



Site Audit Report

0503-1905

4 Bellara Avenue
North Narrabeen NSW

13 February 2019

55453/120449 (Rev 0)

JBS&G Australia Pty Ltd



NSW Site Auditor Scheme

Site Audit Statement

A site audit statement summarises the findings of a site audit. For full details of the site auditor's findings, evaluations and conclusions, refer to the associated site audit report.

This form was approved under the *Contaminated Land Management Act 1997* on 12 October 2017.

For information about completing this form, go to Part IV.

Part I: Site audit identification

Site audit statement no. **0503-1905**

This site audit is a:

- statutory audit
- non-statutory audit

within the meaning of the *Contaminated Land Management Act 1997*.

Site auditor details

(As accredited under the *Contaminated Land Management Act 1997*)

Name **Andrew Lau**

Company **JBS&G**

Address **Level 1, 50 Margaret Street**

Sydney **NSW**

Postcode **2000**

Phone **02 8245 0300**

Email **alau@jbsg.com.au**

Site details

Address **4 Bellara Avenue**

North Narrabeen NSW

Postcode **2101**

Property description

(Attach a separate list if several properties are included in the site audit.)

Lot 26 DP236548

Local government area **Northern Beaches**

Area of site (include units, e.g. hectares) **563 m² (approx.)**

Current zoning **Zone SP2 – Infrastructure**

Regulation and notification

To the best of my knowledge:

~~the site is~~ the subject of a declaration, order, agreement, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*, as follows: (provide the no. if applicable)

Declaration no. _____

Order no. _____

Proposal no. _____

Notice no. _____

the site is not the subject of a declaration, order, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*.

To the best of my knowledge:

~~the site has~~ been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*

the site **has not** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*.

Site audit commissioned by

Name **Amy Dobson**

Company **Sydney Water Corporation**

Address **Level 13, 1 Smith Street**

Parramatta NSW

Postcode **2150**

Phone **0411 306 656**

Email **amy.dobson@sydneywater.com.au**

Contact details for contact person (if different from above)

Name **As Above**

Phone

Email

Nature of statutory requirements (not applicable for non-statutory audits)

~~Requirements under the *Contaminated Land Management Act 1997*
(e.g. management order; please specify, including date of issue)~~

~~Requirements imposed by an environmental planning instrument
(please specify, including date of issue)~~

~~Development consent requirements under the *Environmental Planning and Assessment Act 1979* (please specify consent authority and date of issue)~~

~~Requirements under other legislation (please specify, including date of issue)~~

Purpose of site audit

A1 To determine land use suitability

Intended uses of the land: **Residential with garden / accessible soil and parks/
open space**

OR

~~**A2** To determine land use suitability subject to compliance with either an active or
passive environmental management plan~~

Intended uses of the land: _____

OR

(Tick all that apply)

~~**B1** To determine the nature and extent of contamination~~

~~**B2** To determine the appropriateness of:~~

~~an investigation plan~~

~~a remediation plan~~

~~a management plan~~

~~**B3** To determine the appropriateness of a **site testing plan** to determine if groundwater
is safe and suitable for its intended use as required by the *Temporary Water Restrictions
Order for the Botany Sands Groundwater Resource 2017*~~

~~**B4** To determine the compliance with an approved:~~

~~**voluntary management proposal** or~~

~~**management order** under the *Contaminated Land Management Act 1997*~~

~~**B5** To determine if the land can be made suitable for a particular use (or uses) if the site
is remediated or managed in accordance with a specified plan.~~

Intended uses of the land: _____

Information sources for site audit

Consultancies which conducted the site investigations and/or remediation:

Progressive Risk Management Pty Ltd (PRM)

Titles of reports reviewed:

- *Sampling, Analysis and Quality Plan, 4 Bellara Avenue, North Narrabeen NSW, P033802.001 / C0151, Progressive Risk Management Pty Ltd (PRM), 17 October 2018 (PRM 2018); and*

Site Audit Statement

- *Contamination Assessment, North Narrabeen Deep Creek Submain (MS000123), 4 Bellara Avenue, North Narrabeen NSW, P033802.002 / C0151, Progressive Risk Management Pty Ltd (PRM), 9 January 2019.*

Other information reviewed, including previous site audit reports and statements relating to the site:

NIL

Site audit report details

Title **Site Audit Report 0503-1905, 4 Bellara Avenue, North Narrabeen NSW**

Report no. **55453/120449 (Rev 0)**

Date **13 February 2019**

Part II: Auditor's findings

Please complete either Section A1, Section A2 or Section B, not more than one section. (Strike out the irrelevant sections.)

- Use **Section A1** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **without the implementation** of an environmental management plan.
- Use **Section A2** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **with the implementation** of an active or passive environmental management plan.
- Use **Section B** where the audit is to determine:
 - (B1) the nature and extent of contamination, and/or
 - (B2) the appropriateness of an investigation, remediation or management plan¹, and/or
 - (B3) the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or
 - (B4) whether the terms of the approved voluntary management proposal or management order have been complied with, and/or
 - (B5) whether the site can be made suitable for a specified land use (or uses) if the site is remediated or managed in accordance with the implementation of a specified plan.

¹ For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

Section A1

I certify that, in my opinion:

The **site is suitable** for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

- ~~Residential, including substantial vegetable garden and poultry~~
 - ~~Residential, including substantial vegetable garden, excluding poultry~~
 - Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry
 - Day care centre, preschool, primary school
 - Residential with minimal opportunity for soil access, including units
 - Secondary school
 - Park, recreational open space, playing field
 - Commercial/industrial
 - ~~Other (please specify):~~
-

OR

- ~~I certify that, in my opinion, the **site is not suitable** for any use due to the risk of harm from contamination.~~

Overall comments:

- The site investigation works (PRM 2019) are considered to have met the requirements of the Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd Edition) (EPA 2017).

- The site was historically used for agricultural purposes and was acquired by Sydney Water in 1970 to accommodate construction of the Deep Creek Submain.

- There were no levels of contaminants of potential concern (i.e., heavy metals, TPH, BTEX, PAHs, OCPs/OPPs, PCBs or asbestos) in soil identified at the subject site, which require remediation or management under either a standard residential use or parks/open space use.

- There is no evidence of migration of contaminants from the site which is likely to result in any unacceptable risks to surrounding human or ecological receptors.

- Based on the information provided, the site is considered suitable for the proposed land use (i.e. residential with garden/accessible soil and parks/open space) as defined in NEPC 2013.

- The suitability for the stated land use is not dependent on any long-term management plan. However, with consideration to anthropogenic inclusions identified in the fill material and the depth of fill at the site, a Construction Environmental Management

Site Audit Statement

Plan (CEMP) inclusive of an Unexpected Finds Protocol (UFP) should be developed and implemented, in the event that the site is redeveloped.

Section A2

~~I certify that, in my opinion:~~

~~Subject to compliance with the **attached** environmental management plan² (EMP), the site is suitable for the following uses:~~

~~(Tick all appropriate uses and strike out those not applicable.)~~

- ~~Residential, including substantial vegetable garden and poultry~~
 - ~~Residential, including substantial vegetable garden, excluding poultry~~
 - ~~Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~
 - ~~Day care centre, preschool, primary school~~
 - ~~Residential with minimal opportunity for soil access, including units~~
 - ~~Secondary school~~
 - ~~Park, recreational open space, playing field~~
 - ~~Commercial/industrial~~
 - ~~Other (please specify):~~
-

~~EMP details~~

~~Title~~

~~Author~~

~~Date~~

~~No. of pages~~

~~EMP summary~~

~~This EMP (attached) is required to be implemented to address residual contamination on the site.~~

~~The EMP: (Tick appropriate box and strike out the other option.)~~

- ~~requires operation and/or maintenance of **active** control systems³~~
- ~~requires maintenance of **passive** control systems only³.~~

² Refer to Part IV for an explanation of an environmental management plan.

³ Refer to Part IV for definitions of active and passive control systems.

Site Audit Statement

Purpose of the EMP:

Description of the nature of the residual contamination:

Summary of the actions required by the EMP:

How the EMP can reasonably be made to be legally enforceable:

How there will be appropriate public notification:

Overall comments:

Section B

Purpose of the plan⁴ which is the subject of this audit:

I certify that, in my opinion:

(B1)

- ~~The nature and extent of the contamination **has** been appropriately determined~~
- ~~The nature and extent of the contamination **has not** been appropriately determined~~

AND/OR (B2)

- ~~The investigation, remediation or management plan **is** appropriate for the purpose stated above~~
- ~~The investigation, remediation or management plan **is not** appropriate for the purpose stated above~~

AND/OR (B3)

~~The site testing plan:~~

- ~~**is** appropriate to determine~~
- ~~**is not** appropriate to determine~~

~~if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*~~

AND/OR (B4)

~~The terms of the approved voluntary management proposal* or management order** (strike out as appropriate):~~

- ~~**have** been complied with~~
- ~~**have not** been complied with.~~

~~*voluntary management proposal no.~~

~~**management order no.~~

AND/OR (B5)

~~The site **can be made suitable** for the following uses:~~

~~(Tick all appropriate uses and strike out those not applicable.)~~

- ~~Residential, including substantial vegetable garden and poultry~~
- ~~Residential, including substantial vegetable garden, excluding poultry~~

⁴ For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

Site Audit Statement

- Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry
- Day care centre, preschool, primary school
- Residential with minimal opportunity for soil access, including units
- Secondary school
- Park, recreational open space, playing field
- Commercial/industrial
- Other (please specify):

IF the site is remediated/managed* in accordance with the following plan (**attached**):

*Strike out as appropriate

Plan title _____

Plan author _____

Plan date _____

No. of pages _____

SUBJECT to compliance with the following condition(s):

Overall comments:

Part III: Auditor's declaration

I am accredited as a site auditor by the NSW Environment Protection Authority (EPA) under the *Contaminated Land Management Act 1997*.

Accreditation no. **0503**

I certify that:

- I have completed the site audit free of any conflicts of interest as defined in the *Contaminated Land Management Act 1997*, and
- with due regard to relevant laws and guidelines, I have examined and am familiar with the reports and information referred to in Part I of this site audit, and
- on the basis of inquiries I have made of those individuals immediately responsible for making those reports and obtaining the information referred to in this statement, those reports and that information are, to the best of my knowledge, true, accurate and complete, and
- this statement is, to the best of my knowledge, true, accurate and complete.

I am aware that there are penalties under the *Contaminated Land Management Act 1997* for wilfully making false or misleading statements.

Signed 

Date 13 February 2019

Part IV: Explanatory notes

To be complete, a site audit statement form must be issued with all four parts.

How to complete this form

Part I

Part I identifies the auditor, the site, the purpose of the audit and the information used by the auditor in making the site audit findings.

Part II

Part II contains the auditor's opinion of the suitability of the site for specified uses or of the appropriateness of an investigation, or remediation plan or management plan which may enable a particular use. It sets out succinct and definitive information to assist decision-making about the use or uses of the site or a plan or proposal to manage or remediate the site.

The auditor is to complete either Section A1 or Section A2 or Section B of Part II, **not** more than one section.

Section A1

In Section A1 the auditor may conclude that the land is *suitable* for a specified use or uses OR *not suitable* for any beneficial use due to the risk of harm from contamination.

By certifying that the site is *suitable*, an auditor declares that, at the time of completion of the site audit, no further investigation or remediation or management of the site was needed to render the site fit for the specified use(s). **Conditions must not be** imposed on a Section A1 site audit statement. Auditors may include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

Section A2

In Section A2 the auditor may conclude that the land is *suitable* for a specified use(s) subject to a condition for implementation of an environmental management plan (EMP).

Environmental management plan

Within the context of contaminated sites management, an EMP (sometimes also called a 'site management plan') means a plan which addresses the integration of environmental mitigation and monitoring measures for soil, groundwater and/or hazardous ground gases throughout an existing or proposed land use. An EMP succinctly describes the nature and location of contamination remaining on site and states what the objectives of the plan are, how contaminants will be managed, who will be responsible for the plan's implementation and over what time frame actions specified in the plan will take place.

By certifying that the site is suitable subject to implementation of an EMP, an auditor declares that, at the time of completion of the site audit, there was sufficient information satisfying guidelines made or approved under the *Contaminated Land Management Act 1997*

(CLM Act) to determine that implementation of the EMP was feasible and would enable the specified use(s) of the site and no further investigation or remediation of the site was needed to render the site fit for the specified use(s).

Implementation of an EMP is required to ensure the site remains suitable for the specified use(s). The plan should be legally enforceable: for example, a requirement of a notice under the CLM Act or a development consent condition issued by a planning authority. There should also be appropriate public notification of the plan, e.g. on a certificate issued under s.149 of the *Environmental Planning and Assessment Act 1979*.

Active or passive control systems

Auditors must specify whether the EMP requires operation and/or maintenance of active control systems or requires maintenance of passive control systems only. Active management systems usually incorporate mechanical components and/or require monitoring and, because of this, regular maintenance and inspection are necessary. Most active management systems are applied at sites where if the systems are not implemented an unacceptable risk may occur. Passive management systems usually require minimal management and maintenance and do not usually incorporate mechanical components.

Auditor's comments

Auditors may also include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

Section B

In Section B the auditor draws conclusions on the nature and extent of contamination, and/or suitability of plans relating to the investigation, remediation or management of the land, and/or the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or whether the terms of an approved voluntary management proposal or management order made under the CLM Act have been complied with, and/or whether the site can be made suitable for a specified land use or uses if the site is remediated or managed in accordance with the implementation of a specified plan.

By certifying that a site *can be made suitable* for a use or uses if remediated or managed in accordance with a specified plan, the auditor declares that, at the time the audit was completed, there was sufficient information satisfying guidelines made or approved under the CLM Act to determine that implementation of the plan was feasible and would enable the specified use(s) of the site in the future.

For a site that *can be made suitable*, any **conditions** specified by the auditor in Section B should be limited to minor modifications or additions to the specified plan. However, if the auditor considers that further audits of the site (e.g. to validate remediation) are required, the auditor must note this as a condition in the site audit statement. The condition must not specify an individual auditor, only that further audits are required.

Auditors may also include **comments** which are observations in light of the audit which provide a more complete understanding of the environmental context to aid decision-making in relation to the site.

Part III

In **Part III** the auditor certifies their standing as an accredited auditor under the CLM Act and makes other relevant declarations.

Where to send completed forms

In addition to furnishing a copy of the audit statement to the person(s) who commissioned the site audit, statutory site audit statements must be sent to

- the **NSW Environment Protection Authority**:
nswauditors@epa.nsw.gov.au or as specified by the EPA

AND

- the **local council** for the land which is the subject of the audit.

Site Audit Report
0503-1905

4 Bellara Avenue
North Narrabeen NSW

13 February 2019
55453/120449 (Rev 0)
JBS&G Australia Pty Ltd

Table of Contents

Abbreviations.....	v
1. Introduction.....	1
1.1 Introduction and Background.....	1
1.2 Objectives of the Site Audit.....	1
1.3 Type of Audit.....	1
1.4 Documents Reviewed.....	1
1.5 Site Inspections.....	1
1.6 Chronology of Site Assessment Works.....	2
2. Site Description.....	3
2.1 Site Identification.....	3
2.2 Site Condition.....	3
2.3 Topography.....	3
2.4 Soils and Geology.....	3
2.5 Acid Sulphate Soils.....	4
2.6 Hydrology.....	4
2.7 Hydrogeology.....	4
2.8 Surrounding Environment.....	4
2.9 Audit Findings.....	4
3. Site History.....	6
3.1 Site History Information Sources.....	6
3.2 Aerial Photographs.....	6
3.3 NSW EPA Records.....	6
3.4 Sydney Water Records.....	6
3.4.1 Sydney Water CLRR Screening Summary.....	6
3.4.2 Sydney Water HYDRA Plans.....	7
3.5 Audit Findings.....	7
4. Conceptual Site Model.....	8
4.1 Sources of Contamination.....	8
4.2 Potentially Affected Media.....	8
4.3 Potential Human and Ecological Receptors.....	8
4.4 Potential Exposure Pathways.....	9
4.5 Preferential Pathways.....	9
4.6 Audit Findings.....	9
5. Sampling Analytical and Quality Program.....	10
5.1 Data Useability Assessment.....	10
5.2 Audit Findings.....	15

6.	Soil Assessment Criteria	16
6.1	Audit Findings.....	16
7.	Site Investigation Results.....	17
7.1	Field Observations.....	17
7.2	Soil Analytical Results.....	17
7.3	Consultant’s Interpretations and Conclusions	18
7.3.1	Soil.....	18
7.4	Audit Findings.....	19
8.	Evaluation of Land Use Suitability	20
8.1	Reporting in Accordance with EPA requirements	20
8.2	Aesthetics Have Been Addressed	20
8.3	Soils Have Been Assessed Against the Appropriate Investigation Levels	20
8.4	Background Soil Concentrations Have Been Adequately Addressed	20
8.5	All impacts of Chemical Mixtures Have Been Assessed	20
8.6	Any potential ecological risks have been assessed	20
8.7	Site Management Strategy is Appropriate	21
8.8	Contaminant Migration (actual or potential) Has Been Addressed	21
9.	Audit Summary Opinion	22
10.	Limitations	23

List of Tables

Table 1.1:	Summary of Audit Inspections	2
Table 1.2:	Summary of Investigation and Audit Works Undertaken at the Site.....	2
Table 2.1:	Summary Site Details	3
Table 5.1	Data Usability Assessment (PRM 2019)	10
Table 7.1:	Summary of Soil Analytical Results (PRM 2019) (mg/kg).....	17

Appendices

Appendix A	Guidelines made or approved by the EPA
Appendix B	Audit Correspondence
Appendix C	Consultant’s Figures
Appendix D	Consultant’s Summary Tables
Appendix E	Regulatory Search Results

Abbreviations

Term	Definition
As	Arsenic
AST	Aboveground Storage Tank
Cd	Cadmium
Cr	Chromium
Cu	Copper
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
B(a)P	Benzo(a) pyrene
DO	Dissolved oxygen
DP&E	NSW Department of Planning and Environment
DQO	Data Quality Objectives
EC	Electrical conductivity
EH	Redox potential
EIL	Ecological Investigation Level
EPA	New South Wales Environment Protection Authority
Hg	Mercury
HIL	Health Based Investigation Level
LOR	Limit of Reporting
MAH	Monocyclic Aromatic Hydrocarbon
Ni	Nickel
OCP	Organochlorine Pesticide
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCB	Polychlorinated Biphenyls
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percentage Difference
SAR	Site Audit Report
SAS	Site Audit Statement
TPH	Total Petroleum Hydrocarbons
UST	Underground Storage Tank
Zn	Zinc

1. Introduction

1.1 Introduction and Background

Andrew Lau of JBS&G Australia Pty Ltd (JBS&G) was engaged by Sydney Water Corporation (Sydney Water, the client) on 8 October 2018 to conduct a site audit for the property located at 4 Bellara Avenue, North Narrabeen NSW ('the site'). The site is legally identified as Lot 26 DP236548, occupying an area of approximately 563 m² (**Appendix C**).

The site was historically used for agricultural purposes and was acquired by Sydney Water in 1970 to accommodate construction of the Deep Creek Submain. The audit relates to the proposed divestment of the site for low density residential land use.

Andrew Lau is a Site Auditor accredited by the NSW Environment Protection Authority (EPA) under the *Contaminated Land Management Act 1997* (CLM Act 1997) (Accreditation Number 0503). The audit was completed with the assistance of Christine Louie and Sahani Gunatunge, JBS&G's consultants trained and experienced in contaminated land assessment and auditing. The audit reference number is 0503-1905.

No previous Site Audit Statements (SAS) or Site Audit Reports (SAR) are known to exist for the site.

1.2 Objectives of the Site Audit

The objectives of this site audit were to:

- Independently review the environmental investigation report prepared for the site; and
- Prepare a SAR and issue a SAS, providing an opinion on the appropriateness of the investigation, and to confirm whether the site is suitable for the proposed land use.

In accordance with the requirements of the CLM Act 1997, the site audit was undertaken with consideration to:

- The provisions of the CLM Act, Regulations and subsequent amendments;
- The provisions of any environmental planning instruments applying to the site; and
- Relevant guidelines made or approved by the EPA (**Appendix A**).

1.3 Type of Audit

Since the site audit is not being undertaken in response to a legal requirement imposed by a consent authority or the EPA, the site audit has been conducted as a non-statutory audit. The audit reference number is 0503-1905.

1.4 Documents Reviewed

The following documentation was reviewed as part of the site audit:

- *Sampling, Analysis and Quality Plan, 4 Bellara Avenue, North Narrabeen NSW, P033802.001 / C0151, Progressive Risk Management Pty Ltd (PRM), 17 October 2018 (PRM 2018); and*
- *Contamination Assessment, North Narrabeen Deep Creek Submain (MS000123), 4 Bellara Avenue, North Narrabeen NSW, P033802.002 / C0151, Progressive Risk Management Pty Ltd (PRM), 9 January 2019.*

Additional correspondence relating to the site audit is provided in **Appendix B**.

1.5 Site Inspections

The site was inspected on dates shown on **Table 1.1** below.

Table 1.1: Summary of Audit Inspections

Date	Attendance	Purpose
30 October 2018	Site Auditor Assistant (Christine Louie)	Site inspection to observe site layout and condition, and field works conducted by the consultant.

1.6 Chronology of Site Assessment Works

The process of the assessment and audits undertaken at the site has been chronologically listed in **Table 1.2**.

Table 1.2: Summary of Investigation and Audit Works Undertaken at the Site

Date	Purpose
8 October 2018	Commencement of site audit (0503-1905)
October 2018	Preparation of Sampling, Analysis and Quality Plan (SAQP) for the proposed contamination assessment at the site. Based on comments issued by the auditor, a final report was issued on 17 October 2018 (PRM 2018).
January 2019	Preparation of a site contamination assessment report by PRM. The scope of works comprised a desktop review of site history, intrusive soil investigation via six test pits, and subsequent laboratory analysis for identified contaminants of potential concern (COPCs). Based on comments provided by the site auditor, a final report was issued on 9 January 2019 (PRM 2019).
13 February 2019	Preparation of a site audit statement (0503-1905) and accompanying site audit report (JBS&G 2019) confirming the site is suitable for the proposed land use (i.e. residential with garden/ accessible soil).

2. Site Description

2.1 Site Identification

The site details have been summarised in **Table 2.1** and described in further detail in the following sections. A plan identifying the subject site has been presented in **Appendix C**.

Table 2.1: Summary Site Details

Street Address	4 Bellara Avenue, North Narrabeen NSW
Property Description	Lot 26 DP236548
Parish	Narrabeen
County	Cumberland
Local Government Area	Northern Beaches
Property Size	563 m ²
Zoning	Zone SP2 – Infrastructure
Previous Use	Agricultural
Current Use	Vacant, accessible site with below-ground pipeline
Proposed Use	Residential with garden/ accessible soil

2.2 Site Condition

At the time of the site investigation, the consultant (PRM 2019) reported that the site comprised a vacant and accessible parcel of land located within a residential setting. The consultant stated that the current land use was consistent with open space land use. The site was covered in grass and minor established vegetation primarily around the north and eastern site boundary. A timber retaining structure was observed along the northern boundary of the site and the site sloped steeply from the northern boundary toward Bellara Avenue.

The vegetation at the site was observed to be in good condition. No buildings or above ground structures were identified at the site. A large service pit was observed centrally along the eastern boundary of the site along with a smaller service pit located in the southern portion of the western boundary. The consultant (PRM 2019) reported that the Sydney Water Deep Creek Submain traverses the site below ground in a northeast and southeast direction. A maintenance hole for the Submain was observed centrally along the eastern site boundary, with other underground service covers observed along the western boundary.

2.3 Topography

The consultant (PRM 2018 and 2019) reported that the site slopes steeply from the northeast corner towards the southwestern corner of the site.

2.4 Soils and Geology

The consultant (PRM 2018 and 2019) undertook a search of on-line mapping information available on the eSPADE web site sourced from the NSW Soil and Land Information System, including soil landscape mapping data. The consultant identified that residual soil at the site would be part Warriewood soil landscape. Soils of the Warriewood landscape are typically deep, well sorted sandy Humus Podzols and dark, mottled Siliceous Sands overlying Acid Peats in depressions (in poorly drained areas). Dominant soil materials in well drained areas would expect to include loose, speckled, dark-grey loamy sand and bleached massive sand. Loose, speckled, dark-grey loamy sand overlain dark brown soft organic pan and Siliceous Sand and Acid Peats would be expected in poorly drained areas.

The consultant (PRM 2019) also completed a review of the Sydney 1:100,000 Geological Map (Geological Series Sheet 9130 (Edition 1), 1983, Department of Mineral Resources) which indicated the site is part of the Newport Formation and Garie Formation, with Narrabeen Group interbedded laminate, shale and quartz, to lithic-quartz sandstone and minor red claystone.

Intrusive investigations completed by the consultant (PRM 2019) identified that the sub surface profile at the site typically comprised dark brown silty/ clayey sand filling underlain by yellow-brown silty clay. Based on the consultant's test pit logs, majority of the test pits terminated in the fill and fill material was identified to a maximum depth of 1.2 m bgs. Anthropogenic inclusions of ceramic tile, steel, glass, plastic and concrete was observed within the fill profile at all test pits whilst observations of ash were reported at TP03 and TP04. Natural silty clay was encountered at one location (TP05) at 0.5 m bgs.

2.5 Acid Sulphate Soils

The consultant (PRM 2018 and PRM 2019) completed a search of the National Acid Sulphate Soil map (Australian Soil Resource Information System, CSIRO) which indicated there is no known occurrence of Acid Sulphate Soils at the site. It was noted that land within 100m to the south east of the site is mapped as 'Low Probability 1-3m below ground level (bgl)', followed by a portion of land further south east towards Narrabeen lagoon (<200m from the site) of 'high probability (<1m bgl)'. The consultant reported that these mapped areas were considerably lower in elevation than the site.

2.6 Hydrology

The consultant (PRM 2018 and PRM 2019) reported that surface water is expected to either infiltrate the site surface or drain off the site surface and into the local stormwater located in Bellara Avenue. Local stormwater is expected to flow into the open unnamed tributary located approximately 200 m southeast of the site which in turn flows to South Creek and Narrabeen Lagoon located approximately 1 km to the southeast.

2.7 Hydrogeology

The consultant (PRM 2018 and PRM 2019) reported that a search of the NSW Department of Primary Industries online database identified six registered groundwater bores within 2 km of the site. No registered wells were identified within the Site. The nearest registered groundwater bore, located approximately 140m south of the site, indicates groundwater is at a depth of 1.5 m. The consultant reported that this groundwater bore was located significantly lower than the site and not likely indicative of the depth to groundwater at the site.

Based on the summary of groundwater bore searches provided in PRM (2018), the auditor notes that the monitoring wells have been established for a range of purposes including domestic, recreation groundwater, monitoring and groundwater exploration.

2.8 Surrounding Environment

The consultant (PRM 2019) reported that the site is surrounded by the following:

- North – Low density residential properties
- East – Low density residential properties.
- South – Bellara Avenue and low-density residential properties.
- West – Low density residential properties.

2.9 Audit Findings

The information provided by the consultant (PRM 2018 and PRM 2019) in regard to the site condition and surrounding environment has been checked against and generally meets the requirements of OEH 2011. The information provided was also consistent with the observations made during a site inspection conducted by the site auditor's assistant on the date indicated in **Section 1.5**.

Site identification details were not provided in the consultant's reports (PRM 2018 and PRM 2019), however these have been confirmed by the auditor, with current title plans provided in **Appendix E**.

Overall, the information provided by the consultant (PRM 2018 and PRM 2019), information supplemented by observations made during the site audit inspection and review of publicly available information in relation to the site condition and the surrounding environment is considered adequate for the purposes of the site audit, with the exception that details of climate were not provided.

For completeness, the auditor conducted a review of Bureau of Meteorology (BOM) climate statistics for Terrey Hills (Terrey Hills AWS)¹ which indicates the following:

- Mean maximum temperatures ranging from 16.3° C in July to 26.8° C in January.
- Mean minimum temperatures ranging from 7.6° C in July to 18.4° C in January.
- Mean monthly rainfall ranging from 51.1 mm in May to 144.3 mm in June, with an average annual rainfall of 1089.9 mm.

In general, the climate of the site area is described as comprising warm summers and mild winters, rainfall was described as occurring throughout the year with wetter periods from February to June. This additional data does not affect the outcome of the audit.

Overall, the information provided by the consultant (PRM 2018 and PRM 2019) in relation to site condition and the surrounding environment is considered adequate for the purposes of assessing the contamination status of the site.

¹ Bureau of Meteorology Climate Statistics for Terrey Hills, accessed 5/02/2019, http://www.bom.gov.au/climate/averages/tables/cw_066059.shtml

3. Site History

3.1 Site History Information Sources

A comprehensive desktop investigation, including a review of historical aerial photographs; historical title records and NSW EPA records was undertaken by PRM (2018 and 2019).

3.2 Aerial Photographs

The consultant (PRM 2019) reviewed historical aerial photographs for the site and surrounding areas, with the following information provided:

- 1940s: The site appeared to be vacant and located within the northeastern extremes of a larger property potentially used for agricultural purposes. Vegetation was visible on the site. The surrounding areas generally appeared to be bushland, with the agricultural property the site appeared to form part of visible to the south and west.
- 1950s: The site generally appeared similar to the 1940s imagery however the agricultural land use which the site formed part of appeared to have ceased. Vegetation appeared to have been cleared and two bowling greens constructed in the former adjoining agricultural land use. A small water course was visible close to the southern property boundary. The remaining surrounding areas generally appeared similar to the 1940s imagery.
- 1960: The site and its immediate surrounds appear similar to the 1950s imagery. Vegetation coverage at the site appeared to have increased.
- 1970s: The site and its immediate surrounds appeared to form part of a wider area undergoing residential development. Vegetation was no longer visible at the site with a disturbed surface visible. The vegetation visible in the surrounding areas to the north and east appear to have been cleared with earthworks appearing to have been undertaken. The watercourse visible in the early imagery appears to have been filled in. Bellara Avenue is visible to the south along with Tatiara Crescent to the southwest and west. Residential properties appeared to have been constructed in the neighbouring properties to the west of the site and surrounding areas.
- 1980s: The site appeared to be grassed with trees visible along the eastern boundary. Residential properties had increased in density in the surrounding areas.
- 1990s – 2018: The site and its immediate surrounds remained generally unchanged.

3.3 NSW EPA Records

The consultant (PRM 2019) reported that the site or land immediately adjoining the site has not been notified to EPA under the CLM Act, the POEO act, nor is in the list of sites in NSW that have been notified to the EPA.

3.4 Sydney Water Records

3.4.1 Sydney Water CLRR Screening Summary

The consultant (PRM 2019) conducted a search of Sydney Water's in-house contaminated land risk ranking (CLRR) tool and reported that site was acquired by Sydney Water in 1970 to accommodate the construction of the Deep Creek Submain (1,500 mm sewer trunk main) which runs through the site. The CLRR screening did not identify previous developments or activities of concern at the site. The CLRR screening identified that large earthworks had occurred in the surrounding land and that cut and fill may have been used for backfill on properties on surrounding land (cuttings on hill to the north east), and possibly following installation of Sydney Water infrastructure.

3.4.2 Sydney Water HYDRA Plans

The consultant (PRM 2019) reported that review of Sydney Water HYDRA Plans including survey data of Sydney Water assets and utilities identified that the Deep Creek Submain passes through the site in a northeast and southeast direction. The plans indicate that the depth to the invert of the submain at the maintenance hole located centrally along the eastern boundary is 8.2 m and the depth to the invert at the maintenance hole located within Bellara Avenue is 4.4 m. The consultant further reported that an internal search of the database by Sydney Water has indicated that the submain was laid in 1977, however, the method of installation was not known. The consultant reported that likely the submain was installed using top down excavation techniques.

3.5 Audit Findings

The site history information provided by the consultant (PRM 2019) has been checked against, and generally meets, the requirements of the OEH 2011, with some exceptions as noted below.

The consultant did not undertake a search of relevant heritage databases. For completeness, the auditor undertook a search of the Australian and NSW Heritage databases on 5 February 2019 which did not identify any heritage items listed on site (search records provided in **Appendix E**).

Whilst historical titles, council records, or Worksafe records were not provided, these omissions are considered to be relatively insignificant as the site has been associated exclusively with Sydney Water since circa 1970, and a broad suite of COPC were assessed during the investigation, which adequately take into account the historical usage of the site.

The extent of the site history information presented by the consultant (PRM 2019) is considered adequately complete for the purposes of identifying contamination issues at the site as part of the site investigation process.

4. Conceptual Site Model

The National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) NEPC 2013) identifies a conceptual site model (CSM) as a representation of site related information regarding contamination sources, receptors, and exposure pathways between those sources and receptors. The development of a CSM is an essential part of all site assessments and remediation activities.

NEPC (2013) identified the essential elements of a CSM as including:

- Known and potential sources of contamination and contaminants of concern including the mechanism(s) of contamination;
- Potentially affected media (soil, sediment, groundwater, surface water, indoor and ambient air);
- Human and ecological receptors;
- Potential and complete exposure pathways; and
- Any potential preferential pathways for vapour migration (if potential for vapours identified).

Based on the known contamination, each of the elements of the CSM are discussed as follows.

4.1 Sources of Contamination

Based on a review of site history review, the consultant (PRM 2018 and PRM 2019) identified the following areas of potential contamination as requiring assessment during the intrusive phase of works:

- Cut and fill earthworks during the Deep Creek Sub Main tunnelling works.
- Historic agricultural land use activities including use of pesticides.
- Small-scale fly-tipping of demolition/ building waste during suburb development.
- Small-scale spraying of pesticides for vegetation maintenance purposes.

Based on the identified sources of contamination, the consultant (PRM 2018 and PRM 2019) identified the following contaminants of potential concern:

- Heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, mercury and zinc).
- Total Recoverable Hydrocarbons (TRH).
- Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)
- Polycyclic Aromatic Hydrocarbons (PAHs).
- Organochlorine pesticides and Organophosphorus Pesticides (OCPs/OPPs).
- Polychlorinated Biphenyls (PCBs).
- Asbestos.

4.2 Potentially Affected Media

Whilst potentially contaminated media were not explicitly identified by the consultant, the scope of intrusive works was limited to a soil investigation.

4.3 Potential Human and Ecological Receptors

Potential human receptors identified included the following:

- Sydney Water grounds maintenance staff;
- Future contractors during re-development works; and
- Future residential land users.

On-site flora and fauna were identified as potential ecological receptors.

4.4 Potential Exposure Pathways

Based on the identified COPCs and potential receptors, the following potential exposure pathways were identified for human receptors by the consultant:

- Direct contact with soil;
- Ingestion or inhalation of soils or soil derived dust; and
- Inhalation of fibres.

4.5 Preferential Pathways

The consultants (PRM 2018 and PRM 2019) did not provide consideration of potential preferential pathways within the extent of the site.

4.6 Audit Findings

The consultant (PRM 2019) identified a number of potential contamination issues at the site, and considered both human and ecological receptors. Taking into consideration the site history review and site inspections conducted at the site, the auditor considers that list of COPCs identified by the consultants was adequate in assessing the nature and extent of contamination across the site as part of the site investigation process.

5. Sampling Analytical and Quality Program

5.1 Data Useability Assessment

An assessment of quality assurance and quality control (QA/QC) has been undertaken by the consultant (PRM 2019) by developing data quality indicators (DQIs), broadly based on the seven-step process referred to in EPA 2017.

The auditor has undertaken a review of the QA/QC undertaken by the consultant, which has been summarised in **Tables 5.1** against the PARCC parameters (precision, accuracy, representativeness, comparability and completeness).

Table 5.1 Data Usability Assessment (PRM 2019)

Parameter	DQIs	Requirement	Auditor Assessment
Field and Lab QA/QC			
Precision	Intra-laboratory duplicates (blind)	Collected at a rate of 1 per 20 samples. Analysed for primary contaminants of concern. RPDs typically 30-50%	One intra-lab soil duplicate (Dup A) was collected and analysed for the main contaminants of concern (incl. heavy metals, PAHs, OCP/OPP, TRH/BTEX and PCB) during the intrusive soil investigation. The frequency of collection equated to 11%, above the minimum requirement of 5%. RPDs ranged from 0-40%, and no DQI exceedances were noted.
	Inter-laboratory duplicates (spilt)	Collected at a rate of 1 per 20 samples. Analysed for primary contaminants of concern. RPDs typically 30-50%	One inter-lab soil duplicate (Dup B) was collected and analysed for the main contaminants of concern (incl. heavy metals, PAHs, OCP/OPP, TRH/BTEX and PCB) during the intrusive soil investigation. The frequency of collection equated to 11%, above the minimum requirement of 5%. RPDs ranged from 0-19 % and were within the DQIs.
	Laboratory duplicates	One per batch. RPDs less than 50%.	Laboratory duplicates were undertaken by the primary laboratory for soil analysis and the reported RPDs were within laboratory acceptance limits, with the exception of laboratory RPB for 204389-1 for lead reported at 58%. The laboratory therefore issued a triplicate result for laboratory sample number 204389-24.
Accuracy	Field rinsate blanks	Collected at a rate of 1 per piece of decontaminated sampling equipment. Analysed for primary contaminants of concern. Laboratory results below the laboratory limit of reporting (LOR).	A field rinsate sample was collected for each hand tool including hand auger (FR_HA) and shovel (FR_SH), with laboratory results reported below laboratory LOR.
	Trip blanks	Collected at a rate of 1 per day of sampling where primary	One laboratory prepared trip blank (soil) was submitted by the consultant during the soil investigation, with all results reported below laboratory LORs.

Parameter	DQIs	Requirement	Auditor Assessment
		contaminants of concern include volatiles. Analysed for volatiles of concern. Laboratory results below laboratory LOR.	
	Trip spike	Collected at a rate of 1 per batch where primary contaminants of concern include volatiles. Laboratory results / recovery within 30 % of the spiked concentration.	One laboratory prepared trip spike (soil) was submitted by the consultant during the soil investigation with laboratory recoveries reported between 86-94%, within the DQI.
Accuracy	Laboratory surrogate spikes	Surrogate spikes to be performed as required by NATA accreditation, generally per sample analysed.	Surrogate recoveries reported by the primary and secondary laboratory ranged between 68.4-119% and were within laboratory control limits.
	Laboratory method blanks	Laboratory method blanks to be performed as required by NATA accreditation, generally 1 blank per batch. Results to be below laboratory LOR.	All laboratory method blanks <LOR.
	Laboratory control samples (LCS)	LCS to be performed as required by NATA accreditation, generally one per 20 samples per batch.	LCS recoveries reported by the primary and secondary laboratory ranged between 73.7-111% and were within laboratory control limits.
	Laboratory matrix spikes (MS)	MS to be performed as required as NATA accreditation, generally one per 20 samples per batch. Recoveries to be within 70-130 % or 30-130 % (phenols only).	Matrix spikes were not completed in the primary lab batch. The laboratory report stated that matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. The laboratory report further stated that all samples are tested in batches of 20 and the duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Matrix spikes were completed by the secondary laboratory and reported between 70.3-127.

Parameter	DQIs	Requirement	Auditor Assessment
			The auditor considers that the absence of MS (in the primary lab batch) does not reduce the precision of the testing laboratory or the accuracy of the results used for assessing site suitability.
Soil Sampling and Analytical Schedule and Sampling Methodology			
Representativeness	Soil sampling locations	Samples to be collected on a representative basis consistent with the CSM.	<p>Six systematic/targeted locations were placed across the site via test pit. The sample locations were placed on a general grid base to provide site coverage whilst two test pits (TP04 and TP06) were targeted at the Deep Creek Submain alignment.</p> <p>The total number of soil sampling locations met the minimum sampling density requirements of 6 sample points for a site area of 563 m² outlined in EPA (1995).</p> <p>The auditor considers that the number of soil sampling locations and the rationale adopted by the consultant provided adequate coverage of the site, noting the potential areas of concern and associated COPCs identified as part of the site history review.</p>
	Soil sampling depths and intervals	Soil sampling depths should be consistent with the anticipated distribution of contamination as detailed in the consultant's CSM.	<p>Test pits were excavated to a maximum depth of 1.2 m bgs, with samples collected at the surface and every 0.5 m or when field observations warranted sampling. Selected samples were submitted for laboratory analysis including samples collected from the surface at 0-0.1 m bgs in all locations and from underlying fill material at TP02 and TP03 at 0.5-0.6 m bgs and TP05 at 0.3-0.4 m bgs.</p> <p>Only one test pit location (TP01) extended into underlying natural clays whilst other test pits encountered method refusal within the fill. Further, the auditor notes that the sample collected from the natural material at TP01 was not analyzed at the laboratory.</p> <p>However, based on the review of analytical data and the absence of significant contamination within site fill materials, the sampling depths are considered appropriate to assess the vertical extent of contamination at the site.</p>
	Soil sampling methodology	Soil samples to be collected using a methodology which is appropriate for the primary contaminants of concern.	<p>Soil samples were collected using hand auger and shovel. Each soil sample was collected using fresh nitrile gloves and placed into laboratory supplied 250 mL Teflon-lined jars and clip-lock bags, each with a unique sample ID.</p> <p>Collected samples were immediately stored on ice in an esky and sent to NATA-accredited analytical laboratories under chain of custody conditions for analysis.</p> <p>The following sampling procedure was adopted for the collection of soil samples for asbestos analysis:</p> <ul style="list-style-type: none"> • The surface of each sample location was initially inspected for any ACMs >7 mm. Where evident, surficial ACMs were collected, weighed and recorded. • One 10 L sample of the relevant stratum to be assessed was collected from spoil at each sample location, weighed and recorded.

Parameter	DQIs	Requirement	Auditor Assessment
			<ul style="list-style-type: none"> Each 10 L sample was manually screened on site through a 7 mm sieve into a bucket. Materials if evident which did not pass through the sieve were examined for any ACM and/or suspect material. Sieving was conducted in batches so material retained on the sieve could be adequately inspected. Once the 10 L sample had been screened, all ACM and suspected material retained on the sieve (i.e. >7 mm) is collected, weighed and recorded. Where evident, a fragment of retained suspected ACM is collected and sealed in a clip lock plastic bag for analysis (as required). To target any Asbestos Fines (AF) and/or Friable Asbestos (FA) within soil, a 500 mL wetted sample was collected from the sieved 10 L sample and sealed in a clip-lock plastic bag for analysis (as required). <p>The sampling method adopted by the consultant during the soil investigation works (hand excavated test pits), had the potential to result in volatile loss from samples. However, in light of the absence of evidence of widespread volatile contamination at the site this is not considered to affect the representativeness of the soil data.</p>
	Soil sampling containers	Soil samples to be collected into laboratory supplied, clean unpreserved Teflon lined jars.	<p>Soil samples were immediately placed in laboratory supplied samples jars which were sealed and placed on ice for transport to the analytical laboratories.</p> <p>Soil samples collected for asbestos analysis was placed in sealed clip-lock plastic bag for analysis.</p>
Representativeness	Soil sampling equipment decontamination	Soil sampling equipment to be decontamination between sampling locations or between sampling depths	<p>The consultant reported that a decontaminated hand auger and shovel were used for the collection of samples. All equipment used for sampling were decontaminated prior to fieldwork and between each investigation location, by scraping and scrubbing with brushes and Decon-90 solution and rinsing with deionised water. Rinsate samples are collected in the field by passing laboratory prepared deionised water over decontaminated sampling equipment.</p> <p>The auditor considers the sampling methods employed by the consultants during the investigation works are generally acceptable and are unlikely to have resulted in significant cross-contamination between sample locations.</p>
	Soil sample contamination screening	Soil samples to be screened for contamination via visual / olfactory observations and photo-ionisation detector (PID) measurement.	The consultant provided test pit logs detailing observations of material types; visual observations and sample depths. Soil samples were also screened in the field using a PID.
	Sample storage and transport	Samples to be placed in an insulated	All soil samples were transported in ice-cooled/insulated chests, under chain of custody

Parameter	DQIs	Requirement	Auditor Assessment
		<p>container and chilled.</p> <p>Samples to be transported to laboratory under chain of custody conditions.</p>	<p>conditions, to laboratories that were NATA accredited for the analysis performed.</p>
Representativeness	Laboratory sample receipt advice	<p>No damaged containers.</p> <p>No samples submitted in containers which have not been chilled.</p> <p>No samples to be submitted without sufficient times to comply with recommended holding times.</p>	<p>Laboratory sample receipt advice provided by the nominated laboratories confirmed that all samples were received in suitable condition.</p> <p>Review of the sample receipt advice identified that the sample temperature on receipt by the primary and secondary laboratory was 17.4 °C and 10.9 °C respectively. The auditor notes that there is a potential for volatilisation to have occurred in these samples. However, based on the review of analytical results and all volatile COPC results generally reported below laboratory LOR/ adopted assessment criteria, this non-conformance is not considered to affect the outcome of this audit.</p>
	Holding times	Samples to be extracted and analysed within recommended holding times.	All samples extracted and analysed within holding times.
	Analytical Method	Samples to be analysed using NATA accredited methodology.	<p>Laboratories used included: Envirolab Services Pty Ltd (primary) and ALS Sydney (secondary).</p> <p>All laboratories utilized were NATA accredited.</p> <p>The primary laboratory and the secondary laboratory employed for the chemical analyses used analytical methods which were considered appropriate for the identified COPCs at the site and for which the laboratories were NATA accredited.</p>
Completeness	Sampling, analysis and quality plan completeness	100 % of sampling, analysis and quality plan to be implemented.	The soil investigation was implemented in accordance with the approved SAQP.
	Field documentation	All relevant field documentation to be collated including sampling logs and calibration records.	<p>The consultant provided relevant test pit logs, soil field screening results, site photos, and relevant site plans showing the locations of all test pits.</p> <p>The consultant provided calibration records for the PID unit used during the site investigation.</p>
	Laboratory documentation	All relevant laboratory documentation to be collated, including chain of custody records, sample receipt advice and analytical reports.	The consultant provided all relevant COC documentation; laboratory sample receipt advice; and full laboratory certificates in the reports.

Parameter	DQIs	Requirement	Auditor Assessment
	Critical sample validity	All critical sample data to be valid.	The auditor considers that the data is considered reliable, for the purpose of the soil investigation.
	Sampling, analysis and quality approach	Adequately comparable sampling, analysis and quality approach to be used throughout the project.	The auditor considers that the data is comparable, as consistent sampling methods were employed throughout the direction of the investigation and subsequent validation program and analysis was undertaken by NATA accredited laboratories. Furthermore, consistent field staff were employed by consultant during the field program.
	Sampler	Samplers used throughout the project to have sufficient experience.	

5.2 Audit Findings

The quality assurance/quality control measures employed by the consultant (PRM 2019) were checked and found to indicate that the consultant implemented a systematic planning process, and adequately complied with the requirements outlined in OEH 2011, NEPC 2013 and EPA 2017. The laboratory QA/QC results have been reviewed and the results indicate that the analytical laboratories were achieving adequate levels of precision and accuracy. As such, the sampling, analytical and quality protocols undertaken by the consultant were considered to be adequately reliable for the purpose of assessing the contamination status of the site; and the data is therefore considered reliable and useable for the purpose of this audit.

6. Soil Assessment Criteria

The consultant (PRM 2018 and PRM 2019) stated the site was proposed for divestment for low density residential land use.

Based on the proposed use, the site was assessed by the consultant (PRM 2019) against guidelines presented in NEPC (2013), including the following:

- Health Investigation Levels (HIL): HIL A – residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake, no poultry, also includes children’s day care centres, preschools and primary schools).
- Health Screening Levels (HSL): HSL A for vapour intrusion in low-high density residential land use, for coarse soils.
- HSLs for direct contact in residential land use for TRH C₁₆ – C₄₀ fractions adopted from CRC CARE Technical Document (Friebel and Nadebaum 2011).
- Ecological Screening Levels (ESL): urban residential/ public open space land use, coarse grained soils.
- Ecological Investigation Levels (EIL) – urban residential/public open space; site specific EILs calculated using pH of 6, CEC of 15.5 cmol/kg, clay content of 12 % and organic carbon content of 4.6% based average laboratory results.
- HSLs for asbestos contamination in soil for Residential use with garden/accessible soil.

The consultant also adopted aesthetic criteria as part of the site assessment. It was noted that soils at the site should no exhibit the following: discolouration (staining), a malodorous nature (odours) and abnormal consistency (anthropogenic contaminants).

6.1 Audit Findings

The soil criteria adopted by the consultant (PRM 2019) have been checked against and were consistent with criteria endorsed by the EPA for the proposed residential with garden/accessible soil land use. The consultant also established aesthetic criteria as part of the site assessment, in accordance with NEPC 2013 and EPA 2017.

Based on the review of analytical summary tables prepared by the consultant (PRM 2019), the auditor also notes that NEPC (2013) Management Limits for TPH fractions in F1-F4 in soil were adopted by the consultant relating to residential, parkland and public open space land use based on the identified soil lithology (i.e. coarse soil). The Management Limits have been adopted after consideration of relevant HSLs and ESLs and therefore is considered appropriate for the interpretation of data.

The consultant conservatively adopted ambient background concentrations (ABC) of zero for the calculation of EILs. Two samples were analysed for pH, CEC and organic clay content, with the average value used to provide a basis for selection of appropriate Added Contaminant Limits (ACL).

Whilst Soil HSLs for direct contact based on Friebel and Nadebaum (2011) were nominated by the consultant (PRM 2019), the auditor notes that these guideline values were not included in the consultant’s summary tables for the assessment of data. However, review of the analytical results identified no exceedances to the adopted soil HSLs for vapour intrusion, which are more conservative in comparison to direct contact HSLs. As such, the omission of direct contact HSLs does not have any material impact on the conclusions drawn regarding soil contamination status at the site, and therefore does not affect the outcome of this audit.

Overall, the auditor considers that the criteria adopted by the consultant were appropriate for assessing the nature and extent of contamination that may be present at the site.

7. Site Investigation Results

7.1 Field Observations

A summary of field observations encountered during the field investigations undertaken by PRM (2019) is provided below:

- The subsurface profile across the site typically comprised dark brown silty/ clayey sand filling underlain by yellow-brown silty clay.
- A review of the consultant's test pit logs identified that majority of the test pits terminated in the fill with only one test pit (TP01) extending into underlying natural silty clays at 0.5 m bgs.
- Fill material was identified to a maximum depth of 1.2 m bgs, with anthropogenic inclusions of ceramic tile, steel, glass, plastic and concrete observed within the fill profile at all test pits whilst observations of ash were reported at test pits TP03 and TP04.
- Test pit TP06 encountered refusal in shallow fill at 0.25 m bgs. The consultant reported that four additional observational test pits excavated within 2 m either side of TP06 encountered similar subsurface conditions to TP06 including refusal depths ranging from 0.2-0.3 m bgs.
- Review of the test pit logs identified that PID field screening results of the soil samples were all reported at 0 ppm.
- No potential asbestos containing material (ACM) was observed during the soil investigation.
- An organic odour was noted at TP03 0.3-0.4 m bgs. No other odours were noted during the soil investigation.

7.2 Soil Analytical Results

A soil investigation was undertaken by PRM (2019). The consultant provided summary tables (**Appendix D**) in addition to laboratory reports and chain of custody documentation.

A summary of the soil analytical results, in comparison to the adopted soil investigation levels (as provided in **Section 6.1**) is provided in **Table 7.1**, below.

Table 7.1: Summary of Soil Analytical Results (PRM 2019) (mg/kg)

Substance	Minimum concentration	Maximum concentration	Exceedance to SIL
Metals			
Arsenic	< 4	9	No exceedance
Cadmium	<0.4	0.5	No exceedance
Chromium (III + VI)	6	20	No exceedance
Copper	<1	28	No exceedance
Lead	9	190	No exceedance
Nickel	<1	6	No exceedance
Zinc	8	100	No exceedance
BTEXN			
Benzene	<0.2	<0.2	No exceedance
Toluene	<0.5	<0.5	No exceedance
Ethylbenzene	<1	<1	No exceedance
Total Xylenes	<1	<1	No exceedance
Naphthalene	<1	<1	No exceedance
TRH			
TRH C ₆ -C ₁₀ (less BTEX) (F1)	<25	<25	No exceedance
TRH C ₁₀ -C ₁₆ (minus naphthalene) (F2)	<50	<50	No exceedance
TRH C ₁₆ -C ₃₄ (F3)	<100	330	Exceedance to ESL of 300 mg/kg reported at TP04 0-0.1 mg/kg.

Substance	Minimum concentration	Maximum concentration	Exceedance to SIL
TRH C ₃₄ -C ₄₀ (F4)	<100	100	No exceedance
PAHs			
Benzo(a)pyrene	<0.05	0.08	No exceedance
Benzo(a)pyrene TEQ	< 0.5	< 0.5	No exceedance
Total PAHs	< 0.05	0.3	No exceedance
OCPs			
DDE+DDD+DDT	< 0.1	< 0.1	No exceedance
Aldrin+Dieldrin	< 0.1	< 0.1	No exceedance
Individual OCPs	< 0.1	< 0.1	No exceedance
OPPs			
Individual OPPs	< 0.1	< 0.1	No exceedance
PCBs			
total PCBs	< 0.1	< 0.1	No exceedance
Asbestos			
Asbestos fragments on surface	-	-	No potential ACM was observed during test pit excavation or 7mm sieving process..
Asbestos (ACM >7mm)	<0.01% w/w	<0.01% w/w	No exceedance
Asbestos in soil (<2mm AF/FA)	<0.001% w/w	<0.001% w/w	No exceedance

7.3 Consultant's Interpretations and Conclusions

7.3.1 Soil

The consultant (PRM 2019) provided the following discussion of soil results, conclusions and recommendations:

- Soil analytical results were reported below the adopted site assessment criteria, with the exception of TRH C₁₆-C₃₄ (F3) concentration at TP04 0-0.1 mg/kg which marginally exceeded the ESL criterion of 300 mg/kg. The consultant reported that sample inspection and review of chromatography assessment for the sample indicated that the reported TRH concentration was likely associated with naturally occurring hydrocarbon sources such as leaves/bark which were present in the sample. Additionally, the consultant reported that no evidence of distressed vegetation was observed in the area of TP04. Therefore, the consultant concluded that the slightly elevated TRH concentration identified is likely to pose a low risk to potential receptors.
- Method refusal was encountered in stiff fill material and as such, the depth of fill was not completely delineated at the site. However, the consultant reported that the likelihood of gross soil contamination present at depths across the site was considered to be low due to the following:
 - Fill material encountered at the site was consistent in nature with minimal anthropogenic inclusions identified, with the exception of surficial soils.
 - All laboratory results were reported at either below laboratory LOR or below the adopted site assessment criteria.
 - No visual or olfactory indications of contamination was identified during the intrusive works.
 - Deeper fill material identified at the site is likely associated with residual soils won during localised earthworks during the suburb development and/or the deep excavations required for the installation of the Deep Creek Submain.
- Minor amounts of anthropogenic material including tile, plastic, concrete, steel and glass was observed in surficial soils across the site, however, these anthropogenic inclusions were not likely to present a risk to current or future land users and are of low aesthetic concern for the proposed use.

- As the soil analytical results indicated no source pathway receptor linkages, the consultant reported that the risk posed to identified potential receptors with regards to site contamination was low. The consultant considered the site to be suitable for the proposed divestment for low density residential land use and the current open space landuse.

7.4 Audit Findings

The consultant (PRM 2019) provided tables which adequately summarised the laboratory results, in addition to the provision of complete laboratory reports and chain of custody documentation.

The auditor notes that the higher duplicate result relating to primary sample TP05 0-0.1 was not used by the consultant in the assessment of data. Review of detailed laboratory reports provided by the consultant identified that the intra-laboratory duplicate (Dup A) reported marginally higher concentrations of TRH C₁₆-C₃₄, chromium, copper lead, nickel and zinc in comparison to the primary sample. However, the auditor notes that the higher duplicate results were below the adopted site assessment criteria. As such, it does not have any material impact on the conclusions drawn regarding soil contamination status at the site, and therefore does not affect the outcome of this audit.

The site plans provided by the consultant (PRM 2019) adequately identified the sampling locations relevant to the main site features such as boundaries and street frontage and have been produced to scale. Figures prepared by the consultant are included as **Appendix C**.

The laboratory procedures were appropriate for identified potential contaminants of concern and adopted soil criteria against which results were compared.

A review of the laboratory reports and associated chain of custody documentation indicates that samples were received appropriately, and no discrepancies were noted.

No exceedances of adopted human health or ecological assessment criteria were identified in fill materials with the exception of minor ESL exceedance for TRH C₁₆-C₃₄ (F3) fraction reported at TP04 0-0.1. The auditor concurs with the consultant's conclusion that the reported TRH concentration is likely associated with naturally occurring hydrocarbon sources and unlikely to pose an unacceptable risk to potential ecological receptors.

The consultant addressed the potential migration of the identified contaminants of concern through an assessment of soils across the site. Based on the findings of the site investigation, site soils are not considered to pose an unacceptable risk to any on-site or off-site sensitive human or ecological receptors.

Should site materials require excavation and off-site disposal during any site development works, waste disposal classification will be required for all materials requiring offsite disposal in accordance with the Protection of the Environment Operations (Waste) Regulations 2014.

The consultant (PRM 2019) concluded that the site was considered suitable for the proposed divestment for low density residential land use and current open space landuse. The conclusion reached by the consultant in relation to landuse suitability is considered by the auditor to be appropriate and meet the requirements of the site audit.

8. Evaluation of Land Use Suitability

In assessing the suitability of a site for an existing or proposed land use in an urban context, the decision process for assessing urban redevelopment sites should be followed (Page 46 and 47, EPA 2017), as discussed in the following sections. For the purposes of this assessment, the future use of the site is residential with garden/accessible soil, as described in Schedule B7 of NEPC 2013.

8.1 Reporting in Accordance with EPA requirements

The documents provided by the consultant have been checked against, and meet the requirements of OEH 2011. As such, the reporting of the site investigation works is considered to be appropriate.

8.2 Aesthetics Have Been Addressed

As part of the site investigation works, the consultant (PRM 2019) completed an assessment for aesthetic considerations including staining, odours and anthropogenic contaminants.

The consultant (PRM 2019) reported that minor amounts of anthropogenic material including tile, plastic, concrete, steel and glass was observed in surficial soils across the site, however, these anthropogenic inclusions were not likely to present a risk to current or future land users and are of low aesthetic concern for the proposed residential use.

As such, aesthetic issues are considered to have been adequately addressed.

8.3 Soils Have Been Assessed Against the Appropriate Investigation Levels

The criteria adopted by the consultant for the site investigation works were checked against, and are consistent with, appropriate criteria endorsed by the EPA for the proposed residential land use with garden/accessible soil. As such, the soils are considered to have been assessed against appropriate investigation levels.

8.4 Background Soil Concentrations Have Been Adequately Addressed

Background samples were not collected and analysed during the investigation, and the consultant conservatively adopted an ABC of zero to enable the calculation of EILs.

The concentrations of metals identified in all analysed samples were either below the laboratory LOR, or the adopted HIL and/or EIL for low density residential land use.

In the absence of identified contamination at the site, the concentrations of metals identified are considered to be representative of background conditions, and therefore background soil concentrations are considered to have been adequately addressed.

8.5 All impacts of Chemical Mixtures Have Been Assessed

No issues relating to chemical mixtures in relation to the identified contaminants of concern were identified by the consultant. Hence, there was no requirement to give any further consideration to the impact of chemical mixtures.

8.6 Any potential ecological risks have been assessed

The consultant (PRM 2019) identified potential ecological risks relating to identified contamination issues. The consultant reported that TRH C₁₆-C₃₄ (F3) concentration at TP04 0-0.1 mg/kg marginally exceeded the ESL criterion of 300 mg/kg. Based on sample inspection and review of chromatography assessment for the sample indicated that the reported TRH concentration was likely associated with naturally occurring hydrocarbon sources such as leaves/bark which were present in the sample. Additionally, the consultant reported that no evidence of distressed vegetation was observed in the area of TP04. Therefore, the consultant concluded that the slightly elevated TRH concentration identified is likely to pose a low risk to potential receptors.

As such, the requirements of the site audit in relation to potential ecological risks have been met.

8.7 Site Management Strategy is Appropriate

Based on the site assessment, long term site management is not required.

However, with consideration to anthropogenic inclusions identified in the fill material and the depth of fill at the site, a Construction Environmental Management Plan (CEMP) inclusive of an Unexpected Finds Protocol (UFP) should be developed and implemented, in the event that the site is redeveloped.

8.8 Contaminant Migration (actual or potential) Has Been Addressed

The consultant addressed both the potential and actual migration of the identified contaminants of concern through an assessment of site history, site setting and soils across the site.

In the absence of any identified source, there are no contaminant migration pathways which require consideration. Based on the findings of the site investigation, the potential for migration of contamination from the site is considered to be low, such that there is unlikely to be any unacceptable risk to any on-site or off-site sensitive human or ecological receptors.

As such, the requirements of the site audit in relation to consideration of contaminant migration have been met.

9. Audit Summary Opinion

On the basis of the findings of the site audit, and subject to the limitations in **Section 11**, the following summary opinions are provided:

- The site investigation works (PRM 2019) are considered to have met the requirements of the Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd Edition) (EPA 2017).
- The site was historically used for agricultural purposes and was acquired by Sydney Water in 1970 to accommodate construction of the Deep Creek Submain.
- There were no levels of contaminants of potential concern (i.e., heavy metals, TPH, BTEX, PAHs, OCPs/OPPs, PCBs or asbestos) in soil identified at the subject site, which require remediation or management under either a standard residential use or parks/open space use.
- There is no evidence of migration of contaminants from the site which is likely to result in any unacceptable risks to surrounding human or ecological receptors.
- Based on the information provided, the site is considered suitable for the proposed land use (i.e. residential with garden/accessible soil and parks/open space) as defined in NEPC 2013.
- The suitability for the stated land use is not dependent on any long-term management plan. However, with consideration to anthropogenic inclusions identified in the fill material and the depth of fill at the site, a Construction Environmental Management Plan (CEMP) inclusive of an Unexpected Finds Protocol (UFP) should be developed and implemented, in the event that the site is redeveloped.

10. Limitations

This audit was conducted with a reasonable level of scrutiny, care and diligence on behalf of the client for the purposes outlined in the Contaminated Land Management Act 1997. The data used to support the conclusions reached in this audit were obtained by other consultants and the limitations which apply to the consultant's report(s) apply equally to this audit report.

Every reasonable effort has been made to identify and obtain all relevant data, reports and other information that provide evidence about the condition of the site, and those that were held by the client and the client's consultants, or that were readily available. No liability can be accepted for unreported omissions, alterations or errors in the data collected and presented by other consultants. Accordingly, the data and information presented by others are taken and interpreted in good faith.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations reviewed, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this audit are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G and the Site Auditor reserve the right to review the report in the context of the additional information, subject to meeting relevant guideline requirements imposed by the EPA.

Appendix A Guidelines made or approved by the EPA

Guidelines made or approved by the EPA (s.105 CLM Act 1997)

Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia (ANZG 2018)

Australian Drinking Water Guidelines, National Health and Medical Research Council and Agriculture and Resource Management Council of Australia and New Zealand, 2011 (NHMRC/NRMMC 2011)

Composite Sampling, Lock, W. H., National Environmental Health Forum Monographs, Soil Series No.3, 1996, SA Health Commission, (NEHF 1996)

Contaminated Sites: Sampling Design Guidelines, NSW EPA, 1995 (EPA 1995)

Contaminated Sites: Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land, NSW EPA, 1995 (EPA 1995b)

Contaminated Sites: Guidelines for the Assessment and Clean Up of Cattle Tick Dip Sites for Residential Purposes, NSW Agriculture and CMPS&F Environmental, February 1996 (NSW Agr. 1996)

Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites, NSW EPA, 1997 (EPA 1997, reprinted and updated by the Office of Environment and Heritage in 2011)

Contaminated Sites: Guidelines for Assessing Banana Plantation Sites, NSW EPA, 1997 (EPA 1997b)

Contaminated Sites: Guidelines for Assessing Former Orchards and Market Gardens, NSW EPA, 2005 (EPA 2005)

Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd Edition), NSW EPA, 2017 (EPA 2017)

Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination, NSW EPA, March 2007 (EPA 2007)

Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997, NSW EPA, June 2009 (EPA 2009)

Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards, Department of Health and Ageing and EnHealth Council, Commonwealth of Australia, June 2002 (EnHealth 2002)

National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013, National Environment Protection Council (NEPC 2013)

Appendix B Audit Correspondence

Sahani Gunatunge

From: Andrew Lau
Sent: Wednesday, 10 October 2018 1:16 PM
To: DOBSON, AMY; Andrew Lau
Cc: Christine Louie
Subject: RE: North Narrabeen Draft SAQP for comment

Follow Up Flag: Flag for follow up
Flag Status: Completed

Hi Amy,

I've reviewed the SAQP and have the following comments for inclusion/incorporation in the SAQP:

- The sampling approach across the broader site is considered appropriate. Insufficient justification has been provided as to whether the deep creek potential backfill alignment has sufficient sampling locations, considering the potential volume of material which is the target of the proposed 2 locations.
- The analytical approach is generally fine, however, the analytical suites for imported fill and small scale tipping should be expanded to include OCPs/PCBs and OCPs, PCBs, TRH/BTEX respectively given the unknown origin of such materials if present. Asbestos analyses should be undertaken on any imported fill materials or fly tipped materials regardless whether potential ACMs are observed.
- The decisions identified in the DQOs are only partially complete and must be consistent with the decision making process in appendix A of the site auditor guidelines (EPA 2017).
- The competency of the field team has not been demonstrated as per relevant guidance in DoH 2009 and NEPC 2013. In addition, it is requested that the report is reviewed/approved by a certified practitioner prior to being submitted to me for review, given the proposed changes to SEPP55 and likely requirements for reports submitted to council for remediation or DA consideration purposes be reviewed/approved by a certified practitioner.

Happy to discuss if anything's unclear.

Regards,
Andrew



Andrew Lau | Managing Director, Accredited Auditor | JBS&G
Sydney | Melbourne | Adelaide | Perth | Brisbane | Canberra | Darwin | Wollongong
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From: DOBSON, AMY <AMY.DOBSON@sydneywater.com.au>
Sent: Monday, 8 October 2018 10:10 AM
To: Andrew Lau <ALau@jbsg.com.au>

Cc: Christine Louie <clouie@jbsg.com.au>

Subject: North Narrabeen Draft SAQP for comment

Hi Andrew,

Please find attached PRM's draft SAQP for North Narrabeen. I have some comments which I'll return concurrently with yours, though they are minor in nature.

I look forward to hearing from you.

Regards,

Amy Dobson

Senior Project Manager – Environmental Services

Property, Sydney Water

Level 13, 1 Smith Street, Parramatta NSW 2150



Mob 0411 306 656

amy.dobson@sydneywater.com.au

All enquiries to propertyenvironmental@sydneywater.com.au



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Sahani Gunatunge

From: Andrew Lau
Sent: Monday, 15 October 2018 3:01 PM
To: DOBSON, AMY; Christine Louie; Andrew Lau
Subject: RE: North Narrabeen Amended SAQP for Comment

Hi Amy,

Thanks for sending through.

I'm satisfied with the responses to comments 1 & 3.

Comment 2 has only been partially addressed. While the imported fill analytical suite has been adjusted to address my comment, the fly tipping analytical suite has not been adjusted to address my comment.

Comment 4 has only been partially addressed. While I'm satisfied about the certified practitioner review, I am not able to assess the competency of the field person(s) against the relevant NEPC 2013 / DoH 2009 requirements. I'm specifically interested in the DoH 2009 asbestos-related competencies.

Regards,
Andrew



Andrew Lau | Managing Director, Accredited Auditor | JBS&G
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From: DOBSON, AMY <AMY.DOBSON@sydneywater.com.au>
Sent: Monday, 15 October 2018 12:57 PM
To: Andrew Lau <ALau@jbsg.com.au>; Christine Louie <clouie@jbsg.com.au>
Subject: North Narrabeen Amended SAQP for Comment

Hi Andrew,

Please find amended North Narrabeen SAQP attached from PRM along with separate comment logs for the SW/JBS&G comments.

I will also review this afternoon.

Cheers,

Regards,

Amy Dobson
Senior Project Manager – Environmental Services
Property, Sydney Water
Level 13, 1 Smith Street, Parramatta NSW 2150

All enquiries to propertyenvironmental@sydneywater.com.au

From: Jonathan Coffey [<mailto:jonathan.coffey@progressiverm.com.au>]
Sent: Monday, 15 October 2018 12:38 PM
To: DOBSON, AMY <AMY.DOBSON@sydneywater.com.au>
Subject: Re: North Narrabeen Draft SAQP for comment - Auditor Comments

Hi Amy,

Please see attached the updated SAQP. Also attached is a comment register/ response to your comments, and a separate set of responses for Andrews comments.

Please forward the updated SAQP and the auditor responses to Andrew for review.

Thanks and Kind regards,

Jono

Jonathan Coffey
Team Leader - Environmental Risk

E: jonathan.coffey@progressiverm.com.au
M: 0435 448 008



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Sahani Gunatunge

From: Andrew Lau
Sent: Friday, 19 October 2018 11:49 AM
To: DOBSON, AMY
Cc: Christine Louie
Subject: Re: North Narrabeen Amended SAQP for Comment

Changes are acceptable. Thanks

Andrew Lau
JBS&G
0412 512 614
www.jbsg.com.au

On 19 Oct 2018, at 10:42, DOBSON, AMY <AMY.DOBSON@sydneywater.com.au> wrote:

Morning Andrew,

PRM have amended the North Narrabeen SAQP, attached, based on your final two comments. I've indicated below where each has been addressed within the document.

Can you please advise at your earliest convenience whether these have been suitably addressed to allow us to schedule the site works.

Many thanks and enjoy your weekend.

- *Comment 2 has only been partially addressed. While the imported fill analytical suite has been adjusted to address my comment, the fly tipping analytical suite has not been adjusted to address my comment. Section 4. CSM Table 5 Updated.*
- *Comment 4 has only been partially addressed. While I'm satisfied about the certified practitioner review, I am not able to assess the competency of the field person(s) against the relevant NEPC 2013 / DoH 2009 requirements. I'm specifically interested in the DoH 2009 asbestos-related competencies. Section 5. Step 1 Table updated adding a section on Competency of PRM Project Team.*

Regards,

Amy Dobson
Senior Project Manager – Environmental Services
Property, Sydney Water
Level 13, 1 Smith Street, Parramatta NSW 2150

<image003.png>Mob 0411 306 656
amy.dobson@sydneywater.com.au

All enquiries to propertyenvironmental@sydneywater.com.au

From: DOBSON, AMY
Sent: Monday, 15 October 2018 3:04 PM

To: 'Andrew Lau' <ALau@jbsg.com.au>; Christine Louie <clouie@jbsg.com.au>
Subject: RE: North Narrabeen Amended SAQP for Comment

Appreciated Andrew,

I'll discuss with PRM and advise of their response.

Safe travels interstate.

Regards,

Amy Dobson
Senior Project Manager – Environmental Services
Property, Sydney Water
Level 13, 1 Smith Street, Parramatta NSW 2150

<image005.png>Mob 0411 306 656
amy.dobson@sydneywater.com.au

All enquiries to propertyenvironmental@sydneywater.com.au

From: Andrew Lau [<mailto:ALau@jbsg.com.au>]
Sent: Monday, 15 October 2018 3:01 PM
To: DOBSON, AMY <AMY.DOBSON@sydneywater.com.au>; Christine Louie <clouie@jbsg.com.au>; Andrew Lau <ALau@jbsg.com.au>
Subject: RE: North Narrabeen Amended SAQP for Comment

Hi Amy,

Thanks for sending through.

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Comment 4 has only been partially addressed. While I'm satisfied about the certified practitioner review, I am not able to assess the competency of the field person(s) against the relevant NEPC 2013 / DoH 2009 requirements. I'm specifically interested in the DoH 2009 asbestos-related competencies.

Regards,
Andrew

<image007.jpg>**Andrew Lau** | Managing Director, Accredited Auditor | JBS&G
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From: DOBSON, AMY <AMY.DOBSON@sydneywater.com.au>
Sent: Monday, 15 October 2018 12:57 PM
To: Andrew Lau <ALau@jbsg.com.au>; Christine Louie <clouie@jbsg.com.au>
Subject: North Narrabeen Amended SAQP for Comment

Hi Andrew,

Please find amended North Narrabeen SAQP attached from PRM along with separate comment logs for the SW/JBS&G comments.

I will also review this afternoon.

Cheers,

Regards,

Amy Dobson
Senior Project Manager – Environmental Services
Property, Sydney Water
Level 13, 1 Smith Street, Parramatta NSW 2150

<image006.png>Mob 0411 306 656
amy.dobson@sydneywater.com.au

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From: Jonathan Coffey [<mailto:jonathan.coffey@progressiverm.com.au>]
Sent: Monday, 15 October 2018 12:38 PM
To: DOBSON, AMY <AMY.DOBSON@sydneywater.com.au>
Subject: Re: North Narrabeen Draft SAQP for comment - Auditor Comments

Hi Amy,

Please see attached the updated SAQP. Also attached is a comment register/response to your comments, and a separate set of responses for Andrews comments.

Please forward the updated SAQP and the auditor responses to Andrew for review.

Thanks and Kind regards,

Jono

Jonathan Coffey
Team Leader - Environmental Risk

E: jonathan.coffey@progressiverm.com.au
M: 0435 448 008



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<P033802 SW North Narrabeen SAQP Report Rev1_Final.pdf>

Sahani Gunatunge

From: Andrew Lau
Sent: Wednesday, 12 December 2018 10:05 AM
To: DOBSON, AMY; Christine Louie; Andrew Lau
Subject: RE: Draft CA Report for Narrabeen

Follow Up Flag: Follow up
Flag Status: Completed

Hi Amy,

I've reviewed the draft report and have no comments on the report which influence the conclusions or recommendations.

Please note that, in light of the anthropogenic inclusions identified in the fill material and the depth at which fill materials were assessed (ie., not the full depth), I intend to provide a comment on the SAS noting the presence of such materials and that a Construction Environmental Management Plan (CEMP) with an Unexpected Finds Protocol (UFP) should be prepared and followed as part of any development works on the site.

Please send through the final when it's ready.

Regards,
Andrew



Andrew Lau | Managing Director, Accredited Auditor | JBS&G
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From: DOBSON, AMY <AMY.DOBSON@sydneywater.com.au>
Sent: Tuesday, 11 December 2018 11:41 AM
To: Christine Louie <clouie@jbsg.com.au>
Cc: Andrew Lau <ALau@jbsg.com.au>
Subject: Draft CA Report for Narrabeen

Hi Christine, Andrew –

I hope you are both well.

Please find PRM's draft contamination assessment report for North Narrabeen site attached for your comment.

I will review concurrently.

Cheers,

Regards,

Amy Dobson

Senior Project Manager

Group Property – Environmental Services

Sydney Water, Level 13, 1 Smith Street, Parramatta NSW 2150



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amy.dobson@sydneywater.com.au



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From: Christine Louie <clouie@jbsg.com.au>

Sent: Thursday, 1 November 2018 9:51 AM

To: DOBSON, AMY <AMY.DOBSON@sydneywater.com.au>

Cc: Andrew Lau <ALau@jbsg.com.au>

Subject: RE: Draft Report ETAs for Narrabeen and Ashbury

Hi Amy,

I've just tried to contact you to discuss your request to review preliminary results from PRM. Please give me a call when you are in the office.

Regards,

Christine



Christine Louie | Principal | JBS&G

Sydney | Melbourne | Adelaide | Perth | Brisbane | Canberra | Darwin | Wollongong

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From: DOBSON, AMY <AMY.DOBSON@sydneywater.com.au>

Sent: Wednesday, 31 October 2018 10:08 AM

To: Christine Louie <clouie@jbsg.com.au>

Cc: Andrew Lau <ALau@jbsg.com.au>

Subject: RE: Draft Report ETAs for Narrabeen and Ashbury

Great to hear!

PRM have advised that they didn't reach natural material across most locations. The plan is to provide a summary once the lab results are received (before mid-Nov) to present recommendations and inform next steps. Ideally this summary can be reviewed and commented on before Andrew's leave (can you confirm the dates for this please) so that PRM can remobilise or plan accordingly. Can you confirm if this is achievable?

Regards,

Amy Dobson
Senior Project Manager – Environmental Services
Property, Sydney Water
Level 13, 1 Smith Street, Parramatta NSW 2150



Mob 0411 306 656
amy.dobson@sydneywater.com.au

All enquiries to propertyenvironmental@sydneywater.com.au

From: Christine Louie <clouie@jbsg.com.au>
Sent: Wednesday, 31 October 2018 9:57 AM
To: DOBSON, AMY <AMY.DOBSON@sydneywater.com.au>
Cc: Andrew Lau <ALau@jbsg.com.au>
Subject: RE: Draft Report ETAs for Narrabeen and Ashbury

Hi Amy,

Apparently yesterday was the opening of the Northern Beaches Hospital! Yes, the trip back outside of peak hour was much quicker.

Early December review will be fine.

Regards,
Christine



Christine Louie | Principal | JBS&G
Sydney | Melbourne | Adelaide | Perth | Brisbane | Canberra | Darwin | Wollongong
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From: DOBSON, AMY <AMY.DOBSON@sydneywater.com.au>
Sent: Wednesday, 31 October 2018 9:33 AM
To: Christine Louie <clouie@jbsg.com.au>; Andrew Lau <ALau@jbsg.com.au>
Subject: Draft Report ETAs for Narrabeen and Ashbury

Hi Christine,

Great again to meet you in person yesterday.

I trust the return drive to the office was less congested!

PRM have confirmed they wont be issuing the draft DSI report for Narrabeen or the Ashbury draft GW/GG reports before mid-November. Can we aim for review in early December instead?

Many thanks,

Regards,

Amy Dobson
Senior Project Manager – Environmental Services
Property, Sydney Water
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Appendix C Consultant's Figures

339500 340000 340500 341000 341500 342000 342500 343000 343500

6271000

6270500

6270000

6269500

6269000

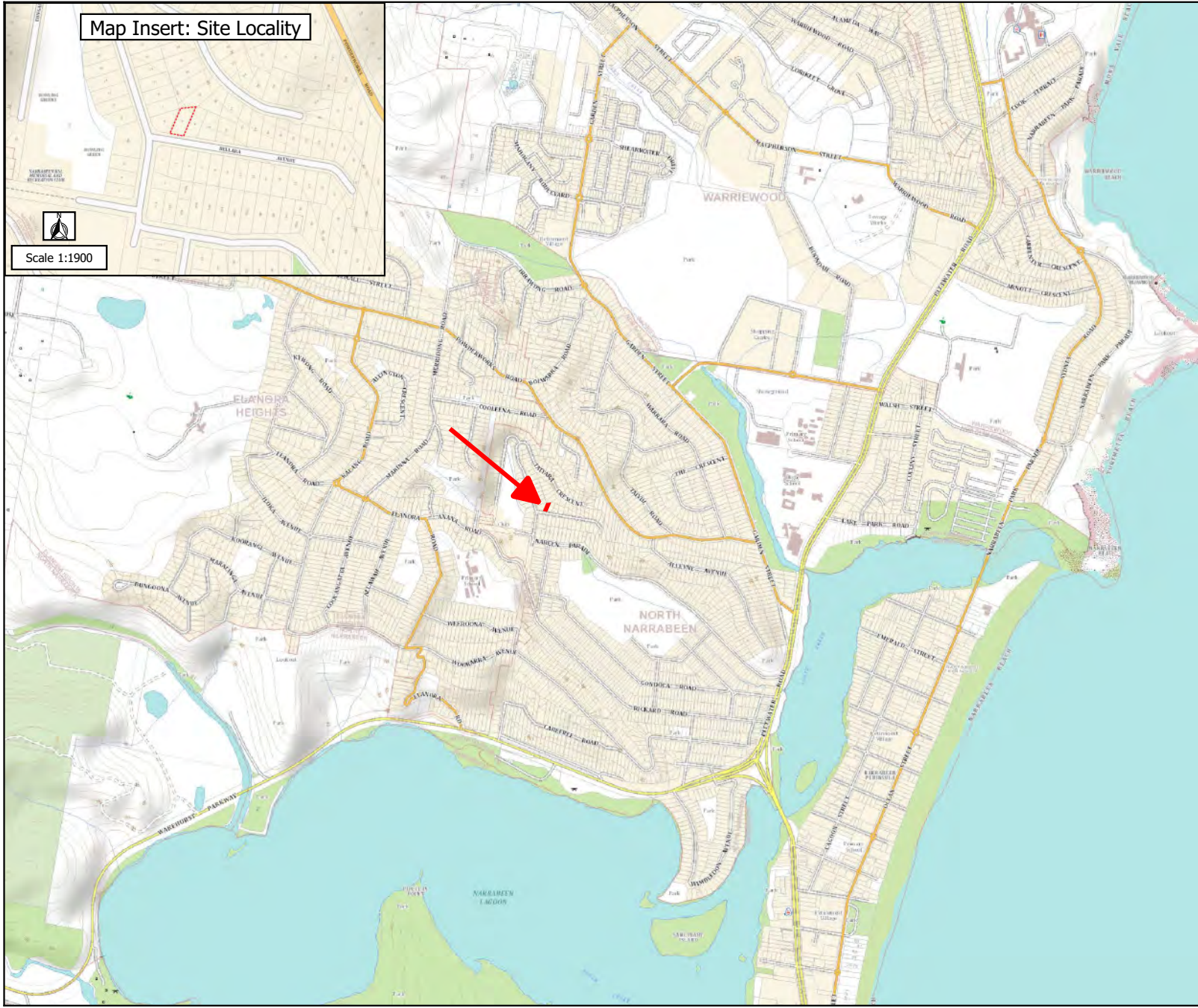
6268500

6268000

339500 340000 340500 341000 341500 342000 342500 343000 343500

Map Insert: Site Locality

Scale 1:1900



Project Reference	P033802.002
Report Name	Contamination Assessment
Client	Sydney Water

4 Bellara Avenue, North Narrabeen NSW

Figure 1 - Regional Site Locality



PROGRESSIVE RISK MANAGEMENT

Scale: 1:25000

Coor. Sys: GDA 1994 MGA Zone56

Legend

 Site Location

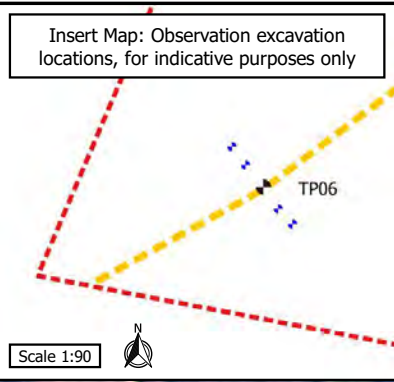


0 200 400 600 800 m

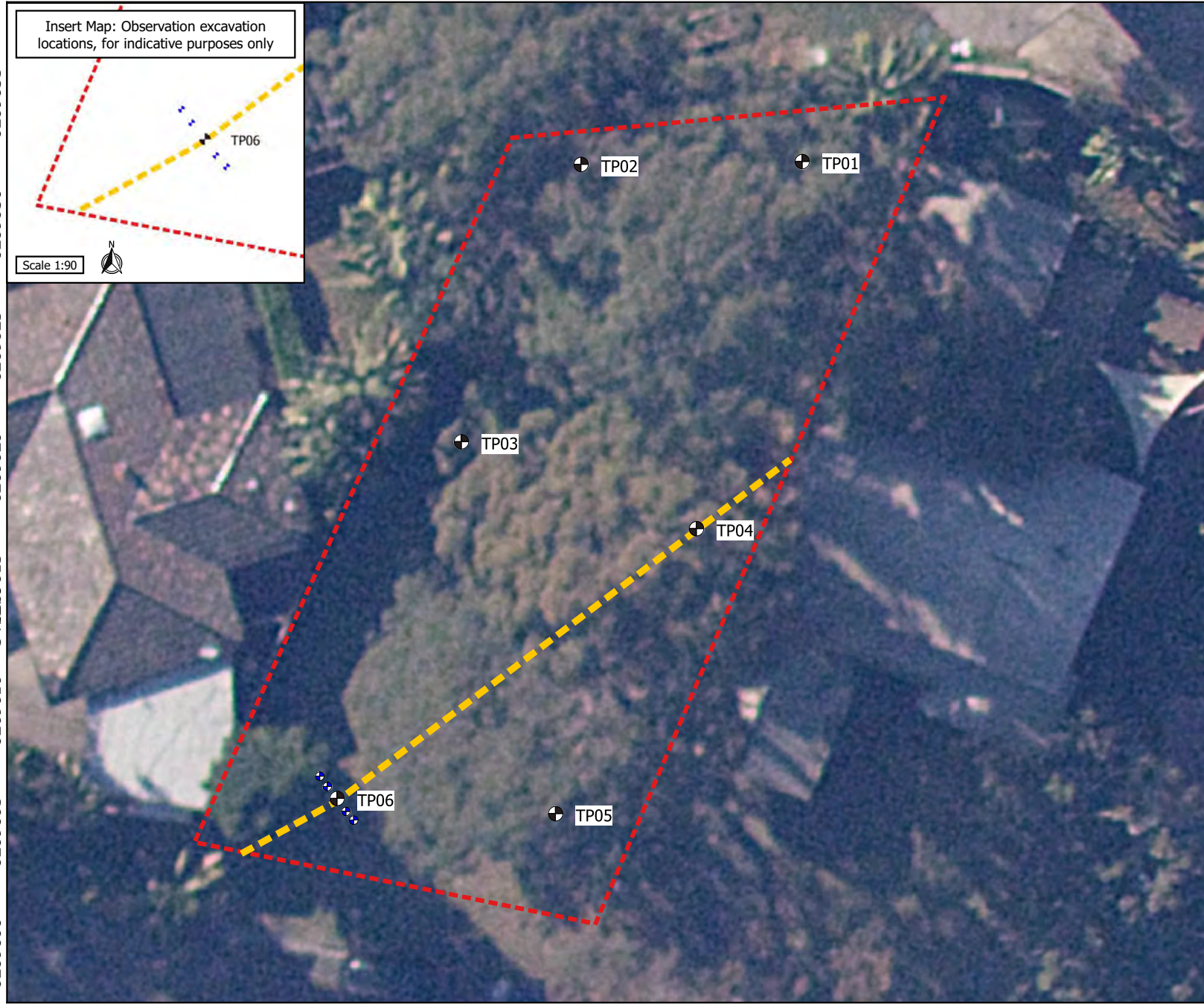


Image Source: Sixmaps (2017)

341270 341275 341280 341285 341290 341295 341300 341305 341310 341315 6269640



6269635
6269630
6269625
6269620
6269615
6269610
6269605
6269600



341275 341280 341285 341290 341295 341300 341305 341310 341315

Project Reference	P033802.002
Report Name	Contamination Assessment
Client	Sydney Water

4 Bellara Aveune, North Narrabeen NSW

Figure 2 - Investigation Locations



Scale: 1:280

Coord. Sys: GDA 1994 MGA Zone56

Legend

- Test Pit Locations
- Additional Observation Excavation
- Approximate Location of Submain Easement
- Approximate Site Boundary



0 2 4 6 8 m



Image Source: Sixmaps (2017)

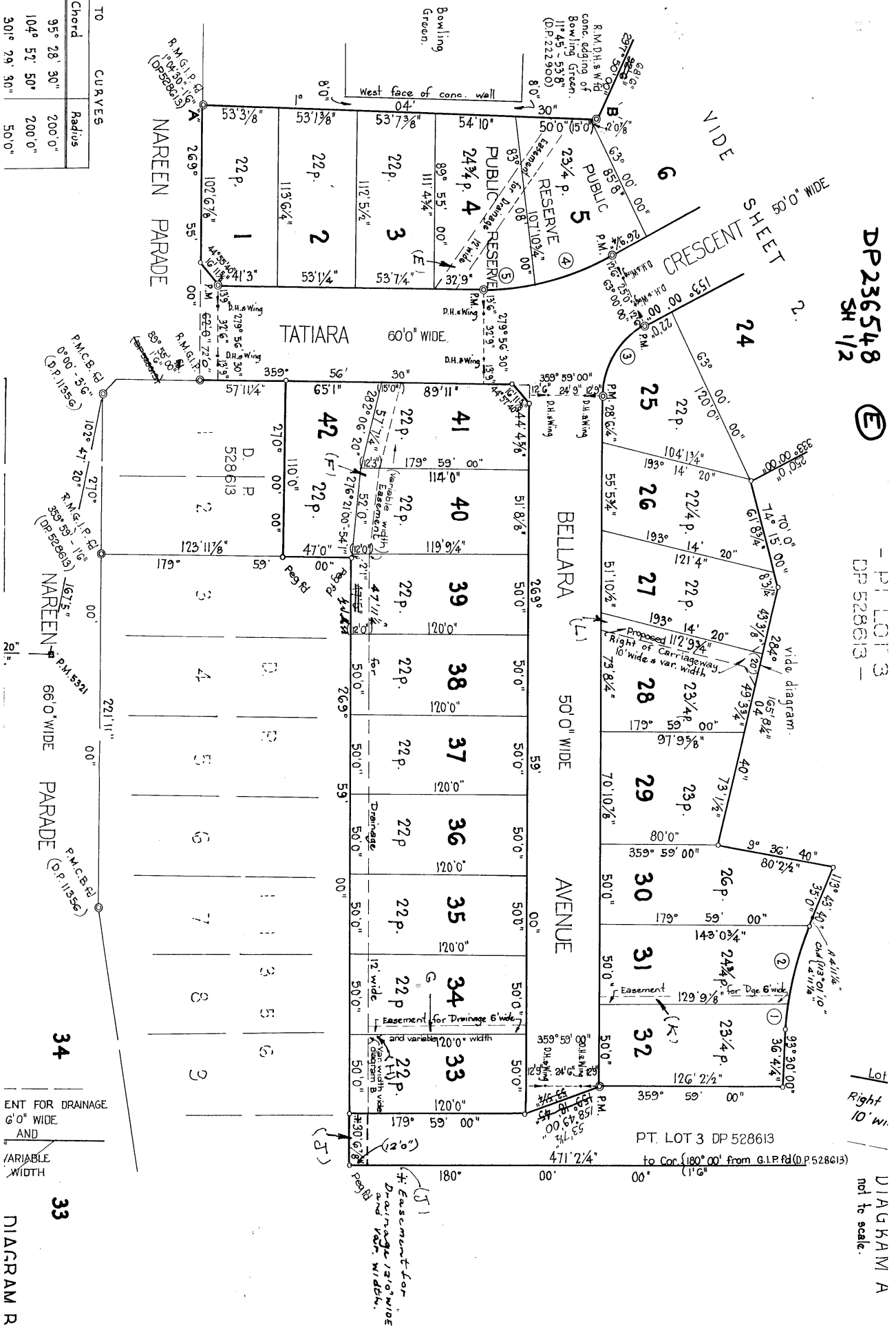
Appendix D Consultant's Summary Tables

		Organochlorine Pesticides in soil															Organophosphorus Pesticides																		
		4,4'-DDE	4-BHC	Aldrin	4-BHC	Chlordane (cis)	Chlordane (trans)	4-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	4-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Hexachlorobenzene	Methoxychlor	Azinphos methyl	Bromophos-ethyl	Chlorpyrifos	Chlorpyrifos-methyl	Diazinon	Dichlorvos	Dimethoate	Edthion	Fenitrothion	Malathion	Parathion	Phonnel	
		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	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
EQL		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
NEPM 2013 Table 18(5) Generic EIL - Urban Res & Public Open Space									180																										
NEPM 2013 Table 1A(1) HILs Res A Soil										240						10			6			10	300			160									
Field ID	Date	Depth	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
TP01	30/10/2018	0 - 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
TP02	30/10/2018	0 - 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP02	30/10/2018	0.5 - 0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP03	30/10/2018	0 - 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP03	30/10/2018	0.5 - 0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP04	30/10/2018	0 - 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP05	30/10/2018	0 - 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP05	30/10/2018	0.3 - 0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TP06	30/10/2018	0 - 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

		Field ID	FR_HA	FR_SH
		Date	30/10/2018	30/10/2018
		Sample Type	Rinsate	Rinsate
	Unit	EQL		
Metals in Water - Dissolved				
Arsenic (filtered)	mg/L	0.05	<0.05	<0.05
Cadmium (filtered)	mg/L	0.01	<0.01	<0.01
Chromium (III+VI) (filtered)	mg/L	0.01	<0.01	<0.01
Copper (filtered)	mg/L	0.01	<0.01	<0.01
Lead (filtered)	mg/L	0.03	<0.03	<0.03
Mercury (filtered)	mg/L	0.0005	<0.0005	<0.0005
Nickel (filtered)	mg/L	0.02	<0.02	<0.02
Zinc (filtered)	mg/L	0.02	<0.02	<0.02
OCP in water				
4,4-DDE	µg/L	0.2	<0.2	<0.2
a-BHC	µg/L	0.2	<0.2	<0.2
Aldrin	µg/L	0.2	<0.2	<0.2
b-BHC	µg/L	0.2	<0.2	<0.2
Chlordane (cis)	µg/L	0.2	<0.2	<0.2
Chlordane (trans)	µg/L	0.2	<0.2	<0.2
d-BHC	µg/L	0.2	<0.2	<0.2
DDD	µg/L	0.2	<0.2	<0.2
DDT	µg/L	0.2	<0.2	<0.2
Dieldrin	µg/L	0.2	<0.2	<0.2
Endosulfan I	µg/L	0.2	<0.2	<0.2
Endosulfan II	µg/L	0.2	<0.2	<0.2
Endosulfan sulphate	µg/L	0.2	<0.2	<0.2
Endrin	µg/L	0.2	<0.2	<0.2
Endrin aldehyde	µg/L	0.2	<0.2	<0.2
g-BHC (Lindane)	µg/L	0.2	<0.2	<0.2
Heptachlor	µg/L	0.2	<0.2	<0.2
Heptachlor epoxide	µg/L	0.2	<0.2	<0.2
Hexachlorobenzene	µg/L	0.2	<0.2	<0.2
Methoxychlor	µg/L	0.2	<0.2	<0.2
OP Pesticides in water				
Azinophos methyl	µg/L	0.2	<0.2	<0.2
Bromophos-ethyl	µg/L	0.2	<0.2	<0.2
Chlorpyrifos	µg/L	0.2	<0.2	<0.2
Chlorpyrifos-methyl	mg/L	0.0002	<0.0002	<0.0002
Diazinon	µg/L	0.2	<0.2	<0.2
Dichlorvos	µg/L	0.2	<0.2	<0.2
Dimethoate	µg/L	0.2	<0.2	<0.2
Ethion	µg/L	0.2	<0.2	<0.2
Fenitrothion	µg/L	0.2	<0.2	<0.2
Malathion	µg/L	0.2	<0.2	<0.2
Parathion	µg/L	0.2	<0.2	<0.2
Ronnel	µg/L	0.2	<0.2	<0.2
PAHs in Water				
Benzo(b+j+k)fluoranthene	mg/L	0.002	<0.002	<0.002
Acenaphthene	µg/L	1	<1	<1
Acenaphthylene	µg/L	1	<1	<1
Anthracene	µg/L	1	<1	<1
Benz(a)anthracene	µg/L	1	<1	<1
Benzo(a) pyrene	µg/L	1	<1	<1
Benzo(g,h,i)perylene	µg/L	1	<1	<1
Chrysene	µg/L	1	<1	<1
Dibenz(a,h)anthracene	µg/L	1	<1	<1
Fluoranthene	µg/L	1	<1	<1
Fluorene	µg/L	1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	1	<1	<1
Naphthalene	µg/L	1	<1	<1
Phenanthrene	µg/L	1	<1	<1
Pyrene	µg/L	1	<1	<1
Benzo(a)pyrene TEQ	mg/L	0.005	<0.005	<0.005
PAHs (Sum of positives)	mg/L	0.001	0	0
PCBs in Water				
Arochlor 1016	µg/L	2	<2	<2
Arochlor 1221	µg/L	2	<2	<2
Arochlor 1232	µg/L	2	<2	<2
Arochlor 1242	µg/L	2	<2	<2
Arochlor 1248	µg/L	2	<2	<2
Arochlor 1254	µg/L	2	<2	<2
Arochlor 1260	µg/L	2	<2	<2
svTRH (C10-C40) in Water				
C10-C14	µg/L	50	<50	<50
C15-C28	µg/L	100	<100	<100
C29-C36	µg/L	100	<100	<100
C10-C16	µg/L	50	<50	<50
C10-C16 (F2 minus Naphthalene)	µg/L	50	<50	<50
C16-C34	µg/L	100	<100	<100
C34-C40	µg/L	100	<100	<100
vTRH(C6-C10)/BTEXN in Water				
C6-C9	µg/L	10	<10	<10
C6-C10	µg/L	10	<10	<10
C6-C10 (F1 minus BTEX)	µg/L	10	<10	<10
Naphthalene	µg/L	1	<1	<1
Benzene	µg/L	1	<1	<1
Toluene	µg/L	1	<1	<1
Ethylbenzene	µg/L	1	<1	<1
Xylene (m & p)	µg/L	2	<2	<2
Xylene (o)	µg/L	1	<1	<1

Appendix E Regulatory Search Results

TO CURVES	
Chord	Radius
95° 28' 30"	200' 0"
104° 52' 50"	200' 0"
301° 29' 30"	50' 0"



DP 236548
SM 1/2



- P1 LOT 3
DP 528613 -

Lot
Right
10' w.

DIAGRAM A
not to scale.

ENT FOR DRAINAGE
6' 0" WIDE
AND
VARIABLE
WIDTH

DIAGRAM R

PT. LOT 3 DP 528613
to Cor. 180° 00' from G.I.P.R. (DP 528613)

Search Results

3 results found.

Long Reef Barrenjoey Coastal Rocks Pittwater Rd	Mona Vale, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Narrabeen Lagoon Catchment Wakehurst Pwy	Narrabeen, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Narrabeen Rock Pool Mackenzie Pde	North Narrabeen, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)

Report Produced: Tue Feb 5 13:10:01 2019



Home > Topics > Heritage places and items > [Search for heritage](#)

Search for NSW heritage

[Return to search page where you can refine/broaden your search.](#)

Statutory listed items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that there may be several entries for the same heritage item in the database. For clarity, the search results have been divided into three sections.

- **Section 1** - contains Aboriginal Places declared by the **Minister for the Environment** under the National Parks and Wildlife Act. This information is provided by the Heritage Division.
- **Section 2** - contains heritage items listed by the **Heritage Council of NSW** under the NSW Heritage Act. This includes listing on the State Heritage Register, an Interim Heritage Order or protected under section 136 of the NSW Heritage Act. This information is provided by the Heritage Division.
- **Section 3** - contains items listed by **local councils** on Local Environmental Plans under the Environmental Planning and Assessment Act, 1979 and **State government agencies** under s.170 of the Heritage Act. This information is provided by local councils and State government agencies.

Section 1. Aboriginal Places listed under the National Parks and Wildlife Act.

Your search did not return any matching results.

Section 2. Items listed under the NSW Heritage Act.

Your search did not return any matching results.

Section 3. Items listed by Local Government and State Agencies.

Your search returned 3 records.

Item name [▲]	Address	Suburb	LGA	Information source
Concrete geodesic domes (North Narrabeen Public School)	6 Namona Street	North Narrabeen	Pittwater	LGOV
German rock carvings and associated landscape	[Opposite footbridge] Deep Creek Reserve	North Narrabeen	Pittwater	LGOV
Ocean rock pool	Narrabeen Beach	North Narrabeen	Pittwater	LGOV

There was a total of 3 records matching your search criteria.

Key:

LGA = Local Government Area

GAZ = NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.

Note: While the Heritage Division seeks to keep the Inventory up to date, it is reliant on State agencies and local councils to provide their data. Always check with the relevant State agency or local council for the most up-to-date information.


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Document Status

Rev No.	Author	Reviewer	Approved for Issue		
		Name	Name	Signature	Date
0	Sahani Gunatunge/ Andrew Lau	Andrew Lau	Andrew Lau		13/02/2019

