CONSULTING EARTH SCIENTISTS

SAMPLING, ANALYTICAL AND QUALITY PLAN AMMONIA MONITORING PROGRAMME – BICENTENNIAL RESERVE FORMER LANDFILL SMALL STREET, WILLOUGHBY NSW 2068

PREPARED FOR WILLOUGHBY CITY COUNCIL

CES DOCUMENT REFERENCED: CES210306-WIL-AU

Written by: F. Deilamy

Reviewed by: V. Arias

SC41156 & CEnvP (General) 682

Authorised by: D. Lowe

Client: WILLOUGHBY CITY COUNCIL
CHATSWOOD NSW
Ground Level, 31 Victor Street

Date: 2 May 2024

Level 1, Suite 3, 55 Grandview Street, Pymble • NSW 2073 • Australia • www.consultingearth.com.au
Telephone: 02 8569 2200 • **Fax**: 02 9983 0582 • www.consultingearth.com.au

Document Control

SAMPLING, ANALYTICAL AND QUALITY PLAN
AMMONIA MONITORING PROGRAMME –
BICENTENNIAL RESERVE FORMER LANDFILL
SMALL STREET, WILLOUGHBY NSW 2068
PREPARED FOR WILLOUGHBY CITY COUNCIL
CES DOCUMENT REFERENCED: CES210306-WIL-AU

Distribution Register

Digital copy	Recipient	Location
1	David Roberts (Environment Manager)	PO Box 57 Chatswood NSW 2057
1	CES Library	Consulting Earth Scientists Pty Ltd

The Distribution Register identifies the recipients of issued copies of this report.

Revision Register

Issue Number	Revision Date	Description
0.0	19 January 2024	SAQP Ammonia Monitoring Programme
1.0	25 January 2024	SAQP Ammonia Monitoring Programme
2.0	06 March 2024	SAQP Ammonia Monitoring Programme (Addresses NSW EPA comments)
3.0	2 May 2024	SAQP Ammonia Monitoring Programme (Addresses Additional NSW EPA comments)

The revision register tracks changes to the document.

The latest revision of this document supersedes all previous revisions. It is the responsibility of the recipient to ensure that superseded revisions of this document are removed from circulation.

Documents are only valid if they are signed, original documents issued by CES. CES does not accept any liability for actions taken based upon incomplete copies of this document.

SAMPLING, ANALYTICAL AND QUALITY PLAN
AMMONIA MONITORING PROGRAMME –
BICENTENNIAL RESERVE FORMER LANDFILL
SMALL STREET, WILLOUGHBY NSW 2068
PREPARED FOR WILLOUGHBY CITY COUNCIL
CES DOCUMENT REFERENCED: CES210306-WIL-AU

TABLE OF CONTENTS

1 INTRODUCTION 6
1.1 ORGANISATION OF THIS SAQP 6
1.2 OBJECTIVES AND SCOPE 6
2 SITE IDENTIFICATION AND ENVIRONMENTAL SETTING 8
2.1 SITE IDENTIFICATION 8
2.2 SITE ZONING AND LAND USE 8
2.3 SURROUNDING LAND USE 9
2.4 TOPOGRAPHY 9
2.5 HYDROLOGY 10
2.6 GEOLOGY 10
2.7 SOILS 11
2.8 ACID SULFATE SOILS 11
2.9 HYDROGEOLOGY 11
2.10 ADDITIONAL INFORMATION 12
3 REVISED CONCEPTUAL SITE MODEL 13
3.1 POTENTIAL SOURCES OF CONTAMINATION 13
3.1.1 Former Landfill and Municipal Waste Incineration Activities 13
3.2 POTENTIAL PATHWAYS 14
3.3 RECEPTORS 14
4 DATA QUALITY OBJECTIVES 15
4.1 STEP 1 – STATE THE PROBLEM 15
4.2 STEP 2 – IDENTIFY THE DECISION STATEMENT 15
4.3 STEP 3 – IDENTIFY INPUTS TO THE DECISION 16

4.4 STEP 4 – DEFINE THE STUDY BOUNDARIES 16
4.5 STEP 5 – DEVELOP THE DECISION RULE 16
4.6 STEP 6 – SPECIFY LIMITS ON DECISION ERRORS 19
4.7 STEP 7 – OPTIMISE THE FIELDWORK PROGRAM DESIGN 19
5 HEALTH AND SAFETY 20
6 SAMPLING AND ANALYSIS SCHEDULE 21
6.1 SAMPLING LOCATIONS 21
6.1.1 Groundwater 21
6.1.2 Surface Water 21
6.2 SAMPLING FREQUENCY 22
6.3 ANALYSIS SCHEDULE 22
7 SAMPLE PRESERVATION, CONTAINERS, HOLDING TIMES 23
8 DOCUMENTATION OF SAMPLING AND FIELD ACTIVITIES 24
8.1 SAMPLE IDENTIFICATION 24
8.2 FIELD DATA SHEETS 24
8.3 SAMPLE LABELLING 25
8.4 CHAIN OF CUSTODY FORMS 25
8.5 LABORATORY ANALYSIS REPORTS 26
9 SAMPLE PACKAGING, HANDLING AND STORAGE 28
10 QUALITY ASSURANCE AND QUALITY CONTROL PROGRAMME 29
10.1 FIELD QA/QC PROGRAMME 29
10.1.1 Environmental Samples 29
10.1.2 Blind Replicates 29
10.2 LABORATORY QA/QC PROGRAMME 29
10.2.1 Laboratory Duplicate Samples 30
10.2.2 Standards 30
10.2.3 Laboratory Control Samples 30
10.2.4 Matrix Spike 30
10.2.5 Method Blanks 30
11 SAMPLING METHODS 31
11.1 GROUNDWATER 31

11.2 SURFACE WATER 31
12 DATA ACCEPTANCE CRITERIA 33
12.1 FIELD MEASUREMENTS 33
12.2 ANALYTICAL DATA 33
12.3 HOLDING TIMES 33
13 ASSESSMENT CRITERIA 34
13.1 AUSTRALIAN AND NEW ZEALAND GUIDELINES FOR FRESH AND MARINE WATER QUALITY 34
14 REPORTING TO CLIENT 35
15 REFERENCES 36

LIST OF TABLES

Table 1. Investigation Area - Lot and Deposited Plan
Table 2. Adjacent Land Uses
Table 3. Laboratory Data Quality Indicators/ QA/QC Data Acceptance Criteria
Table 4: Monitoring Program
Table 5: Groundwater Monitoring Wells Locations
Table 6: Analytical Program
Table 7: Sample preservation, containers, colour codes and maximum holding times

LIST OF FIGURES

Figure 1: Site Location
Figure 2: Sampling Locations

LIST OF APPENDICES

Appendix A: Project Safety Plan

1 INTRODUCTION

Consulting Earth Scientists Pty Ltd (CES) was commissioned by Willoughby City Council (the Client) to prepare a Sampling, Analytical and Quality Plan (SAQP) prescribing the requirement for monitoring of ammonia concentrations in surface water and groundwater at the Bicentennial Reserve located on Small Street, Willoughby, NSW 2068 (the site).

A Voluntary Management Proposal (VMP) has been prepared for the site. Objective 2 of the VMP indicates “Development and Implementation of a Sampling, Analytical and Quality Plan (SAQP)” To satisfy this objective the SAQP (this document) will define the sampling locations, frequency and protocols to be implemented and specify the quality assurance and quality controls (QAQC) applicable to the sampling.

This Sampling and Analysis Quality Plan (SAQP) provides an outline of methods and protocols to be adopted by CES in order to provide the Client with quality assured, accurate and useful data to meet or exceed the environmental objectives established by the organisation and the Environment Protection Authority (EPA).

1.1 ORGANISATION OF THIS SAQP

This SAQP will be finalised and issued as a “controlled document”. Revisions will be incorporated into the document as required. Requests for modifications to this document should be made in writing to the author. Copies of all updates will be issued to all people listed on the covering page of this plan as required.

1.2 OBJECTIVES AND SCOPE

The principal objectives of this SAQP are to:

(i) Ensure good communication between CES, the Client and the analytical laboratory (Envirolab Services Pty Ltd);

(ii) Document field methods and QA/QC procedures to ensure that appropriate and valid data are collected.

This document will guide the project manager, field sampling personnel and analytical laboratory and allow the Client personnel to monitor quality control during the monitoring programme. The scope of this SAQP includes:

(i) A sampling and analysis schedule including analytical methods, container and preservation requirements;

(ii) Procedures for groundwater and surface water sampling;

(iii) Procedures for field measurements;

(iv) Procedures for documenting field and sampling activities;

(v) Outline of field and laboratory QA/QC programme;

(vi) Data Quality Objectives (DQOs) and procedures for data management and reporting.

2 SITE IDENTIFICATION AND ENVIRONMENTAL SETTING

2.1 SITE IDENTIFICATION

The site consists of the Bicentennial Reserve former landfill, NSW 2068 inclusive of the following lots:

Table 1. Investigation Area - Lot and Deposited Plan

Full Lots	
Lot 869 in DP 752067	Lot 1 in DP 125620
Lot 2 in DP 57586	Lot 1 in DP 115636
Lot 3 in DP 522788	Lots 1 & 2 in DP 115624
Lot 1 in DP 524253	Lot 702 in DP 778776
Lot 1 in DP 334861	Lot 1 in DP 5889
Lot 7 in DP 666241	Lot 1 in DP 399
Lots 111, 112 & 113 in DP 129029	Lots 20 & 22 in DP 977176
Lot 2 in DP 332680	Lot C in DP 316969
Lot 21 in DP 1257434	Lots 1 & 2 in DP 115622
Lot 3 in DP 506449	Lot 1 in DP 125619
Lot 1 in DP 315723	Lot 1 in DP 725764
Lot 7 in DP 524254	Lot 21 in DP 977176
Partial Lots	
Lot 1 in DP81035	Lot 1 in DP 963964
Lot C in DP 360612	

Coordinates (approximate centre of site): Easting: 333659.70 Northing: 6257219.71

The site location is shown in Figure 1.

2.2 SITE ZONING AND LAND USE

The current land use zoning is defined by the Land Zoning Map – (Willoughby Local Environmental Plan 2012) and is currently listed as Public Recreation – RE1.

Previous Environmental Site Investigation CES, 2022 (CES Document Ref.: CES210306-WIL-AD Dated 5 April 2022) indicated that:

"The site currently serves as a multipurpose sporting, community recreation and environmental management area. Situated in the north central portion of the site is the prominent Willoughby

Leisure centre, which includes indoor sporting facilities (basketball and aerobics) and an indoor pool in the eastern and western wings, respectively. Adjoining south of the leisure centre are extensive tarmacked surfaces, purposed as netball courts to the south-west and mixed netball and basketball courts to the south-east. A level car park is situated adjacent west to the leisure centre, while secondary terraced parking is located along the drive-through loop, situated directly south of the netball courts.

Located in the south-eastern and western ends of the site are the Flat Rock International Baseball Diamond and the Bicentennial Oval, respectively. These playing fields are characterised by level grassy areas and open-air dugouts/shelters positioned along their boundaries. Hallstrom Park Playground is situated just north of Bicentennial Oval, encompassing the north-western corner of the site. The playground comprises a children's bike track, picnic and barbeque facilities, level lawn areas, and three structures; one of which is understood to be a toilet block.

The former waste incinerator is situated in the north central portion of the site and is positioned between Hallstrom Park Playground to the west and Willoughby Leisure Centre to the east. The retrofitted structure currently acts as a café and art gallery.

Walkways and accessible bushland paths can be found extending across the southern and eastern boundaries of the site."

2.3 *SURROUNDING LAND USE*

The surrounding land use (CES Document Ref.: CES210306-WIL-AD Dated 5 April 2022) is described in Table 2:

Table 2. Adjacent Land Uses

Orientation	Description
North	Small Street borders the site to the north with low density residential properties beyond.
West	High density residential properties to the west of Willoughby Road, with Tree of Life Early Learning School
East	Flat Rock Drive borders the site area to the east, crossing above Small Street as an overpass.
South	Garland Road, with low density residential properties

2.4 *TOPOGRAPHY*

The topography of the site was presented in CES Document Ref.: CES210306-WIL-AD Dated 5 April 2022 and can be summarised as follows:

- *"The site is located within an infilled natural gully, historically referred to as Flat Rock Gully, and occupies the valley between South Willoughby and Naremburn."*

- *"the site follows two distinct slope planes: (1) a main slope extends in a nominal north to south direction, decreasing abruptly in elevation across terracing from approx. 60 m AHD at the northern site boundary to 48 m AHD along the infilled gully floor under which Flat Rock Creek flows within a concrete culvert; and (2) a cross slope extending from the north-western corner of the site to the south-eastern, decreasing in elevation from approx. 60 m AHD to between 40-45 m AHD at the point Flat Rock Creek re-emerges into a gorge. "*

2.5 HYDROLOGY

The hydrology of the site was presented in CES Document Ref.: CES210306-WIL-AD Dated 5 April 2022 and can be summarised as follows:

- "*There are many marked surface water/drainage systems located on-site, including the culverted Flat Rock Creek which intersects the site in a west to east direction across the central southern portion of the site. It is understood that the culvert is located underneath the waste and flows from west to east. However, the Environmental Site Assessment (ESA) (EESI, 2019) indicates that the culvert lies underneath a footpath and flows in an east to west direction. "*
- *"Flat Rock Creek is naturalised and forms a ravine at Flat Rock Gully between Naremburn and Willoughby. The substrate of Flat Rock Creek consists of bedrock at the valley floor and an alluvium bed where the creek becomes tidally influenced downstream. The natural drainage characteristics of the Flat Rock Creek catchment have been altered by residential, commercial and industrial development. The creek is predominantly a concrete lined (open and closed) stormwater channel draining the suburbs of Artarmon, Naremburn and Willoughby. The channel travels underground through a culvert from between Grandview Drive at Naremburn and Flat Rock Drive at Willoughby and has low flows during dry weather. Flat Rock Creek at its downstream reach drains a relatively steep catchment characterised by rocky riffle/runs with low to moderate flow during dry weather. The end point is a tidally influenced naturalised estuary at the base of Flat Rock Gully discharging into Long Bay".*
- *"A review of the Sharing and Enabling Environmental Data (SEED) interactive flood planning area did not highlight the site as being in a flood prone area that would require additional management."*
- *"Drainage from the site is likely to be downslope to the south (in the central northern part of the site) as a result of the site's topography."*

2.6 GEOLOGY

The geology of the site was presented in CES Document Ref.: CES210306-WIL-AD Dated 5 April 2022 and can be summarised as follows:

- *"The site is located within the Sydney Basin and noted on the Sydney 1:100,000 Geological Sheet 9130 (Herbert, 1983) to be underlain by manmade fill underlain by Middle Triassic aged medium to coarse grained quartz sandstone (Hawkesbury Sandstone)."*
- *"fill materials at the site range from shallow (<3 m deep) in the north of the site, nearing Small Street, to a maximum depth of 33 m towards the south-east of the site. Anecdotal evidence of fill depths of up to 50 m have been noted (McKillop, 2012).*

2.7 SOILS

The site is classified within the Soil Landscapes of the interactive website eSPADE from the NSW Department of Planning, Industry and Environment (DPIE), and defined as 'disturbed terrain'. This landscape is terrain disturbed by human activity and includes areas of artificial fill with demolition rubble, industrial and household waste.

2.8 ACID SULFATE SOILS

According to the Willoughby Local Environmental Plan (LEP) (2012) Acid Sulfate Soils map – Sheet ASS_004, the site is identified as being within a Class 5 acid sulfate soil risk area.

Class 5 corresponds with an extremely low likelihood of acid sulfate soil occurrence during any excavation works. Salinity is not known to present a risk within the Willoughby Council area.

2.9 HYDROGEOLOGY

The hydrogeology of the site was presented in CES Document Ref.: CES210306-WIL-AD Dated 5 April 2022 and can be summarised as follows:

- *"Groundwater flow as local flow systems via the underlying Hawkesbury Sandstone bedrock.*
- *West to east groundwater flow direction (Jacobs. 2020).*
- *CES 2022 Environmental Site Investigation (CES Document Ref.: CES210306-WIL-AD Dated 5 April 2022) identified ten groundwater bores within a 500 m radius of the site. All ten private bores were located approximately 200 to 250 m to the northeast of the site and ranged in depth between 4.5 and 8.0 m in depth and were used for monitoring purposes.*
- *One moderate potential groundwater dependant ecosystem (GDE) has been identified approximately 175 m to the east of the, with a High potential GDE located 650 m to the east of the site."*

2.10 ADDITIONAL INFORMATION

For the following additional site information refer to CES Document Ref.: CES210306-WIL-AD Dated 5 April 2022:

- Meteorology
- NSW Contaminated Site Register
- NSW PFAS Investigation Programme
- Site History
- Previous Environmental Reports

3 REVISED CONCEPTUAL SITE MODEL

The Revised Conceptual Site Model (RCSM) was presented in Section 14 of CES Document Ref.: CES210306-WIL-AD Dated 5 April 2022 and has been derived based on the information and data collected during the site investigation completed in 2022. The RCSM is represented in the below sections.

3.1 *POTENTIAL SOURCES OF CONTAMINATION*

The following potential contamination sources are relevant to the site:

3.1.1 Former Landfill and Municipal Waste Incineration Activities

"There are no changes to the potential sources of contamination indicated in the Preliminary Conceptual Site Model (PCSM). The landfill remains the key contaminant source.

The site was used as a landfill from approximately 1930 to 1980. This included a waste incinerator, commissioned in 1934, in response to the management of waste generated by the Willoughby community. Based on a review of the historic aerial imagery and anecdotal information, landfilling activities appear to have occurred across the entirety of the site, however, the bulk of the waste tipping was determined to have taken place across the central and eastern portions of the site.

In consideration of the site-wide landfilling activities, the innate heterogeneity of anthropogenic landfilled waste and the concentrations detected in soil, groundwater and surface water, the following COPCs were identified:

- *Heavy metal concentrations in groundwater (cadmium, chromium, copper, lead and zinc) were detected in the upgradient monitoring well (GW101) and chromium in GW105. Otherwise, the metal concentrations detected in groundwater were below the adopted screening criteria. In particular, elevated heavy metals were not detected in the downgradient monitoring wells;*
- *Ammonia in groundwater was detected above the pH corrected ammonia trigger value in the central and eastern parts of the site (GW105 and GW107). It is noted that ammonia concentrations reduce between GW105 and GW107 by an order of magnitude; and*
- *Ammonia in surface water in the downstream sampling location in Flat Rock Creek exceeded the adopted screening criteria and the ammonia concentration was higher than the upstream sampling location.*

It is noted that no contaminants were identified in soil which represented a human health or ecological risk during this investigation."

3.2 *POTENTIAL PATHWAYS*

"The pathways through which contaminants may reach receptors are in part dependent on the nature and behaviour of the contaminant. The following potential pathways have been identified:

- *Leaching of contaminants from site fill / soils into groundwater;*
- *Lateral migration of contaminants in leachate (dissolved and immiscible phases) to surface waters (Flat Rock Creek).*

Preferential flow pathways may be provided by:

- *More permeable layers within the fill and / or natural strata; and*
- *Underground services e.g. water pipes and drainage networks that may transect the site."*

3.3 *RECEPTORS*

"Potential sensitive receptors (on and off-site) are listed below:

- *Underlying aquifer (groundwater); and*
- *Sensitive ecological (aquatic and terrestrial) receptors supported by Flat Rock Creek.*

The groundwater dependant ecosystems located off-site and to the south east of the subject site are not in hydraulic continuity with the groundwater underlying the landfill, or the leachate. As a result, the GDEs are not considered to be a receptor."

4 DATA QUALITY OBJECTIVES

The DQO process is a seven-step iterative planning approach that is used to define the type, quantity and quality of data needed to inform decisions relating to the objectives of the investigation.

4.1 STEP 1 – STATE THE PROBLEM

This step comprises a summary of the environmental impact that will require new environmental data and identifies the resources required to resolve the issue.

The objective of the programme of ammonia monitoring is to establish fluctuations in ambient ammonia concentrations and responses to seasonal changes and climatic events, and to ascertain if natural attenuation of ammonia is occurring at the site. The monitoring will provide information to confirm whether an Ecological Risk Assessment (ERA) of Flat Rock Creek is warranted.

The consultant project team will comprise Victor Arias (Senior Environmental Scientist, CENVP:SC), Fred Deilamy (Environmental Scientist) and Shaun Claughton (Environmental Scientist) as the field team.

The Sub-contract analytical laboratories are Envirolab (Primary) and ALS (Secondary).

The revised conceptual site model is presented in Section 3.

4.2 STEP 2 – IDENTIFY THE DECISION STATEMENT

This step comprises the identification of decisions that need to be made about the impact and the new environmental data required to make them.

- What are the ammonia concentrations identified in the Revised Conceptual Site Model in surface water and groundwater?
- Do ammonia concentrations exceed the adopted screening criteria?
- Is natural attenuation of ammonia occurring at the site?
- Do ammonia concentrations pose an unacceptable risk to human health or the environment?
- Is an Ecological Risk assessment of Flat Rock Creek needed?
- Is remediation or management of contaminated media required?

It is expected that by resolving these questions, it will be possible to resolve the objectives of the project.

4.3 STEP 3 – IDENTIFY INPUTS TO THE DECISION

This step involves the identification of the information required to support any decision and whether any new environmental data will be required.

- Relevant existing groundwater and surface water data from previous environmental site assessments and investigations;
- New groundwater and surface water laboratory analytical data collected, field observations and measurements made during field work;
- The adopted site screening criteria for ammonia is discussed in Section 13.

4.4 STEP 4 – DEFINE THE STUDY BOUNDARIES

This step involves the spatial and temporal aspects of the environmental media that the data must represent to support the decision (s).

- Lateral – as defined by the site perimeter shown on Figure 2;
- Vertical – as defined to the maximum depth of the deepest existing groundwater monitoring well, estimated to be 53.16 m (Elevation top of casing) and
- This project involves the collection of spot sampling events at the proposed locations. As a result, the concentrations detected by the laboratory in the samples recovered will be representative of discrete moments in time and as such, will be subject to climatic and anthropogenic activities at that point or related to human activities that have occurred up to that point at the particular sampling location, and therefore may not be representative of long-term concentrations. If average concentrations are required to enable an understanding of longer term (chronic) risks, then additional sampling may be required.

4.5 STEP 5 – DEVELOP THE DECISION RULE

This step comprises defining the parameter of interest, specifying the action level and integrating Step 1 to 4 into a single statement that gives a logical basis for choosing between alternative actions.

- The acceptable limits for the QA/QC samples collected during the investigation are presented in Table 3;
  A decision on the acceptance of the analytical data will be made on the basis of the Data Quality Indicators (DQI) in the context of the PARCC parameters as follows.
    - Precision: A quantitative measure of the variability (or reproducibility) of data;
    - Accuracy: A quantitative measure of the closeness of reported data to the “true” value;

  - Representativeness: The confidence (expressed qualitatively) that data is representative of each media present on Site;
  - Completeness: A measure of the amount of useable data from a data collection activity; and
  - Comparability: The confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event.
- The parameters of interest are the concentrations in the various sampled media of the contaminants of concern;

The following decision rules are presented:

1. Is the data collected of suitable quality?
2. Do ammonia concentrations exceed the adopted screening criteria?
3. Do ammonia concentrations pose an unacceptable risk to human health or the environment?
4. Do ammonia concentrations are naturally attenuating?
5. Is an Ecological Risk assessment of Flat Rock Creek needed?
6. Is remediation or management of contaminated media required?

Table 3. Laboratory Data Quality Indicators/QA/QC Data Acceptance Criteria

QA/QC Sample Type	Method of Assessment	Acceptable Range
Field QA/QC		
Blind and Split Replicates	The assessment of split replicate is undertaken by calculating the Relative Percent Difference (RPD) of the replicate concentration compared with the original sample concentration. The RPD is defined as: $RPD = 100 \times \frac{\lvert X_1 - X_2 \rvert}{Average}$ Where: X_1 and X_2 are the concentration of the original and replicate samples.	*The acceptable range depends upon the levels detected:* ▪ *0 – 100% RPD (When the average concentration is < 5 times the PQL)* ▪ *0 – 75% RPD (When the average concentration is 5 to 10 times the PQL)* ▪ *0 – 50% RPD (When the average concentration is > 10 times the PQL)*
Blanks (Rinsate, Trip and Field Blanks)	Each blank is analysed as per the original samples.	*Analytical Result < PQL*
Laboratory-prepared Trip Spike	The trip spike is analysed after returning from the field and the % recovery of the known spike is calculated.	*70% - 130%*
Laboratory QA/QC		
Laboratory Duplicates	Assessment as per Split Replicates.	*The acceptable range depends upon the levels detected:* ▪ *0 – 100% RPD (When the average concentration is < 4 times the PQL)* ▪ *0 – 50% RPD (When the average concentration is 4 to 10 times the PQL)* ▪ *0 – 30% RPD (When the average concentration is > 10 times the PQL)*
Surrogates Matrix Spikes Laboratory Control Samples	Assessment is undertaken by determining the % Recovery of the known spike or addition to the sample. $\% \text{ Recovery} = 100 \times \frac{C - A}{B}$ Where: A = Concentration of analyte determined in the original sample; B = Added Concentration; C = Calculated Concentration.	Surrogates: 70% – 130% Matrix Spikes: 70% - 130% (Organics) 80% - 120% (Inorganics) LCS: 70% - 130% (Organics) 90% - 110% (Inorganics)
Method Blanks	Each blank is analysed as per the original samples.	*Analytical Result < PQL*
Note: *PQL = Laboratory Practical Quantitation Limit or the minimum detection limit for a particular analyte.*		

4.6 STEP 6 – SPECIFY LIMITS ON DECISION ERRORS

This step involves specifying the decision-maker's acceptable limits on decision errors.

Specific limits for this project are in accordance with the appropriate guidance made or endorsed by the NSW EPA, appropriate indicators of data quality, and standard procedures for field sampling and handling. As such, even with the collection of robust field data, there will be inherent uncertainty in conclusive/summary statements based on the assessment undertaken.

4.7 STEP 7 – OPTIMISE THE FIELDWORK PROGRAM DESIGN

The optimised program for the fieldwork is presented as Section 6.

5 HEALTH AND SAFETY

A Project Safety Plan (PSP) is presented in Appendix A. CES field staff will be supplied with the following Personal Protective Equipment (PPE):

- Mobile phone;
- UHF Radio;
- Leather, steel-capped boots;
- Safety vest (to be worn at all times);
- Hard hats (to be worn at all times);
- Cotton drill overalls or similar clothing;
- Un-powdered latex gloves;
- First aid kit (vehicle) including crepe bandages; and
- Sun block and sun hat (as required);
- Four wheel drive vehicle;
- Safety glasses; and
- Snake gaiters/guards.

Complete site induction, Develop induction and obtain Permit to Work (PTW) prior to commencing work. Reporting procedures including scheduled calls to CES offices will be arranged as required.

The field team is to call the CES office on each field day in order to notify regarding progress and expected time of departure. CES will also notify the client contact 10 business days prior to site attendance.

Emergency contact numbers are:

- Shaun Claughton 0403 273 626;
- Thomas Marback 0499 071 665;
- Fred Deilamy 0427028047
- Victor Arias 0439 261 637;
- Duncan Lowe 0407 013 990.

6 SAMPLING AND ANALYSIS SCHEDULE

The environmental monitoring program for the site is presented below:

Table 4: Monitoring Programme

Type	Locations	Programme	Frequency	Testing Suite
Groundwater	GW101 GW105 GW107	Ammonia monitoring	Quarterly	Ammonia
Surface Water	US DS1 DS2	Ammonia monitoring	Quarterly	Ammonia

6.1 SAMPLING LOCATIONS

6.1.1 Groundwater

There are three groundwater monitoring bores GW101, GW105 and GW107 included in the environmental monitoring programme (see Table 5).

Each of the groundwater monitoring bore locations are shown in Figure 2 and the coordinates provided below.

Table 5: Groundwater Monitoring Wells Locations

Site ID	Easting	Northing	Elevation top of casing	Depth to Water (mBTOC)
GW101	333385.6	6257333.3	53.16	7.25
GW105	333760.3	6257194.6	50.84	27.93
GW107	333956.5	6257083.6	44.25	22.81

6.1.2 Surface Water

Surface water sampling of Flat Rock Creek is at two locations downstream of the site (sampling locations referenced DS1 and DS2) and one surface water sampling location upstream of the site (referred to as sampling location US).

The sampling locations are shown in Figure 2

6.2 SAMPLING FREQUENCY

The sampling frequency is quarterly monitoring of surface water sampling locations US, DS1 and DS2 and groundwater monitoring locations GW101, GW105 and GW107.

6.3 ANALYSIS SCHEDULE

Collected samples will be submitted for analysis of ammonia to a NATA accredited laboratory (Envirolab).

In addition, the following field parameters will be incorporated into the monitoring:

- pH,
- Electric Conductivity (EC),
- temperature,
- Dissolved Oxygen, and
- Redox Potential

The analysis schedules, including field parameters are presented in Table 6.

Table 6: Analytical Program

Parameter	Unit	PQL	Sampling Method	GW101, GW105 and GW107 (Quarterly)	US, DS1 and DS2 (Quarterly)
Standing Water Level	m	+/- 0.01 m BTOC	Decontaminated dip meter	✔	-
pH (field)	Units	0.1	Field Meter	✔	✔
Electrical Conductivity (field)	uS/cm	1	Field Meter	✔	✔
Dissolved Oxygen (field)	mg L^{-1}	0.01	Field Meter	✔	✔
Redox (field)	mV	+/- 1	Field Meter	✔	✔
Temperature (field)	^{o}C	0.1	Field Meter	✔	✔
Ammonia as N	mg/L	0.005	Grab sample	✔	✔

7 SAMPLE PRESERVATION, CONTAINERS, HOLDING TIMES

The addition of preservatives to water samples is required in order to maintain sample integrity. Similarly, containers must be appropriately selected and cleaned to prevent sample contamination. Strict adherence to sample holding times is also necessary in order to ensure that laboratory data are representative of field conditions. Sample preservation, container selection and holding times conform to the requirements of APHA 20th Edition *Standard Methods for the Examination of Water and Wastewater*. Methods generally also conform to AS/NZS 5667.1:1998 (R2016) for water quality sampling.

Sample bottles used in the monitoring programme shall be colour coded to prevent confusion and incorrect labelling. Sample preservation, containers, colour codes and maximum holding times adopted are listed in Table 7.

Table 7: Sample preservation, containers, colour codes and maximum holding times.

Analytes	Minimum Volume Required (mL)	Type	Preservative	Colour Code	Field Filtered	Holding Time
Ammonia	250	Glass or Plastic	H_2SO_4	Purple	No	28 days

8 DOCUMENTATION OF SAMPLING AND FIELD ACTIVITIES

A copy of this SAQP as well as multiple blank copies of the COC and Field Data Sheets (FDS) will be carried into the field. All relevant correspondence, COCs, laboratory reports are to be stored in a dedicated project file. The file is clearly marked with the project code. COCs and Sample Receipt Acknowledgement (SRA) will be stored in a dedicated section of the project file. Similarly, field data sheets and laboratory reports will also be stored in separate, clearly marked, dedicated sections of the project file.

Instructions on the use of FDS, field notes, sample labels and COCs are provided in subsequent sections.

8.1 SAMPLE IDENTIFICATION

Each sample is to be labelled according to the location ID. Laboratory sample identification may also be entered upon receipt of results. Sample identifications are to be quoted on COCs and field data sheets.

8.2 FIELD DATA SHEETS

All field measurements, observations and comments are to be recorded on the FDS. Details to be included on the sheets include:

- CES project code;
- Name of project manager;
- Project location;
- Sampler(s);
- Signature of sampler;
- Sample identification (ID);
- Site name;
- Date (dd/mm/yyyy);
- Time (hh:mm, twenty four hour clock);
- Calibration details;
- Field measurements (pH, Eh, EC, DO, water temperature, turbidity as required);
- Comments (flow conditions, water odour, algal growth, debris, log of any photographs taken); and
- Page numbers. “Page 1 of 1” when only a single sheet and “Page X of Y” when multiple sheets used.

Additional notes are to be recorded on separate sheets of paper or on the back of the FDS. Separate sheets are to be attached to the FDS at the conclusion of field work. Comments on the FDS will refer to the attached sheets as appropriate.

FDS are to be completed using permanent blue or black ink.

8.3 SAMPLE LABELLING

Samples are to be labelled in blue or black indelible ink. Only biros or xylene-free permanent markers are to be used to label samples. Every sample label will include the following elements:

1. Project identification name and/or number
2. Sample identification number unique to the sample (Section 8.1);
3. Date and time of sample collection; and
4. Field technician's initials.

8.4 CHAIN OF CUSTODY FORMS

The handling of all samples collected must be traceable from the time of collection, through sample transport, analysis and final disposal. This documentation of sample collection and transport history is referred to as a COC. The chain of custody records to be maintained for all water, leachate and dust samples are described below.

A sample is considered under the custody of a particular person if it is:

1. In that persons physical possession;
2. Placed in a secure place by that person;
3. Not recorded to have been transferred to another person or party with proper notation on the COC documents.

As detailed in Section 9, samples will be placed in a cooler containing ice and/or ice bricks immediately following collection. At the conclusion of each field day, a Consulting Earth Scientists Custody Seal will be placed on each cooler. Samples will be collected by a courier for transport to the laboratory. The following details are to be completed on COC forms in indelible blue or black ink:

- CES contact details including project manager and sampler;
- Laboratory address and contact details;
- Date dispatched and date results required (10 working days otherwise notify);
- Number of pages ("Page 1 of 1" when only a single sheet and "Page X of Y" when multiple sheets used);

- CES project identification name and number of sampling round (ie, Round 1 being the first round);
- Laboratory quote number containing references to required PQLs;
- Account code;
- Released for CES (name and signature);
- List of samples (list by sample ID);
- Date and time of sample collection (twenty four hour clock);
- Matrix;
- Comments (note samples potentially containing hazardous materials);
- Total number of containers for each sample;
- List of analytes, preservation, bottle colour;
- Total number of bottles submitted for analysis; and
- Laboratory representative is to sign and date the COC to document the change of sample custody.

Where possible, COC forms should be emailed directly to the laboratory (no cover letter required) prior to pickup in order to expedite the process of sample log in.

Upon arrival at the laboratory the COC will be checked against samples delivered, signed, copied by laboratory staff and faxed to CES together with a laboratory "SRA". The laboratory will contact CES immediately if discrepancies are noted between the samples listed on the COC and those delivered.

Envirolab will email a signed copy of the COC within 24 hours of receipt along with a SRA. COCs and sample acknowledgement forms will be stapled, checked and placed in clearly labelled, dedicated manila folders in the project file.

8.5 LABORATORY ANALYSIS REPORTS

The laboratory analysis reporting format shall include the following:

- Date issued;
- Report number;
- Page;
- Client;
- Sample type;
- Date sampled;
- Laboratory numbers;
- Reference;

- Method;
- Results;
- QA Appendices;
- Authorising chemist;
- Copy of signed COC form;
- Date of sample extraction for each test;
- Date of sample analysis for each test;
- Preservation compliance;
- Holding time compliance;
- COC compliance and;
- Envirolab QA/QC compliance and specific comments with respect to the analysis of each batch of samples.

In addition, the listing of results will include sample location, PQL, units of measurement and analytical details if required.

When results (waters) appear unusual or anomalous CES will corroborate the results with the laboratory within 5 working days.

9 SAMPLE PACKAGING, HANDLING AND STORAGE

Samples will be placed in coolers containing ice bricks immediately following collection to maintain temperatures at 4^{o}C. Samples will be collected by a courier for transport to the laboratory.

Sample pickup for Envirolab couriers will be organised with the laboratory at least 24 hours prior to field sampling (Ph: 9910 6200). Samples for Envirolab are to be transported on Envirolab COC forms.

Samples will be transported under a CES COC. The use of COCs is explained in Section 8.4.

10 QUALITY ASSURANCE AND QUALITY CONTROL PROGRAMME

10.1 FIELD QA/QC PROGRAMME

As part of our QA/QC protocols, we will collect quality control intra-laboratory duplicate at each monitoring event. The QA/QC sample will be analysed for the same analytical suite as the primary samples i.e. ammonia.

10.1.1 Environmental Samples

Environmental samples are the representative samples of surface-water and groundwater collected for analysis to determine aspects of their chemical composition. Environmental samples are the original sample taken from a particular location and other samples are replicates or triplicates of the original.

10.1.2 Blind Replicates

Blind replicate samples otherwise known as ‘intra-laboratory duplicates’ or “field duplicates’ are provided by the collection of two environmental samples from the same location or successively from the same monitoring bore. These samples are preserved, stored, transported, prepared and analysed in an identical manner. As a minimum, the results of analyses on the blind replicate sample pair are assessed by calculating the Relative Percentage Differences (RPDs) between the results. The RPD is calculated as the difference between the results divided by their mean value and expressed as a percentage. If the RPD exceeds the value adopted for any analytes, additional investigation will be required, or justification provided for not conducting additional investigation.

Blind replicate samples will be collected at a rate of one per sampling round (one groundwater sample).

10.2 LABORATORY QA/QC PROGRAMME

The reliability of test results from the analytical laboratories will be monitored according to the QA/QC procedures used by the NATA accredited laboratory. The QA/QC programme employed by the NATA registered laboratory specifies sample tracking procedures, methods of extraction, analysis, PQLs and acceptance criteria for results. Laboratory QA/QC procedures adopted by Envirolab Laboratories limited are summarised below. The laboratory QA/QC programme outlined below is consistent with EPA NSW and NEPC requirements.

10.2.1 Laboratory Duplicate Samples

Laboratory duplicates provide data on analytical precision for each batch of samples. Where required and in order to provide sufficient sample for analysis of laboratory duplicate, two batches of samples will be collected at the first site listed on the Chain of Custody form. This is done in order to ensure that sufficient sample is collected. Duplicate analyses are conducted on separate extractions in each instance.

10.2.2 Standards

Calibration standards are prepared from individual certified materials, AR Grade or better reagents purchased as certified mixtures. Stock solutions are replaced every 6 months. Working standards are prepared at least every month from the stock solutions.

10.2.3 Laboratory Control Samples

Laboratory control samples consist of a clean matrix (de-ionised water or clean sand) spiked with a known concentration of the analyte being measured. These samples monitor method recovery in clean samples and can also be used to evaluate matrix interference by comparison with matrix spikes. Laboratory control samples may be certified reference materials.

10.2.4 Matrix Spike

A matrix spikes consist of samples spiked with a known concentration of the analyte being measured, in order to identify properties of the matrix that may hinder method effectiveness. Samples are spiked with concentrations equivalent to 5 to 10 times the EQL. Percent recovery is calculated and reported.

10.2.5 Method Blanks

Method blanks (de-ionised water or clear sand) are carried through all stages of sample preparation and analysis at a rate of 1 per batch or 1 per day. Analyte concentrations in blanks should be less than the stated PQL. Reagent blanks are run if the method blank exceeds the EQL. The purpose of method blanks is to detect laboratory contamination.

11 SAMPLING METHODS

Sampling methods for the programme are presented below. Samples are to be analysed according to the schedule outlined in Section 6.

11.1 GROUNDWATER

Groundwater sampling will be undertaken in accordance with the requirements of *Approved methods for the sampling and analysis of water pollutants in NSW* (NSW EPA 2022), *Environmental Guidelines Solid Waste: Landfill Guidelines* (NSW EPA 2016) and *Contaminated Land Guidelines: Sampling design part 1 – application & Part 2 interpretatio*n (NSW EPA 2022).

- CES Environmental Scientist will attend the site to inspect and carry out a condition assessment of the well headworks condition and develop the groundwater wells requiring monitoring prior to sample collection (i.e. GW101, GW105 and GW107).
- For each location a Field Data Sheet will be completed to record the details of the inspection and sampling including observations of groundwater samples.
- Groundwater samples will be obtained by collection of grab samples using a hydrasleeve or similar.
- During sampling, field parameters (pH, electrical conductivity, redox conditions, dissolved oxygen and temperature) will be monitored and recorded.
- Samples will be labelled with a unique sample identifier and the date of sample collection, and the sample identifier will be recorded on the Field Data Sheet.
- Samples will be immediately placed in an insulated sample transport container in which a suitable cooling medium has been added.
- Samples will be delivered to the NATA accredited laboratory within 24 hours for analysis.
- During sample collection CES field staff with wear nitrile gloves, with new gloves utilised at each sample location.

11.2 SURFACE WATER

Surface water sampling will be completed in accordance with *Approved methods for the sampling and analysis of water pollutants in NSW* (NSW EPA 2022) and *Environmental Guidelines Solid Waste: Landfill Guidelines* (NSW EPA 2016) and *Contaminated Land Guidelines: Sampling design part 1 – application & Part 2 interpretatio*n (NSW EPA 2022).:

- Surface water sampling will be completed by sampling directly from the water body or where available from designed sampling points.

- Sampling will be undertaken by inserting a closed laboratory supplied sampling container with the opening pointing down to avoid the collection of surface films into the water body, using new nitrile gloves. Where practicable, when opening the contained, the container will be positioned more than 10cm from the bottom of the sampled water body to avoid sediment collection and more than 10cm below the surface water level.
- In flowing channels, samples will be collected from as close to the centre of the channel as possible with the container pointed upstream so that gloved hands, sample container, and sampler are downstream of where sample is being collected.
- In non-flowing channels, care will be taken by the sampler to ensure a representative sample is collected.
- During sampling, field parameters (pH, electrical conductivity, redox conditions dissolved oxygen and temperature) will be recorded using decontaminated probes inserted directly into the water body. In flowing waterbodies, the water quality probes will be inserted downstream of the sampling point and in non-flowing waterbodies water quality readings will be collected immediately following sample collection.
- Samples will be labelled with a unique sample identifier and the date of sample collection, and the sample identifier will be recorded on the Field Data Sheet.
- Samples will be immediately placed in an insulated sample transport container in which a suitable cooling medium has been added.
- Samples will be delivered to the NATA accredited laboratory within 24 hours of leaving site.

12 DATA ACCEPTANCE CRITERIA

12.1 FIELD MEASUREMENTS

Instrument calibration may also be checked in the field against standard solutions unless there are clear reasons for deviations. Records of calibration i.e. calibration certificates provided by instrument supplier are to be kept and provide a copy as attachment in the report.

12.2 ANALYTICAL DATA

Data Acceptance Criteria (DAC) for this project is summarised in Table 3.
An investigation will be conducted if results fall outside the QA/QC acceptance criteria. This may include the following steps:

- Check instrument performance;
- Check operator performance;
- Check standard solutions;
- Check sample preparation procedures;
- Repeat analysis 5% of samples in the batch.

If the investigation indicates no difference between results then the report will be issued. Affected results will be flagged with the following statement “QC results not within acceptable criteria”. If the problem occurs again, the Laboratory Manager or QA Supervisor must be notified and no further results reported until the problem has been rectified.

In addition, when results (waters) appear unusual or anomalous CES will corroborate the results with the laboratory within 5 working days.

12.3 HOLDING TIMES

Analytical results will be qualified in terms of holding times for specific analyses. In the event that holding times are exceeded, results will be flagged with the following statement “Holding times not within acceptable criteria”.

13 ASSESSMENT CRITERIA

13.1 AUSTRALIAN AND NEW ZEALAND GUIDELINES FOR FRESH AND MARINE WATER QUALITY

For protection of Aquatic Ecosystems and protection of aquatic foods, the Toxicant Default Guideline Values published in ANZG 2018 Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality (online: http://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants/search) have been selected in substitution of the groundwater investigation levels (GILs) presented in the Guideline on Investigation Levels for Soil and Groundwater (Schedule B1, NEPC, 2013).

ANZG state that freshwater systems typically have slightly to moderately cleared catchments or reasonably intact riparian vegetation (e.g. rural streams receiving runoff from land disturbed to varying degrees by grazing or pastoralism). Therefore, slightly to moderately disturbed ecosystem values (95% species protection) for freshwater have been adopted.

ANZECC & ARMCANZ (2000) in Section 8.3.7 indicates that freshwater trigger values change with pH (due to the different data types and the different equations applicable to each system). As a result, the adopted criteria will be modified in accordance with Table 8.3.7 of ANZECC (2000) with reference to the average pH detected during the groundwater sampling and average pH detected during the surface water sampling.

Previous investigations carried by CES (CES Document Ref.: CES210306-WIL-AD Dated 5 April 2022) indicated that:

- for groundwater the pH generally increases from the north west (GW101, pH of 5.5) towards the south and east (GW107, pH of 6.95). An average pH of 6.3 was detected during the groundwater monitoring and therefore this pH was used to determine the relevant ammonia screening criterion for the site in accordance with Table 8.3.7 of ANZECC & ARMCANZ (2000). The freshwater trigger value for ammonia at a pH of 6.3, is 2.52 mg/L.
- for surface water an average pH of 8.3 was detected during the 2022 monitoring. The freshwater trigger value for ammonia at a pH of 8.3 in surface water is 0.56 mg/L in accordance with Table 8.3.7 of ANZECC (2000).

14 REPORTING TO CLIENT

Reporting requirements on this project are as follows:

- Following the completion of the Quarterly and yearly monitoring of surface waters located at US, DS1 and DS2 and groundwater wells GW101, GW105 and GW107 a Quarterly monitoring report issued incorporating the fieldwork description, the monitoring results including reporting of pollutants in the standard measurement units.
  The report is to be prepared and submitted to the Client in PDF format within 28 days from the day of site attendance.

15 REFERENCES

ANZECC & ARMCANZ 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality,* Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

ANZG 2018. *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.

AS/NZS 5667.1:1998 (R2016): *Australian/New Zealand Standard. Water quality – sampling. Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples*. Standards Australia, Standards New Zealand, 56 pp.

Consulting Earth Scientists (2016). *CES Quality Work Procedures*, February 2016.

Consulting Earth Scientists (5 April 2022) *Environmental Site Investigation Bicentennial Reserve Former Landfil Small Street, Willoughby NSW 2068, CES Document Ref.: CES210306-WIL-AD*

NSW EPA (2016). *Solid Waste Guidelines 2nd Edition.*

NSW EPA 2022 *Contaminated Land Guidelines: Sampling design part 1 – application & Part 2 – interpretation.*

Willoughby City Council (8 December 2023) *Voluntary Management Proposal Bicentennial Reserve Former Landfill, Willoughby, NSW 2068*

FIGURES

Document Set ID: 7090891
Version: 1, Version Date: 18/10/2024

CONSULTING EARTH SCIENTISTS
Suite 3, Level 1
55 Grandview Street, Pymble, NSW, 2073
ph 8569 2200 fax 9983 0582

Title

Figure 1: SiteLocation

CES Project ID:	Date:
CES210306-WIL	15/12/2021
Prepared By: T. Goodbody	Checked By: M. Challoner

CONSULTING EARTH SCIENTISTS
Suite 3, Level 1
55 Grandview Street, Pymble, NSW, 2073
ph 8569 2200 fax 9983 0582

Title

Figure 2: Sampling Locations

CES Project ID:	Date:
CES210306-WIL	02/05/2024
Prepared By: V. Arias	Checked By: D. Johnson

Document Set ID: 7090851
Version: 1, Version Date: 18/10/2024

APPENDIX A

Project Safety Plan

CONSULTING EARTH SCIENTISTS

PROJECT SAFETY PLAN:
AMMONIA MONITORING PROGRAMME –
BICENTENNIAL RESERVE FORMER LANDFILL
SMALL STREET, WILLOUGHBY NSW 2068
PREPARED FOR WILLOUGHBY CITY COUNCIL
CES DOCUMENT REFERENCED: CES210306-WIL-AV

Written by: F. Deilamy
Reviewed by: V. Arias

SC41156 & CEnvP (General) 682
Authorised by: D. Lowe

Client: Veolia Australia and New Zealand
Woodlawn Eco-Precinct
619 Collector Road
Tarago NSW 2580

Date: 19 January 2024

Level 1, Suite 3 55 Grandview Parade, Pymble, NSW 2073 • Australia
Telephone: 02 9488 7364 • Fax: 02 9552 4399 • www.consultingearth.com.au

1 PLAN SIGN OFF

THE UNDERSIGNED AGREE:

1. That this document is the project safe work plan for the Ammonia monitoring programme undertaken at the **BICENTENNIAL RESERVE FORMER LANDFILL**.

2. That the Responsible Manager will coordinate the compliance to this project safe work plan.

3. Consulting Earth Scientists Pty Ltd (CES) and its subcontractors will implement and not deviate from this safe work plan for this project without prior notification to the Responsible Manager.

4. That this safe work plan will be reviewed by the Responsible Manager from time to time to ensure its effectiveness.

I note that this project safety plan has been prepared in relation to this project by Victor Arias of Consulting Earth Scientists.

Responsible Manager

Name: Duncan Lowe

Date: 19 January 2024

2 PROJECT DESCRIPTION AND POTENTIAL HAZARDS

2.1 PROJECT DESCRIPTION

The project to which this project safety plan (PSP) applies comprises an ammonia monitoring programme for the Bicentennial Reserve located on Small Street, Willoughby, NSW 2068 (the site). The site location is shown on Figure 1.

The objectives of the programme of ammonia monitoring are to establish fluctuations in ambient ammonia concentrations and responses to seasonal changes and climatic events and to ascertain if natural attenuation of ammonia is occurring at the site. The monitoring will provide information to ascertain whether an Ecological Risk assessment of Flat Rock Creek is warranted.

2.2 CHEMICAL HAZARDS

The following chemicals may be encountered on the site:

- Nutrients (Ammonia, nitrate, nitrite, phosphorous);
- Landfill Gas (Methane, Carbon Monoxide, Hydrogen Sulfide);
- Heavy Metals;
- Hydrocarbon Compounds (TPH, BTEX);

Potential human exposure routes include:

- Skin contact – contaminated groundwater and dust/soot;
- Eyes – contaminated groundwater and dust/soot;
- Ingestion – eating or smoking prior to decontaminating skin (washing hands and face); and
- Inhalation – by breathing in contaminated dusts/soot or fibres during sampling.

2.3 PHYSICAL HAZARDS

The following physical hazards may exist at the site:

- Tripping on objects or uneven surfaces;
- Vehicle movement/traffic;
- Heat exposure and exhaustion;
- Dust;
- Working near water bodies; and
- flora and fauna hazards i.e.. wildlife, snakes, insects etc,

Personnel should also be aware of the necessary precautions with respect to smoking, drugs and alcohol, first aid, privacy of information, environmental considerations, health surveillance, working alone, incident reporting and OHS consultation.

2.4 PERSONAL PROTECTIVE EQUIPMENT (PPE)

To avoid and minimise exposure to the potential contaminants, appropriate PPE should be used, and basic hygiene procedures adhered to (refer to Section 6).

All CES field staff and sub-contractors are to follow the CES site safety rules and PPE requirements established in this PSP. Section 6 outlines the appropriate PPE for the project.

2.5 WILLOUGBY CITY COUNCIL INDUCTION

All CES and Subcontractor staff working onsite to undergo the Willoughby City Council induction prior to commencement of site works.

2.6 SITE AND EMERGENCY CONTACT DETAILS

Table 1: Contact Details

Title	Name	Contact Number
Responsible Manager	Duncan Lowe	02 8569 2200
Project Manager	Victor Arias	0439 261 637
CES Field Contacts	Fred Deilamy Shaun Claughton	0427 028 047 0403 273 626
Willoughby City Council (Environment Manager)	David Roberts	0434 603 368
Hospital	Royal North Shore Hospital	02 9926 7111
Envirolab Services	Reception	02 9910 6200
Australian Laboratory Services	Reception	02 8784 8555
Police, Ambulance, Fire	-	000

An image showing the route to the nearest emergency department is included as Figure 1. An accident/incident and investigation report form has been included in the appendix at the back of this PSP.

3 RESPONSIBILITIES MATRIX

Table 2 details the responsibilities for all staff involved in the project.

Table 2: Responsibilities Matrix

Task	CES as employer	Site controller	Responsible Manager	Project Manager	CES Staff	Sub-contractors
Provide safe premises	✓	✓	n/a	n/a	n/a	n/a
Provide safe systems of work	✓	n/a	n/a	n/a	n/a	✓
Provide information, instruction, training and supervision	✓	✓	n/a	n/a	n/a	✓
Provide suitable working environment and facilities	✓	✓	n/a	n/a	n/a	n/a
Take reasonable care for health and safety of workers	✓	✓	✓	✓	✓	✓
Cooperate with employer and management to ensure safe work place	n/a	n/a	✓	✓	✓	✓
Ensure that your actions do not put others at risk	✓	✓	✓	✓	✓	✓
Ensure that your work area is free of hazards	✓	✓	✓	✓	✓	✓
Do not do anything that could put at risk your own health or safety or that of CES staff, visitors, members of the public, subcontractors or other person	✓	✓	✓	✓	✓	✓
Conduct risk assessment prior to operation	✓	✓	✓	✓	✓	✓
Sign off Project Safety Plan	n/a	n/a	✓	✓	✓	✓
Read and understand Project Safety Plan	n/a	n/a	✓	✓	✓	✓
Review sub-contractor Project Safety Plan	n/a	n/a	✓	✓	✓	✓
Induct sub-contractors	n/a	n/a	✓	✓	✓	✓
Undertake compliance audits in field from time to time	n/a	n/a	✓	n/a	n/a	n/a
Maintain plant/equipment	✓	✓	✓	✓	✓	✓
Report hazards	✓	✓	✓	✓	✓	✓
Report incidents/accidents to CES	✓	✓	✓	✓	✓	✓
Maintain records	✓	✓	✓	✓	✓	✓
First Aid	✓	✓	✓	✓	✓	✓

4 HAZARD / RISK ASSESSMENT AND SAFE WORK PROCEDURES

Table 3: OHS Risk Assessment Matrix				
	PROBABILITY			
CONSEQUENCE	**VERY LIKELY** (**VL**-Could happen anytime)	**LIKELY** (**L**-Could happen at some time)	**UNLIKELY** (**U**-Could happen but very rarely)	**VERY UNLIKELY** (**VU**-Could happen but probably never will.)
CATASTROPHIC (**Cat.** - Fatality or permanent disability or illness)	**1**	**1**	**2**	**3**
MAJOR (**Maj.** - Extensive injuries)	**1**	**2**	**3**	**4**
MODERATE (**Mod.** - Medical treatment required)	**2**	**3**	**4**	**5**
MINOR (**Min.** - First Aid Needed)	**3**	**4**	**5**	**6**

Table 4: Risk ratings	
Risk Rating	**Action**
1	Immediate action required. Management to be immediately notified. Shut down the cause of the hazard and implement control action prior to recommencing activity.
2	Immediate action required. Management to be immediately notified. May need to shut down the cause of the hazard and implement control action prior to recommencing activity. Short-term controls required to reduce consequence or impact. Longer-term controls, which may involve significant capital expenditure, should be budgeted.
3	Action should be taken within an intermediate period to implement short-term controls to reduce the likelihood and/or the consequence or impact.
4	Monitor the task and reassess at regular intervals. If possible implement controls within a reasonable period to reduce the likelihood and/or the consequence or impact.
5	Monitor the task and reassess at regular intervals. Consider implementing controls within an acceptable time frame to reduce the likelihood and/or the consequence or impact.
6	Monitor the task and reassess at regular intervals. More often than not, acceptance of a risk at this level would be considered appropriate.

Table 5: Hazard Register and Safe Work Method Statements

Client: WILLOUGHBY CITY COUNCIL								**Project Code:** CES210306-WIL	
Project: BICENTENNIAL RESERVE FORMER LANDFILL SMALL STREET, WILLOUGHBY NSW 2068								**Project Manager:** V. Arias	
Hazard Identification			**Risk Identification**		**Risk Assessment**			**Control**	
			Risk						
No.	**Task**	**Hazard**	**What can happen?**	**How can it Happen?**	**Consequence**	**Likelihood**	**Risk**	**Safe Work Procedure**	**Responsibility**
1	**Packing/unpacking vehicle**	Manual Handling, Weight of equipment	Back strain or other injury	Bad posture/lifting technique, Lifting too much	Mod.	L	3	- Ensure personnel are trained in and use correct manual handling methods; - Use 2 people when required (e.g. when lifting awkward, large and heavy items or lifting aids e.g. trolley).	CES, All staff
2	**Drive to and from site**	Traffic	Accident	Vehicular or pedestrian collision, vehicle not safe for use (e.g. brake light out)	Cat.	VU	3	- Hold drivers licence; - Obey traffic laws; - Conduct vehicle safety checks; - Do not use vehicle if faults identified.	CES, All staff
3a	**Site Work**	Unfamiliar Site, unanticipated changes to work environment	Accident	Unknown, site specific hazards	Cat.	VU	3	- Undergo site specific safety induction; - If there is not a site specific induction, site controller to be present or notified of work locations and to provide input on site hazards; - Request site controller make site personnel aware of CES presence on site; - Review site layout and activities that may affect work and conduct a risk assessment. Identify measures needed to provide safe access (e.g. move items, divert traffic etc; - Do not work on site if unsafe.	All staff

Hazard Identification			Risk Identification		Risk Assessment			Control	
			Risk						
No.	Task	Hazard	What can happen?	How can it Happen?	Consequence	Likelihood	Risk	Safe Work Procedure	Responsibility
3b	**Site Work**	Site traffic/vehicle and machinery movement	Accident causing injury	Collision, lack of visibility, flashing light not on, standing too close to machinery	Cat.	VU	3	- Wear reflective clothing; - Give way to larger vehicles; - Turn on flashing light on vehicle; - Inform site controller of work locations; - Ensure work locations are cordoned off, are visible to site traffic and off site access ways; - Ensure qualified traffic controllers are present during all works where work is adjacent to the roadway; - Keep away from operating machinery in a position visible to the operator; - Obey operators' commands whilst machine is in operation; - Maintain positive radio comms with plant/vehicles in vicinity i.e. calling on hauls roads etc.	All staff
3c	**Site Work**	Trip hazard	Fall, foot/knee injury etc.	Uneven ground, equipment lying around on ground	Mod.	L	3	- Be diligent; - Maintain a tidy work area; - Wear steel cap boots.	All staff
3d	**Site Work**	Terrain hazard	Vehicle rollover	Driving on poor, steep, boggy ground, wet conditions	Maj.	VU	4	- Follow route assessed as least risk; - Travel at safe speeds; - Walk route before driving as necessary; - Stand clear and upslope of moving vehicles or vehicles parked on an incline.	All staff

Hazard Identification			Risk Identification		Risk Assessment			Control	
			Risk						
No.	Task	Hazard	What can happen?	How can it Happen?	Consequence	Likelihood	Risk	Safe Work Procedure	Responsibility
3e	**Site Work**	Landfill gas	Explosion, asphyxiation	Expose gas to ignition source, inhale gas.	Cat.	VU	3	- Do not use naked flames or ignition sources (e.g. no smoking); - Use intrinsically safe electronic equipment in explosive environments; - Do not breathe landfill gas or enter confined space where gas may be present. Wear PPE.	All staff
3f	**Site Work**	Insects/animals	Bites/poisoning from spiders, ticks etc.	Lack of diligence where snakes/spiders may be encountered. Not wearing PPE.	Cat.	VU	3	- Wear long pants, shirts and appropriate footwear; - Wear gloves (e.g. when opening borehole covers); - Be diligent and aware of habitats; - Move cautiously, walk loudly and avoid long grass - Wear bright clothing. Inspect clothing for spiders/tics after walking through vegetated areas. - Apply insect repellent containing diethyl-meta-toluamide (DEET) or picaridin prior to entering vegetated areas. - If you suffer from allergic reactions to ticks, only attempt to remove a tick whilst at a medical facility such as an Emergency Department. - When removing a tick with fine tipped forceps (not household tweezers unless fine tipped forceps are not available), grasp the tick as close to the skin's surface as possible. Pull upwards with steady pressure and avoid jerking or twisting the tick. - Prior to removal, the tick may be sprayed with an aerosol insect repellent containing pyrethrin or a pyrethroid chemical, although there is currently no evidence to suggest that this is of benefit. Permethrin based creams, which are available from chemists may also be used. Apply at least twice with a one minute interval between applications.	All staff

Hazard Identification			Risk Identification		Risk Assessment			Control	
			Risk						
No.	Task	Hazard	What can happen?	How can it Happen?	Consequence	Likelihood	Risk	Safe Work Procedure	Responsibility
								- If you have difficulty removing the tick or suffer any symptoms after removal, seek medical attention urgently. - Use only fine tipped forceps and avoid squeezing the body of the tick. - Don't use folklore remedies such as matches or pins because they will irritate the tick and make it harder to completely remove. - Avoid scratching and do not use irritant chemicals such as methylated spirits or kerosene.	
3g	**Site work**	Environmental Conditions – Cold and wet	Hypothermia, becoming wet	Inappropriate clothing	Mod	L	3	- Wear appropriate clothing to protect from rain and cold and change clothes as appropriate; - Stop work in heavy rain.	All staff

Hazard Identification			Risk Identification		Risk Assessment			Control	
			Risk						
No.	Task	Hazard	What can happen?	How can it Happen?	Consequence	Likelihood	Risk	Safe Work Procedure	Responsibility
3h	**Site Work**	Environmental Conditions - Sun and heat exposure	Heat stress including the following symptoms: - heat stroke; - sunburn; - heat rash; - heat cramps; - blurred vision; - dizziness; - exhaustion; - dehydration or feeling thirsty; - fatigue; - nausea; - headache; - fainting; - slurred speech; and - difficulty thinking clearly	Risk factors include: -air temperature; -sustained physical work in hot weather; - high level of PPE including Tyvek suits and respirators; - no sunscreen or sunglasses; - not maintaining fluid levels if sweating; - drinking caffeinated drinks in hot weather; -no or low level of acclimatisation to heat; - low level of fitness; - Medication.	Mod.	L	3	- Conduct a risk assessment prior to field work including checking weather forecast; - if the forecast temperature is >35°C fieldwork is to be carried out by 2 CES staff at a minimum. - In temperatures >38°C - Determine emergency arrangements for the site including first aid station, nearest hospital and contact numbers; - Consider modifying work arrangements such as staff rotation, rotating tasks, reschedule physical work to cooler parts of the day; and recognise reduced work pace in hot conditions - Drink plenty of water or other cool, non-alcoholic fluids. Drink two to four glasses of cool, non-alcoholic fluids each hour. A sports beverage can replace the salt and minerals you lose in sweat. However if you are on a low-salt diet, talk with your doctor before drinking a sports beverage and also check with your doctor if you are on limited fluids or fluid pills. - Avoid drinking extremely cold liquids as they can cause stomach cramps. - Avoid heavy exertion, reduce physical activity and avoid vigorous exercise in hot weather. Where activity is unavoidable, try to schedule activity for the cooler part of the day and rest often. - Whenever possible, stay indoors or in the shade. - Stay cool and keep air circulating around you. Use air conditioning if possible. If not, consider visiting an air-conditioned room as often as practicable.	All staff

Hazard Identification			Risk Identification		Risk Assessment			Control	
			Risk						
No.	Task	Hazard	What can happen?	How can it Happen?	Consequence	Likelihood	Risk	Safe Work Procedure	Responsibility
								- Eat regular, light meals. - Wear lightweight clothing (that conforms with site and PPE requirements). - Protect yourself from the sun and 'slip, slop, slap' when outside by covering exposed skin, using sunscreen and wearing a hat. - Seek' shade and 'slide' on some sunglasses. - Rest regularly in the shade and drink fluids frequently. If someone you are with develops heat stroke: - Notify the safety officer at the site (if applicable) and/or call triple zero (000) for an ambulance. - While waiting for emergency medical help, get the person to a cool shady area and lay them down. - Remove excess clothing and wet their skin with water or wrap in wet cloths, fanning continuously Do not give the person fluids to drink. - Position an unconscious person on their side and clear their airway. - Monitor their body temperature where possible and continue cooling efforts until the body temperature drops below 38°C. - Wait for the ambulance to urgently transport the person to hospital, where more intensive cooling and support can be given. - If medical attention is delayed, seek further instructions from ambulance or hospital emergency staff	

Hazard Identification			Risk Identification		Risk Assessment			Control	
			Risk						
No.	Task	Hazard	What can happen?	How can it Happen?	Consequence	Likelihood	Risk	Safe Work Procedure	Responsibility
4a	**Groundwater sampling**	Manual Handling, Weight of foot valve/pump with water in tubing	Back /shoulder strain or other injury while removing tubing full of water	Bad posture/lifting technique	Mod.	L	3	- Ensure personnel are trained in and use correct manual handling methods; - Lift with back straight and knees slightly bent; - Rest if required.	CES, All staff
4b	**Groundwater sampling**	Chemicals (acid preservative in sample bottles)	Chemical spill, acid burn to skin and eyes	Spill acid preservative from sample bottles	Maj.	U	3	- Provide and ensure staff use appropriate PPE during sampling; - Be diligent while sampling; - Wear appropriate PPE including long sleeved shirt, latex or nitrile gloves and safety glasses when sampling; - Wash hands prior to handling food.	CES, All staff
4c	**Groundwater sampling**	Sampling potentially contaminated groundwater	Illness due to contact with contaminated groundwater	Not using or incorrect use of PPE	Mod.	U	4	- Provide and ensure staff use appropriate PPE during groundwater sampling; - Wear appropriate PPE during sampling groundwater including latex or nitrile gloves and safety glasses.	CES, All staff
4d	**Groundwater sampling**	Vapours and gas	Inhalation of vapours and gases including hydrocarbons and methane resulting in illness	Smelling water for odours, not using or incorrect use of PPE.	Min.	L	4	- Provide and ensure staff use appropriate PPE including respirators; - Do not smell water; - Use respirators as required.	CES, All staff
4e	**Groundwater sampling**	Misuse of equipment	Injury, cuts, bruises, fractures, back strain.	Lack of training in use of equipment. Lack of diligence in use of equipment.	Mod.	U	4	- Ensure that personnel are adequately trained in the use of equipment; - Be diligent and use equipment correctly; - Do not remove safety guards.	CES, All staff

Hazard Identification			Risk Identification		Risk Assessment			Control	
			Risk						
No.	Task	Hazard	What can happen?	How can it Happen?	Consequence	Likelihood	Risk	Safe Work Procedure	Responsibility
4f	**Groundwater sampling**	Manual Handling, Weight of esky with water samples	Back strain or other injury	Bad posture/lifting technique, Lifting too much	Mod.	L	3	- Ensure personnel are trained in and use correct manual handling methods; - Use 2 people when required (e.g. when lifting awkward, large and heavy items or lifting aids e.g. trolley).	CES, All staff
5a	**Sampling surface water**	Sampling potentially contaminated surface water/leachate	Illness due to contact with contaminated surface water or leachate	Not using or incorrect use of PPE	Mod.	U	4	- Provide and ensure staff use appropriate PPE during water/leachate sampling; - Wear appropriate PPE during sampling including latex or nitrile gloves and safety glasses.	CES, All staff
5b	**Sampling surface water**	Working near or over water	Fall into deep water, drowning, illness from contact with leachate	Fall into deep water from a timber platform or from steep banks at the edge of water/leachate while sampling from surface water and leachate dams	Cat	VU	3	- When sampling from the edge of surface water body where the banks are steep or otherwise unsafe, are to use bailers to retrieve samples from a safe distance. - Two people should work together on risky sampling locations.	All staff
5c	**Sampling surface water**	Chemicals (acid preservative in sample bottles)	Chemical spill, acid burn to skin and eyes	Spill acid preservative from sample bottles	Maj.	U	3	- Provide and ensure staff use appropriate PPE during sampling; - Be diligent while sampling; - Wear appropriate PPE including long sleeved shirt, latex or nitrile gloves and safety glasses when sampling; - Wash hands prior to handling food.	CES, All staff

Table 6: Competence Assessment		
Client: WILLOUGHBY CITY COUNCIL		**Project Code:** CES210306-WIL-AU
Project: BICENTENNIAL RESERVE FORMER LANDFILL SMALL STREET, WILLOUGHBY NSW 2068		**Project Manager:** V. Arias
Personal Qualifications and Experience	*Personnel, Duties and Responsibilities*	*Training Required to Complete Work*
Project Manager	Overall project direction and responsibility, Field work. Technical advice and review of final project.	University training in field of work. Extensive field experience.
Environmental Scientists	Field work including supervision of monitoring programme.	University training in field of work. Extensive field experience. Current First Aid certificate and drivers licence.
Engineering Details/Certificates/WorkCover Approvals/Licences		
Current NSW drivers licence Work Cover NSW OHS Construction Induction Training Certificate		
Codes of Practice, Legislation		
CES QWPs		
Plant/Equipment:		**Maintenance Checks**
4WD vehicle		Vehicles are to be maintained by appropriately qualified motor mechanic in accordance with manufacturers' recommendations. CES staff carry out regular safety checks of vehicles. CES staff are to ensure it's adequately fuelled and maintained.
Equipment and Tools		All equipment undergoes regular maintenance checks by qualified experienced staff according to manufacturer standards and as set out by CES Total Quality Management System Documentation.

5 PPE REQUIREMENTS

Based upon the Hazard register and Safe Work Procedures, the following PPE is required to be worn or be present on site during the works in the case that a situation arises where it is required.

Table 7: PPE Requirements

Item of PPE	Required	Present on job	Comments
Hard hat	✓		In accordance with AS/NZS 1800-1801. Ensure hats are less than 5 years old and in sound condition.
Safety footwear	✓		Steel toe cap in accordance with AS/NZS 2210.
Tyvek suit		✓	
High visibility clothing	✓		In accordance with AS/NZS4602.
Hearing protection during noisy activities	✓		In accordance with AS/NZS1269-1270. Required where noise level likely to exceed 85 dB(A) or 140 dB L in peak. Ear muffs during noise up to 110 dB(A).
Appropriate field clothing	✓		Long pants (cotton) and long sleeved shirt (cotton)
Protective gloves	✓		Leather gloves when using hand tools, nitrile or latex gloves when handling samples.
Breathing protection		✓	Dust mask – P2
Breathing protection		✓	Respirator – P3 in accordance with AS/NZS 1715-1716.
Eye protection	✓		Safety glasses or goggles (with side shields) where appropriate in accordance with AS/NZS 1336-1337.
Type B First Aid kit	✓		Present in each work vehicle
Fire extinguisher for flammable liquids	✓		Must have current tag
Mobile phone	✓		
Exclusion zone	✓		Setup as required

If any of the PPE required above is not present on site, it must be obtained before any works can proceed.

In addition, UHF Radio set on Channel 15 and only diesel vehicles permitted onsite.

6 SITE INDUCTIONS

6.1 CES INDUCTIONS

All clients, visitors and contractors are to be inducted into the PSP before commencing work or being allowed to enter a work area (as defined by CES). All inductees are to sign the CES site induction register (Table 8) to confirm that they have understood the project safety plan and agree to comply with its requirements. If the PSP is not signed, clients, visitors and contractors will not be allowed to enter the work area. The site induction register is to be completed by all employees on site at the beginning and end of each work shift (or day).

The undersigned have read and understood the project safety plan and agree to comply with its requirements.

Table 8: CES Site Induction Register

Name	Company	Date	Time on site	Signature	Time off site	Signature

6.2 CLIENT/SITE INDUCTIONS

CES are to identify the site induction requirements from the client prior to commencing work. If CES employees are not inducted into a formal site induction, an assessment must be made as to the safety of commencing work on the site. If the work site is not safe, do not proceed with work. In addition, if commencing work on a site on which you have not been inducted into the formal site induction, the site controller must be with you at all times. All site specific induction documentation should be attached to the PSP. Details of client/site inductions should be recorded in Table 9 below.

Table 9: Client/Site Induction Register

Name of Inductee	Date	Inducted by	Company	Signature	Induction Type

7 CHANGES TO SITE CONDITIONS

Please note below in Table 10 any changes to site conditions that have occurred either between or during work shifts that may require an additional risk assessment.

Table 10: Changes to Site Conditions

Date	Time	Changed Condition	OH&S risk? (Y/N)	Control Implemented	Acknowledgment	
					Name	Signature

8 TOOLBOX TALKS

The Responsible Manager shall ensure that Toolbox talks are conducted daily and recorded on the respective Toolbox Talk form. The Toolbox Talk will define hazards for the respective day of work as identified by CES field staff and subcontractors. Toolbox Talk forms will be provided by the Responsible Manager and must be filled out by field staff and sub-contractors daily. Copies of completed forms will be stored with other contract documentation at the CES Head Office. A CES Toolbox Talk form is included on the following page.

TOOLBOX TALK

Table 11: Record of Toolbox talk			
Location:		**Date:**	**Weather:**
Name	**Organisation**	**Position/Project Role**	**Signature**
Hazard/Issue	**Discussion details**		

9 INCIDENT MANAGEMENT

The Project Manager shall ensure that reports of any accident, incident or dangerous occurrence that occurs, either to CES or contractors, are submitted to the Responsible Manager and the appropriate authorities (WorkSafe, EPA etc). Sub-contractors are required to report any accidents, incidents or dangerous occurrences to any CES field staff, or if unavailable, the **Responsible Manager, Duncan Lowe.**

Incident and WorkCover forms will be provided by the Responsible Manager and must be filled out by sub-contractors following an accident, incident or dangerous occurrence. Copies of completed forms will be stored with other contract documentation at the CES Head Office. A CES Accident/Incident Report and Investigation form is included in at the back of this PSP.

FIGURES

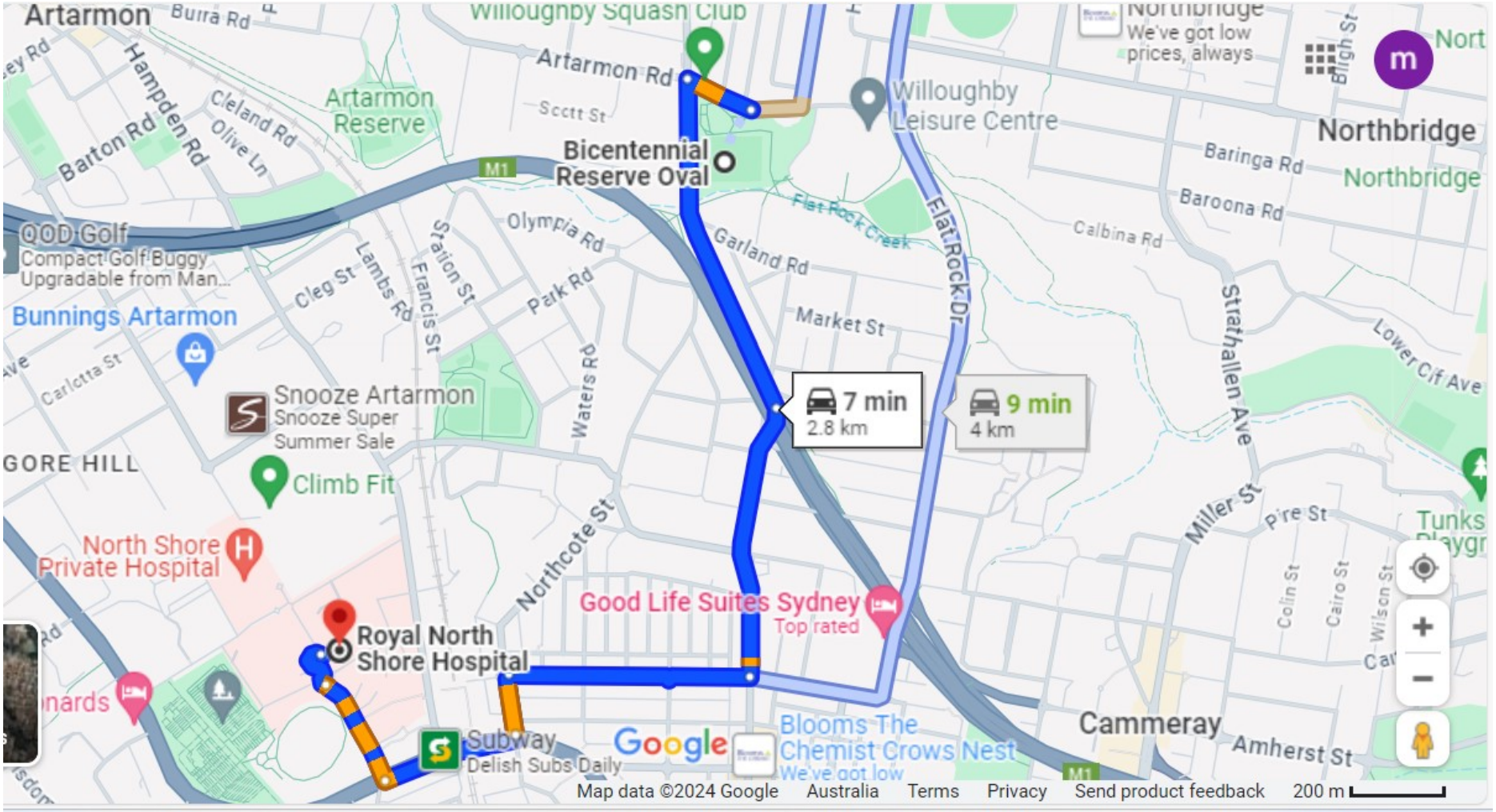

Figure 1. Site location and route to closest hospital