5	0.2	%	95.5	94.6	100.0	97.8	94.6
4-Bromofluorobenzene	460-00-4	0.2	%	96.9	94.0	97.8	96.0	95.0
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	97.5	74.6	128	104	89.9
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	99.0	115	66.0	120	112
13C8-PFOA	----	0.0002	%	76.0	63.0	65.0	90.0	125

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	130
13C8-PFOA	----	60	130

QUALITY CONTROL REPORT

Work Order	: **ES1730018**	Page	: 1 of 14
Client	: **JACOBS GROUP (AUSTRALIA) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: ROBERT GAUTHIER	Contact	: Marnie Thomsett
Address	: 100 CHRISTIE STREET P O BOX 164 ST LEONARDS NSW, AUSTRALIA 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9928 2100	Telephone	: +61-2-8784 8555
Project	: Berry's Bay Sediments	Date Samples Received	: 29-Nov-2017
Order number	: IA171000.70	Date Analysis Commenced	: 01-Dec-2017
C-O-C number	: 233457	Issue Date	: 20-Dec-2017
Sampler	: ROBERT GAUTHIER		
Site	: ----		
Quote number	: EN/003/17 Primary Work Only		
No. of samples received	: 10		
No. of samples analysed	: 10		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ashesh Patel	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 1286639)									
ES1730018-003	3	EA055: Moisture Content	----	1	%	38.2	39.6	3.50	0% - 20%
ES1730206-001	Anonymous	EA055: Moisture Content	----	1	%	15.9	15.6	1.42	0% - 50%
EG005T: Total Metals by ICP-AES (QC Lot: 1284987)									
ES1730009-003	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	4	7	70.3	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	2	4	50.9	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	6	12	62.3	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	9	24	92.4	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	6	11	54.6	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	28	46	49.7	No Limit
ES1730018-002	2	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	39	36	8.12	0% - 50%
		EG005T: Cobalt	7440-48-4	2	mg/kg	4	4	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	8	8	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	13	12	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	263	244	7.37	0% - 20%
		EG005T: Lead	7439-92-1	5	mg/kg	245	215	12.9	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	479	401	17.6	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1284986)									
ES1730009-003	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
ES1730018-002	2	EG035T: Mercury	7439-97-6	0.1	mg/kg	2.0	1.8	10.2	0% - 50%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP004: Organic Matter (QC Lot: 1284879)									
ES1730018-001	1	EP004: Total Organic Carbon	----	0.5	%	1.7	1.8	0.00	No Limit
ES1730240-001	Anonymous	EP004: Total Organic Carbon	----	0.5	%	1.9	1.8	0.00	No Limit
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 1284285)									
ES1730018-001	1	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	0.1	<0.1	0.00	No Limit
ES1730018-010	10	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 1284282)									
ES1730018-001	1	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
ES1730018-010	10	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP068A: Organochlorine Pesticides (OC) (QC Lot: 1284282) - continued									
ES1730018-010	10	EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1284284)									
ES1730018-001	1	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	2.3	1.7	31.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	4.0	3.8	5.35	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	4.0	4.0	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	1.5	1.6	8.52	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	1.6	1.6	0.00	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	2.2	2.5	9.67	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	1.1	1.0	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	2.0	2.2	8.90	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	1.1	1.1	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	1.4	1.5	0.00	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	21.2	21.0	0.948	0% - 20%
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	2.6	2.8	8.44	No Limit
ES1730018-010	10	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	1.5	1.8	15.8	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	3.3	3.5	5.92	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	3.3	3.4	4.23	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	1.5	1.5	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	1.6	1.6	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1284284) - continued									
ES1730018-010	10	EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	1.6	1.5	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	0.7	0.6	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	2.2	2.0	6.78	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	1.3	1.2	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	1.9	1.8	0.00	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	18.9	18.9	0.00	0% - 20%
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	2.7	2.5	8.78	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1283981)									
ES1730018-001	1	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
ES1730100-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1284283)									
ES1730018-001	1	EP071: C15 - C28 Fraction	----	100	mg/kg	100	110	0.00	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
ES1730018-010	10	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	150	150	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1283981)									
ES1730018-001	1	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
ES1730100-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1284283)									
ES1730018-001	1	EP071: >C16 - C34 Fraction	----	100	mg/kg	170	180	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
ES1730018-010	10	EP071: >C16 - C34 Fraction	----	100	mg/kg	240	230	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
EP080: BTEXN (QC Lot: 1283981)									
ES1730018-001	1	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit
ES1730100-001	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP080: BTEXN (QC Lot: 1283981) - continued									
ES1730100-001	Anonymous	EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1283829)									
EM1716312-005	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0034	0.0032	6.18	0% - 50%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
ES1730018-008	8	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1283829)									
EM1716312-005	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
ES1730018-008	8	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1283829) - continued									
ES1730018-008	8	EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1283829)									
EM1716312-005	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
ES1730018-008	8	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1283829)									
EM1716312-005	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
ES1730018-008	8	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1283829) - continued									
ES1730018-008	8	EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 1284987)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	107	86	126
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	99.2	83	113
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	99.6	76	128
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	16 mg/kg	103	88	120
EG005T: Copper	7440-50-8	5	mg/kg	<5	32 mg/kg	100	86	120
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	98.6	80	114
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55 mg/kg	105	87	123
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5.37 mg/kg	87.0	75	131
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	107	80	122
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1284986)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	78.1	70	105
EP004: Organic Matter (QCLot: 1284879)								
EP004: Total Organic Carbon	----	0.5	%	<0.5	1.36 %	94.1	81	99
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 1284285)								
EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	1 mg/kg	84.0	62	126
EP068A: Organochlorine Pesticides (OC) (QCLot: 1284282)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	88.0	69	113
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	106	65	117
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	97.7	67	119
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	95.3	68	116
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	85.8	65	117
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	99.3	67	115
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	104	69	115
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	94.2	62	118
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	79.7	63	117
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	91.1	66	116
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	81.5	64	116
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	83.0	66	116
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	83.1	67	115
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	81.9	67	123
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	90.3	69	115
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	86.9	69	121
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	79.3	56	120
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	99.3	62	124

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP068A: Organochlorine Pesticides (OC) (QCLot: 1284282) - continued								
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	96.2	66	120
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	107	64	122
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	96.4	54	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1284284)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	6 mg/kg	103	77	125
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	6 mg/kg	97.6	72	124
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	6 mg/kg	107	73	127
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	6 mg/kg	103	72	126
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	6 mg/kg	106	75	127
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	6 mg/kg	107	77	127
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	6 mg/kg	107	73	127
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	6 mg/kg	108	74	128
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	6 mg/kg	93.4	69	123
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	6 mg/kg	101	75	127
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	6 mg/kg	98.5	68	116
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	6 mg/kg	104	74	126
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	6 mg/kg	99.7	70	126
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	6 mg/kg	91.6	61	121
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	6 mg/kg	91.4	62	118
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	6 mg/kg	90.0	63	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1283981)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	95.3	68	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1284283)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	110	75	129
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	108	77	131
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	102	71	129
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1283981)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	95.1	68	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1284283)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	250 mg/kg	112	77	125
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	104	74	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	150 mg/kg	102	63	131
EP080: BTEXN (QCLot: 1283981)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	99.7	62	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	98.7	67	121
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	95.3	65	117

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP080: BTEXN (QCLot: 1283981) - continued								
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	98.2	66	118
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	101	68	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	97.9	63	119
EP090: Organotin Compounds (QCLot: 1293952)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	91.9	52	139
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1283829)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.4	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	76.8	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.9	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	73.8	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	76.6	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	79.3	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1283829)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	85.6	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	82.2	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	83.6	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	75.7	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	74.4	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.0	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.0	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	67.1	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	79.0	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	65.6	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	85.5	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1283829)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	64.6	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	84.2	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	75.9	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	88.6	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	85.5	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	76.0	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.7	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1283829)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1283829) - continued								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	69.2	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	69.7	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	71.8	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	70.3	60	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
				Concentration	MS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 1284987)							
ES1730009-003	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	98.5	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	94.2	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	101	70	130
		EG005T: Copper	7440-50-8	250 mg/kg	103	70	130
		EG005T: Lead	7439-92-1	250 mg/kg	95.5	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	107	70	130
		EG005T: Zinc	7440-66-6	250 mg/kg	102	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1284986)							
ES1730009-003	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	94.7	70	130
EP004: Organic Matter (QCLot: 1284879)							
ES1730018-001	1	EP004: Total Organic Carbon	----	1 %	98.0	70	130
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 1284285)							
ES1730018-001	1	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	87.0	70	130
EP068A: Organochlorine Pesticides (OC) (QCLot: 1284282)							
ES1730018-001	1	EP068: gamma-BHC	58-89-9	0.5 mg/kg	95.1	70	130
		EP068: Heptachlor	76-44-8	0.5 mg/kg	108	70	130
		EP068: Aldrin	309-00-2	0.5 mg/kg	79.6	70	130
		EP068: Dieldrin	60-57-1	0.5 mg/kg	93.4	70	130
		EP068: Endrin	72-20-8	2 mg/kg	86.2	70	130
		EP068: 4.4`-DDT	50-29-3	2 mg/kg	88.3	70	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1284284)							
ES1730018-001	1	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	114	70	130
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	106	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1283981)							

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1283981) - continued							
ES1730018-001	1	EP080: C6 - C9 Fraction	----	32.5 mg/kg	95.9	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1284283)							
ES1730018-001	1	EP071: C10 - C14 Fraction	----	523 mg/kg	91.2	73	137
		EP071: C15 - C28 Fraction	----	2319 mg/kg	113	53	131
		EP071: C29 - C36 Fraction	----	1714 mg/kg	117	52	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1283981)							
ES1730018-001	1	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	93.8	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1284283)							
ES1730018-001	1	EP071: >C10 - C16 Fraction	----	860 mg/kg	91.1	73	137
		EP071: >C16 - C34 Fraction	----	3223 mg/kg	121	53	131
		EP071: >C34 - C40 Fraction	----	1058 mg/kg	105	52	132
EP080: BTEXN (QCLot: 1283981)							
ES1730018-001	1	EP080: Benzene	71-43-2	2.5 mg/kg	84.5	70	130
		EP080: Toluene	108-88-3	2.5 mg/kg	85.6	70	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	87.1	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	88.8	70	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	90.1	70	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	86.7	70	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1283829)							
EM1716312-005	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	64.0	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	57.2	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	65.6	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	58.4	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	91.2	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	120	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1283829)							
EM1716312-005	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	74.8	30	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	74.4	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	53.2	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	74.0	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	75.2	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	60.4	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	70.4	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	58.4	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	79.6	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	62.4	30	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1283829) - continued							
EM1716312-005	Anonymous	EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	60.2	30	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1283829)							
EM1716312-005	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	67.6	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	77.6	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	33.3	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	79.3	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	68.8	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	60.4	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	64.8	30	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1283829)							
EM1716312-005	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	64.0	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	68.8	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	60.4	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	65.6	50	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1730018**	Page	: 1 of 9
Client	: **JACOBS GROUP (AUSTRALIA) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: ROBERT GAUTHIER	Telephone	: +61-2-8784 8555
Project	: Berry's Bay Sediments	Date Samples Received	: 29-Nov-2017
Site	: ----	Issue Date	: 20-Dec-2017
Sampler	: ROBERT GAUTHIER	No. of samples received	: 10
Order number	: IA171000.70	No. of samples analysed	: 10

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Laboratory Duplicates (DUP)					
Organotin Analysis	0	10	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Organotin Analysis	0	10	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
1,	2,	**29-Nov-2017**	**----**	----	----	**02-Dec-2017**	13-Dec-2017	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EA150: Particle Sizing								
Soil Glass Jar - Unpreserved (EA150)								
1,	2,	**29-Nov-2017**	**----**	----	----	**06-Dec-2017**	28-May-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EA150: Soil Classification based on Particle Size								
Soil Glass Jar - Unpreserved (EA150)								
1,	2,	**29-Nov-2017**	**----**	----	----	**06-Dec-2017**	28-May-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG005T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved (EG005T)								
1,	2,	**29-Nov-2017**	**01-Dec-2017**	28-May-2018	✓	**01-Dec-2017**	28-May-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035T)								
1,	2,	**29-Nov-2017**	**01-Dec-2017**	27-Dec-2017	✓	**04-Dec-2017**	27-Dec-2017	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EP004: Organic Matter								
Soil Glass Jar - Unpreserved (EP004)								
1,	2,	**29-Nov-2017**	**05-Dec-2017**	27-Dec-2017	✓	**05-Dec-2017**	27-Dec-2017	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EP066: Polychlorinated Biphenyls (PCB)								
Soil Glass Jar - Unpreserved (EP066)								
1,	2,	**29-Nov-2017**	**02-Dec-2017**	13-Dec-2017	✓	**03-Dec-2017**	11-Jan-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EP068A: Organochlorine Pesticides (OC)								
Soil Glass Jar - Unpreserved (EP068)								
1,	2,	**29-Nov-2017**	**02-Dec-2017**	13-Dec-2017	✓	**03-Dec-2017**	11-Jan-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP075(SIM))								
1,	2,	**29-Nov-2017**	**02-Dec-2017**	13-Dec-2017	✓	**03-Dec-2017**	11-Jan-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EP080/071: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved (EP080)								
1,	2,	**29-Nov-2017**	**01-Dec-2017**	13-Dec-2017	✓	**01-Dec-2017**	13-Dec-2017	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
Soil Glass Jar - Unpreserved (EP071)								
1,	2,	**29-Nov-2017**	**02-Dec-2017**	13-Dec-2017	✓	**04-Dec-2017**	11-Jan-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
Soil Glass Jar - Unpreserved (EP080)								
1,	2,	**29-Nov-2017**	**01-Dec-2017**	13-Dec-2017	✓	**01-Dec-2017**	13-Dec-2017	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
Soil Glass Jar - Unpreserved (EP071)								
1,	2,	**29-Nov-2017**	**02-Dec-2017**	13-Dec-2017	✓	**04-Dec-2017**	11-Jan-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EP080: BTEXN								
Soil Glass Jar - Unpreserved (EP080)								
1,	2,	**29-Nov-2017**	**01-Dec-2017**	13-Dec-2017	✓	**01-Dec-2017**	13-Dec-2017	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EP090: Organotin Compounds								
Soil Glass Jar - Unpreserved (EP090)								
1,	2,	**29-Nov-2017**	**08-Dec-2017**	13-Dec-2017	✓	**17-Dec-2017**	17-Jan-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE Soil Jar (EP231X)								
1,	2,	**29-Nov-2017**	**04-Dec-2017**	28-May-2018	✓	**04-Dec-2017**	13-Jan-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE Soil Jar (EP231X)								
1,	2,	**29-Nov-2017**	**04-Dec-2017**	28-May-2018	✓	**04-Dec-2017**	13-Jan-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EP231C: Perfluoroalkyl Sulfonamides								
HDPE Soil Jar (EP231X)								
1,	2,	**29-Nov-2017**	**04-Dec-2017**	28-May-2018	✓	**04-Dec-2017**	13-Jan-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE Soil Jar (EP231X)								
1,	2,	**29-Nov-2017**	**04-Dec-2017**	28-May-2018	✓	**04-Dec-2017**	13-Jan-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							
EP231P: PFAS Sums								
HDPE Soil Jar (EP231X)								
1,	2,	**29-Nov-2017**	**04-Dec-2017**	28-May-2018	✓	**04-Dec-2017**	13-Jan-2018	✓
3,	4,							
5,	6,							
7,	8,							
9,	10							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	0	10	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Organic Matter	EP004	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Organic Matter	EP004	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Organic Matter	EP004	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	0	10	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
PAH/Phenols (SIM)	EP075(SIM)	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Particle Size Analysis (Sieving)	EA150	SOIL	In house: Referenced to AS1289.3.6.1 - 2009. Particle Size Analysis by Sieving
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Organic Matter	EP004	SOIL	In house: Referenced to AS1289.4.1.1 - 1997. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3).
Polychlorinated Biphenyls (PCB)	EP066	SOIL	In house: Referenced to USEPA SW 846 - 8270D Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 504)
Pesticides by GCMS	EP068	SOIL	In house: Referenced to USEPA SW 846 - 8270D Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM (2013) Schedule B(3) (Method 504,505)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015A Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM amended 2013.
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270D. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260B. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM amended 2013.
Organotin Analysis	EP090	SOIL	In house: Referenced to USEPA SW 846 - 8270D Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quanitified against an established calibration curve.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-House. A portion of soil is extracted with MTBE. The extract is taken to dryness, made up in mobile phase. Analysis is by LC/MSMS, ESI Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
Organic Matter	EP004-PR	SOIL	In house: Referenced to AS1289.4.1.1 - 1997. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3) (Method 105)
Sample Extraction for PFAS	EP231-PR	SOIL	In house
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Organotin Sample Preparation	ORG35	SOIL	In house: 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.

Appendix C MPR 2021 Laboratory Certificates

COC 1 of 2

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: Marine Poluution Research PTY LTD
OFFICE:
PROJECT: Noakes Sediment — PROJECT NO.:
ORDER NUMBER: — PURCHASE ORDER NO.:
PROJECT MANAGER: Paul Anink — CONTACT PH: 0412562081
SAMPLER: Jacob Broom — SAMPLER MOBILE: 0405482811
COC Emailed to ALS? (YES / NO) — EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed): Jacobcbroom@gmail.com
Email Invoice to (will default to PM if no other addresses are listed): panink@bigpond.com.au

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)
☑ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):
ALS QUOTE NO.: SY/419/21
COUNTRY OF ORIGIN:

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

RELINQUISHED BY: P. Ani — DATE/TIME: 1412 9/9/21
RECEIVED BY: Juliana G — DATE/TIME: 9/9/21 2:20pm
RELINQUISHED BY: — DATE/TIME:
RECEIVED BY: SO 8/4/10 Ay — DATE/TIME: 9/9/21 1815

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: 19 °C
Other comment:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: (All Samples are Marine Sediments) Analysis boxes marked HOLD - samples require to be put on hold/frozen for future additional analysis.

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price). Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID (ALS USE ONLY)	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Particle Size Analysis by Sieving (Default sieves from 75um) EA150	Moisture Content EA055-103	Total Organic Carbon (TOC) in Soil EP003	Weak HCl-Extractable Metals Sb, As, Cd, Cr, Cu, Pb, Ni, Ag, Zn, Hg SD-04	Organotins TBT, DBT, MBT EP090 (solids)	OC/OP/PCB/PAH ultra trace SD-02	Low Level TRH/BTEXN for Sediments TPH-SD
1	11-S	9/9/21	s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	HOLD	HOLD	HOLD
2	11-B		s	2 x Jar, 2 x Soil Bag	4	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD
3	12-S		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	HOLD	HOLD	HOLD
4	12-B		s	2 x Jar, 2 x Soil Bag	4	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD
5	13-S		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	HOLD	HOLD	HOLD
6	13-B		s	2 x Jar, 2 x Soil Bag	4	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD
7	14-S		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	HOLD	HOLD	HOLD
8	14-B		s	2 x Jar, 2 x Soil Bag	4	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD
9	15-S		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	HOLD	HOLD	HOLD
10	15-B		s	2 x Jar, 2 x Soil Bag	4	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD
11	16-S		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	X	X	X
12	16-B		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	X	X	X
				TOTAL	48							

Additional Information

Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.

Note that all samples are estuarine sediments and thus saline pore water, and that the samples are from Sydney harbour where it is expected that there will be high levels of heavy metal, organic and organotin contamination .

Note that this sampling follows from earlier sampling by others for this project undertaken against ALS ES1730018

Organo tin is to be reported as TBT, DBT and MBT

Subcon / Forward Lab / Split WO: ____
Lab / Analysis: Brisbane
Organised By / Date: (11) - (26)
Relinquished By / Date: ____
Connote / Courier: Newcastle
PO No: 1,3,5,7,9,(6,11),12,14,18, 19,15,20,19,17
Attached By PO / Internal Sheet: ____

Environmental Division
Sydney
Work Order Reference
ES2132764

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plas
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
☐BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
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☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: Marine Poluution Research PTY LTD
OFFICE:
PROJECT: Noakes Sediment **PROJECT NO.:**
ORDER NUMBER: **PURCHASE ORDER NO.:**
PROJECT MANAGER: Paul Anink **CONTACT PH:** 0412562081
SAMPLER: Jacob Broom **SAMPLER MOBILE:** 0405482811
COC Emailed to ALS? (YES / NO) **EDD FORMAT (or default):**
Email Reports to (will default to PM if no other addresses are listed): Jacobcbroom@gmail.com
Email Invoice to (will default to PM if no other addresses are listed): panink@bigpond.com.au

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)
☑ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):
ALS QUOTE NO.: SY/419/21
COUNTRY OF ORIGIN:

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: 19. °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
P. Ans	Juliana6		AY
DATE/TIME: 1412 9/9/21	DATE/TIME: 9/9/21 2:20pm	DATE/TIME:	DATE/TIME: 9/9/21 1815

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: All Samples are Marine Sediments Analysis boxes marked HOLD - samples require to be put on hold/frozen for future additional analysis.

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Particle Size Analysis by Sieving (Default sieves from 75um) EA150	Moisture Content EA055-103	Total Organic Carbon (TOC) in Soil EP003	Weak HCl-Extractable Metals Sb, As, Cd, Cr, Cu, Pb, Ni, Ag, Zn, Hg SD-04	Organotins TBT, DBT, MBT EP090 (solids)	OC/OP/PCB/PAH ultra trace SD-02	Low Level TRH/BTEXN for Sediments TPH-SD		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	17-S	9/9/21	s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	X	X	X		
14	17-B		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	X	X	X		
15	18-S		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	X	X	X		
16	18-B		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	X	X	X		
17	19-S		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	X	X	X		
18	19-B		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	X	X	X		
19	20-S		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	X	X	X		
20	20-B		s	2 x Jar, 2 x Soil Bag	4	X	X	X	X	X	X	X		
				TOTAL	32									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

COC 2 of 2

CERTIFICATE OF ANALYSIS

Work Order	: **ES2132764**	Page	: 1 of 14
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Paul Anink	Contact	: Customer Services ES
Address	: PO BOX 279 CHURCH POINT SYDNEY NSW 2105	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Noakes Sediment	Date Samples Received	: 09-Sep-2021 14:20
Order number	: ----	Date Analysis Commenced	: 14-Sep-2021
C-O-C number	: ----	Issue Date	: 28-Sep-2021 12:10
Sampler	: Jacob Broom		
Site	: ----		
Quote number	: SY/419/21		
No. of samples received	: 20		
No. of samples analysed	: 15		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Morgan Lennox	Senior Organic Chemist	Brisbane Organics, Stafford, QLD
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW
Thomas Donovan	Senior Organic Chemist - PFAS	Brisbane Organics, Stafford, QLD
Vincent Emerton-Bell	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP090 - Organotins: Particular samples show poor surrogate recovery due to matrix interference. Confirmed by re-extraction and re-analysis.
- EP090 - Organotins: Sample '20-B' shows poor matrix spike recovery due to matrix interference. Insufficient sample for re-extraction.
- EP090 - Organotins: Sample '16-B' shows poor matrix spike recovery due to matrix interference. Confirmed by re-extraction and re-analysis.
- EP080-SD: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP131A: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP130: LOR for sample raised due to the high amount of moisture present.
- EP080-SD: Surrogate recovery bias low due to sample matrix interferences, confirmed by re-analysis.
- EP090 - Organotins: Samples '17-S' and '17-B' required dilution due to the presence of high level contaminants. Surrogate recovery was not determined.
- EP131B : Particular samples required dilution due to sample matrix . LOR values have been adjusted accordingly.
- EP132B-SD : Particular samples required dilution due to sample matrix . LOR values have been adjusted accordingly.

Analytical Results

Sub-Matrix: **SEDIMENT**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	11-S	12-S	13-S	14-S	15-S
Sampling date / time				09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00
				ES2132764-001	**ES2132764-003**	**ES2132764-005**	**ES2132764-007**	**ES2132764-009**
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**47.9**	**64.0**	**66.2**	**61.1**	**45.8**
EA150: Particle Sizing								
+75µm	----	1	%	**26**	**2**	**1**	**1**	**45**
+150µm	----	1	%	**13**	<1	<1	<1	**30**
+300µm	----	1	%	**6**	<1	<1	<1	**14**
+425µm	----	1	%	**3**	<1	<1	<1	**7**
+600µm	----	1	%	**2**	<1	<1	<1	**4**
+1180µm	----	1	%	<1	<1	<1	<1	**2**
+2.36mm	----	1	%	<1	<1	<1	<1	<1
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	**74**	**98**	**99**	**99**	**55**
Sand (>75 µm)	----	1	%	**26**	**2**	**1**	**1**	**44**
Gravel (>2mm)	----	1	%	<1	<1	<1	<1	**1**
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES								
Antimony	7440-36-0	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	7440-38-2	1.0	mg/kg	**3.7**	**6.4**	**3.8**	**3.8**	**4.6**
Cadmium	7440-43-9	0.1	mg/kg	**0.2**	**0.1**	<0.1	<0.1	**0.3**
Chromium	7440-47-3	1.0	mg/kg	**30.1**	**42.0**	**37.1**	**38.9**	**36.2**
Copper	7440-50-8	1.0	mg/kg	**94.5**	**140**	**82.0**	**72.1**	**204**
Lead	7439-92-1	1.0	mg/kg	**251**	**310**	**242**	**274**	**561**
Nickel	7440-02-0	1.0	mg/kg	**5.0**	**8.2**	**5.4**	**5.7**	**7.1**
Silver	7440-22-4	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	7440-66-6	1.0	mg/kg	**461**	**614**	**520**	**599**	**1720**
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**3.53**	**3.61**	**3.20**	**3.28**	**4.12**

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	16-S	16-B	17-S	17-B	18-S
			Sampling date / time	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00
Compound	CAS Number	LOR	Unit	ES2132764-011	ES2132764-012	ES2132764-013	ES2132764-014	ES2132764-015
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	29.0	32.5	51.3	52.0	54.7
EA150: Particle Sizing								
+75µm	----	1	%	74	72	40	40	33
+150µm	----	1	%	68	66	28	28	24
+300µm	----	1	%	51	46	14	14	13
+425µm	----	1	%	41	31	9	8	7
+600µm	----	1	%	35	21	7	6	4
+1180µm	----	1	%	28	12	5	3	2
+2.36mm	----	1	%	22	6	3	2	<1
+4.75mm	----	1	%	18	3	2	1	<1
+9.5mm	----	1	%	14	1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	26	28	60	60	67
Sand (>75 µm)	----	1	%	50	64	36	38	32
Gravel (>2mm)	----	1	%	24	8	4	2	1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES								
Antimony	7440-36-0	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	7440-38-2	1.0	mg/kg	3.2	2.8	4.6	4.6	4.6
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.1	0.2	<0.1
Chromium	7440-47-3	1.0	mg/kg	25.8	9.0	32.2	39.6	24.6
Copper	7440-50-8	1.0	mg/kg	81.1	43.6	230	194	120
Lead	7439-92-1	1.0	mg/kg	128	122	366	443	200
Nickel	7440-02-0	1.0	mg/kg	2.2	2.2	6.9	8.7	3.9
Silver	7440-22-4	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	7440-66-6	1.0	mg/kg	255	190	800	923	411
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	2.16	1.60	5.02	5.32	2.66
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								

Analytical Results

Sub-Matrix: **SEDIMENT**
(Matrix: **SOIL**)

			Sample ID	16-S	16-B	17-S	17-B	18-S
			Sampling date / time	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00
Compound	CAS Number	LOR	Unit	ES2132764-011	ES2132764-012	ES2132764-013	ES2132764-014	ES2132764-015
				Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued								
>C10 - C16 Fraction	----	3	mg/kg	<6	<6	<12	<12	<12
>C16 - C34 Fraction	----	3	mg/kg	**317**	**193**	**512**	**771**	**526**
>C34 - C40 Fraction	----	5	mg/kg	**137**	**91**	**243**	**335**	**264**
>C10 - C40 Fraction (sum)	----	3	mg/kg	**454**	**284**	**755**	**1110**	**790**
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg	<6	<6	<12	<12	<12
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg	<3	<3	<6	<6	<6
C15 - C28 Fraction	----	3	mg/kg	**194**	**112**	**312**	**479**	**305**
C29 - C36 Fraction	----	5	mg/kg	**193**	**124**	**325**	**466**	**350**
^ C10 - C36 Fraction (sum)	----	3	mg/kg	**387**	**236**	**637**	**945**	**655**
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	**5**	**2**	**16**	**81**	**2**
Dibutyltin	1002-53-5	1	µgSn/kg	**11**	**4**	**94**	**421**	**6**
Tributyltin	56573-85-4	0.5	µgSn/kg	**43.6**	**10.1**	**453**	**892**	**11.1**
EP130A: Organophosphorus Pesticides (Ultra-trace)								
Bromophos-ethyl	4824-78-6	10	µg/kg	<10	<10	<12	<12	<12
Carbophenothion	786-19-6	10	µg/kg	<10	<10	<12	<12	<12
Chlorfenvinphos (E)	18708-86-6	10.0	µg/kg	<10.0	<10.0	<12.0	<12.0	<12.0
Chlorfenvinphos (Z)	18708-87-7	10	µg/kg	<10	<10	<12	<12	<12

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	16-S	16-B	17-S	17-B	18-S
			Sampling date / time	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00
Compound	CAS Number	LOR	Unit	ES2132764-011	ES2132764-012	ES2132764-013	ES2132764-014	ES2132764-015
				Result	Result	Result	Result	Result
EP130A: Organophosphorus Pesticides (Ultra-trace) - Continued								
Chlorpyrifos	2921-88-2	10	µg/kg	<10	<10	<12	<12	<12
Chlorpyrifos-methyl	5598-13-0	10	µg/kg	<10	<10	<12	<12	<12
Demeton-S-methyl	919-86-8	10	µg/kg	<10	<10	<12	<12	<12
Diazinon	333-41-5	10	µg/kg	<10	<10	<12	<12	<12
Dichlorvos	62-73-7	10	µg/kg	<10	<10	<12	<12	<12
Dimethoate	60-51-5	10	µg/kg	<10	<10	<12	<12	<12
Ethion	563-12-2	10	µg/kg	<10	<10	<12	<12	<12
Fenamiphos	22224-92-6	10	µg/kg	<10	<10	<12	<12	<12
Fenthion	55-38-9	10	µg/kg	<10	<10	<12	<12	<12
Malathion	121-75-5	10	µg/kg	<10	<10	<12	<12	<12
Azinphos Methyl	86-50-0	10	µg/kg	<10	<10	<12	<12	<12
Monocrotophos	6923-22-4	10	µg/kg	<10	<10	<12	<12	<12
Parathion	56-38-2	10	µg/kg	<10	<10	<12	<12	<12
Parathion-methyl	298-00-0	10	µg/kg	<10	<10	<12	<12	<12
Pirimphos-ethyl	23505-41-1	10	µg/kg	<10	<10	<12	<12	<12
Prothiofos	34643-46-4	10	µg/kg	<10	<10	<12	<12	<12
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
alpha-BHC	319-84-6	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
beta-BHC	319-85-7	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
delta-BHC	319-86-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
4.4`-DDD	72-54-8	0.50	µg/kg	<0.50	**3.29**	**12.0**	**11.2**	**2.86**
4.4`-DDE	72-55-9	0.50	µg/kg	<0.50	**1.56**	**9.34**	**9.29**	**3.51**
4.4`-DDT	50-29-3	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.50	µg/kg	<0.50	**4.85**	**21.3**	**20.5**	**6.37**
Dieldrin	60-57-1	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endrin	72-20-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Heptachlor	76-44-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	16-S	16-B	17-S	17-B	18-S
			Sampling date / time	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00
Compound	CAS Number	LOR	Unit	ES2132764-011	ES2132764-012	ES2132764-013	ES2132764-014	ES2132764-015
				Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued								
Heptachlor epoxide	1024-57-3	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
gamma-BHC	58-89-9	0.25	µg/kg	<0.25	<0.25	<0.25	<0.25	<0.25
Methoxychlor	72-43-5	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
cis-Chlordane	5103-71-9	0.25	µg/kg	<0.25	<0.25	<0.25	<0.25	<0.25
trans-Chlordane	5103-74-2	0.25	µg/kg	<0.25	<0.25	<0.25	<0.25	<0.25
^ Total Chlordane (sum)	----	0.25	µg/kg	<0.25	<0.25	<0.25	<0.25	<0.25
Oxychlordane	27304-13-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	<15.6	<15.6	<31.2	<31.2	<31.2
Aroclor 1016	12674-11-2	5.0	µg/kg	<15.6	<15.6	<31.2	<31.2	<31.2
Aroclor 1221	11104-28-2	5.0	µg/kg	<15.6	<15.6	<31.2	<31.2	<31.2
Aroclor 1232	11141-16-5	5.0	µg/kg	<15.6	<15.6	<31.2	<31.2	<31.2
Aroclor 1242	53469-21-9	5.0	µg/kg	<15.6	<15.6	<31.2	<31.2	<31.2
Aroclor 1248	12672-29-6	5.0	µg/kg	<15.6	<15.6	<31.2	<31.2	<31.2
Aroclor 1254	11097-69-1	5.0	µg/kg	<15.6	<15.6	<31.2	<31.2	<31.2
Aroclor 1260	11096-82-5	5.0	µg/kg	<15.6	<15.6	<31.2	<31.2	<31.2
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	**98**	**69**	**185**	**380**	**103**
2-Methylnaphthalene	91-57-6	5	µg/kg	**50**	**30**	**96**	**294**	**51**
Acenaphthylene	208-96-8	4	µg/kg	**386**	**378**	**920**	**1450**	**632**
Acenaphthene	83-32-9	4	µg/kg	**95**	**34**	**217**	**654**	**53**
Fluorene	86-73-7	4	µg/kg	**170**	**85**	**336**	**693**	**130**
Phenanthrene	85-01-8	4	µg/kg	**1000**	**838**	**2720**	**6030**	**1260**
Anthracene	120-12-7	4	µg/kg	**440**	**346**	**1010**	**1810**	**528**
Fluoranthene	206-44-0	4	µg/kg	**1550**	**1760**	**4660**	**9480**	**2760**
Pyrene	129-00-0	4	µg/kg	**3300**	**1800**	**4800**	**9630**	**2850**
Benz(a)anthracene	56-55-3	4	µg/kg	**1960**	**1060**	**2740**	**5470**	**1550**
Chrysene	218-01-9	4	µg/kg	**1890**	**983**	**2530**	**5400**	**1550**
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	**2100**	**1450**	**3870**	**7400**	**2460**
Benzo(k)fluoranthene	207-08-9	4	µg/kg	**859**	**834**	**1730**	**3330**	**990**
Benzo(e)pyrene	192-97-2	4	µg/kg	**1290**	**933**	**2500**	**4640**	**1480**
Benzo(a)pyrene	50-32-8	4	µg/kg	**2160**	**1660**	**4100**	**7730**	**2470**
Perylene	198-55-0	4	µg/kg	**575**	**395**	**1100**	**2110**	**612**

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	16-S	16-B	17-S	17-B	18-S
			Sampling date / time	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00
Compound	CAS Number	LOR	Unit	ES2132764-011	ES2132764-012	ES2132764-013	ES2132764-014	ES2132764-015
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	1510	1170	2990	5480	1830
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	324	251	649	1230	382
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	1180	926	2310	4260	1440
Coronene	191-07-1	5	µg/kg	484	422	1080	1990	636
^ Sum of PAHs	----	4	µg/kg	21400	15400	40500	79500	23800
EP080-SD: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	80.7	102	118	110	106
Toluene-D8	2037-26-5	0.2	%	82.8	104	112	88.0	85.5
4-Bromofluorobenzene	460-00-4	0.2	%	84.5	95.6	100	86.7	87.5
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	58.0	23.2	Not Determined	Not Determined	21.2
EP130S: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	10	%	62.0	63.5	67.3	62.7	53.6
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.50	%	53.1	43.9	43.4	52.9	39.7
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.5	%	100	75.0	43.8	75.0	50.0
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	87.2	118	112	80.0	114
Anthracene-d10	1719-06-8	10	%	124	112	101	106	106
4-Terphenyl-d14	1718-51-0	10	%	84.8	118	112	91.2	113

Analytical Results

Sub-Matrix: **SEDIMENT**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	18-B	19-S	19-B	20-S	20-B
			Sampling date / time	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00
				ES2132764-016	ES2132764-017	ES2132764-018	ES2132764-019	ES2132764-020
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	44.2	35.4	32.9	63.6	57.4
EA150: Particle Sizing								
+75µm	----	1	%	50	64	61	2	3
+150µm	----	1	%	38	50	47	1	2
+300µm	----	1	%	23	21	19	<1	1
+425µm	----	1	%	13	8	8	<1	<1
+600µm	----	1	%	7	4	4	<1	<1
+1180µm	----	1	%	4	1	2	<1	<1
+2.36mm	----	1	%	1	<1	1	<1	<1
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	50	36	39	98	97
Sand (>75 µm)	----	1	%	48	63	60	2	3
Gravel (>2mm)	----	1	%	2	1	1	<1	<1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES								
Antimony	7440-36-0	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	7440-38-2	1.0	mg/kg	3.6	3.8	2.9	5.1	4.5
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	15.9	16.4	15.6	41.9	30.4
Copper	7440-50-8	1.0	mg/kg	59.3	113	61.5	128	97.4
Lead	7439-92-1	1.0	mg/kg	130	175	180	316	304
Nickel	7440-02-0	1.0	mg/kg	3.2	2.8	3.0	6.5	5.2
Silver	7440-22-4	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	7440-66-6	1.0	mg/kg	316	407	335	690	628
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.50	1.90	1.90	3.26	3.10
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								

Analytical Results

Sub-Matrix: SEDIMENT
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	18-B	19-S	19-B	20-S	20-B
			Sampling date / time	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00
				ES2132764-016	ES2132764-017	ES2132764-018	ES2132764-019	ES2132764-020
				Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued								
>C10 - C16 Fraction	----	3	mg/kg	<6	<6	<6	<12	<12
>C16 - C34 Fraction	----	3	mg/kg	**205**	**425**	**556**	**631**	**638**
>C34 - C40 Fraction	----	5	mg/kg	**115**	**196**	**221**	**311**	**304**
>C10 - C40 Fraction (sum)	----	3	mg/kg	**320**	**621**	**777**	**942**	**942**
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg	<6	<6	<6	<12	<12
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg	<3	<3	<3	<6	<6
C15 - C28 Fraction	----	3	mg/kg	**115**	**258**	**341**	**366**	**370**
C29 - C36 Fraction	----	5	mg/kg	**142**	**266**	**328**	**418**	**419**
^ C10 - C36 Fraction (sum)	----	3	mg/kg	**257**	**524**	**669**	**784**	**789**
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	**3**	**2**	<1	**2**	**3**
Dibutyltin	1002-53-5	1	µgSn/kg	**6**	**6**	**3**	**5**	**10**
Tributyltin	56573-85-4	0.5	µgSn/kg	**6.4**	**12.2**	**5.2**	**17.8**	**17.3**
EP130A: Organophosphorus Pesticides (Ultra-trace)								
Bromophos-ethyl	4824-78-6	10	µg/kg	<10	<10	<10	<12	<12
Carbophenothion	786-19-6	10	µg/kg	<10	<10	<10	<12	<12
Chlorfenvinphos (E)	18708-86-6	10.0	µg/kg	<10.0	<10.0	<10.0	<12.0	<12.0
Chlorfenvinphos (Z)	18708-87-7	10	µg/kg	<10	<10	<10	<12	<12

Analytical Results

Sub-Matrix: SEDIMENT
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	18-B	19-S	19-B	20-S	20-B
			Sampling date / time	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00
				ES2132764-016	ES2132764-017	ES2132764-018	ES2132764-019	ES2132764-020
				Result	Result	Result	Result	Result
EP130A: Organophosphorus Pesticides (Ultra-trace) - Continued								
Chlorpyrifos	2921-88-2	10	µg/kg	<10	<10	<10	<12	<12
Chlorpyrifos-methyl	5598-13-0	10	µg/kg	<10	<10	<10	<12	<12
Demeton-S-methyl	919-86-8	10	µg/kg	<10	<10	<10	<12	<12
Diazinon	333-41-5	10	µg/kg	<10	<10	<10	<12	<12
Dichlorvos	62-73-7	10	µg/kg	<10	<10	<10	<12	<12
Dimethoate	60-51-5	10	µg/kg	<10	<10	<10	<12	<12
Ethion	563-12-2	10	µg/kg	<10	<10	<10	<12	<12
Fenamiphos	22224-92-6	10	µg/kg	<10	<10	<10	<12	<12
Fenthion	55-38-9	10	µg/kg	<10	<10	<10	<12	<12
Malathion	121-75-5	10	µg/kg	<10	<10	<10	<12	<12
Azinphos Methyl	86-50-0	10	µg/kg	<10	<10	<10	<12	<12
Monocrotophos	6923-22-4	10	µg/kg	<10	<10	<10	<12	<12
Parathion	56-38-2	10	µg/kg	<10	<10	<10	<12	<12
Parathion-methyl	298-00-0	10	µg/kg	<10	<10	<10	<12	<12
Pirimphos-ethyl	23505-41-1	10	µg/kg	<10	<10	<10	<12	<12
Prothiofos	34643-46-4	10	µg/kg	<10	<10	<10	<12	<12
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
alpha-BHC	319-84-6	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
beta-BHC	319-85-7	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
delta-BHC	319-86-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
4.4`-DDD	72-54-8	0.50	µg/kg	**2.66**	**6.37**	**4.08**	**7.63**	**6.26**
4.4`-DDE	72-55-9	0.50	µg/kg	**1.52**	**3.84**	**2.62**	**4.87**	**5.13**
4.4`-DDT	50-29-3	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.50	µg/kg	**4.18**	**10.2**	**6.70**	**12.5**	**11.4**
Dieldrin	60-57-1	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endrin	72-20-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Heptachlor	76-44-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	18-B	19-S	19-B	20-S	20-B
			Sampling date / time	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00
Compound	CAS Number	LOR	Unit	ES2132764-016	ES2132764-017	ES2132764-018	ES2132764-019	ES2132764-020
				Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued								
Heptachlor epoxide	1024-57-3	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
gamma-BHC	58-89-9	0.25	µg/kg	<0.25	<0.25	<0.25	<0.25	<0.25
Methoxychlor	72-43-5	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
cis-Chlordane	5103-71-9	0.25	µg/kg	<0.25	<0.25	<0.25	<0.25	<0.25
trans-Chlordane	5103-74-2	0.25	µg/kg	<0.25	<0.25	<0.25	<0.25	<0.25
^ Total Chlordane (sum)	----	0.25	µg/kg	<0.25	<0.25	<0.25	<0.25	<0.25
Oxychlordane	27304-13-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	<15.6	<15.6	<15.6	<31.2	<31.2
Aroclor 1016	12674-11-2	5.0	µg/kg	<15.6	<15.6	<15.6	<31.2	<31.2
Aroclor 1221	11104-28-2	5.0	µg/kg	<15.6	<15.6	<15.6	<31.2	<31.2
Aroclor 1232	11141-16-5	5.0	µg/kg	<15.6	<15.6	<15.6	<31.2	<31.2
Aroclor 1242	53469-21-9	5.0	µg/kg	<15.6	<15.6	<15.6	<31.2	<31.2
Aroclor 1248	12672-29-6	5.0	µg/kg	<15.6	<15.6	<15.6	<31.2	<31.2
Aroclor 1254	11097-69-1	5.0	µg/kg	<15.6	<15.6	<15.6	<31.2	<31.2
Aroclor 1260	11096-82-5	5.0	µg/kg	<15.6	<15.6	<15.6	<31.2	<31.2
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	**80**	**113**	**183**	**118**	**144**
2-Methylnaphthalene	91-57-6	5	µg/kg	**34**	**48**	**74**	**59**	**82**
Acenaphthylene	208-96-8	4	µg/kg	**295**	**569**	**811**	**656**	**813**
Acenaphthene	83-32-9	4	µg/kg	**30**	**76**	**93**	**55**	**76**
Fluorene	86-73-7	4	µg/kg	**63**	**178**	**265**	**120**	**165**
Phenanthrene	85-01-8	4	µg/kg	**597**	**1680**	**2640**	**1220**	**1670**
Anthracene	120-12-7	4	µg/kg	**253**	**564**	**866**	**553**	**726**
Fluoranthene	206-44-0	4	µg/kg	**1330**	**2950**	**4400**	**2840**	**3730**
Pyrene	129-00-0	4	µg/kg	**1380**	**2960**	**4410**	**2980**	**3920**
Benz(a)anthracene	56-55-3	4	µg/kg	**754**	**1620**	**2480**	**1650**	**2230**
Chrysene	218-01-9	4	µg/kg	**700**	**1530**	**2110**	**1580**	**2030**
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	**1090**	**2300**	**3150**	**2440**	**3200**
Benzo(k)fluoranthene	207-08-9	4	µg/kg	**521**	**900**	**1450**	**1240**	**1620**
Benzo(e)pyrene	192-97-2	4	µg/kg	**691**	**1350**	**1910**	**1570**	**1970**
Benzo(a)pyrene	50-32-8	4	µg/kg	**1160**	**2330**	**3470**	**2590**	**3400**
Perylene	198-55-0	4	µg/kg	**278**	**601**	**868**	**617**	**804**

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	18-B	19-S	19-B	20-S	20-B
			Sampling date / time	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00	09-Sep-2021 00:00
Compound	CAS Number	LOR	Unit	ES2132764-016	ES2132764-017	ES2132764-018	ES2132764-019	ES2132764-020
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	853	1690	2500	1980	2540
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	178	348	510	411	541
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	672	1330	1960	1540	1990
Coronene	191-07-1	5	µg/kg	321	626	922	741	962
^ Sum of PAHs	----	4	µg/kg	11300	23800	35100	25000	32600
EP080-SD: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	111	84.4	71.1	56.4	79.5
Toluene-D8	2037-26-5	0.2	%	90.6	88.3	60.3	57.6	77.2
4-Bromofluorobenzene	460-00-4	0.2	%	95.3	99.8	70.3	72.4	80.0
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	25.4	26.2	16.1	64.3	43.4
EP130S: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	10	%	63.6	72.1	58.3	60.5	68.4
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.50	%	50.8	46.1	60.6	41.0	37.5
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.5	%	68.8	106	68.8	43.8	62.5
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	114	74.0	87.2	115	84.0
Anthracene-d10	1719-06-8	10	%	99.9	102	116	102	116
4-Terphenyl-d14	1718-51-0	10	%	120	81.0	82.3	116	75.4

Surrogate Control Limits

Sub-Matrix: **SEDIMENT**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP080-SD: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	67	137
Toluene-D8	2037-26-5	74	134
4-Bromofluorobenzene	460-00-4	73	137
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP130S: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	14	102
EP131S: OC Pesticide Surrogate			
Dibromo-DDE	21655-73-2	10	119
EP131T: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	10	106
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	55	135
Anthracene-d10	1719-06-8	70	136
4-Terphenyl-d14	1718-51-0	57	127

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EP003: Total Organic Carbon (TOC) in Soil

(SOIL) EP090: Organotin Compounds

(SOIL) EP090S: Organotin Surrogate

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EA150: Particle Sizing

(SOIL) EA150: Soil Classification based on Particle Size

Certificate of Analysis

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ALS Environmental

Newcastle, NSW

CLIENT: Paul Anink

DATE REPORTED: 17-Sep-2021

COMPANY: MARINE POLLUTION RESEARCH PTY LTD

DATE RECEIVED: 9-Sep-2021

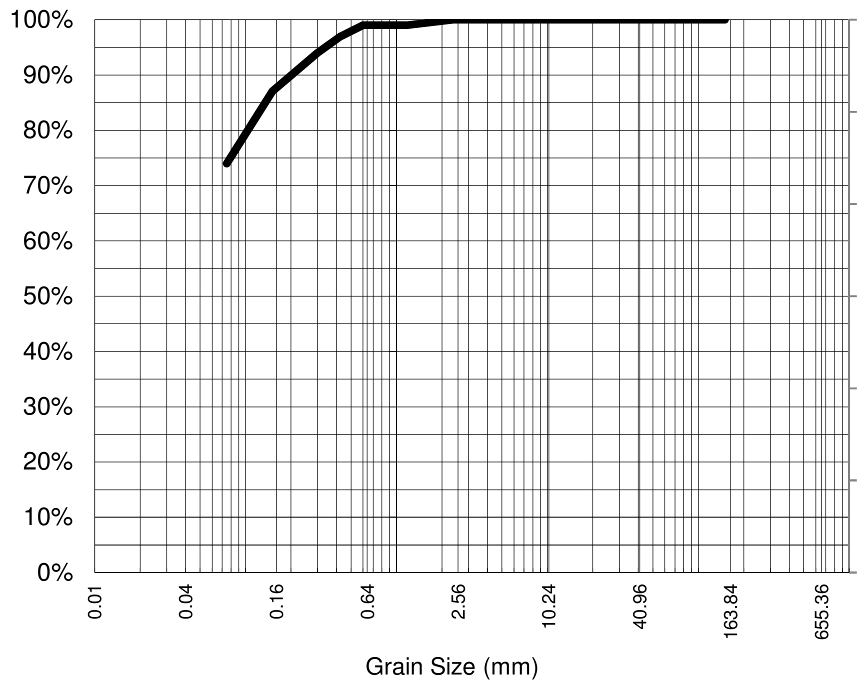
ADDRESS: Po Box 279
Church Point
Sydney Nsw

REPORT NO: ES2132764-001 / PSD

PROJECT: Noakes Sediment

SAMPLE ID: 11-S

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	99%
0.425	97%
0.300	94%
0.150	87%
0.075	74%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND

Test Method: AS1289.3.6.2/AS1289.3.6.3

NATA Accreditation: 825 Site: Newcastle
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Newcastle, NSW

CLIENT: Paul Anink

DATE REPORTED: 17-Sep-2021

COMPANY: MARINE POLLUTION RESEARCH PTY LTD

DATE RECEIVED: 9-Sep-2021

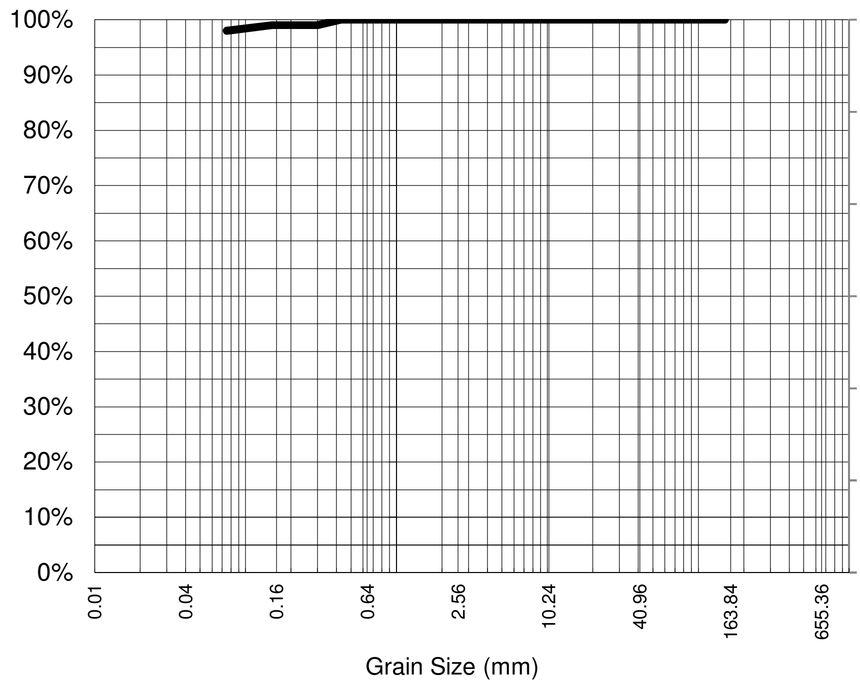
ADDRESS: Po Box 279
Church Point
Sydney Nsw

REPORT NO: ES2132764-003 / PSD

PROJECT: Noakes Sediment

SAMPLE ID: 12-S

Particle Size Distribution



Particle Size (mm)	% Passing
0.425	100%
0.300	99%
0.150	99%
0.075	98%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND

Test Method: AS1289.3.6.2/AS1289.3.6.3

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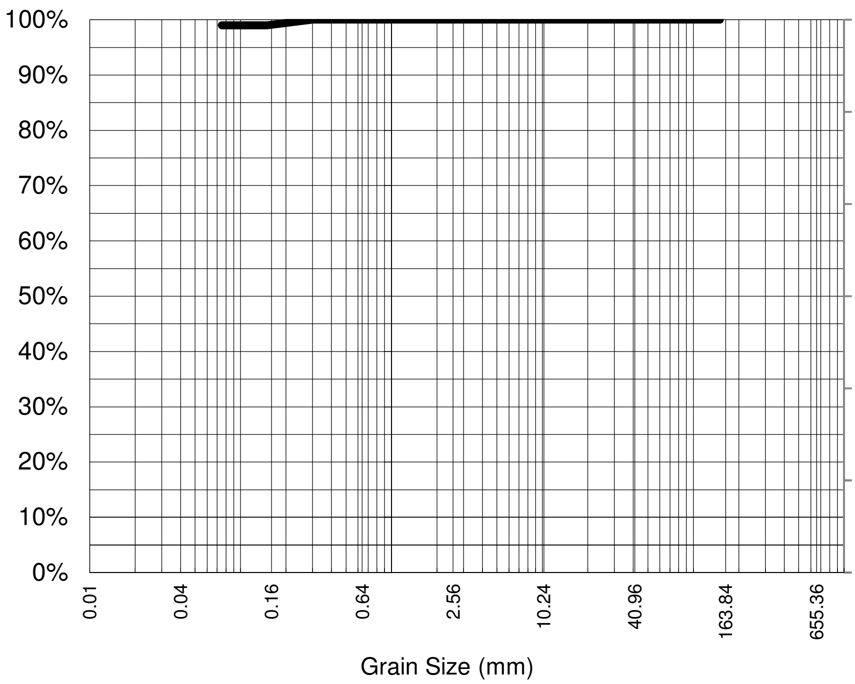
CLIENT:	Paul Anink	**DATE REPORTED:**	17-Sep-2021
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	9-Sep-2021
ADDRESS:	Po Box 279 Church Point Sydney Nsw	**REPORT NO:**	ES2132764-005 / PSD
PROJECT:	Noakes Sediment	**SAMPLE ID:**	13-S

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	99%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND

Test Method: AS1289.3.6.2/AS1289.3.6.3

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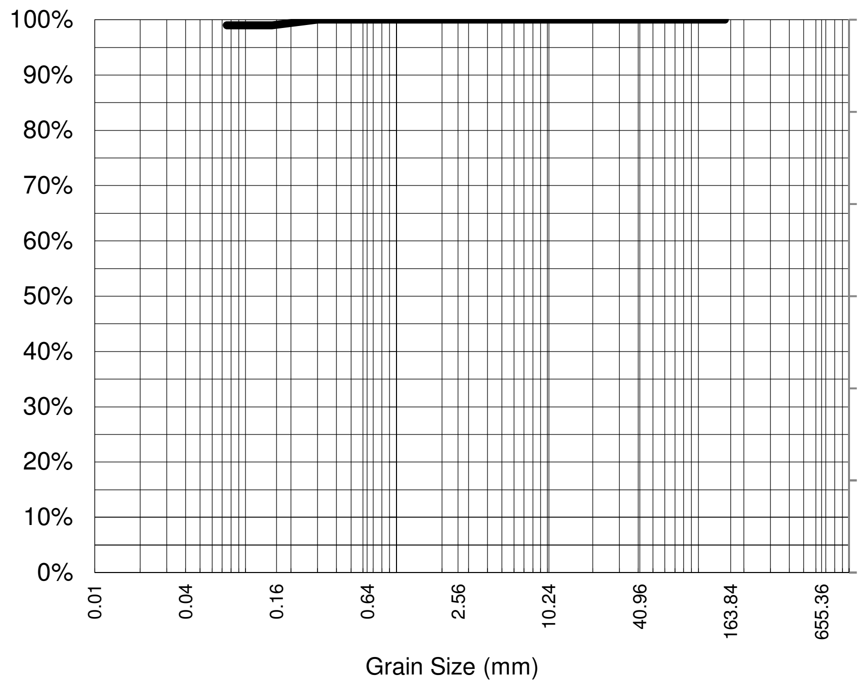
CLIENT:	Paul Anink	**DATE REPORTED:**	17-Sep-2021
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	9-Sep-2021
ADDRESS:	Po Box 279 Church Point Sydney Nsw	**REPORT NO:**	ES2132764-007 / PSD
PROJECT:	Noakes Sediment	**SAMPLE ID:**	14-S

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	99%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND

Test Method: AS1289.3.6.2/AS1289.3.6.3

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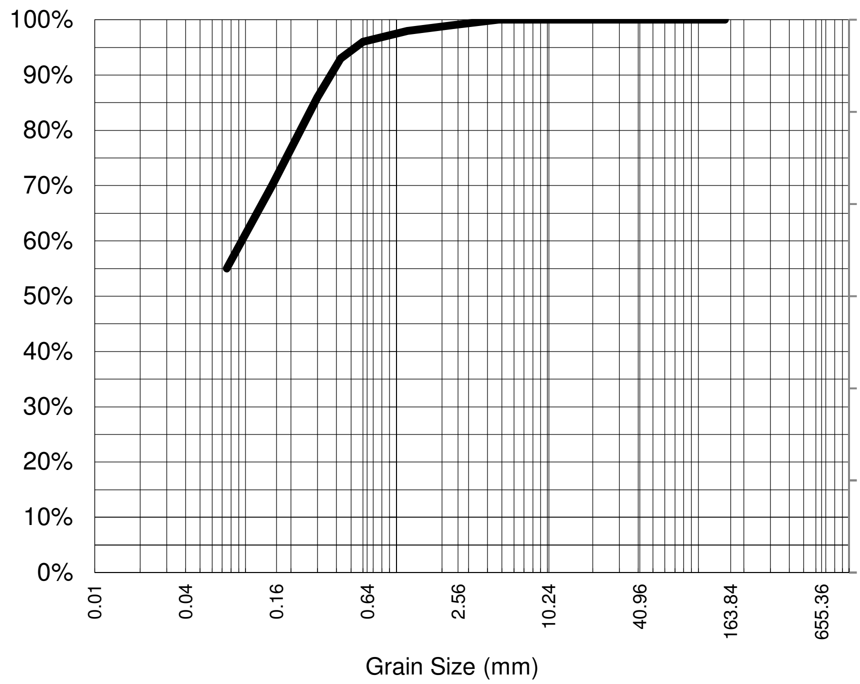
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	9-Sep-2021
ADDRESS:	Po Box 279 Church Point Sydney Nsw	**REPORT NO:**	ES2132764-009 / PSD
PROJECT:	Noakes Sediment	**SAMPLE ID:**	15-S

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	96%
0.425	93%
0.300	86%
0.150	70%
0.075	55%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL

Test Method: AS1289.3.6.2/AS1289.3.6.3

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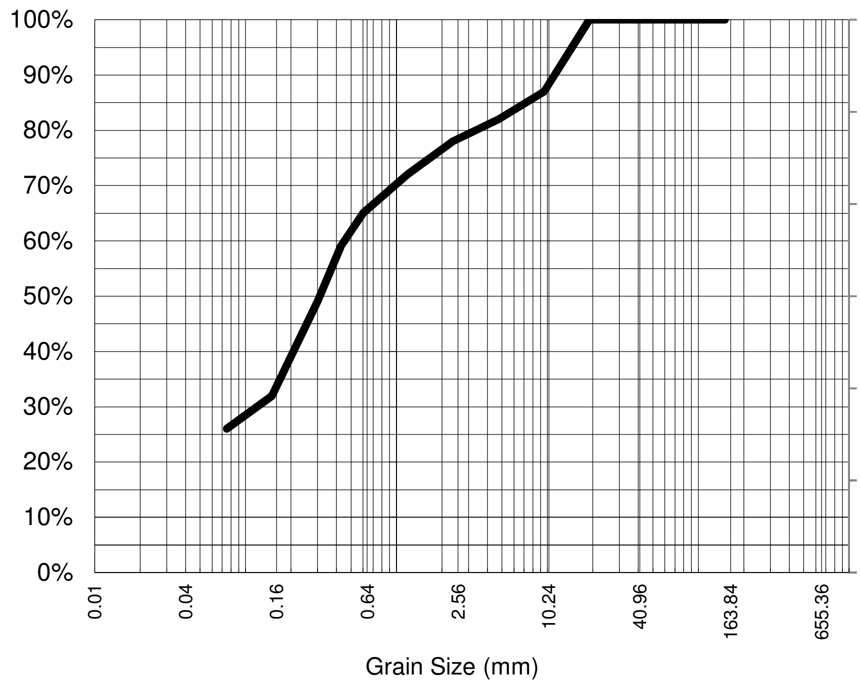
CLIENT:	Paul Anink	**DATE REPORTED:**	17-Sep-2021
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	9-Sep-2021
ADDRESS:	Po Box 279 Church Point Sydney Nsw	**REPORT NO:**	ES2132764-011 / PSD
PROJECT:	Noakes Sediment	**SAMPLE ID:**	16-S

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	87%
4.75	82%
2.36	78%
1.18	72%
0.600	65%
0.425	59%
0.300	49%
0.150	32%
0.075	26%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.313

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL

Test Method: AS1289.3.6.2/AS1289.3.6.3

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CLIENT: Paul Anink

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DATE RECEIVED: 9-Sep-2021

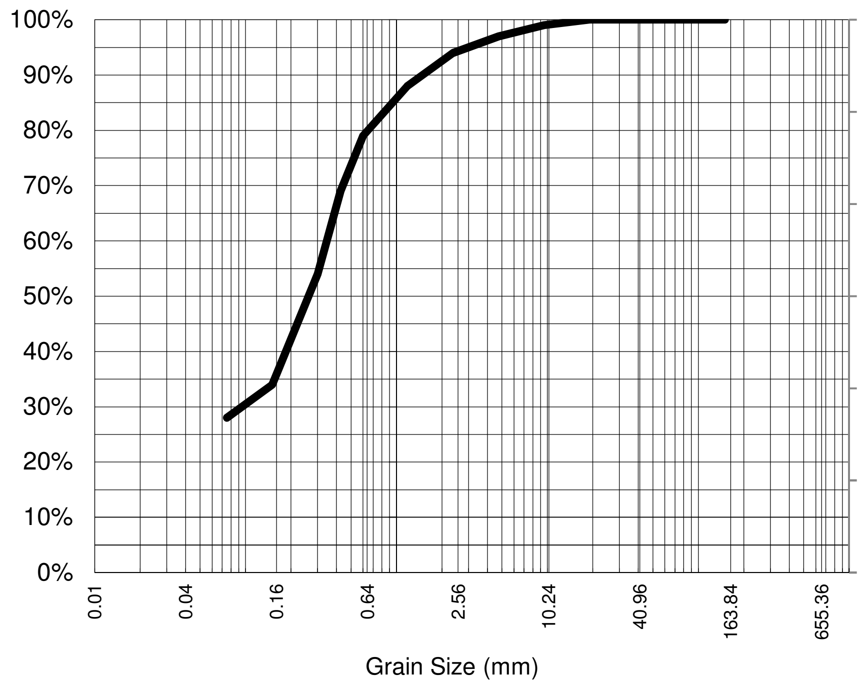
ADDRESS: Po Box 279
Church Point
Sydney Nsw

REPORT NO: ES2132764-012 / PSD

PROJECT: Noakes Sediment

SAMPLE ID: 16-B

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	99%
4.75	97%
2.36	94%
1.18	88%
0.600	79%
0.425	69%
0.300	54%
0.150	34%
0.075	28%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.270

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL

Test Method: AS1289.3.6.2/AS1289.3.6.3

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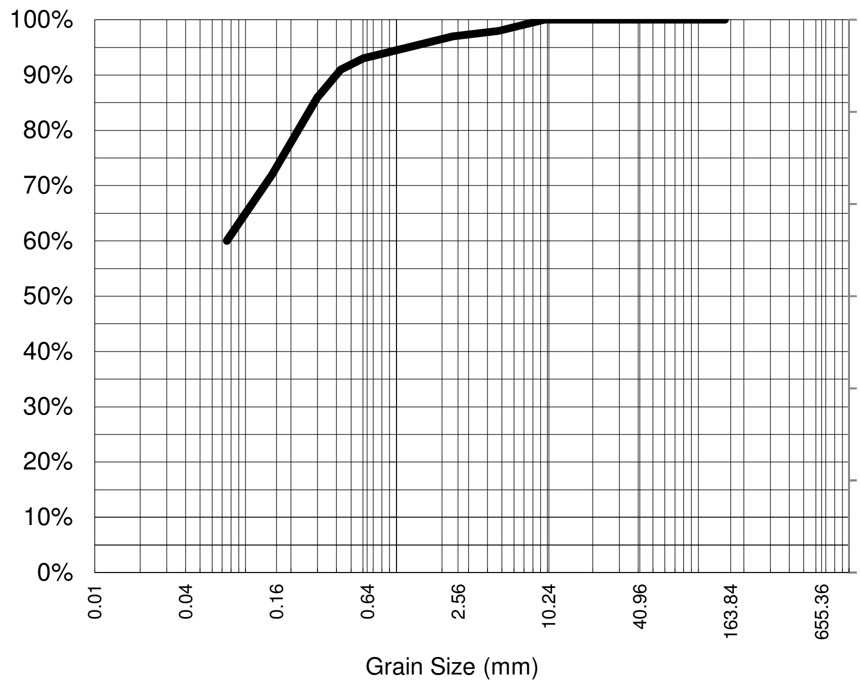
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	9-Sep-2021
ADDRESS:	Po Box 279 Church Point Sydney Nsw	**REPORT NO:**	ES2132764-013 / PSD
PROJECT:	Noakes Sediment	**SAMPLE ID:**	17-S

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	98%
2.36	97%
1.18	95%
0.600	93%
0.425	91%
0.300	86%
0.150	72%
0.075	60%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL

Test Method: AS1289.3.6.2/AS1289.3.6.3

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CLIENT: Paul Anink

DATE REPORTED: 17-Sep-2021

COMPANY: MARINE POLLUTION RESEARCH PTY LTD

DATE RECEIVED: 9-Sep-2021

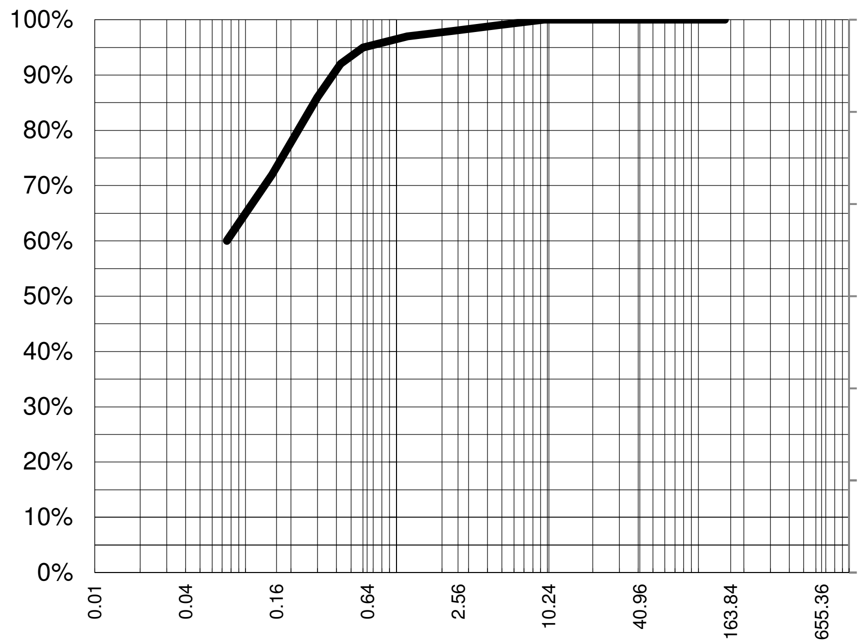
ADDRESS: Po Box 279
Church Point
Sydney Nsw

REPORT NO: ES2132764-014 / PSD

PROJECT: Noakes Sediment

SAMPLE ID: 17-B

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	98%
1.18	97%
0.600	95%
0.425	92%
0.300	86%
0.150	72%
0.075	60%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL

Test Method: AS1289.3.6.2/AS1289.3.6.3

NATA Accreditation: 825 Site: Newcastle
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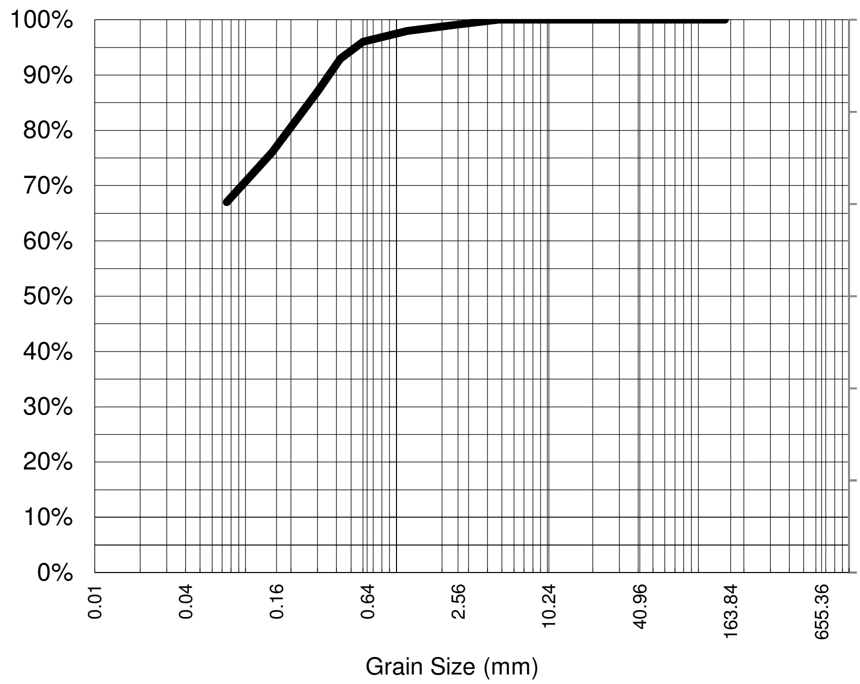
ALS Environmental

Newcastle, NSW

CLIENT:	Paul Anink	**DATE REPORTED:**	17-Sep-2021
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	9-Sep-2021
ADDRESS:	Po Box 279 Church Point Sydney Nsw	**REPORT NO:**	ES2132764-015 / PSD
PROJECT:	Noakes Sediment	**SAMPLE ID:**	18-S

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	96%
0.425	93%
0.300	87%
0.150	76%
0.075	67%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL

Test Method: AS1289.3.6.2/AS1289.3.6.3

NATA Accreditation: 825 Site: Newcastle
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ALS Environmental

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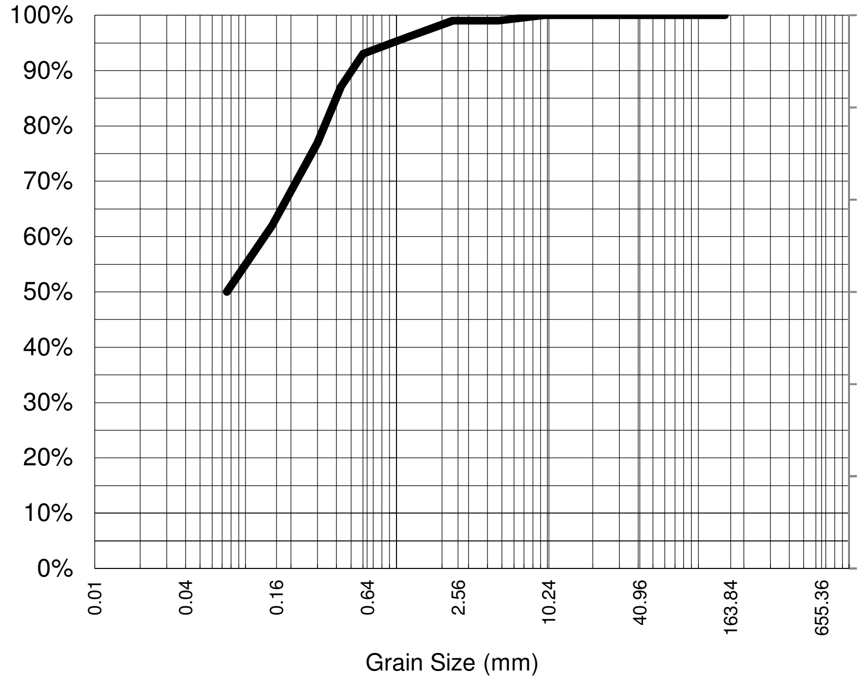
CLIENT:	Paul Anink	**DATE REPORTED:**	17-Sep-2021
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	9-Sep-2021
ADDRESS:	Po Box 279 Church Point Sydney Nsw	**REPORT NO:**	ES2132764-016 / PSD
PROJECT:	Noakes Sediment	**SAMPLE ID:**	18-B

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	99%
1.18	96%
0.600	93%
0.425	87%
0.300	77%
0.150	62%
0.075	50%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL

Test Method: AS1289.3.6.2/AS1289.3.6.3

NATA Accreditation: 825 Site: Newcastle
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ALS Environmental

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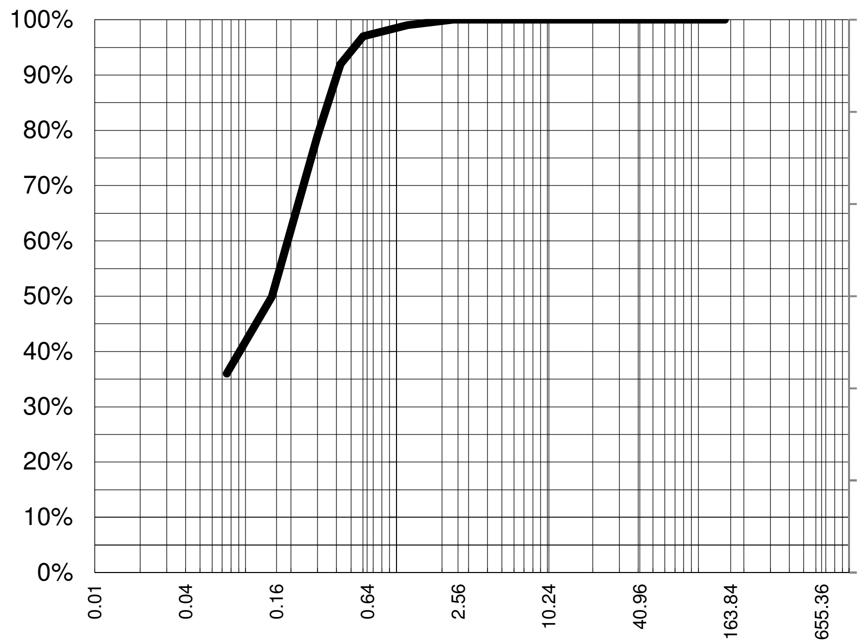
CLIENT:	Paul Anink	**DATE REPORTED:**	17-Sep-2021
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	9-Sep-2021
ADDRESS:	Po Box 279 Church Point Sydney Nsw	**REPORT NO:**	ES2132764-017 / PSD
PROJECT:	Noakes Sediment	**SAMPLE ID:**	19-S

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	97%
0.425	92%
0.300	79%
0.150	50%
0.075	36%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.150

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL

Test Method: AS1289.3.6.2/AS1289.3.6.3

NATA Accreditation: 825 Site: Newcastle
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WORLD RECOGNISED ACCREDITATION

Vincent Emerton-Bell
Laboratory Aanalyst
Authorised Signatory

Certificate of Analysis

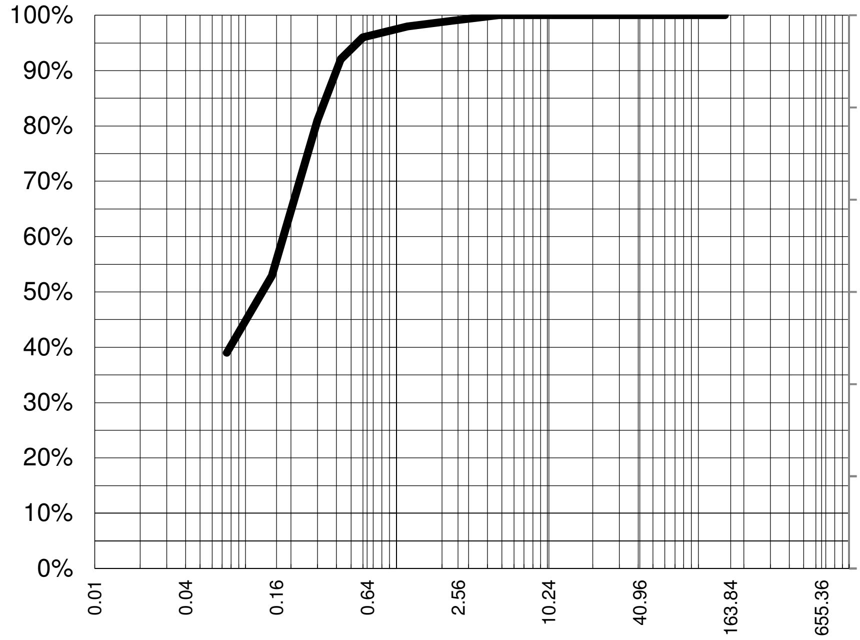
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT:	Paul Anink	**DATE REPORTED:**	17-Sep-2021
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	9-Sep-2021
ADDRESS:	Po Box 279 Church Point Sydney Nsw	**REPORT NO:**	ES2132764-018 / PSD
PROJECT:	Noakes Sediment	**SAMPLE ID:**	19-B

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	96%
0.425	92%
0.300	81%
0.150	53%
0.075	39%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.134

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL

Test Method: AS1289.3.6.2/AS1289.3.6.3

NATA Accreditation: 825 Site: Newcastle
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NATA
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fax 02 4968 0349
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ALS Environmental

Newcastle, NSW

CLIENT: Paul Anink

DATE REPORTED: 17-Sep-2021

COMPANY: MARINE POLLUTION RESEARCH PTY LTD

DATE RECEIVED: 9-Sep-2021

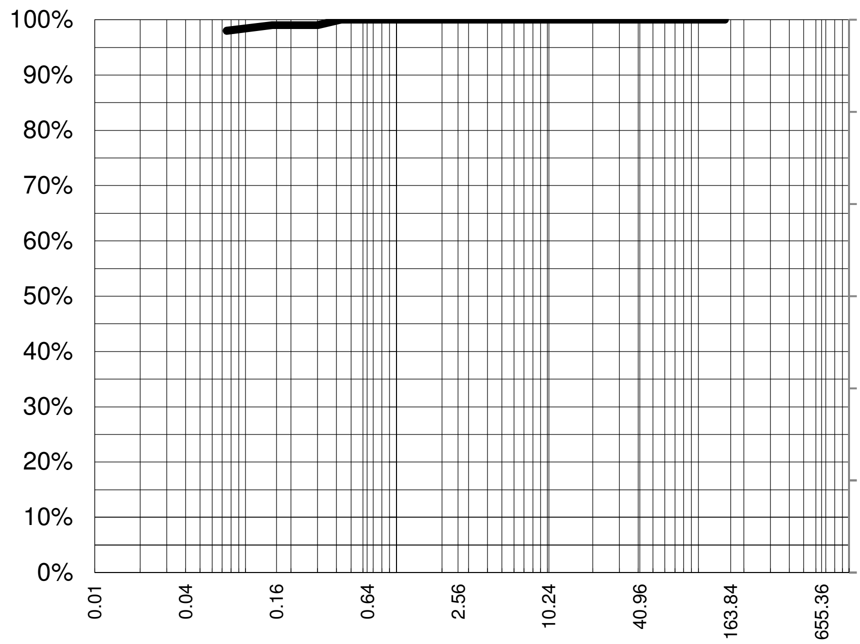
ADDRESS: Po Box 279
Church Point
Sydney Nsw

REPORT NO: ES2132764-019 / PSD

PROJECT: Noakes Sediment

SAMPLE ID: 20-S

Particle Size Distribution



Particle Size (mm)	% Passing
0.425	100%
0.300	99%
0.150	99%
0.075	98%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND

Test Method: AS1289.3.6.2/AS1289.3.6.3

NATA Accreditation: 825 Site: Newcastle
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WORLD RECOGNISED ACCREDITATION

Vincent Emerton-Bell
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Authorised Signatory

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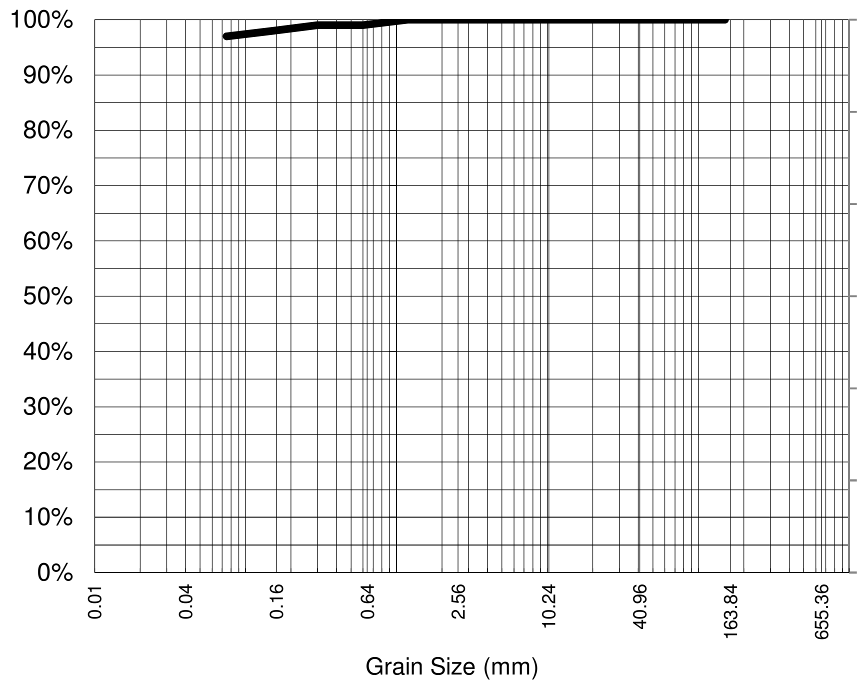
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT:	Paul Anink	**DATE REPORTED:**	17-Sep-2021
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	9-Sep-2021
ADDRESS:	Po Box 279 Church Point Sydney Nsw	**REPORT NO:**	ES2132764-020 / PSD
PROJECT:	Noakes Sediment	**SAMPLE ID:**	20-B

Particle Size Distribution



Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	99%
0.300	99%
0.150	98%
0.075	97%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND

Test Method: AS1289.3.6.2/AS1289.3.6.3

Vincent Emerton-Bell
Laboratory Aanalyst
Authorised Signatory

QUALITY CONTROL REPORT

Work Order	: **ES2132764**	Page	: 1 of 12
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Paul Anink	Contact	: Customer Services ES
Address	: PO BOX 279 CHURCH POINT SYDNEY NSW 2105	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Noakes Sediment	Date Samples Received	: 09-Sep-2021
Order number	: ----	Date Analysis Commenced	: 14-Sep-2021
C-O-C number	: ----	Issue Date	: 28-Sep-2021
Sampler	: Jacob Broom		
Site	: ----		
Quote number	: SY/419/21		
No. of samples received	: 20		
No. of samples analysed	: 15		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Morgan Lennox	Senior Organic Chemist	Brisbane Organics, Stafford, QLD
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW
Thomas Donovan	Senior Organic Chemist - PFAS	Brisbane Organics, Stafford, QLD
Vincent Emerton-Bell	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES (QC Lot: 3904574)									
ES2132764-001	11-S	EG005-SDH: Cadmium	7440-43-9	0.1	mg/kg	0.2	0.1	0.0	No Limit
		EG005-SDH: Antimony	7440-36-0	1	mg/kg	<1.0	<1.0	0.0	No Limit
		EG005-SDH: Arsenic	7440-38-2	1	mg/kg	3.7	3.4	6.7	No Limit
		EG005-SDH: Chromium	7440-47-3	1	mg/kg	30.1	31.3	3.8	0% - 20%
		EG005-SDH: Copper	7440-50-8	1	mg/kg	94.5	106	11.3	0% - 20%
		EG005-SDH: Lead	7439-92-1	1	mg/kg	251	255	1.6	0% - 20%
		EG005-SDH: Nickel	7440-02-0	1	mg/kg	5.0	4.8	4.3	No Limit
		EG005-SDH: Silver	7440-22-4	1	mg/kg	<1.0	<1.0	0.0	No Limit
		EG005-SDH: Zinc	7440-66-6	1	mg/kg	461	488	5.5	0% - 20%
ES2132764-016	18-B	EG005-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG005-SDH: Antimony	7440-36-0	1	mg/kg	<1.0	<1.0	0.0	No Limit
		EG005-SDH: Arsenic	7440-38-2	1	mg/kg	3.6	3.5	0.0	No Limit
		EG005-SDH: Chromium	7440-47-3	1	mg/kg	15.9	15.6	2.0	0% - 50%
		EG005-SDH: Copper	7440-50-8	1	mg/kg	59.3	54.2	9.1	0% - 20%
		EG005-SDH: Lead	7439-92-1	1	mg/kg	130	127	2.1	0% - 20%
		EG005-SDH: Nickel	7440-02-0	1	mg/kg	3.2	3.0	7.8	No Limit
		EG005-SDH: Silver	7440-22-4	1	mg/kg	<1.0	<1.0	0.0	No Limit
		EG005-SDH: Zinc	7440-66-6	1	mg/kg	316	276	13.6	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3907854)									
EP2110444-003	Anonymous	EA055: Moisture Content	----	0.1	%	21.9	22.4	2.1	0% - 20%
ES2132764-005	13-S	EA055: Moisture Content	----	0.1	%	66.2	67.9	2.5	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3907855)									
ES2132764-019	20-S	EA055: Moisture Content	----	0.1	%	63.6	62.4	1.9	0% - 20%
ES2133418-038	Anonymous	EA055: Moisture Content	----	0.1	%	16.8	18.3	8.1	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG035-SDH: 1M HCl extractable Mercury by FIMS (QC Lot: 3904573)									
ES2132764-016	18-B	EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	0.0	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 3907013)									
ES2132764-001	11-S	EP003: Total Organic Carbon	----	0.02	%	3.53	3.56	1.0	0% - 20%
ES2132764-016	18-B	EP003: Total Organic Carbon	----	0.02	%	1.50	1.52	0.7	0% - 20%
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 3897696)									
ES2132764-011	16-S	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
ES2132764-020	20-B	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 3898099)									
ES2132764-011	16-S	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	194	189	2.2	0% - 20%
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	387	384	0.8	0% - 20%
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	193	195	1.2	0% - 20%
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 3898099)									
ES2132764-011	16-S	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<6	<6	0.0	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	317	314	1.3	0% - 20%
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	454	457	0.7	0% - 20%
		EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	137	143	4.5	0% - 20%
EP080-SD: BTEXN (QC Lot: 3897696)									
ES2132764-011	16-S	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
ES2132764-020	20-B	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 3904645)									
EM2117925-002	Anonymous	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.0	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 3907476)									
ES2132764-011	16-S	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	43.6	36.0	19.0	0% - 20%
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	5	7	29.2	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	11	14	19.1	0% - 50%
EP130A: Organophosphorus Pesticides (Ultra-trace) (QC Lot: 3898078)									

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
				Laboratory Duplicate (DUP) Report					
EP130A: Organophosphorus Pesticides (Ultra-trace) (QC Lot: 3898078) - continued									
ES2132764-011	16-S	EP130: Bromophos-ethyl	4824-78-6	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Carbophenothion	786-19-6	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Chlorfenvinphos (E)	18708-86-6	10	µg/kg	<10.0	<10.0	0.0	No Limit
		EP130: Chlorfenvinphos (Z)	18708-87-7	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Chlorpyrifos	2921-88-2	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Chlorpyrifos-methyl	5598-13-0	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Demeton-S-methyl	919-86-8	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Diazinon	333-41-5	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Dichlorvos	62-73-7	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Dimethoate	60-51-5	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Ethion	563-12-2	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Fenamiphos	22224-92-6	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Fenthion	55-38-9	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Malathion	121-75-5	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Azinphos Methyl	86-50-0	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Monocrotophos	6923-22-4	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Parathion	56-38-2	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Parathion-methyl	298-00-0	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Pirimphos-ethyl	23505-41-1	10	µg/kg	<10	<10	0.0	No Limit
		EP130: Prothiofos	34643-46-4	10	µg/kg	<10	<10	0.0	No Limit
EP131A: Organochlorine Pesticides (QC Lot: 3898080)									
ES2132764-011	16-S	EP131A: gamma-BHC	58-89-9	0.25	µg/kg	<0.25	<0.25	0.0	No Limit
		EP131A: cis-Chlordane	5103-71-9	0.25	µg/kg	<0.25	<0.25	0.0	No Limit
		EP131A: trans-Chlordane	5103-74-2	0.25	µg/kg	<0.25	<0.25	0.0	No Limit
		EP131A: Total Chlordane (sum)	----	0.25	µg/kg	<0.25	<0.25	0.0	No Limit
		EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDD	72-54-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDE	72-55-9	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDT	50-29-3	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP131A: Organochlorine Pesticides (QC Lot: 3898080) - continued									
ES2132764-011	16-S	EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
EP131B: Polychlorinated Biphenyls (as Aroclors) (QC Lot: 3898079)									
ES2132764-011	16-S	EP131B: Total Polychlorinated biphenyls	----	5	µg/kg	<15.6	<15.6	0.0	No Limit
		EP131B: Aroclor 1016	12674-11-2	5	µg/kg	<15.6	<15.6	0.0	No Limit
		EP131B: Aroclor 1221	11104-28-2	5	µg/kg	<15.6	<15.6	0.0	No Limit
		EP131B: Aroclor 1232	11141-16-5	5	µg/kg	<15.6	<15.6	0.0	No Limit
		EP131B: Aroclor 1242	53469-21-9	5	µg/kg	<15.6	<15.6	0.0	No Limit
		EP131B: Aroclor 1248	12672-29-6	5	µg/kg	<15.6	<15.6	0.0	No Limit
		EP131B: Aroclor 1254	11097-69-1	5	µg/kg	<15.6	<15.6	0.0	No Limit
		EP131B: Aroclor 1260	11096-82-5	5	µg/kg	<15.6	<15.6	0.0	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3898075)									
ES2132764-011	16-S	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	386	401	3.8	0% - 50%
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	95	52	57.5	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	170	107	45.5	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	1000	1050	4.7	0% - 20%
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	440	406	8.1	0% - 50%
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	1550	1540	0.9	0% - 20%
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	3300	2860	14.4	0% - 20%
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	1960	1610	19.4	0% - 20%
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	1890	1840	2.6	0% - 20%
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	2100	2160	2.9	0% - 20%
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	859	841	2.1	0% - 20%
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	1290	1240	3.6	0% - 20%
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	2160	2120	1.9	0% - 20%
		EP132B-SD: Perylene	198-55-0	4	µg/kg	575	546	5.3	0% - 20%
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	1510	1460	3.1	0% - 20%
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	324	307	5.3	0% - 50%
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	1180	1140	3.5	0% - 20%
		EP132B-SD: Sum of PAHs	----	4	µg/kg	21400	20400	5.0	0% - 20%
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	98	67	38.1	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	50	36	34.3	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	484	588	19.4	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES (QCLot: 3904574)								
EG005-SDH: Antimony	7440-36-0	1	mg/kg	<1.0	----	----	----	----
EG005-SDH: Arsenic	7440-38-2	1	mg/kg	<1.0	11.79 mg/kg	98.6	90.0	109
EG005-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.3 mg/kg	68.5	68.0	132
EG005-SDH: Chromium	7440-47-3	1	mg/kg	<1.0	7 mg/kg	91.8	91.0	108
EG005-SDH: Copper	7440-50-8	1	mg/kg	<1.0	----	----	----	----
EG005-SDH: Lead	7439-92-1	1	mg/kg	<1.0	----	----	----	----
EG005-SDH: Nickel	7440-02-0	1	mg/kg	<1.0	5.29 mg/kg	102	90.0	109
EG005-SDH: Silver	7440-22-4	1	mg/kg	<1.0	----	----	----	----
EG005-SDH: Zinc	7440-66-6	1	mg/kg	<1.0	45.42 mg/kg	101	93.0	107
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 3904573)								
EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 3907013)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	4.16 %	103	70.0	130
				<0.02	0.2 %	109	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3897696)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	6.2 mg/kg	90.0	61.0	133
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3898099)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	5 mg/kg	108	78.0	118
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	7.5 mg/kg	106	84.0	118
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	5 mg/kg	102	73.0	119
EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 3898099)								
EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	6.25 mg/kg	112	70.0	130
EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	8.75 mg/kg	103	74.0	138
EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	3.75 mg/kg	102	63.0	131
EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD: BTEXN (QCLot: 3897696)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	0.2 mg/kg	106	66.0	122
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	0.2 mg/kg	103	70.0	130
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	0.2 mg/kg	105	66.0	126
EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	0.4 mg/kg	105	59.0	129
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	0.2 mg/kg	103	66.0	126

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP090: Organotin Compounds (QCLot: 3904645)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	86.9	36.0	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	84.6	42.0	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	85.0	52.0	139
EP090: Organotin Compounds (QCLot: 3907476)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	88.1	36.0	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	70.2	42.0	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	83.1	52.0	139
EP130A: Organophosphorus Pesticides (Ultra-trace) (QCLot: 3898078)								
EP130: Bromophos-ethyl	4824-78-6	10	µg/kg	<10	50 µg/kg	90.4	49.0	117
EP130: Carbophenothion	786-19-6	10	µg/kg	<10	50 µg/kg	87.6	54.0	104
EP130: Chlorfenvinphos (E)	18708-86-6	10	µg/kg	<10.0	5 µg/kg	76.4	48.0	156
EP130: Chlorfenvinphos (Z)	18708-87-7	10	µg/kg	<10	50 µg/kg	87.1	53.0	119
EP130: Chlorpyrifos	2921-88-2	10	µg/kg	<10	50 µg/kg	86.3	54.0	112
EP130: Chlorpyrifos-methyl	5598-13-0	10	µg/kg	<10	50 µg/kg	85.9	52.0	108
EP130: Demeton-S-methyl	919-86-8	10	µg/kg	<10	50 µg/kg	92.4	51.0	109
EP130: Diazinon	333-41-5	10	µg/kg	<10	50 µg/kg	80.8	57.0	121
EP130: Dichlorvos	62-73-7	10	µg/kg	<10	50 µg/kg	82.0	48.0	104
EP130: Dimethoate	60-51-5	10	µg/kg	<10	50 µg/kg	96.0	52.0	120
EP130: Ethion	563-12-2	10	µg/kg	<10	50 µg/kg	79.4	51.0	121
EP130: Fenamiphos	22224-92-6	10	µg/kg	<10	50 µg/kg	76.2	50.0	120
EP130: Fenthion	55-38-9	10	µg/kg	<10	50 µg/kg	93.8	48.0	112
EP130: Malathion	121-75-5	10	µg/kg	<10	50 µg/kg	86.5	51.0	121
EP130: Azinphos Methyl	86-50-0	10	µg/kg	<10	50 µg/kg	82.9	45.0	127
EP130: Monocrotophos	6923-22-4	10	µg/kg	<10	50 µg/kg	76.9	48.0	128
EP130: Parathion	56-38-2	10	µg/kg	<10	50 µg/kg	79.1	49.0	125
EP130: Parathion-methyl	298-00-0	10	µg/kg	<10	50 µg/kg	76.8	51.0	119
EP130: Pirimphos-ethyl	23505-41-1	10	µg/kg	<10	50 µg/kg	75.4	48.0	120
EP130: Prothiofos	34643-46-4	10	µg/kg	<10	50 µg/kg	91.6	51.0	117
EP131A: Organochlorine Pesticides (QCLot: 3898080)								
EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	5 µg/kg	100	38.0	139
EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	5 µg/kg	71.2	17.6	136
EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	5 µg/kg	57.5	30.5	131
EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	5 µg/kg	68.1	37.0	140
EP131A: 4.4`-DDD	72-54-8	0.5	µg/kg	<0.50	5 µg/kg	93.6	25.9	141
EP131A: 4.4`-DDE	72-55-9	0.5	µg/kg	<0.50	5 µg/kg	87.3	35.0	129
EP131A: 4.4`-DDT	50-29-3	0.5	µg/kg	<0.50	5 µg/kg	73.6	23.4	138
EP131A: Sum of DDD + DDE + DDT	72-54-8/72-5 5-9/50-2	0.5	µg/kg	<0.50	----	----	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP131A: Organochlorine Pesticides (QCLot: 3898080) - continued								
EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	5 µg/kg	99.9	30.2	140
EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	5 µg/kg	95.4	38.0	140
EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	5 µg/kg	93.8	32.0	152
EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	5 µg/kg	50.8	36.0	155
EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	5 µg/kg	128	25.8	158
EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	5 µg/kg	76.1	20.1	118
EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	5 µg/kg	111	13.4	135
EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	5 µg/kg	84.9	39.0	155
EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	5 µg/kg	86.5	34.0	148
EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	5 µg/kg	86.1	26.1	152
EP131A: gamma-BHC	58-89-9	0.25	µg/kg	<0.25	5 µg/kg	70.5	31.2	137
EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	5 µg/kg	81.5	36.0	152
EP131A: cis-Chlordane	5103-71-9	0.25	µg/kg	<0.25	5 µg/kg	83.4	36.0	142
EP131A: trans-Chlordane	5103-74-2	0.25	µg/kg	<0.25	5 µg/kg	93.3	29.5	138
EP131A: Total Chlordane (sum)	----	0.25	µg/kg	<0.25	----	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 3898079)								
EP131B: Total Polychlorinated biphenyls	----	5	µg/kg	<5.0	50 µg/kg	76.5	45.0	115
EP131B: Aroclor 1016	12674-11-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1221	11104-28-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1232	11141-16-5	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1242	53469-21-9	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1248	12672-29-6	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1254	11097-69-1	5	µg/kg	<5.0	50 µg/kg	76.5	45.0	115
EP131B: Aroclor 1260	11096-82-5	5	µg/kg	<5.0	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3898075)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	92.6	63.0	129
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	109	64.0	128
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	106	65.0	129
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	107	68.0	132
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	109	68.0	124
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	108	64.0	134
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	110	65.0	131
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	106	64.0	130
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	105	67.0	133
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	113	62.0	130
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	104	65.0	133
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	25 µg/kg	116	68.0	120

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3898075) - continued								
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	97.8	61.0	133
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	112	63.0	127
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	116	66.0	118
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	108	69.0	119
EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	105	66.0	120
EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	102	64.0	122
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	103	64.0	120
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	97.9	68.0	136
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
				Concentration	MS	Low	High
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES (QCLot: 3904574)							
ES2132764-001	11-S	EG005-SDH: Arsenic	7440-38-2	50 mg/kg	98.7	70.0	130
		EG005-SDH: Cadmium	7440-43-9	12.5 mg/kg	90.2	70.0	130
		EG005-SDH: Chromium	7440-47-3	50 mg/kg	104	70.0	130
		EG005-SDH: Copper	7440-50-8	50 mg/kg	127	70.0	130
		EG005-SDH: Lead	7439-92-1	50 mg/kg	71.7	70.0	130
		EG005-SDH: Nickel	7440-02-0	50 mg/kg	106	70.0	130
		EG005-SDH: Zinc	7440-66-6	50 mg/kg	# Not Determined	70.0	130
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 3904573)							
ES2132764-001	11-S	EG035-SDH: Mercury	7439-97-6	2.5 mg/kg	115	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3897696)							
ES2132764-011	16-S	EP080-SD: C6 - C9 Fraction	----	6.5 mg/kg	93.8	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3898099)							
ES2132764-011	16-S	EP071-SD: C10 - C14 Fraction	----	14 mg/kg	110	70.0	130
		EP071-SD: C15 - C28 Fraction	----	59 mg/kg	79.7	70.0	130
		EP071-SD: C29 - C36 Fraction	----	42 mg/kg	108	70.0	130
EP080-SD: BTEXN (QCLot: 3897696)							
ES2132764-011	16-S	EP080-SD: Benzene	71-43-2	0.5 mg/kg	97.5	70.0	130
		EP080-SD: Toluene	108-88-3	0.5 mg/kg	86.9	70.0	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Acceptable Limits (%) Low	High
EP080-SD: BTEXN (QCLot: 3897696) - continued							
ES2132764-011	16-S	EP080-SD: Ethylbenzene	100-41-4	0.5 mg/kg	91.3	70.0	130
		EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.5 mg/kg	90.8	70.0	130
		EP080-SD: ortho-Xylene	95-47-6	0.5 mg/kg	91.6	70.0	130
EP090: Organotin Compounds (QCLot: 3904645)							
ES2132764-020	20-B	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# Not Determined	20.0	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	# Not Determined	20.0	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	# 8.2	20.0	130
EP090: Organotin Compounds (QCLot: 3907476)							
ES2132764-012	16-B	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# Not Determined	20.0	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	41.6	20.0	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	# Not Determined	20.0	130
EP130A: Organophosphorus Pesticides (Ultra-trace) (QCLot: 3898078)							
ES2132764-011	16-S	EP130: Bromophos-ethyl	4824-78-6	50 µg/kg	56.1	36.0	144
		EP130: Carbophenothion	786-19-6	50 µg/kg	69.8	38.0	120
		EP130: Chlorfenvinphos (E)	18708-86-6	5 µg/kg	62.9	49.0	157
		EP130: Chlorfenvinphos (Z)	18708-87-7	50 µg/kg	61.1	53.0	145
		EP130: Chlorpyrifos	2921-88-2	50 µg/kg	69.8	60.0	140
		EP130: Chlorpyrifos-methyl	5598-13-0	50 µg/kg	61.6	56.0	126
		EP130: Demeton-S-methyl	919-86-8	50 µg/kg	51.5	9.70	148
		EP130: Diazinon	333-41-5	50 µg/kg	60.0	60.0	122
		EP130: Dichlorvos	62-73-7	50 µg/kg	53.5	33.0	123
		EP130: Dimethoate	60-51-5	50 µg/kg	60.1	36.0	142
		EP130: Ethion	563-12-2	50 µg/kg	63.1	48.0	136
		EP130: Fenamiphos	22224-92-6	50 µg/kg	49.6	42.0	136
		EP130: Fenthion	55-38-9	50 µg/kg	50.7	35.0	131
		EP130: Malathion	121-75-5	50 µg/kg	67.3	55.0	141
		EP130: Azinphos Methyl	86-50-0	50 µg/kg	51.3	23.5	132
		EP130: Monocrotophos	6923-22-4	50 µg/kg	54.5	35.0	153
		EP130: Parathion	56-38-2	50 µg/kg	66.7	57.0	147
		EP130: Parathion-methyl	298-00-0	50 µg/kg	68.4	48.0	140
		EP130: Pirimphos-ethyl	23505-41-1	50 µg/kg	52.4	45.0	137
		EP130: Prothiofos	34643-46-4	50 µg/kg	56.3	51.0	137
EP131A: Organochlorine Pesticides (QCLot: 3898080)							

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP131A: Organochlorine Pesticides (QCLot: 3898080) - continued							
ES2132764-011	16-S	EP131A: Aldrin	309-00-2	5 µg/kg	52.5	23.4	153
		EP131A: alpha-BHC	319-84-6	5 µg/kg	60.4	17.6	156
		EP131A: beta-BHC	319-85-7	5 µg/kg	59.2	24.9	153
		EP131A: delta-BHC	319-86-8	5 µg/kg	101	25.2	147
		EP131A: 4.4`-DDD	72-54-8	5 µg/kg	86.6	25.9	150
		EP131A: 4.4`-DDE	72-55-9	5 µg/kg	67.6	31.2	125
		EP131A: 4.4`-DDT	50-29-3	5 µg/kg	114	23.4	163
		EP131A: Dieldrin	60-57-1	5 µg/kg	67.4	30.2	140
		EP131A: alpha-Endosulfan	959-98-8	5 µg/kg	59.2	28.8	135
		EP131A: beta-Endosulfan	33213-65-9	5 µg/kg	63.5	22.6	141
		EP131A: Endosulfan sulfate	1031-07-8	5 µg/kg	93.8	16.1	156
		EP131A: Endrin	72-20-8	5 µg/kg	96.7	17.7	162
		EP131A: Endrin aldehyde	7421-93-4	5 µg/kg	47.6	20.1	116
		EP131A: Endrin ketone	53494-70-5	5 µg/kg	51.2	13.4	151
		EP131A: Heptachlor	76-44-8	5 µg/kg	46.6	23.8	170
		EP131A: Heptachlor epoxide	1024-57-3	5 µg/kg	55.9	28.3	140
		EP131A: Hexachlorobenzene (HCB)	118-74-1	5 µg/kg	56.4	17.7	144
		EP131A: gamma-BHC	58-89-9	5 µg/kg	47.4	21.8	158
		EP131A: Methoxychlor	72-43-5	5 µg/kg	95.3	24.4	158
		EP131A: cis-Chlordane	5103-71-9	5 µg/kg	103	27.3	139
		EP131A: trans-Chlordane	5103-74-2	5 µg/kg	53.1	29.5	138
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 3898079)							
ES2132764-011	16-S	EP131B: Total Polychlorinated biphenyls	----	50 µg/kg	70.0	44.0	136
		EP131B: Aroclor 1254	11097-69-1	50 µg/kg	70.0	44.0	136
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3898075)							
ES2132764-011	16-S	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	118	70.0	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	124	70.0	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	118	70.0	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	# Not Determined	70.0	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%) MS	Acceptable Limits (%) Low	Acceptable Limits (%) High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3898075) - continued							
ES2132764-011	16-S	EP132B-SD: Pyrene	129-00-0	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	# Not Determined	70.0	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	# Not Determined	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2132764**	Page	: 1 of 12
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Paul Anink	Telephone	: +61-2-8784 8555
Project	: Noakes Sediment	Date Samples Received	: 09-Sep-2021
Site	: ----	Issue Date	: 28-Sep-2021
Sampler	: Jacob Broom	No. of samples received	: 20
Order number	: ----	No. of samples analysed	: 15

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **<u>NO</u> Method Blank value outliers occur.**
- **<u>NO</u> Duplicate outliers occur.**
- **<u>NO</u> Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

- **<u>NO</u> Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICF	ES2132764--001	11-S	**Zinc**	7440-66-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP090: Organotin Compounds	ES2132764--020	20-B	**Tributyltin**	56573-85-4	8.2 %	20.0-130%	**Recovery less than lower data quality objective**
EP090: Organotin Compounds	ES2132764--012	16-B	**Tributyltin**	56573-85-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Acenaphthylene**	208-96-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Fluorene**	86-73-7	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Phenanthrene**	85-01-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Anthracene**	120-12-7	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Fluoranthene**	206-44-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Pyrene**	129-00-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Benz(a)anthracene**	56-55-3	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Chrysene**	218-01-9	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Benzo(b+j)fluoranthene**	205-99-2 205-82-3	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Benzo(k)fluoranthene**	207-08-9	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries - Continued							
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Benzo(e)pyrene**	192-97-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Benzo(a)pyrene**	50-32-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Perylene**	198-55-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Benzo(g.h.i)perylene**	191-24-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Dibenz(a.h)anthracene**	53-70-3	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Indeno(1.2.3.cd)pyrene**	193-39-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES2132764--011	16-S	**Coronene**	191-07-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Regular Sample Surrogates

Sub-Matrix: **SEDIMENT**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP080-SD: TPH(V)/BTEX Surrogates	ES2132764-019	20-S	**1.2-Dichloroethane-D4**	17060-07-0	56.4 %	67.0-137 %	**Recovery less than lower data quality objective**
EP080-SD: TPH(V)/BTEX Surrogates	ES2132764-018	19-B	**Toluene-D8**	2037-26-5	60.3 %	74.0-134 %	**Recovery less than lower data quality objective**
EP080-SD: TPH(V)/BTEX Surrogates	ES2132764-019	20-S	**Toluene-D8**	2037-26-5	57.6 %	74.0-134 %	**Recovery less than lower data quality objective**
EP080-SD: TPH(V)/BTEX Surrogates	ES2132764-018	19-B	**4-Bromofluorobenzene**	460-00-4	70.3 %	73.0-137 %	**Recovery less than lower data quality objective**
EP080-SD: TPH(V)/BTEX Surrogates	ES2132764-019	20-S	**4-Bromofluorobenzene**	460-00-4	72.4 %	73.0-137 %	**Recovery less than lower data quality objective**
EP090S: Organotin Surrogate	ES2132764-012	16-B	**Tripropyltin**	----	23.2 %	35.0-130 %	**Recovery less than lower data quality objective**
EP090S: Organotin Surrogate	ES2132764-015	18-S	**Tripropyltin**	----	21.2 %	35.0-130 %	**Recovery less than lower data quality objective**
EP090S: Organotin Surrogate	ES2132764-016	18-B	**Tripropyltin**	----	25.4 %	35.0-130 %	**Recovery less than lower data quality objective**

Sub-Matrix: **SEDIMENT**

Compound Group Name	Laboratory Sample ID	Client Sample ID	**Analyte**	CAS Number	Data	Limits	**Comment**
Samples Submitted - Continued							
EP090S: Organotin Surrogate	ES2132764-017	19-S	**Tripropyltin**	----	26.2 %	35.0-130 %	**Recovery less than lower data quality objective**
EP090S: Organotin Surrogate	ES2132764-018	19-B	**Tripropyltin**	----	16.1 %	35.0-130 %	**Recovery less than lower data quality objective**

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
1M HCl Extractable Mercury by FIMS	1	15	6.67	10.53	NEPM 2013 B3 & ALS QC Standard
Moisture Content	4	42	9.52	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
***Container** / Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055) 11-S, 12-S, 13-S, 15-S, 16-S, 16-B, 17-B, 18-S, 18-B, 19-S, 19-B, 20-S, 20-B	**09-Sep-2021**	**----**	----	----	**17-Sep-2021**	23-Sep-2021	✓
Soil Glass Jar - Unpreserved (EA055) 14-S, 17-S	**09-Sep-2021**	**----**	----	----	**20-Sep-2021**	23-Sep-2021	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing								
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150)								
11-S,	12-S,	**09-Sep-2021**	**----**	----	----	**17-Sep-2021**	08-Mar-2022	✓
13-S,	14-S,							
15-S,	16-S,							
16-B,	17-S,							
17-B,	18-S,							
18-B,	19-S,							
19-B,	20-S,							
20-B								
EA150: Soil Classification based on Particle Size								
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150)								
11-S,	12-S,	**09-Sep-2021**	**----**	----	----	**17-Sep-2021**	08-Mar-2022	✓
13-S,	14-S,							
15-S,	16-S,							
16-B,	17-S,							
17-B,	18-S,							
18-B,	19-S,							
19-B,	20-S,							
20-B								
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES								
Soil Glass Jar - Unpreserved (EG005-SDH)								
11-S,	12-S,	**09-Sep-2021**	**16-Sep-2021**	08-Mar-2022	✓	**16-Sep-2021**	08-Mar-2022	✓
13-S,	14-S,							
15-S,	16-S,							
16-B,	17-S,							
17-B,	18-S,							
18-B,	19-S,							
19-B,	20-S,							
20-B								
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035-SDH)								
11-S,	12-S,	**09-Sep-2021**	**16-Sep-2021**	07-Oct-2021	✓	**16-Sep-2021**	07-Oct-2021	✓
13-S,	14-S,							
15-S,	16-S,							
16-B,	17-S,							
17-B,	18-S,							
18-B,	19-S,							
19-B,	20-S,							
20-B								

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EP003: Total Organic Carbon (TOC) in Soil							
Pulp Bag (EP003)							
11-S, 12-S, 13-S, 14-S, 15-S, 16-S, 16-B, 17-S, 17-B, 18-S, 18-B, 19-S, 19-B, 20-S, 20-B	**09-Sep-2021**	**17-Sep-2021**	07-Oct-2021	✓	**17-Sep-2021**	07-Oct-2021	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP071-SD)							
16-S, 16-B, 17-S, 17-B, 18-S, 18-B, 19-S, 19-B, 20-S, 20-B	**09-Sep-2021**	**14-Sep-2021**	23-Sep-2021	✓	**16-Sep-2021**	24-Oct-2021	✓
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP071-SD)							
16-S, 16-B, 17-S, 17-B, 18-S, 18-B, 19-S, 19-B, 20-S, 20-B	**09-Sep-2021**	**14-Sep-2021**	23-Sep-2021	✓	**16-Sep-2021**	24-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP080-SD)							
16-S, 16-B, 17-S, 17-B, 18-S, 18-B, 19-S, 19-B, 20-S, 20-B	**09-Sep-2021**	**14-Sep-2021**	23-Sep-2021	✓	**17-Sep-2021**	23-Sep-2021	✓
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080-SD)							
16-S, 16-B, 17-S, 17-B, 18-S, 18-B, 19-S, 19-B, 20-S, 20-B	**09-Sep-2021**	**14-Sep-2021**	23-Sep-2021	✓	**17-Sep-2021**	23-Sep-2021	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EP080-SD: BTEXN								
Soil Glass Jar - Unpreserved (EP080-SD)								
16-S,	16-B,	**09-Sep-2021**	**14-Sep-2021**	23-Sep-2021	✓	**17-Sep-2021**	23-Sep-2021	✓
17-S,	17-B,							
18-S,	18-B,							
19-S,	19-B,							
20-S,	20-B							
EP090: Organotin Compounds								
Soil Glass Jar - Unpreserved (EP090)								
20-B		**09-Sep-2021**	**16-Sep-2021**	23-Sep-2021	✓	**17-Sep-2021**	26-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP090)								
16-S,	16-B,	**09-Sep-2021**	**17-Sep-2021**	23-Sep-2021	✓	**21-Sep-2021**	27-Oct-2021	✓
17-S,	17-B,							
18-S,	18-B,							
19-S,	19-B,							
20-S								
EP130A: Organophosphorus Pesticides (Ultra-trace)								
Soil Glass Jar - Unpreserved (EP130)								
16-S,	16-B,	**09-Sep-2021**	**14-Sep-2021**	23-Sep-2021	✓	**17-Sep-2021**	24-Oct-2021	✓
17-S,	17-B,							
18-S,	18-B,							
19-S,	19-B,							
20-S,	20-B							
EP131A: Organochlorine Pesticides								
Soil Glass Jar - Unpreserved (EP131A)								
16-S,	16-B,	**09-Sep-2021**	**14-Sep-2021**	23-Sep-2021	✓	**17-Sep-2021**	24-Oct-2021	✓
17-S,	17-B,							
18-S,	18-B,							
19-S,	19-B,							
20-S,	20-B							
EP131B: Polychlorinated Biphenyls (as Aroclors)								
Soil Glass Jar - Unpreserved (EP131B)								
16-S,	16-B,	**09-Sep-2021**	**14-Sep-2021**	23-Sep-2021	✓	**17-Sep-2021**	24-Oct-2021	✓
17-S,	17-B,							
18-S,	18-B,							
19-S,	19-B,							
20-S,	20-B							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP132B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP132B-SD)								
16-S,	16-B,	**09-Sep-2021**	**14-Sep-2021**	23-Sep-2021	✓	**16-Sep-2021**	24-Oct-2021	✓
17-S,	17-B,							
18-S,	18-B,							
19-S,	19-B,							
20-S,	20-B							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	15	**6.67**	**10.53**	✗	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	4	42	**9.52**	**10.00**	✗	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (Ultra-trace)	EP131A	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organophosphorus Pesticides (Ultra-trace)	EP130	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace)	EP131B	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
1M HCl Extractable Metals	EG005-SDH	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (Ultra-trace)	EP131A	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organophosphorus Pesticides (Ultra-trace)	EP130	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	2	11	**18.18**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace)	EP131B	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	15	**6.67**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (Ultra-trace)	EP131A	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organophosphorus Pesticides (Ultra-trace)	EP130	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	2	11	**18.18**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace)	EP131B	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	15	**6.67**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (Ultra-trace)	EP131A	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
Organophosphorus Pesticides (Ultra-trace)	EP130	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	2	11	**18.18**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace)	EP131B	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Particle Size Analysis (Sieving)	EA150	SOIL	In house: Referenced to AS1289.3.6.1. Particle Size Analysis by Sieving
1M HCl Extractable Metals	EG005-SDH	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined via ICPAES following weak acid extraction. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3). LORs per NAGD. ALS is not NATA accredited for the analysis of Barium, Boron, Molybdenum and Strontium by this method.
1M HCl Extractable Mercury by FIMS	EG035-SDH	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B. Mercury is determined via FIMS following weak acid extraction. FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automatically measured by infra-red detector.
TPH - Semivolatile Fraction	EP071-SD	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX in Sediments	EP080-SD	SOIL	In house: Referenced to USEPA SW 846 - 8260 Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve.
Organotin Analysis	EP090	SOIL	In house: Referenced to USEPA SW 846 - 8270 Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quanitified against an established calibration curve.
Organophosphorus Pesticides (Ultra-trace)	EP130	SOIL	In house: Referenced to USEPA Method 3640 (GPC cleanup), 8141 (GC/FPD - Capillary Column) This technique is compliant with NEPM Schedule B(3)
Organochlorine Pesticides (Ultra-trace)	EP131A	SOIL	In house: Referenced to USEPA Method 3640 (GPC cleanup),3620 (Florisil), 8081/8082 (GC/µECD/µECD) This technique is compliant with NEPM Schedule B(3)
PCB's (Ultra-trace)	EP131B	SOIL	In house: Referenced to USEPA Method 3640 (GPC cleanup),3620 (Florisil), 8081/8082 (GC/µECD/µECD) This technique is compliant with NEPM Schedule B(3)
PAHs in Sediments by GCMS(SIM)	EP132B-SD	SOIL	In house: Referenced to USEPA 8270 GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection.

Preparation Methods	Method	Matrix	Method Descriptions
1M HCl Extraction for Metals in Sediments (1 hour)	EN71	SOIL	In house: Referenced to In house, Allen (1993). 1g of sample is leached at room temperature for 1 hour in 10% hydrochloric acid. The resultant extract is filtered and bulked for analysis of extracted metals.
Dry and Pulverise (up to 100g)	GEO30	SOIL	#

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids (Option A - Concentrating)	ORG17A	SOIL	In house: Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Tumbler Extraction of Solids/ Sample Cleanup	ORG17A-UTP	SOIL	In house: Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. Samples are extracted, concentrated (by KD) and exchanged into an appropriate solvent for GPC and florisil cleanup as required.
Tumbler Extraction of Solids for LVI (Non-concentrating)	ORG17D	SOIL	In house: 10g of sample, Na2SO4 and surrogate are extracted with 50mL 1:1 DCM/Acetone by end over end tumbling. An aliquot is concentrated by nitrogen blowdown to a reduced volume for analysis if required.
Organotin Sample Preparation	ORG35	SOIL	In house: 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.

Appendix D CV

Geosyntec
consultants

David A. Reynolds PhD, CEnvP (SC)
Senior Principal

site investigation and modelling
expert review and auditing
remediation design and regulatory guidance
applied research

CAREER SUMMARY

Dr. Reynolds career has included time as a tenured academic position, as research director of a multi-partner Centre focusing on groundwater issues, and senior technical positions at two international consulting companies. Dave has been an author of several ITRC guidance documents, as well as an author on National Academies publications. He is the co-inventor of electrokinetic oxidation approaches for remediation of heterogeneous and low permeability source zones, as well as the use of electromigration for in-situ desalination. Dr. Reynolds has extensive experience in remediation design and costing as well as litigation support, both as a consulting and testifying expert (Australia, Canada, and the United States). Currently a contaminated sites Auditor in Western Australia and Queensland, Dave is responsible for the oversight of all Geosyntec remediation projects across Australasia.

EDUCATION

Ph.D., Environmental Engineering, Queen's University, Kingston, Ont.
M.Sc. (Eng.), Environmental Engineering, Queen's University, Kingston, Ont.
B.A.Sc., Geological Engineering, University of Waterloo, Waterloo, Ont.

REGISTRATIONS, CERTIFICATIONS, MEMBERSHIPS

Accredited Contaminated Sites Auditor, Western Australia and Queensland
Certified Environmental Practitioner – Site Contamination Specialist
Professional Engineer, Ontario, Canada

SELECTED PROJECTS

Remediation and Technology Development

Remedial Options Assessment, RAAF Williamtown. Project Director. The Department of Defence engaged Geosyntec to perform a "Clean Sheet" review of the remediation approaches historically implemented on the Base as interim measures and to undertake a full remedial options assessment for PFAS in soil, surface water, and groundwater.

Remedial Options Assessment, Confidential Client, W.A. Project Director. Geosyntec provided a remedial options assessment for redevelopment of a site with PFAS-impacted soil and groundwater due to historical fire training activities.

In-Situ Treatment of PFAS Using D-FAS Technology, ESTCP ER19-5075. Principal Investigator. D-FAS is an innovative in-situ approach to dealing with dissolved-phase PFAS contamination in source zones. Taking advantage of the surfactant properties of the individual PFAS compounds, D-FAS removes them from a water column via engineered bubbles, resulting in a concentrated PFAS foam extract for disposal and groundwater below most criteria. This project is undertaking a demonstration of the technology at a US Naval facility.

Interactive Training System for Reductions in Cost and Complexity of Remediation and Long-term Management of Contaminated Sites, ESTCP ER-201566-T2. Principal Investigator. Leveraging the results and deliverables of the DIVER project (ER-2313), the TEMPO project produced an interactive training system for contaminated site investigation and optimization of remediation performance monitoring. The training tool is being used for CE credits by RPMs, as well as in a number of university programs around the world.

Demonstration of Smouldering Combustion Treatment of PFAS-impacted Investigation-derived Waste, SERDP ER18-1593. Co-Principal Investigator. The primary research objective of the work was to demonstrate proof-of-concept for the use of smoldering combustion (SC) to treat investigation-derived waste (IDW - both liquid and solid) generated during investigation of per- and polyfluoroalkyl substance (PFAS) impacted sites. Results indicated that SC is a highly suitable remedy for PFAS-impacted soil.

Electrokinetically-delivered, Thermally-activated Persulfate Oxidation (EK-TAP) for the Remediation of Chlorinated and Recalcitrant Compounds in Heterogeneous and Low Permeability Source Zones. ESTCP ER-201626. Technical Lead. This on-going project is demonstrating the ability of a novel combined in situ remediation approach, referred to as electrokinetically-delivered, thermally-activated persulfate (EK-TAP), to remediate chlorinated solvents and recalcitrant chemicals (e.g., 1,4-dioxane) in low permeability (K) and heterogeneous geological materials.

Electrokinetic-enhanced (EK-Enhanced) Amendment Delivery for Remediation of Low Permeability and Heterogeneous Materials. ESTCP ER-201325. Technical Lead. This demonstration/validation project, performed at Naval Air Station (NAS) Jacksonville to target a tetrachloroethene (PCE) source area in clay materials, successfully validated the performance of an electrokinetic (EK) technique to promote uniform and effective distribution of lactate (as an electron donor) in low-permeability (low-K) and heterogeneous subsurface materials.

Former Waste Transfer Facility, Perth, W.A. Principal Engineer. Multi-year, multi-faceted project involving site investigation and remediation of dissolved chlorinated ethenes plume. Project included detailed site investigation, numerical modelling for remedy design, installation of dual permeable reactive barriers, and enhanced in-situ bioremediation using EVO.

Chemical Manufacturing Facility, Lake Charles, LA. Project Director. Pilot-scale demonstration of Electrokinetic remediation using EK-TAP. Project included design, stakeholder consultation, regulatory approval, installation, operation and optimization.

Former Industrial Park, Ballerup, Denmark. Technical Lead. Dipole-scale demonstration of Electrokinetic remediation using EK-TAP. Project included design, stakeholder consultation, regulatory approval and technical oversight.

Lorentz Barrel and Drum Superfund Site, San Jose, CA. Project Director. Pilot-scale demonstration of Electrokinetic remediation using EK-TAP in conjunction with USEPA. Project included design, stakeholder consultation, regulatory approval, installation, operation and optimization.

Benchmark Storage Facility, California. Technical Lead. Pilot-scale demonstration of Electrokinetic remediation using EK-TAP. Project included design, stakeholder consultation, regulatory approval, installation, operation and optimization.

Enhanced In-situ Bioremediation of Former Dry Cleaner Site, Florida. Technical Advisor and Project Manager. Designed and oversaw implementation of emulsified vegetable oil (EVO) injections and bioaugmentation for remediation of shallow groundwater downgradient of a former dry-cleaning facility.

In-situ Biological Remediation of Fractured Rock, New York. Project Director. Led the technical design and implementation of a density-assisted pilot-scale assessment of surface lactate delivery to deeper formations. High-density lactate (DAPL) additions in the shallow formations at the site have been emplaced to migrate through the higher-impacted regions deeper in the system. The approach was used to avoid drilling into or through the heavily contaminated and more porous deeper sections of the fractured rock aquifer. Reductions of COC concentrations at the downgradient boundary in the deeper targeted system have been observed.

Forecasting Effective Site Characterization and Early Remediation Performance, SERDP ER-2313. Project Manager and Technical Lead. The DIVER (Data Information Value to Evaluate Remediation) project is developing technical guidance on the value of data in both the site characterization and remediation contexts based on detailed field data, empirical evidence gathered from some of the most respected and successful practitioners in the field, highly detailed virtual site investigations, and stochastic approaches to quantifying the value of additional information. The primary research objective is to develop a framework for optimizing the site characterization process, such that the total cost of investigation, the cost of achieving remedial goals, and the likelihood of failure of remedial approaches are minimized.

Litigation and Expert Witness

Organics

Major Infrastructure Project, Melbourne, Australia. Acted as expert witness for mediation involving PFAS impacted spoil.

PFAS Impacts, Perth, Australia. Acted as expert witness for mediation involving potential impacts on adjacent land from historical firefighting training.

Former Service Station, Perth, Australia. Acted as expert witness (Plaintiff) for litigation involving historical impacts from operation of a service station.

Active Dry-Cleaning Facility, Sydney, Australia. Acted as expert witness (Defendant) for litigation involving historical releases of dry-cleaning fluid and associated impacts on adjacent commercial and residential properties.

Former Dry-Cleaning Facility, Melbourne, Victoria. Acted as expert witness (Plaintiff) for litigation involving the contamination of a medium-density residential development by PCE.

Former Dry Cleaner Site, Ottawa, Ontario. Acted as expert witness (Plaintiff) for litigation involving historical releases of dry-cleaning products.

Fire Training Facility, Ottawa, Ontario. Expert witness (Plaintiff) for litigation involving the contamination of residential water wells with PFAS.

Former Industrial Site, Macon, Missouri. Acted as expert (Defendant) for a matter involving the timing of releases of contaminants to the subsurface and the attribution of remediation costs.

Agricultural Land, Assumption Parish, Louisiana. Acted as expert witness (Defendant) for litigation involving petroleum hydrocarbon impacts.

Inorganics

Agricultural Land, St. Martin Parish, Louisiana. Acted as expert witness (Defendant) for litigation involving alleged oil and gas exploration and production activities impacts on agricultural land.

Agricultural Land, Parish of St. Landry, Louisiana. Acted as expert witness (Defendant) for litigation involving alleged oil and gas exploration and production activities impacts on agricultural land.

Agricultural Land, Jefferson Parish, Louisiana. Acted as expert witness (Defendant) for litigation involving alleged oil and gas exploration and production activities impacts on agricultural land.

Land Impacts, LaFourche Parish, Louisiana. Acted as expert witness (Defendant) for litigation involving alleged oil and gas exploration and production activities impacts on uninhabited land.

Private Land, Cameron Parish, Louisiana. Acted as an expert witness (Defendant) on matters concerning potential exploration and production activities on private land.

Agricultural Land, Catahoula Parish, Louisiana. Acted as expert witness (Defendant) for litigation involving alleged oil and gas exploration and production activities impacts on agricultural land.

PROFESSIONAL EXPERIENCE

Geosyntec Family of Companies, 2011 – Present

Golder Associates Pty. Ltd., West, Perth, Australia, 2008 - 2011

School of Environmental Systems Engineering, University of Western Australia, Crawley, Australia, Senior Lecturer, 2006 - 2008

Flinders University, Adelaide, Australia, Research Director, Centre for Groundwater Studies, 2005 – 2007

University of Western Australia, Crawley, Australia, Tenured Lecturer, School of Environmental Systems Engineering, 2001 – 2006; tenure granted July 2004

Queen's University, Kingston, Ontario, Lecturer, Department of Civil Engineering, 2000 – 2001

REFEREED JOURNAL PUBLICATIONS

20-01 Head, N.A., Gerhard, J.I., Inglis, A.M., Garcia, A.N., Chowdhury, A.I.A., Reynolds, D.A., V. de Boer, C., Sidebottom, A., Austrins, L.M., Eimers, J., and D.M. O'Carroll. 2020. *Field Test of Electrokinetically-delivered Thermally Activated Persulfate for Remediation of Chlorinated Solvents in Clay*, Water Research, Vol. 183, pgs. 1-10.

18-01 Milley, S., Koch, I., Fortin, P., Archer, J., Reynolds, D., and K. Weber. 2018. *Estimating the Number of Airports Potentially Contaminated with Perfluoroalkyl and Polyfluoroalkyl Substances from Aqueous Film Forming Foam: A Canadian Example*, Journal of Environmental Management, 222, 122-131.

17-01 Chowdhury, A.I.A., Gerhard, J.G., Reynolds, D.A., and D.M. O'Carroll. 2017. *Low Permeability Zone Remediation via Oxidant Delivered by Electrokinetics and Activated by Electrical Resistance Heating: Proof of Concept*, Environmental Science & Technology, 51 (22), 13295-13303.

17-02 Lima, A.T., Hofmann, A., Reynolds, D., Ptacek, CJ, Van Cappellen, P., Ottosen, L.M., Pamukcu, S., Alshawabekh, A., O'Carroll, DM, Riis, C., Cox, E., Gent, D.B., Landis, R., Wang, J., Chowdhury, AIA, Secord, E.L., and A. Sanchez-Hachair. 2017. *Environmental Electrokinetics for a Sustainable Subsurface*, Chemosphere, 181, 122-133.

17-03 Chowdhury, A.I.A., Gerhard, J.I., Reynolds, D., Sleep, B.E., and D.M. O'Carroll. 2017. *Electrokinetic-enhanced Permanganate Delivery and Remediation of Contaminated Low Permeability Porous Media*, Water Research, 113, 215-222.

13-01 Hodges, D., Fourie, A., Thomas, D.G., and D.A. Reynolds. 2013. *Overcoming Permanganate Stalling During Electromigration*, ASCE Journal of Environmental Engineering, 139 (5), 677-684.

13-02 Wu, M.Z., Reynolds, D.A., Fourie, A., and D.G. Thomas. 2013. *Optimal Field Approaches for Electrokinetic In Situ Oxidation Remediation*, Ground Water Monitoring and Remediation, Vol. 33, No. 1, pgs. 62-74.

12-01 Wu, M.Z., Reynolds, D.A., Fourie, A., and D.G. Thomas. 2012. *Electrokinetic In Situ Chemical Oxidation Remediation: Assessment of Parameter Sensitivities and the Influence of Aquifer Heterogeneity on Remediation Efficiency*, J. Contaminant Hydrology, Vol. 136-137, pgs. 72-85.

12-02 Wu, M.Z., Reynolds, D.A., Prommer, H., Fourie, A., and D.G. Thomas. 2012. *Numerical Evaluation of Voltage Gradient Constraints on Electrokinetic Injection of Amendments*, Advances in Water Resources, Vol. 38, pgs. 60-69.

11-01 Hodges, D, A. Fourie, D. Reynolds, and D.G. Thomas. 2011. *Development of an Apparatus for pH-Isolated Electrokinetic In-Situ Chemical Oxidation*, ASCE Journal of Environmental Engineering, Vol. 137, No.9, pgs. 809-816.

11-02 Jones, E., D. Reynolds, L. Wood, and D. Thomas. 2011. *Use of Electrophoresis for Transporting Nano-Iron in Porous Media*. Journal of Groundwater, Vol 49, No 2, pgs 172 – 183.

09-01 Horsnell, T.K., Smettem, K.R.J., Reynolds, D.A., and E.M. Mattiske. 2009. Composition and relative health of remnant vegetation fringing lakes along a salinity and waterlogging gradient. Wetland Ecology and Management. 17; 489-502.

08-01 Reynolds, D.A., E. Jones, M. Gillen, I. Yusoff, and D.G. Thomas. 2008. *Electrokinetic Migration of Permanganate Through Low-Permeability Media*, Journal of Groundwater, Vol 46, No 4, pgs 629 - 637.

08-02 Weatherill, D., T. Graf, C. T. Simmons, P. G. Cook, R. Therrien, and D. A. Reynolds. 2008. *Discretising the fracture-matrix interface to Simulate Solute Transport*, Journal of Groundwater, Vol 46, No 4, pgs 606-615.

08-03 Kusumastuti, D, Sivapalan, M., Struthers, I., Reynolds, D., Murray, K. and B. Turlach. 2008. *Thresholds in the storm response of a catchment-lake system and the occurrence and magnitude of lake overflows: implications for flood frequency*, Water Resources Research, Vol 44, W02438, doi:10.1029/2006WR005628.

07-01 Mundle, K., Kueper, B., West, M., and D. Reynolds. 2007. *Concentration Rebound Following ISCO in Fractured Clay*, Journal of Groundwater, Vol 45, No 6, pgs 692-702.

07-02 Marimuthu, S., and D.A. Reynolds. 2007. *Deuterium composition and flow path analysis as additional calibration targets to calibrate groundwater flow simulation in a coastal wetlands system*, Hydrogeology Journal, Vol. 15, No. 3, 515 – 535.

06-01 Kusumastuti, D., Reynolds, D.A., Struthers, I. and M.S. Sivapalan. 2006. *Threshold Effects in a Catchment Storm Response and the Occurrence and Magnitude of Flood Events: Implications for Flood Frequency*, HESS, Vol 5, 3239-3277.

06-02 Putzlocher, B., D.A. Reynolds, B.H. Kueper. 2006. *Verification of Conceptual Models of Relative Rates of Aqueous and Nonaqueous Phase Contamination in Tilted Systems*, Journal of Contaminant Hydrology, Vol. 88, No. 3, pgs 321-336.

06-03 Steele, A.D., Reynolds, D.A., Kueper, B.H., and D.N. Lerner. 2006. *In-situ Determination of Fracture Aperture Through Oil Injection*, Geotechnique, Vol. 56, No. 1, pgs 27 - 38.

05-01 Marimuthu, S., Reynolds, D.A., and C. Le Gal La Salle. 2005. *A Field Study of Hydraulic, Geochecmical and Stable Isotope Relationships in a Coastal Wetlands System*, J Hydrology, Vol. 315, 93-116.

04-01 Marimuthu, S., Reynolds, D.A., and C. Le Gal La Salle. 2004. *Interaction Between Groundwater and Surface Water in a Coastal Wetlands System in Southwestern Australia*, Isotope Hydrology and Integrated Water Resources Management, 437.

03-01 Reynolds, D.A., and B.H. Kueper. 2003. *Effective constitutive properties for DNAPL migration in large fracture networks: A computational study,* Water Resources Research, Vol. 39, No. 9, SBH 6-1.

03-02 Reynolds, D.A., and B.H. Kueper. 2003. *Migration of NAPLs in Fractured Heterogeneous Porous Media*, J. Contaminant Hydrology, Vol 71, pgs 89-110.

02-01 Reynolds, D.A. and B.H. Kueper. 2002. *Numerical Examination of the Factors Controlling DNAPL Migration Through a Single Fracture*, Ground Water, Vol. 40, 368-377.

00-01 Reynolds, D.A., and B.H. Kueper. 2000. *Factors Affecting Multiphase Flow and Transport in Fractured Geologic Sequences*, J. Contaminant Hydrology, Vol. 51, 41-62.

96-01 Bizzigotti, G.O., Reynolds, D.A., and B.H. Kueper. 1996. *Enhanced Solubilization and Destruction of Tetrachloroethylene by Hydroxypropyl*-b-*cyclodextrin and Iron*, Environmental Science and Technology, Vol. 31, 472-478.

REPRESENTATIVE PRESENTATIONS (2013 ONWARDS)

16-02 Reynolds, D.A. *Characterization, Modeling, Monitoring, and Remediation of Fractured Rock: An Academies Report*, Battelle Remediation of Chlorinated and Other Recalcitrant Compounds Conference, Palm Springs, California.

16-01 Reynolds, D.A. *Electrokinetic-enhanced Remediation: Past, Present, and Future, Keynote Address*, Renew/Integrate Symposium, Toronto, Ontario.

15-04 Reynolds, D.A. *Subsurface Characterization, Modeling, Monitoring, and Remediation of Fractured Rocks*, CleanUp2015, Melbourne, Victoria.

15-03 Reynolds, D.A., Wealthall, G., and M. Kavanaugh. *Remediation of Complex Contaminated Groundwater Sites: Perspectives on Effective Decision Making to Meet Project Objectives*, CleanUp 2015, Melbourne, Victoria.

15-02 Reynolds, D.A., Cox, E., Wang, J., Riis, C., and D. Gent. *An Examination of Recent Field Results from Implementation of Electrokinetic Remediation Approaches in Low Permeability Soils*, CleanUp 2015, Melbourne, Victoria.

15-01 Reynolds, D.A., and D. Major. *Environmental Measurements as the Basis of Policy Change – A Case of the Tail Wagging the Dog?*, CleanUp2015, Melbourne, Victoria.

14-01 Reynolds, D.A., Soucy, N., Mumford, K, Cox, E., and J. Wang. 2014. A *Coupled Electrokinetic and Electrical Resistance Heating Approach for Persulfate Distribution and Activation in Low Permeability Soils*, Ninth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California, May 19-22.

13-04 Reynolds, D.A. 2013. *Bugs, Rocket Fuel, and High Voltage!: A Short Walk Through the History of Bioremediation of Soil and Groundwater*, Robert and Joyce Jones Speaker Series, Department of Civil Engineering, Queens University, Kingston, Ontario, Canada.

13-03 Reynolds, D.A., Wang, J., and E.Cox. 2013. *Electrokinetic Enhanced Amendment Delivery: Results of the First Field Pilot*, GQ2013, Gainesville, Florida.

13-02 Reynolds, D.A., Grant, G., Scholes, G., Major, D., Dworatzek, S., Konzuk, J., and P. Dollar. 2013. *Self-sustaining Treatment for Active Remediation (STAR): In Situ Testing and Scale-up for the Smoldering Combustion Treatment of Coal Tar*, Cleanup 2013, Melbourne, Victoria, Australia

13-01 Reynolds, D.A., Wang, J., Cox, E., Gent, D., and C. Riis. 2013. *Electrokinetic-enhanced Amendment Delivery for Remediation of Low permeability and Heterogeneous materials: Results of the First Field Pilot*, Cleanup 2013, Melbourne, Victoria, Australia