Preliminary contamination investigation

Proposed Animal Shelter Development, 301 Golf Links Road, Condobolin NSW

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Summary report

Introduction

An animal shelter development is proposed for an approximate 300m^2 parcel of land located within 301 Golf Links Road, Condobolin NSW. The first phase of the development will include an office building. The animal shelter development is located on vacant land adjacent to the Condobolin Sewage Treatment Plant. A preliminary contamination investigation is required for the site to determine suitability for the proposed land-use.

Scope

The objective was to identify past potentially contaminating activities, identify potential types of contamination, discuss the site condition, provide a preliminary assessment of site contamination and assess the need for further investigation to determine suitability for the proposed land-use.

Summary

An inspection of the site was made on 4 March and 12 April 2021. Three locations were assessed across the site from the 0 to 100mm soil depth for analysis of metals, phosphorus, nitrogen, fluoride, sulphate, electrical conductivity, pH and microbiology.

The site is vacant land adjacent to the Condobolin Sewage Treatment Plant. No evidence of mines, sheep dips, mixing sheds or contaminating industrial activities were identified on the site from the review of site history and site walkover. The application of raw or treated effluent is not known to have occurred on the site.

Surface cover on the site was dominated by saltbush and roly poly. Vegetation cover was generally 80 to 90%. Bare areas were identified associated with the presence of salt scalds. A disposal location containing discarded concrete, wire, steel fence posts and rock is located on the south eastern corner of the site. The material is considered an amenity hazard.

Soil samples LSC1 and LSC2 contained levels of total nitrogen at 4,500mg/kg and 3,200mg/kg which is greater than the adopted threshold of 857mg/kg. High levels of nitrogen have the potential to leach into waterways. The levels present have potential to cause off-site impacts.

The majority of the soil samples were non-saline. Samples LSC3 was moderately saline. Vegetation on the site has adapted to the saline conditions and is dominated by salt tolerant species. The level of salinity may impact on infrastructure.

E. coli was detected in one soil sample. The presence of *E. coli* has the potential to impact on human health.

The levels of all other assessed potential contaminants in the soil samples were below the commercial land-use thresholds (NEPC 1999).

Recommendations

Remediation of coliforms is recommended by cultivation to 300mm and the addition of lime.

Removal of the discarded concrete, wire, steel fence posts and rock located on the south eastern corner of the site.

Infrastructure will need to be designed to consider the saline soil conditions.

Erosion and sediment control measures are required to ensure sediments remain on site. Erosion and sediment control measures should be installed and maintained prior to any remediation or construction works.

Construction shall be undertaken in such a manner as to ensure vegetation outside the work area is maintained. Vegetation buffers are to be maintained on downslope boundaries.

Statement of suitability

The investigation area can be made suitable for the proposed commercial land-use.

Contents

page

1. Introduction

An animal shelter development is proposed for a 300m^2 parcel of land within 301 Golf Links Road, Condobolin NSW. The animal shelter development is located on vacant land adjacent to the Condobolin Sewage Treatment Plant. A preliminary contamination investigation is required to determine the soil contamination status and the suitability of the site for use as an animal shelter.

2. Objectives

The objective of the investigation was to determine suitability of the site for the proposed commercial land-use.

3. Scope of work

Envirowest Consulting Pty Ltd was commissioned by Lachlan Shire Council to undertake a preliminary contamination investigation, in accordance with the contaminated land management planning guidelines, from the *Contaminated Land Management Act 1997* and the *State Environmental Policy No. 55 (SEPP 55)*, for part 301 Golf Links Road, Condobolin NSW. The objective was to identify past potentially contaminating activities, identify potential contamination types, discuss the site condition, provide a preliminary assessment of site contamination and assess the need for further investigation. The scope of works included site inspection, soil sampling and analysis of the soil samples for contaminants of concern.

4. Site identification

Address	301 Golf Links Road Condobolin NSW
Deposited plans	Lot 16 DP914643
Latitude and longitude	-33.08°, 147.14°
Geographic coordinates	55H E512659m N6340368m
Client	Lachlan Shire Council
Owner	Lachlan Shire Council
Current occupier	Condobolin Sewage Treatment plant
Area	Total lot 14.3 hectares Investigation area approximately 300m^2
Local government area	Lachlan Shire Council
Current zoning	SP2 – Sewage Systems (Lachlan LEP 2013)
Trigger for investigation	Change in land-use
Locality map	Figure 1

5. Site history

5.1 Land-uses

The site is currently vacant. The site is located on a vacant section of the Condobolin Sewage Treatment plant. The site is located outside of the sewage treatment plant exclusion fencing.

5.2 Summary of council records

Lachlan Shire Council holds a licence (EPL 4480) under Schedule 1 of the Protection of the Environment Operations Act 1997 relating to the Condobolin Sewage Treatment Plant.

5.3 Sources of information

Site inspection 4 March and 12 April 2021 by Envirowest Consulting Pty Ltd
Discussions with Rowan Bentick, Environment and Waste Officer Lachlan Shire Council
Environment Protection Licence 4480 Condobolin Sewage Treatment Plant
NSW EPA records of public notices under the CLM Act 1997
Soil and geological maps
Spatial information exchange historic parish maps
Historical aerial photographs (1965, 1974, 1983, 1989, 1997, 2008, 2010, 2011, 2012, 2013, 2015, 2018, 2020) including NSW Government historical imagery, Google Earth and SIX Maps
Lachlan LEP 2013

5.4 Review of historic aerial photographs, maps and plans

5.4.1 Aerial photographs

Year	Visual observations on site	Surrounding area
1965	Land-use is vacant. A track is located through the centre of the site. The track provide access to the STP. Assumed land-use prior to vacant is grazing.	STP located to the south
1974	The track is less evident, site remains vacant	Trees has been cleared from the lot. A large dam has been constructed in the far west of the lot
1983	No obvious changes to the site are evident	The STP has been extended, ponds have been constructed to the south. Oval primary treatment pond has been constructed. The salinity pond is evident. A small tree plot has been constructed in the west.
1989	No obvious changes to the site are evident	The pond in the far west has been removed
1997	The track is more evident, the site remains vacant.	A pond has been constructed to the west
2008	The track is evident, the track extends to the west to the tree plot. The site remains vacant	A tree plot has been established to the west. Water is evident in the salinity pond.
2010	No obvious changes to the site are evident	Water is evident in the salinity pond and pond located to the west.
2011	No obvious changes to the site are evident	Stockpiling is evident south of the site. The salinity pond is at capacity. Minimal water in west pond.
2012	No obvious changes to the site are evident	No obvious changes are evident on the surrounding land

2013	No obvious changes to the site are evident	Salt scalds in west pond evident
2015	No obvious changes to the site are evident	Surrounding land appears dry likely due to climatic stress
2018	Bare areas evident, likely due to dry climatic conditions	Additional stockpiling is evident south of the site
2020	Vegetation on the site is re-established	Introduced material evident at approximate location of stockpile to the south

5.4.2 Interview with site owner representative

Rowan Bentick Environment and Water Officer at Lachlan Shire Council advised that the adjacent land was developed as the Condobolin Sewage Treatment Plant in the 1950's or 1960's.

The redundant salinity pond is thought to have been dug to provide fill for the sewage treatment plant. The pond is not known to have been utilised and water within the pond is runoff. The pond is not known to have overflowed.

Biosolids are not applied to the site. Historical night soil was not disposed on the site. Lachlan Shire Council do not have any records of effluent being disposed on the site.

5.5 Chronological list of site uses

Aerial photographs indicate the site has been vacant land adjacent to the Condobolin Sewage Treatment Plant since the 1960's. The 1983 aerial photograph shows that the sewage treatment plant was upgraded to include a series of primary and secondary treatment ponds. No infrastructure has been located on the site.

No stockpiles, mines, sheep dips, underground storage tanks (UST), bunkers, biosolid application or contaminating industrial activities are known to have been located on the site from the site inspection and site history.

5.6 Buildings and infrastructure

No buildings or infrastructure are located on the proposed animal shelter site from review of historical aerial photographs. All Condobolin Sewage Treatment Plant infrastructure is located within the exclusion fence greater than 50m south of the animal shelter site. A pipe transporting treated effluent to the tree plot is located approximately 50m south of the site.

5.7 Spills, losses or discharges

The proposed animal shelter is located on a vacant land adjacent to the Condobolin Sewage Treatment Plant. The site is upslope and outside of the sewage treatment plant exclusion fence.

A redundant salinity pond is located west of the site. The pond is not known to have been utilised and water within the pond is runoff.

Lachlan Shire Council holds a licence (EPL 4480) under Schedule 1 of the Protection of the Environment Operations Act 1997 relating to the Condobolin Sewage Treatment Plant. Spills, losses and discharges relating to the STP are reported to the EPA under conditions of the licence.

The STP discharges water from the final maturation pond towards the south. The discharge point is located approximately 200m south of the investigation area (Figure 4).

Treated effluent is utilised for irrigation at the Condobolin Sewage Treatment Plant and Condobolin Golf Course. Condobolin Golf Course is located 150m west of the investigation area. Reuse at the Condobolin Sewage Treatment plant is spray and drip irrigation to the tree lot located 170m west of the investigation area and Condobolin Sewage Treatment plant located 50m south. Effluent application to land is regulated by the NSW EPA under licence 4480.

No records for spills or losses on the site were available. No records for discharges to land, water or air were available.

5.8 Relevant complaint history

Nil

5.9 Contaminated sites register

The investigation area is not listed on the NSW EPA register of contaminated sites (6 May 2021) or sites notified to the EPA (6 May 2021).

5.10 Previous investigations

A waste classification of material stockpiled at Condobolin Sewage Treatment Plant, Golf Links Road, Condobolin, NSW was undertaken by Envirowest Consulting in 2019.

The waste classification concluded that the stockpiled material located at Condobolin Sewage Treatment Plant, Condobolin is classified as ***Special Waste Asbestos with a subclassification of General Solid Waste.***

The stockpiled material was not located on the proposed animal shelter site.

5.11 Historical neighbouring land-use

North – Silos Roads, rural beyond
South – Condobolin Sewage Treatment Plant
East – Condobolin Sewage Treatment Plant
West – Condobolin Sewage Treatment Plant

The adjacent sewage treatment land-use is not expected to have resulted in the application of raw or treated sewage to the site.

5.12 Contaminant sources

Potential exists for contaminating activities to have been undertaken on site which may impact on the suitability for the proposed land-use. The adjacent sewage treatment land-use is not expected to have resulted in the application of raw or treated sewage to the site.

A disposal location containing discarded concrete, wire, steel fence posts and rock is located on the south eastern corner of the site.

5.13 Contaminants of concern

Based on historical activities and site inspection, potential contaminants have been identified as;

- Heavy metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc, mercury)
- Nutrients (Phosphorus, nitrogen)
- Microbiology

5.14 Integrity assessment

The site history was obtained from a site inspection, interview with the site owner and history review. The information is consistent with the current site condition and to the best of the assessor's knowledge is accurate.

6. Site condition and surrounding environment

6.1 Site inspection

The site was inspected by an environmental scientist of Envirowest Consulting Pty Ltd on 4 March and 12 April 2021.

6.2 Land-use

The site is current vacant and located on a disused part of the Condobolin Sewage Treatment Plant. The land-use is commercial.

6.3 Current neighbouring land-use

North – Road reserve, Silos Road, rural-residential beyond
South – Condobolin Sewage Treatment Plant
East – Condobolin Sewage Treatment Plant, redundant salinity pond
West – Condobolin Sewage Treatment Plant, redundant pond

6.4 Surface cover and vegetation

Surface cover was dominated by saltbush, roly poly and weed species including pig weed, Paterson's curse and Bathurst burr. Grass species on the site included love grass spp. hairy panic and umbrella grass.

A small dead tree is located south east of the site. Saline conditions on the site are thought to have contributed to the mortality of the tree.

Vegetation cover was generally 80 to 90%. Bare areas were identified and thought to be associated with saline soils and salt scalds. A gravel track traversed the site.

6.5 Evidence of visible contamination

Salt scalds were visible on the soil surface. No signs of visible contamination such as discolouration or staining was identified on the site. No signs of settlement or subsidence was identified on the site.

6.6 Topography

The site is located on a lower slope and has a predominately easterly aspect. Elevation is 195 metres above sea level and inclines ranging between 0 to 2%. The lowest elevation occurs on the south eastern corner.

6.7 Soils and geology

The site is located within the Derriwong Soil Landscape (eSPADE 2019). Soil in the Derriwong landscape consists of red earths and non-calcic brown soils.

Quaternary alluvium is the main geological unit. Localised salinity. Erosion hazard is moderate to high.

No erosion was identified on the site. Salt scalds were visible on the site.

6.8 Water

6.8.1 Surface water

A disused salinity pond is located east of the site. The bank of the salinity pond prevents surface water from the site flowing south east into the salinity pond. Low flow surface water from the site pool in a depression west of the salinity pond. High flow surface water flows to the south.

The nearest surface water feature is the Lachlan River located approximately 1.5km south of the site.

Treatment ponds associated with the Condobolin Sewage Treatment Plant are elevated or contained by large banks. Surface water from the site is unable enter the treatment ponds.

6.8.2 Groundwater

No groundwater bores are known to be located on the site. No groundwater bores are identified within 500m of the site on the NSW Office of Water groundwater database.

The presence of salt scald suggests a high seasonal water table within the site.

6.9 Evidence of possible naturally occurring contaminants

No natural sources of PAH were identified.

The site is not mapped as an acid sulphate soil risk (NSW SEED Portal accessed 16 March 2021).

The site is not mapped as a geological unit with asbestos potential (NSW SEED Portal accessed 16 March 2021).

Salt scald were observed on the soil surface within and surrounding the investigation area.

6.10 Environmentally sensitive features or habitats

A stand of Eucalyptus spp. is located south west of the investigation area. The Eucalyptus spp. may provide foraging and shelter habitat for local flora and fauna.

The Lachlan River is located approximately 1.5km south of the site. The river provides an irrigation, stock, domestic, recreational and ecological beneficial uses. The river is considered an environmental sensitive receptor.

6.11 Integrity assessment

The site history was obtained from a site inspection and history review. The information is consistent with the current site condition and to the best of the assessor's knowledge is accurate.

7. Conceptual site model

7.1 Contaminant sources

Potential exists for contaminating activities to have been undertaken on site which may impact on the suitability for the proposed land-use. The adjacent sewage treatment plant land-use of the site may have resulted in application of contaminants.

7.2 Contaminants of concern

Based on historical activities and site inspection the contaminants of concern across the site are:

- Heavy metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury)
- Nutrients (nitrogen and phosphorus)
- Microbiology

7.3 Potential receptors

The proposed land-use of the site is commercial. The site is vacant land adjacent to the sewage treatment plant.

Human receptors include:

- Visitors (adults and children)
- Staff (adults)
- Site workers
- Construction workers
- Intrusive maintenance workers

Ecological receptors include:

- Flora and fauna on the site and adjacent to the site
- Aquatic flora and fauna receptors off-site

7.4 Exposure pathways

Pathways for exposure to contaminants are:

- Dermal contact following soil disturbance
- Ingestion and inhalation after soil disturbance
- Surface water and sediment runoff into waterways
- Leaching of contaminants into the groundwater
- Direct contact of flora and fauna with the soil

7.5 Source receptor linkages

Potential source pathway receptor linkages are identified to enable evaluation of any adverse impact on human health or ecology.

The proposed land-use of the site is an animal shelter and human receptors to the investigation area are likely. Proposed users of the site may have a risk of exposure if contaminants are present and the soil is disturbed. Construction workers, visitors, staff and intrusive maintenance workers to the site may potentially be receptors to soil contaminants through direct contact to soil which includes ingestion and dermal contact. Following construction external areas adjacent to the office building are expected to be hardstand.

The contaminants of concern are non-volatile and inhalation of soil material is not considered a pathway for exposure. Inhalation may occur as a result of soil disturbance and dust production. Major soil disturbance before and after the development of the site is considered unlikely. Soil disturbance during construction and development of the site is expected to be accompanied by erosion control measures which will reduce the incidence of dust production.

Vegetation on the site may be potential receptors to soil contamination through direct uptake of contaminants. Vegetation on the site is dominated by salt tolerant species is therefore adapted to the presence of moderately saline soils. Vegetation is not showing signs of stress due to the presence of nitrogen.

The source receptor linkage to aquatic organisms and ecosystems is considered incomplete. The site is moderately well vegetated. A bare track may provide pathway movement of sediments from the site. Sediment movement is expected to be contained within the site. Movement of sediments from the site is unlikely. Soil disturbance during construction and development of the site is expected to be accompanied by erosion control measures which will reduce the incidence of sediment movement. Vegetation outside the investigation area is expected to be maintained. Following development of the site it is expected that external areas adjacent to the office building will be hardstand. The Lachlan River is located approximately 1.5km west. Well vegetated pasture is located between the site and the Lachlan River. It is not expected that contaminants from the site will be transported to aquatic receptors within the Lachlan River.

Groundwater is identified as a potential receptor to contamination. Seasonal groundwater levels in the area are expected to be high due to the presence of salt scalds on and surrounding the site. Groundwater bores are located greater than 500m from the site. Contaminants are expected to originate from the soil surface. Shallow groundwater in the site is unreliable not expected to impact on deep groundwater due to the presence of a confined deep clay layer greater than 10m. The site is not identified as an area with vulnerable groundwater.

Source/contaminant	Transport	Potential exposure pathways	Receptors
☒ Application of raw or treated effluent	☐ Wind ☒ Sedimentation ☐ Groundwater	☒ Direct contact (ingestion and absorption) (human and environment) ☐ Inhalation ☐ Runoff ☒ Leaching	☒ Construction workers ☐ Workers ☐ Visitors ☒ Intrusive maintenance workers ☒ Vegetation ☐ Aquatic

☒ Potential, ☐ unknown/unlikely

8. Data quality objectives (DQO)

8.1 State the problem

An animal shelter is proposed for the site. Land-use will change from vacant to commercial. The site is located on a vacant land adjacent to the Condobolin Sewage Treatment Plant which may have resulted in the application of treated effluent and contaminating activities. The site requires investigation to ensure suitability for the proposed land-use.

8.2 Identify the decision

The land-use proposed is commercial and the levels of contaminants should be less than the thresholds listed in Section 11. The decision problem is, do the levels of potential contaminants exceed the assessment criteria listed in Section 11.

8.3 Identify the inputs decision

Investigations of the site is required to identify any potential contaminants from historical land-use.

8.4 Define the boundaries of the study

The investigation area is an approximately 300m^2 parcel of land located within Lot 16 DP914643, 301 Golf Links Road, Condobolin NSW.

8.5 Develop a decision rule

The decision rule for suitability for commercial land-use is based on the adopted threshold or thresholds listed in Schedule B1 of the NEPM (1999) *Guideline on Investigation Levels for Soil and Groundwater*.

8.6 Specify acceptable limits on the decision errors.

The 95% upper confidence limit of average levels of samples collected is less than the threshold levels and the results are less than 250% of relevant thresholds.

8.7 Optimize the design for obtaining data

Soil samples were collected from the site on a systematic 10m grid pattern. Samples were analysed for heavy metals, nitrogen and phosphorus.

9. Sampling analysis plan and sampling methodology

9.1 Sampling strategy

9.1.1 Sampling design

A systematic sampling pattern was adopted to provide a preliminary assessment of the contamination status of the site. Uniform management practices are expected to have occurred across the site.

9.1.2 Sampling locations

Soil samples were collected from the proposed animal shelter development area on an approximate 10m grid pattern (Figure 2). Soil samples were collected for analysis of heavy metals, nitrogen, phosphorus, electrical conductivity, aluminium, cobalt, cation exchange capacity, pH, fluoride, sulphate, and microbiology.

A visual inspection was undertaken over the site for evidence of contamination.

9.1.3 Sampling density

The sampling density can detect a potential hot spot across the site with a radius of 6m at a 95% level of confidence.

The sampling frequency is considered appropriate due to the preliminary nature of the investigation.

The sampling density will enable a preliminary assessment of contamination resulting from historical land-use.

9.1.4 Sampling depth

Sampling depth was 0 to 100mm below the surface. Heavy metals, nutrients and microbiology potentially present are expected to have been applied to the surface, are generally immobile and expected to be contained in the 0 to 100mm soil layer. Minimal soil disturbance has occurred on the site.

9.2 Analytes

Soil samples were evaluated for arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury, electrical conductivity, nitrogen, phosphorus aluminium, cobalt, cation exchange capacity (CEC), pH, fluoride, sulphate, total coliforms, faecal coliforms, *E. coli*. Heavy metals, nutrients and microbiology were identified as the contaminants of concern possibly present as a result of adjacent sewage treatment plant activities.

Table 1. Schedule of samples and analyses

Sample ID	Location (Figure 2)	Analysis undertaken
LSC1	1	Arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn), mercury (Hg), phosphorus (P), nitrogen (N), electrical conductivity (EC), aluminium (Al), cobalt (Co), cation exchange capacity (CEC), pH, fluoride, sulphate, total coliforms, faecal coliforms, *E. coli*
LSC2	2	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, P, N, EC, Al, Co, CEC, pH, fluoride, sulphate, total coliforms, faecal coliforms, *E. coli*
LSC3	3	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, P, N, EC, Al, Co, CEC, pH, fluoride, sulphate, total coliforms, faecal coliforms, *E. coli*

9.3 Sampling methods

Soil samples were taken using a stainless-steel hand shovel. Soil was taken at each individual sampling location below the vegetated and detrital layer.

The soil was transferred to a solvent rinsed glass jar with a Teflon lid and sterile sodium thiosulphate rinsed plastic jar.

Tools were decontaminated between sampling locations to prevent cross contamination by brushing to remove and rinsing with clean tap water and drying with clean towel. Sampling protocols are presented in Appendix 5.

10. Quality assurance and quality control

10.1 Sampling design

The sampling program is intended to provide data as to the presence and levels of contaminants.

Soil samples were collected across the site on a systematic grid pattern of 10m. This sampling density will enable the detection of an area with an elevated concentration on a radius of 6 metres with a 95% confidence level.

The number of sampling locations is considered appropriate due to the preliminary nature of the investigation.

10.2 Field

The collection of samples was undertaken in accordance with accepted standard protocols (NEPC 1999). Sampling equipment was decontaminated between each sampling event. Samples were stored and transported under refrigeration and in insulated containers. Appropriate storage duration was observed. A chain of custody form tracked the samples to the laboratory (Appendix 4).

A single sampler was used to collect the samples using standard methods. Soil collected was a fresh sample from the corer. After collection the samples were immediately placed in new glass or plastic sampling jars and placed in a cooler. Sample jars were filled to minimise headspace and maintain sample integrity.

One intra laboratory duplicate sample was analysed to evaluate sample integrity and data comparability. The frequency of field duplicates is greater than the NEPM (1999) recommendation of 5%. Samples from all batches did not contain contaminants which confirm the absence of cross contamination during transport and storage.

A field sampling log is presented in Appendix 3.

10.3 Laboratory

Chemical analysis was conducted by SGS Laboratories, Sydney, which is NATA accredited for the tests undertaken. The laboratories have quality assurance and quality control programs in place, which include internal replication and analysis of spike samples and recoveries.

Method blanks, matrix duplicates and laboratory control samples were within acceptance criteria. The quality assurance and quality control report is presented together with the laboratory report as Appendix 4.

10.4 Data evaluation

The laboratory quality control report indicates the data variability is within acceptable industry limits. The data is considered representative and usable for the purposes of the investigation. Data quality indicators are presented in Appendix 1.

11. Assessment criteria

The proposed land-use of the site is an animal shelter development. The laboratory results were assessed against the proposed land-use of commercial (*HIL D*). The health-based investigation levels of

contaminants in the soil for residential sites, for the substances for which criteria are available, are listed in Table 3, as recommended in the NEPM (1999).

Ecological investigation levels (EIL) have been developed for the protection of terrestrial ecosystems for selected metals and organic substances in the soil in the guideline (NEPC 1999). The EILs consider the properties of the soil and contaminants and the capacity of the local ecosystem to accommodate increases in contaminant levels. Typical CEC value for the site is >15-20cmol(+)/kg, clay content of 25% and pH values of between 6 and 6.5 (eSPADE 2019). The proposed land-use is commercial. The contaminants have been identified in the soil for at least two years and are considered aged.

EILs vary with land-use and apply to contaminants up to 2m depth below the surface. The EILs for commercial land-use are listed in Table 3.

Chromium is analysed as total chromium which is the sum of chromium (III) and chromium (VI). Chromium (VI) is a potential contaminant from industrial processes including ferrochrome production, electroplating, pigment production and tanning (WHO 1998). Chromium (VI) is reduced to chromium (III) when it comes into contact with organic matter in biota, soil and water. Chromium in the environment is present in the trivalent state (WHO 1998).

The current NEPM (1999) does not provide health-based investigation levels for phosphorus. The potential impact of phosphorus on ecological values will be assessed against the Ecological Investigation Levels (EILs) (NEPC 1999) for phosphorus of 2,000mg/kg. The NEPC EIL thresholds are endorsed by the EPA. Levels above the phosphorus sorption index of the soil have potential to leach to waterways.

The NSW EPA does not provide health-based investigation levels for nitrogen. Charman and Murphy (2001) provide guidelines for total nitrogen concentrations necessary for satisfactory plant growth. Plants require between 500 to 3000mg/kg of nitrogen for satisfactory growth. This guideline is not considered appropriate for the site as it is expected to have minimal vegetated areas. EPA (1997) recommends the maximum agricultural application rate for nitrogen of 1,200kg/ha (857mg/kg at 0.1m). Levels above this have the potential to move off-site and impact on waterways.

No commercial land-use health-based thresholds are available for microbiology. The environmental guidelines for use and disposal of bio solids products (EPA 2000) are an indicator for assessment of microbiology and are considered appropriate for comparison (Table 4). In this instance the detection of microbiology is considered a potential impact on human health.

Table 2. Soil assessment criteria (mg/kg)

Analyte	Commercial/ industrial HIL D	EIL Commercial /industrial	Agricultural application rate (EPA 1997)	Adopted threshold
Aluminum	-	-	-	
Arsenic	3,000	160	-	-
Cadmium	900	-	-	-
Chromium	3,600	910	-	-
Cobalt	4,000	-	-	-
Copper	240,000	300	-	-
Lead	1,500	1,800	-	-
Nickel	6,000	380	-	-
Zinc	400,000	700	-	-
Mercury	730	-	-	-
Nitrogen	-	-	857	-
Phosphorus	-	2,000	-	
Electrical conductivity	-	-	-	4dS/m
pH	-	-	-	5.5-7.5

Cation change capacity	-	-	-	-
Fluoride	-	-	-	-
Sulphate	-	2,000	-	-
E.coli	-	-	-	-
Total coliforms	-	-	-	-
Thermotolerant coliforms	-	-	-	-

HILs – health investigation levels, EIL – ecological investigation levels, MPN – most probable number, dw – dry weight

Table 3. EIL Calculation sheet, commercial land-use

Analyte	Rationale	ACL (mg/kg)	ABC (mg/kg)	EIL (mg/kg)
Arsenic	Aged	160	0	160
Chromium III	25% clay	910	0	910
Copper	CEC 15cmol/kg, 1% organic carbon, pH 6	300	0	300
Lead	Generic	1,800	0	1,800
Nickel	CEC 15cmol/kg	380	0	380
Zinc	CEC 15cmol/kg, pH 6	700	0	700

ACL- added contaminant limit, ABC- ambient background concentration, EIL- Ecological investigation limit (ACL+ABC)

Soil electrical conductivity (EC) results of the 1:5 (soil:water suspension) were converted to saturated extracts (ECe). EC values are converted to ECe by using a multiplier factor (Charman and Murphy 2001), which is dependent on the soil texture (Table 4). Saline soils are defined as those with an electrical conductivity (ECe) greater than 4 dS/m (Charman and Murphy, 2001). Soil salinity ratings and effects on plant growth are presented in Table 5.

Table 4. ECe texture based conversion factors (Charman and Murphy 2001)

Soil texture	Conversion factor
Loamy sand, clayey sand, sand	23
Sandy loam, fine sandy loam, light sandy clay loam	14
Loam, loam fine sandy, silt loam, sandy clay loam	9.5
Clay loam, silty clay loam, fine sandy clay loam	8.6
Sandy clay, silty clay, light clay	7.5
Light medium clay, medium clay, heavy clay	5.8

Table 5. Soil salinity ratings based on ECe readings

Salinity rating	ECe (dS/m)*	Effects on Plants
Non saline (NS)	0-2	Salinity effects negligible
Slightly saline (SS)	2-4	Very salt sensitive plant growth restricted
Moderately saline (MS)	4-8	Salt sensitive plant growth restricted
Highly saline (HS)	8-16	Only salt tolerant plants unaffected
Extremely saline (ES)	>16	Only extremely tolerant plants unaffected

*ECe - Electrical conductivity of a saturated extract

Table 6 provides a general interpretation of pH results of the 1:5 (soil:water suspension) (Charman and Murphy 2001).

Table 6. Interpretation of pH results

pH	Rating
<4.5	Extremely acid
4.5 – 5.0	Very strongly acid
5.1 – 5.5	Strongly acid
5.6 – 6.0	Moderately acid
6.1 – 6.5	Slightly acid
6.6 – 7.3	Neutral
7.4 – 7.8	Mildly alkaline
7.9 – 8.4	Moderately alkaline
8.5 – 9.0	Strongly alkaline
>9.0	Very strongly alkaline

12. Results and discussion

Surface cover on the site was dominated by saltbush and roly poly. A review of site history indicated that the historical land-use at the site was vacant land adjacent to the Condobolin Sewage Treatment Plant. The application of raw or treated effluent is not known to have occurred on the site. Salt scalds were located on and surrounding the site.

Soil samples LSC1 and LSC2 contained levels of total nitrogen at 4,500mg/kg and 3,200mg/kg which is greater than the adopted threshold of 857mg/kg (Table 6). High levels of nitrogen have the potential to leach into waterways. The levels present have potential to cause off-site impacts.

E. coli was detected in LSC3 at 100cfu/100ml. The presence of microbiology has the potential to cause impacts on human health.

The levels of all other assessed potential contaminants in the soil samples (Table 6) were below the commercial land-use thresholds (NEPC 1999).

Table 6. Analytical results and threshold concentrations – Heavy metals (mg/kg)

Sample ID	Aluminium	Arsenic	Cadmium	Chromium (total)	Cobalt	Copper	Lead	Nickel	Zinc	Mercury
LSC1	7,300	11	0.5	27	6.4	18	14	10	71	0.11
LSC2	7,700	9	ND	28	5.4	16	21	8.2	57	0.07
LSC3	6,600	7	ND	27	4.4	7.2	9	6.6	14	ND
Health Investigation Levels – Commercial land-use threshold (NEPC 1999)										
	-	*3,000*	900	*3,600[1]*	*4,000*	*240,000*	*1,500*	*6,000*	*400,000*	*730*
Ecological Investigation Levels –Commercial land-use threshold (NEPC 1999)										
	-	*160*	-	*910[2]*	-	*300*	*1,800*	*380*	*700*	-

ND = not detected at the detection limit, [1] Chromium (IV), [2] Chromium (III), results in italics exceed EILs.

Table 7. Analytical results and adopted thresholds for EC, nitrogen, phosphorus and microbiology

Sample ID	ECe (dS/m)	Total nitrogen (mg/kg)	Total phosphorus (mg/kg)	Total coliforms	Thermotolerant Coliforms	E. coli	Fluoride	Sulphate	CEC	pH
LSC1	0.703	4500	740	ND	ND	ND	140	170	20	6.4
LSC2	0.5415	3200	640	ND	ND	ND	120	ND	10	5.9
LSC3	7.125	230	230	120	100	100	97	170	8.6	6.6
Adopted thresholds	*4*	*857*	*2,000*	*Detection*	*Detection*	*Detection*		*2000*		*5.5-7.5*

Results in bold exceed the adopted threshold

13. Site characterisation

13.1 Environmental contamination

Levels of nitrogen exceeded the adopted threshold. High levels of nitrogen have the potential to leach into waterways. The levels present have potential to cause off-site impacts.

Vegetation on the site has been impacted by the moderately saline soil conditions. Vegetation has adapted to saline conditions and is dominated by salt tolerant species such as salt bush.

13.2 Chemical degradation production

Nitrogen will be used by vegetation.

Degradation of salt does not occur.

Microbiology will degrade over time.

13.3 Exposed population

13.3.1 Human health

E. coli was detected during the soil sampling program. The presence of *E. coli* has the potential to impact on human health through contact with the soil.

13.3.2 Ecological

Potential ecological receptors identified in the conceptual site model was vegetation. Vegetation on the site was dominated by saltbush and roly poly. No adverse indicators of exposure to elevated nitrogen in the soil was observed in the vegetation. The levels of nitrogen are not expected to be impacting on vegetation growth.

High levels of nitrogen have the potential to leach into waterways and was identified as an ecological receptor in the conceptual site model. The levels of nitrogen present have potential to cause off-site impacts.

Vegetation on the site has been impacted by the moderately saline soil conditions. Vegetation has adapted to saline conditions and is dominated by salt tolerant species such as salt bush.

14. Conclusions and recommendations

14.1 Summary

Summary

An inspection of the site was made on 4 March and 12 April 2021. Three locations were assessed across the site from the 0 to 100mm soil depth for analysis of metals, phosphorus, nitrogen, fluoride, sulphate, electrical conductivity, pH and microbiology.

The site is vacant land adjacent to the Condobolin Sewage Treatment Plant. No evidence of mines, sheep dips, mixing sheds or contaminating industrial activities were identified on the site from the review of site history and site walkover. The application of raw or treated effluent is not known to have occurred on the site.

Surface cover on the site was dominated by saltbush and roly poly. Vegetation cover was generally 80 to 90%. Bare areas were identified associated with the presence of salt scalds. A disposal location containing discarded concrete, wire, steel fence posts and rock is located on the south eastern corner of the site. The material is considered an amenity hazard.

Soil samples LSC1 and LSC2 contained levels of total nitrogen at 4,500mg/kg and 3,200mg/kg which is greater than the adopted threshold of 857mg/kg. High levels of nitrogen have the potential to leach into waterways. The levels present have potential to cause off-site impacts.

The majority of the soil samples were non-saline. Samples LSC3 was moderately saline. Vegetation on the site has adapted to the saline conditions and is dominated by salt tolerant species. The level of salinity may impact on infrastructure.

E. coli was detected in one soil sample. The presence of *E. coli* has the potential to impact on human health.

The levels of all other assessed potential contaminants in the soil samples were below the commercial land-use thresholds (NEPC 1999).

14.2 Assumptions in reaching the conclusions

It is assumed the sampling sites are representative of the site. An accurate history has been obtained and typical past management practices were adopted.

14.3 Extent of uncertainties

The analytical data relate only to the locations sampled. Soil conditions can vary both laterally and vertically and it cannot be excluded that unidentified contaminants may be present. The sampling density was designed to detect a 'hot spot' at the proposed animal shelter within a radius of approximately 6 metres and with a 95% level of confidence.

14.4 Suitability for proposed use of the site

The site can be made suitable for the proposed animal shelter land-use.

14.5 Limitations and constraints on the use of the site

Infrastructure on the site will need to be designed to consider the saline soil conditions.

14.6 Recommendation for further work

Remediation of coliforms is recommended by cultivation to 300mm and the addition of lime.

Removal of the discarded concrete, wire, steel fence posts and rock located on the south eastern corner of the site.

Infrastructure will need to be designed to consider the saline soil conditions.

Erosion and sediment control measures are required to ensure sediments remain on site. Erosion and sediment control measures should be installed and maintained prior to any remediation or construction works.

Construction shall be undertaken in such a manner as to ensure vegetation outside the work area is maintained. Vegetation buffers are to be maintained on downslope boundaries.

15. Report limitations and intellectual property

This report has been prepared for the use of the client to achieve the objectives given the clients requirements. The level of confidence of the conclusion reached is governed by the scope of the investigation and the availability and quality of existing data. Where limitations or uncertainties are known, they are identified in the report. No liability can be accepted for failure to identify conditions or issues which arise in the future and which could not reasonably have been predicted using the scope of the investigation and the information obtained.

The investigation identifies the actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing is interpreted by geologists, engineers or scientists who then render an opinion about overall subsurface conditions, the nature and extent of the contamination, its likely impact on the proposed development and appropriate remediation measures. Actual conditions may differ from those inferred to exist, because no professional, no matter how well qualified, and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock or time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. It is thus important to understand the limitations of the investigation and recognise that we are not responsible for these limitations.

16. References

Charman PE and Murphy BW (2001) *Soils: Their Properties and Management* (Oxford University Press, South Melbourne)

Environment Protection Authority (2020) *Consultants Reporting on Contaminated Land* (NSW Environment Protection Authority, Chatswood)

EPA (1997) *Environmental Guidelines: Use and Disposal of Biosolids Products* (NSW Environment Protection Authority, Chatswood)

EPA (2017) *Contaminated Sites: Guidelines for the NSW Site Auditors Scheme* (NSW Department of

Environment and Conservation, Chatswood)Environment.nsw.gov.au, 'Espade | NSW Environment & Heritage' Version 2. N.p., 2015. Web. April 2021

Environment Protection Authority (1995) *Contaminated sites: Sampling Design Guidelines* (NSW Environment Protection Authority, Chatswood)

NEPC (1999 revised 2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999* (National Environment Protection Council Service Corporation, Adelaide)

Figures

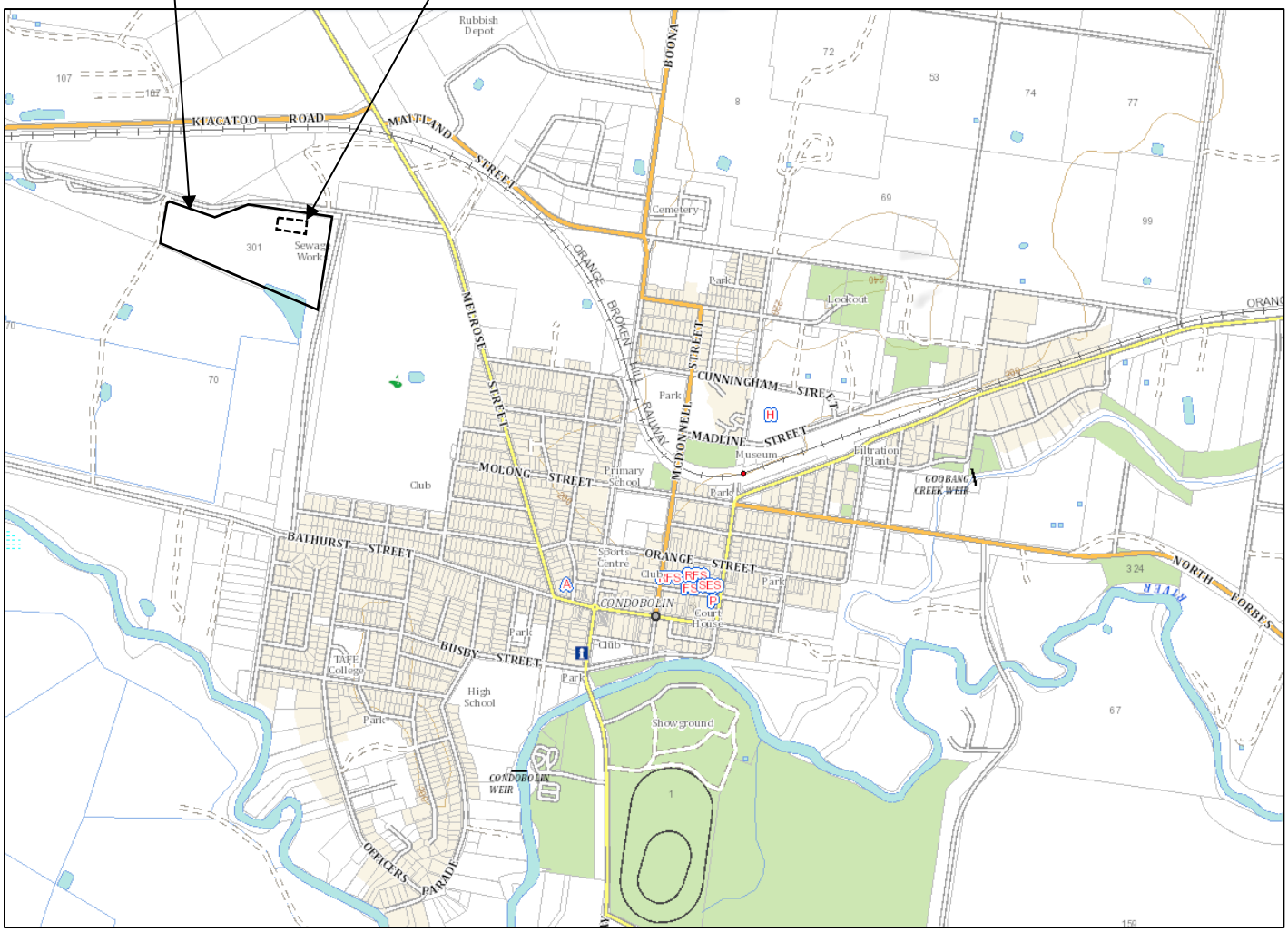


Figure 1. Site locality		
301 Golf Links Road, Condobolin NSW		
	Envirowest Consulting Pty Ltd	
Job: R11460c	Drawn by: TS	Date: 09/03/2021

Investigation area
(see enlargement below)

Lot boundary

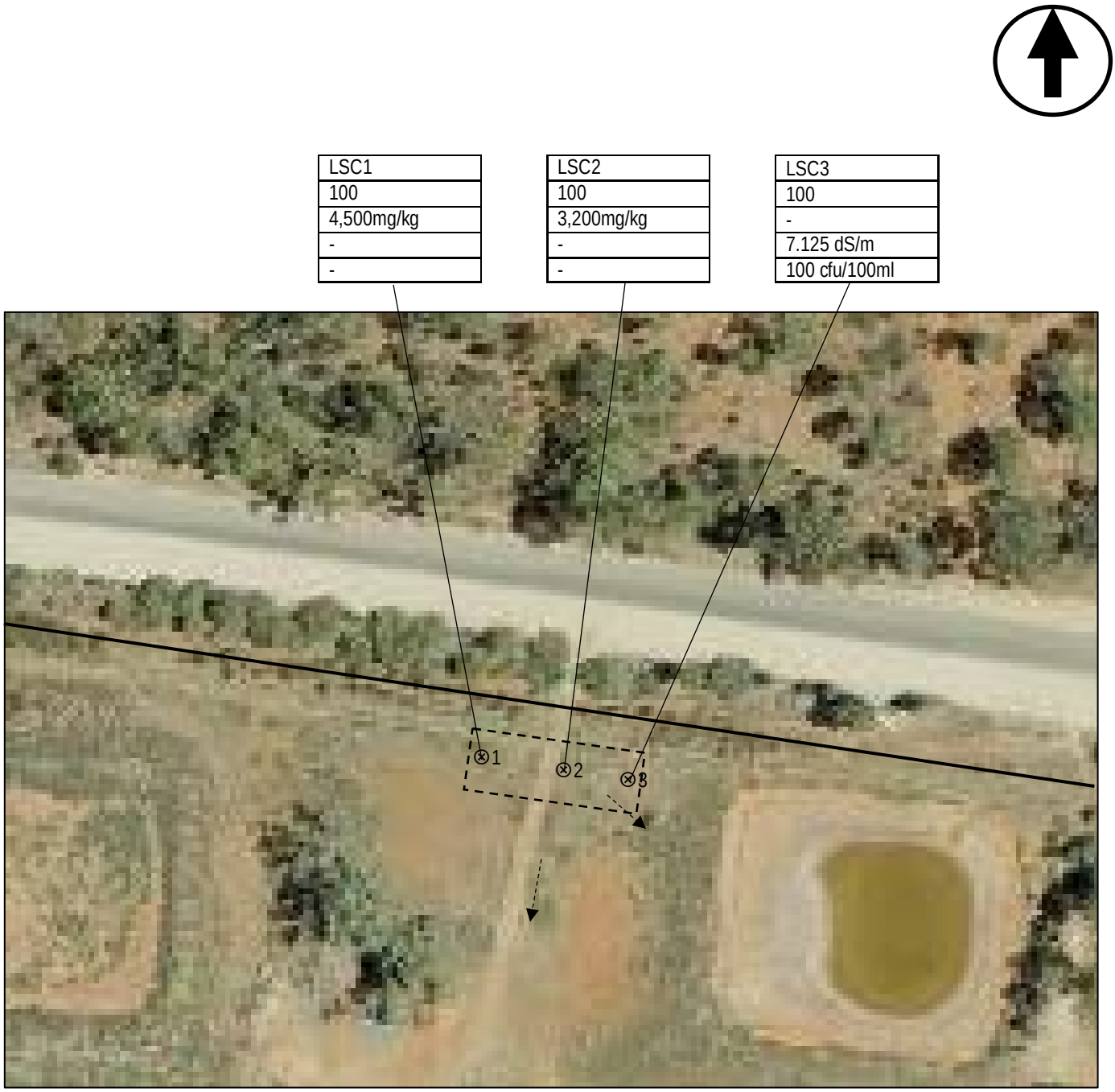
Approximate Scale 1: 1,000

0 10 20 30m

Legend

- Lot boundary
- Investigation area
- ⊗ Sampling location
- Slope

Figure 2. Sampling plan		
301 Golf Links Road, Condobolin NSW		
	Envirowest Consulting Pty Ltd	
Job: R11460c	Drawn by: TS	Date: 09/03/2021



Legend

- Lot boundary
- Investigation area
- ⊗ Sampling location
- Slope

Sample ID
Depth (mm)
Nitrogen (mg/kg)
ECe (dS/m)
E.coli (cfu/100ml)

Approximate Scale 1: 1,000

0 10 20 30m

Figure 3. Soil exceedances

301 Golf Links Road, Condobolin NSW

Envirowest Consulting Pty Ltd

Job: R11460c	Drawn by: TS	Date: 09/03/2021

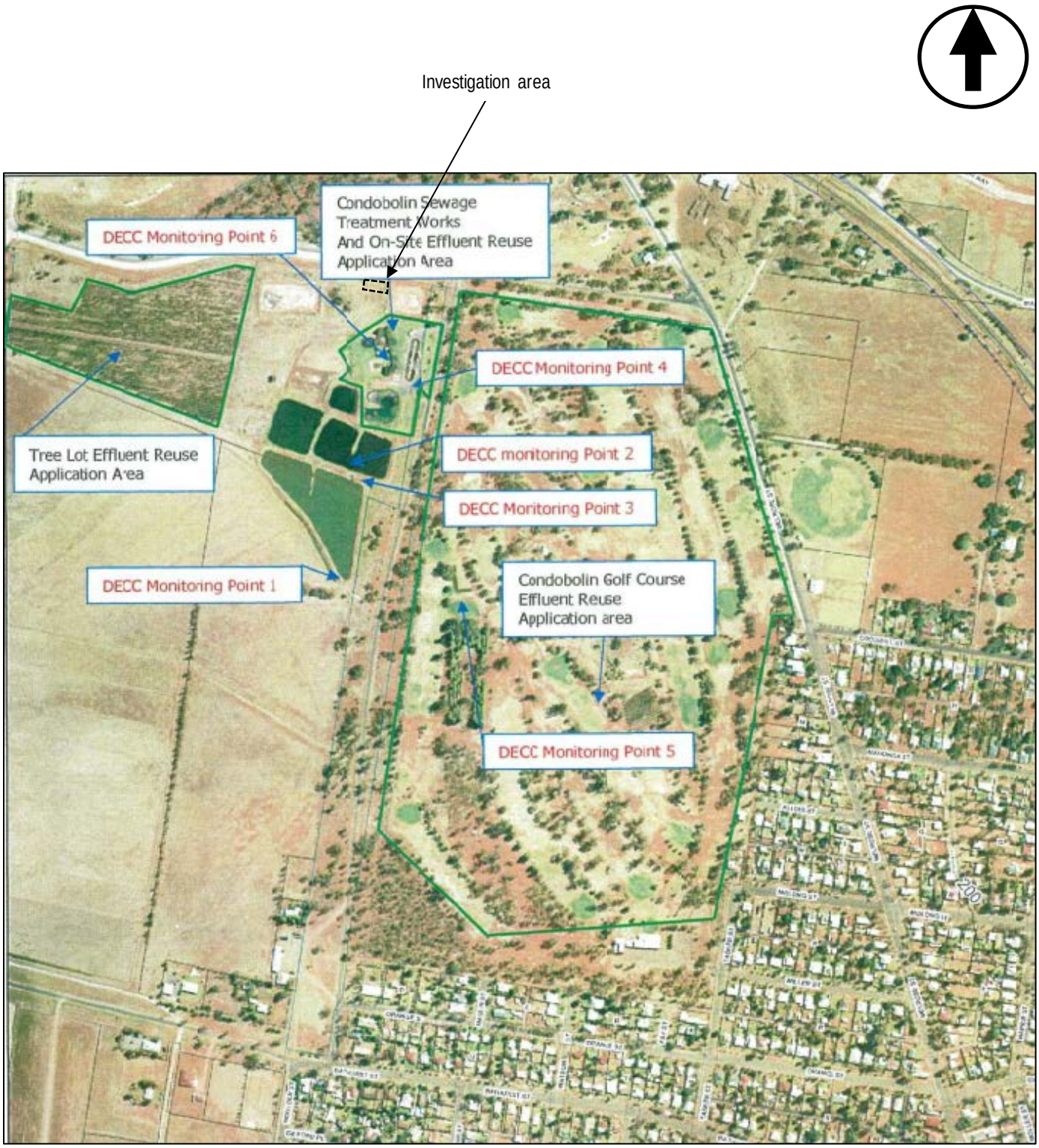


Figure 4. Condobolin Sewage Treatment Works Reuse Application Areas		
301 Golf Links Road, Condobolin NSW		
	Envirowest Consulting Pty Ltd	
Job: R11460c	Drawn by: Supplied by LSC	Date: 20/04/2021

Figure 5. Photographs of the site

Looking east towards redundant salinity pond

Looking west

Appendices

Appendix 1. Sample analysis, quality assurance and quality control (QAQC) report

1. Data quality indicators (DQI) requirements

1.1 Completeness

A measure of the amount of usable data for a data collection activity. Greater than 95% of the data must be reliable based on the quality objectives. Where greater than two quality objectives have less reliability than the acceptance criterion the data may be considered with uncertainty.

1.1.1 Field

Consideration	Requirement
Locations and depths to be sampled	Described in the sampling plan. The acceptance criterion is 95% data retrieved compared with proposed. Acceptance criterion is 100% in crucial areas.
SOP appropriate and compiled	Described in the sampling plan.
Experienced sampler	Sampler or supervisor
Documentation correct	Sampling log and chain of custody completed

1.1.2 Laboratory

Consideration	Requirement
Samples analysed	Number according to sampling and quality plan
Analytes	Number according to sampling and quality plan
Methods	EPA or other recognised methods with suitable PQL
Sample documentation	Complete including chain of custody and sample description
Sample holding times	Metals 6 months, OCP, PAH, TPH, PCB 14 days, microbiology 24 hours

1.2 Comparability

The confidence that data may be considered to be equivalent for each sampling and analytical event. The data must show little or no inconsistencies with results and field observations.

1.2.1 Field

Consideration	Requirement
SOP	Same sampling procedures to be used
Experienced sampler	Sampler or supervisor
Climatic conditions	Described as may influence results
Samples collected	Sample medium, size, preparation, storage, transport

1.2.2 Laboratory

Consideration	Requirement
Analytical methods	Same methods, approved methods
PQL	Same
Same laboratory	Justify if different
Same units	Justify if different

1.3 Representativeness

The confidence (expressed qualitatively) that data are representative of each media present on the site.

1.3.1 Field

Consideration	Requirement
Appropriate media sampled	Sampled according to sampling and quality plan or in accordance with the EPA (1995) sampling guidelines.
All media identified	Sampling media identified in the sampling and quality plan. Where surface water bodies on the site sampled.

1.3.2 Laboratory

Consideration	Requirement
Samples analysed	Blanks

1.4 Precision

A quantitative measure of the variability (or reproduced of the data). Is measured by standard deviation or relative percent difference (RPD). A RPD analysis is calculated and compared to the practical quantitation limit (PQL) or absolute difference AD.

- Levels greater than 10 times the PQL the RPD is 50%
- Levels between 5 and 10 times the PQL the RPD is 75%
- Levels between 2 and 5 times the PQL the RPD is 100%
- Levels less than 2 times the PQL, the AD is less than 2.5 times the PQL

Data not conforming to the acceptance criterion will be examined for determination of suitability for the purpose of site characterisation.

1.4.1 Field

Consideration	Requirement
Field duplicates	Frequency of 5%, results to be within RPD or discussion required indicate the appropriateness of SOP

1.4.2 Laboratory

Consideration	Requirement
Laboratory and inter lab duplicates	Frequency of 5%, results to be within RPD or discussion required. Inter laboratory duplicates will be one sample per batch.
Field duplicates	Frequency of 5%, results to be within RPD or discussion required
Laboratory prepared volatile trip spikes	One per sampling batch, results to be within RPD or discussion required

1.5 Accuracy

A quantitative measure of the closeness of the reported data to the true value.

1.5.1 Field

Consideration	Requirement
SOP	Complied
Inter laboratory duplicates	Frequency of 5%. Analysis criterion 60% RPD for levels greater than 10 times the PQL 85% RPD for levels between 5 to 10 times the PQL 100% RPD at levels between 2 to 5 times the PQL Absolute difference, 3.5 times the PQL where levels are, 2 times PQL

1.5.2 Laboratory

Recovery data (surrogates, laboratory control samples and matrix spikes) data subject to the following control limits:

- 60 to 140% acceptable data
- 20-60% discussion required, may be considered acceptable
- 10-20% data should considered as estimates
- 10% data should be rejected

Consideration	Requirement
Field blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Rinsate blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Method blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Matrix spikes	Frequency of 5%, results to be within +/-40% or discussion required
Matrix duplicates	Sample injected with a known concentration of contaminants with tested. Frequency of 5%, results to be within +/-40% or discussion required
Surrogate spikes	QC monitoring spikes to be added to samples at the extraction process in the laboratory where applicable. Surrogates are closely related to the organic target analyte and not normally found in the natural environment. Frequency of 5%, results to be within +/-40% or discussion required
Laboratory control samples	Externally prepared reference material containing representative analytes under investigation. These will be undertaken at one per batch. It is to be within +/-40% or discussion required
Laboratory prepared spikes	Frequency of 5%, results to be within +/-40% or discussion required

2. Laboratory analysis summary

Two analysis batches were undertaken over the preliminary investigation program. Samples were collected on 4 March and 12 April 2021. Three samples were submitted for analytical testing. The samples were collected in the field by an environmental scientist from Envirowest Consulting Pty Ltd, placed into laboratory prepared receptacles as recommended in NEPM (1999). The samples preservation and storage was undertaken using standard industry practices (NEPC 1999). A chain of custody form accompanied transport of the samples to the laboratory.

The samples were analysed at the laboratories of SGS Laboratories, Alexandria NSW which is National Association of Testing Authorities (NATA) accredited for the tests undertaken. The analyses undertaken, number of samples tested and methods are presented in the following tables:

Laboratory analysis schedule

Sample id. (sampling location)	Number of samples	Duplicate	Analyses	Date collected	Substrate	Laboratory report
LSC1, LSC2, LSC3	3	1	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, N, P, EC	04/03/2021	Soil	SE217284
LSC1, LSC2, LSC3	3	0	Al, Co, Fluoride, Sulphate, CEC, pH, total coliforms, thermotolerant coliforms, E.coli	12/04/2021	Soil	SE218566

Analytical methods

Analyte	Extraction	Laboratory methods
Metals	USEPA 200.2 Mod	APHA USEPA SW846-6010
Chromium (III)	-	APHA 3500 CR-A&B & 3120 and USEPA SW846-3060A
Chromium (VI)	USEPA SW846-3060A	USEPA SW846-3060A
Mercury	USEPA 200.2 Mod	APHA 3112/3500
Total Nitrogen	Tumbler extraction of solids	USEPA SW 846-8260B
Total Phosphorous		

3. Field quality assurance and quality control

One intra laboratory duplicate sample was collected for the investigation. The frequency was greater than the recommended frequency of 5%. Table A5.1 outlines the samples collected and differences in replicate analyses. Relative differences were deemed to pass if they were within the acceptance limits of +/- 40% for replicate analyses or less than 5 times the detection limit.

Field duplicate frequency

Sample id.	Number of samples	Duplicate	Frequency (%)	Date collected	Substrate	Laboratory report
LSC1, LSC2, LSC3	3	1	33	04/03/2021	Soil	SE217284

Table A5.1. Relative differences for intra laboratory duplicates

	LSC 3 and LSC DUP	
	Relative difference (%)	Pass/Fail
Arsenic	0	Pass
Cadmium	NA	Pass
Chromium	10.5	Pass
Copper	1.4	Pass
Lead	10.5	Pass
Nickel	8.7	Pass
Zinc	15.4	Pass
Mercury	NA	Pass
Nitrogen	24.8	Pass
Phosphorous	4.4	Pass

NA – relative difference unable to be calculated as results are less than laboratory detection limit, *Results less than 5 times laboratory detection limits, ^Variation expected to be due to non-homogenised sample. Does not impact results

No trip blanks or spikes were submitted for analysis. This is not considered to create significant uncertainty in the analysis results because of the following rationale:

- The fieldwork was completed within a short time period and consistent methods were used for soil sampling.
- Soil samples were placed in insulated cooled containers after sampling to ensure preservation during transport and storage.
- The samples were placed in single use jars using clean sampling tools and disposable gloves from material not in contact with other samples. This reduces the likelihood of cross contamination.
- Samples in the analysis batch contain analytes below the level of detection. It is considered unlikely that contamination has occurred as a result of transport and handling.
- Target analytes were not volatile

4. Laboratory quality assurance and quality control

Sample holding times are recommended in NEPC (1999). The time between collection and extraction for all samples was less than the criteria listed below:

Analyte	Maximum holding time
Metals, nitrogen, phosphorus	6 months
OCP, TRH, PCB, BTEX, PAH	14 days

The laboratory interpretative reports are presented with individual laboratory report. Assessment is made of holding time, frequency of control samples and quality control samples. No significant outliers exist for the sampling batches. The laboratory report also contains a detailed description of preparation methods and analytical methods.

The results, quality report, interpretative report and chain of custody are presented in the attached appendices. The quality report contains the laboratory duplicates, spikes, laboratory control samples, blanks and where appropriate matrix spike recovery (surrogate).

5. Data quality indicators (DQI) analysis

5.1 Completeness

A measure of the amount of usable data for a data collection activity (total to be greater than 95%).
The data set was found to be complete based on the scope of work. No critical areas of contamination were omitted from the data set.

5.1.1 Field

Consideration	Accepted	Comment
Locations to be sampled	Yes	In accordance with sampling methodology, described in the report. Sampling locations described in figures.
Depth to be sampled	Yes	In accordance with sampling methodology
SOP appropriate and compiled	Yes	In accordance with sampling methodology Sampled with stainless steel spade into lab prepared containers, decontamination between samples, latex gloves worn by sampler
Experienced sampler	Yes	Same soil sampler, environmental scientist
Documentation correct	Yes	Sampling log completed Chain of custody completed

5.1.2 Laboratory

Consideration	Accepted	Comment
Samples analysed	Yes	All critical samples analysed in accordance with chain of custody and analysis plan
Analytes	Yes	All analytes in accordance with chain of custody and analysis plan
Methods	Yes	Analysed in NATA accredited laboratory with recognised methods and suitable PQL
Sample documentation	Yes	Completed including chain of custody and sample results and quality results report for each batch
Sample holding times	Yes	Metals less than 6 months. OCP, TRH, PCB, BTEX less than 14

5.2 Comparability

The confidence that data may be considered to be equivalent for each sampling and analytical event.

The data sets were found to be acceptable.

5.2.1 Field

Consideration	Accepted	Comment
SOP	Yes	Same sampling procedures used and sampled on one date
Experienced sampler	Yes	Experienced scientist
Climatic conditions	Yes	Described in field sampling log
Samples collected	Yes	Suitable size, storage and transport

5.2.2 Laboratory

Consideration	Accepted	Comment
Analytical methods	Yes	Same methods all samples, in accordance with NEPC (1999) or USEPA
PQL	Yes	Suitable for analytes
Same laboratory	Yes	SGS is NATA accredited for the test
Same units	Yes	-

5.3 Representativeness

The confidence (expressed qualitatively) that data are representative of each media present on the site.

The data sets were found to be acceptable.

5.3.1 Field

Consideration	Accepted	Comment
Appropriate media sampled	Yes	Sampled according to sampling and quality plan
All media identified	Yes	Soil Sampling media identified in the sampling and quality plan

5.3.2 Laboratory

Consideration	Accepted	Comment
Samples analysed	Yes	Undertaken in NATA accredited laboratory. No blanks analysed. Samples in the analysis batch contain analytes below the level of detection. It is considered unlikely that contamination has occurred as a result of transport and handling.

5.4 Precision

A quantitative measure of the variability (or reproduced of the data). The data sets were found to be acceptable.

5.4.1 Field

Consideration	Accepted	Comment
SOP	Yes	Complied
Field duplicates	Yes	Collected

5.4.2 Laboratory

Consideration	Accepted	Comment
Laboratory and inter lab duplicates	Yes	Frequency of 5%, results to be within +/-40% or discussion required
Field duplicates	Yes	Frequency of 5%, results to be within +/-40% or discussion required
Laboratory prepared volatile trip spikes	NA	Not analysed due to preliminary nature of investigation

5.5 Accuracy

A quantitative measure of the closeness of the reported data to the true value.

The data sets were found to be acceptable.

5.5.1 Field

Consideration	Accepted	Comment
SOP	Yes	Complied
Field blanks	NA	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Rinsate blanks	NA	Frequency of 5%, <5 times the PQL, PQL may be adjusted

5.5.2 Laboratory

Consideration	Accepted	Comment
Method blanks	Yes	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Matrix spikes	Yes	Frequency of 5%, results to be within +/-40% or discussion required.
Matrix duplicates	Yes	Frequency of 5%, results to be within +/-40% or discussion required.
Surrogate spikes	Yes	Frequency of 5%, results to be within +/-40% or discussion required.
Laboratory control samples	Yes	Frequency of 5%, results to be within +/-40% or discussion required
Laboratory prepared spikes	Yes	Frequency of 5%, results to be within +/-40% or discussion required

No trip blanks, field spikes or sample rinsates were submitted for analysis. This is not considered to create significant uncertainty in the analysis results because of the following rationale:

- The fieldwork methods used for soil sampling were consistent throughout the project with all in situ samples collected from material which had not been subject to exposure.
- The fieldwork was completed within a short time period and consistent methods were used for soil sampling.
- Soil samples were placed in insulated cooled containers as quickly as possible, with the containers filled to minimize headspace. The sample containers were sealed immediately after the sample was collected and chilled in an esky containing ice.
- The samples were stored in a refrigerator and transported with ice bricks to ensure preservation during transport and storage.
- The samples were placed in single use jars using clean sampling tools and disposable gloves from material not in contact with other samples. This reduces the likelihood of cross contamination.
- Samples in the analysis batches contained analytes below the level of detection. It is considered unlikely that contamination has occurred as a result of transport and handling.
- Target analytes were not volatile.

6. Conclusion

All media appropriate to the objectives of this investigation have been adequately analysed and no area of significant uncertainty exist. It is concluded the data is usable for the purposes of the investigation.

Appendix 2. Field sampling log

Client	Lachlan Shire Council
Contact	Rowan Bentick
Job number	R11460c
Location	Golf Links Road, Condobolin NSW
Date	4 March 2021
Investigator(s)	Tiffany Skinner
Weather conditions	Warm, sunny, slight breeze

Sample id	Matrix	Date	Analysis required	Observations/comment
LSC1	Soil	04/03/2021	Arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn), mercury (Hg), phosphorous (P), nitrogen (N), electrical conductivity (EC)	
LSC2	Soil	04/03/2021	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, P, N, EC	
LSC3	Soil	04/03/2021	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, P, N, EC	
LSCDUP	Soil	04/03/2021	As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, P, N, EC	Duplicate of LSC3

Appendix 2. Field sampling log

Client	Lachlan Shire Council
Contact	Rowan Bentick
Job number	R11460c
Location	Golf Links Road, Condobolin NSW
Date	12 April 2021
Investigator(s)	Tiffany Skinner
Weather conditions	Sunny, cool breeze

Sample id	Matrix	Date	Analysis required	Observations/comment
LSC1	Soil	12/04/2021	Total coliforms, thermotolerant coliforms, E. coli, aluminium (Al), cobalt (Co), fluoride, sulphate, cation exchange capacity (CEC), pH	
LSC2	Soil	12/04/2021	Total coliforms, thermotolerant coliforms, E. coli, Al, Co, fluoride, sulphate, CEC, pH	
LSC3	Soil	12/04/2021	Total coliforms, thermotolerant coliforms, E. coli, Al, Co, fluoride, sulphate, CEC, pH	

Appendix 3. Soil analysis results – SGS report number SE217284 and chain of custody form
Soil analysis results – SGS report number SE218566 and chain of custody form

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Tiffany Skinner
Client	ENVIROWEST CONSULTING PTY LIMITED
Address	PO BOX 8158 NSW 2800
Telephone	61 2 63614954
Facsimile	(Not specified)
Email	tiffany@envirowest.net.au
Project	**11460**
Order Number	**11460**
Samples	4

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE217284 R0**
Date Received	8/3/2021
Date Reported	15/3/2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Dong LIANG
Metals/Inorganics Team Leader

Kamrul AHSAN
Senior Chemist

Soluble Anions (1:5) in Soil by Ion Chromatography [AN245] Tested: 10/3/2021

PARAMETER	UOM	LOR	LSC 1 SOIL - 4/3/21 11:30 SE217284.001	LSC 2 SOIL - 4/3/21 11:30 SE217284.002	LSC 3 SOIL - 4/3/21 11:30 SE217284.003	LSC DUP SOIL - 4/3/21 11:30 SE217284.004
Nitrate Nitrogen	mg/kg	0.025	**3.0**	**2.6**	**0.20**	**0.28**

Nitrite Nitrogen in Soil [AN277] Tested: 10/3/2021

PARAMETER	UOM	LOR	LSC 1 SOIL - 4/3/21 11:30 SE217284.001	LSC 2 SOIL - 4/3/21 11:30 SE217284.002	LSC 3 SOIL - 4/3/21 11:30 SE217284.003	LSC DUP SOIL - 4/3/21 11:30 SE217284.004
Nitrite, NO_2 as N in Soil*	mg/kg	0.05	**1.1**	**1.0**	<0.05	<0.05
Total Oxidised Nitrogen, NOx as N in Soil*	mg/kg	0.1	-	-	-	-

TKN Kjeldahl Digestion by Discrete Analyser in Soil [AN292] Tested: 10/3/2021

PARAMETER	UOM	LOR	LSC 1 SOIL - 4/3/21 11:30 SE217284.001	LSC 2 SOIL - 4/3/21 11:30 SE217284.002	LSC 3 SOIL - 4/3/21 11:30 SE217284.003	LSC DUP SOIL - 4/3/21 11:30 SE217284.004
Total Kjeldahl Nitrogen	mg/kg	40	**4500**	**3200**	**680**	**530**

Total Phosphorus by Kjeldahl Digestion DA in Soil [AN279/AN293(Sydney only)] Tested: 10/3/2021

PARAMETER	UOM	LOR	LSC 1 SOIL - 4/3/21 11:30 SE217284.001	LSC 2 SOIL - 4/3/21 11:30 SE217284.002	LSC 3 SOIL - 4/3/21 11:30 SE217284.003	LSC DUP SOIL - 4/3/21 11:30 SE217284.004
Total Phosphorus (Kjeldahl Digestion)	mg/kg	40	**740**	**640**	**230**	**220**

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES [AN040/AN320] Tested: 12/3/2021

PARAMETER	UOM	LOR	LSC 1 SOIL - 4/3/21 11:30 SE217284.001	LSC 2 SOIL - 4/3/21 11:30 SE217284.002	LSC 3 SOIL - 4/3/21 11:30 SE217284.003	LSC DUP SOIL - 4/3/21 11:30 SE217284.004
Arsenic, As	mg/kg	1	**11**	**9**	**7**	**7**
Cadmium, Cd	mg/kg	0.3	**0.5**	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	**27**	**28**	**27**	**30**
Copper, Cu	mg/kg	0.5	**18**	**16**	**7.2**	**7.1**
Lead, Pb	mg/kg	1	**14**	**21**	**9**	**10**
Nickel, Ni	mg/kg	0.5	**10**	**8.2**	**6.6**	**7.2**
Zinc, Zn	mg/kg	2	**71**	**57**	**14**	**12**

Mercury in Soil [AN312] Tested: 12/3/2021

PARAMETER	UOM	LOR	LSC 1 SOIL - 4/3/21 11:30 SE217284.001	LSC 2 SOIL - 4/3/21 11:30 SE217284.002	LSC 3 SOIL - 4/3/21 11:30 SE217284.003	LSC DUP SOIL - 4/3/21 11:30 SE217284.004
Mercury	mg/kg	0.05	**0.11**	**0.07**	<0.05	<0.05

Moisture Content [AN002] Tested: 11/3/2021

PARAMETER	UOM	LOR	LSC 1 SOIL - 4/3/21 11:30 SE217284.001	LSC 2 SOIL - 4/3/21 11:30 SE217284.002	LSC 3 SOIL - 4/3/21 11:30 SE217284.003	LSC DUP SOIL - 4/3/21 11:30 SE217284.004
% Moisture	%w/w	1	**7.5**	**4.2**	**2.1**	**2.9**

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN040	A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analysis by ASS or ICP as per USEPA Method 200.8.
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B
AN277	Nitrite on the extract is determined as an intense red-pink azo dye at 540 nm following diazotisation with sulphanilamide and subsequent coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The original nitrite is determined. Reference APHA 4500-NO2- B.
AN292	The sample is heated in the presence of Sulphuric acid, K2SO4 and CuSO4 for two and half hours using a temperature controlled digestion block. Amino Nitrogen of many organic materials is converted to ammonium ion. Free ammonia also is converted to ammonium. The digest is cooled and placed on the Aquakem 250 discrete analyser for Ammonia determination.
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
***	Indicates that both * and ** apply.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

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Solid samples expressed on a dry weight basis.

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If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-qb/environment-health-and-safety.

This document is issued by the Company under its General Conditions of Service accessible at www.sgs.com/en/Terms-and-Conditions.aspx. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client only. Any unauthorized alteration, forgery or

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Tiffany Skinner
Client	ENVIROWEST CONSULTING PTY LIMITED
Address	PO BOX 8158 NSW 2800
Telephone	61 2 63614954
Facsimile	(Not specified)
Email	tiffany@envirowest.net.au
Project	**11460**
Order Number	**11460**
Samples	4

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE217284A R0**
Date Received	17/3/2021
Date Reported	23/3/2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Shane MCDERMOTT
Inorganic/Metals Chemist

Conductivity and TDS by Calculation - Soil [AN106] Tested: 22/3/2021

PARAMETER	UOM	LOR	LSC 1 SOIL - 4/3/21 11:30 SE217284A.001	LSC 2 SOIL - 4/3/21 11:30 SE217284A.002	LSC 3 SOIL - 4/3/21 11:30 SE217284A.003	LSC DUP SOIL - 4/3/21 11:30 SE217284A.004
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	**74**	**57**	**750**	**1100**

METHOD	METHODOLOGY SUMMARY
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos /cm or µS/cm @ 25°C. For soils, an extract of as received sample with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2510 B.

FOOTNOTES

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**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
***	Indicates that both * and ** apply.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

Chain of Custody Form – Ref 11460

Sheet 1 of 1

Ref:	11460
Investigator:	Envirowest Consulting 9 Cameron Place PO Box 8158 ORANGE NSW 2800
Telephone:	(02) 6361 4954
Email:	tiffany@envirowest.net.au
Contact Person:	Tiffany Skinner
Invoice:	accounts@envirowest.net.au
Laboratory:	SGS SYDNEY 16/33 Maddox Street ALEXANDRIA NSW 2015
Quotation #:	Envir_70119_2019
Courier/CN:	

Sample ID	Container*	Sampling Date/Time	Sample matrix: Water	Soil	Sludge	Sample preservation: Cool	HNO3/HCl	Unpreserved	Analysis: SGS Method Code CL2	AN8			
									CL2 8 Metals	Nitrogen NOx	Phosphorous		
LSC1	P	4/3/21		x		x							
LSC2	P	4/3/21		x		x							
LSC3	P	4/3/21		x		x							
LSCDUP	P	4/3/21		x		x							

SGS EHS Sydney

SE217284

Investigator: I attest that the proper field sampling procedures were used during the collection of these samples.

Sampler name: Tiffany Skinner

Date: 4/3/21 Time: 11:30 a.m.

Relinquished by: (print and signature) Tiffany Skinner Date 4/3/21 Time 2:30pm

Received by: (print and signature) Date 08/03/21 Time @ 6:50

Please return completed form to Envirowest Consulting. *A = Solvent rinsed glass jar with Teflon lined lid and green label, B= Plastic with green label, C= Amber glass, D= Vial with white label, E= Plastic with red label

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Tiffany Skinner
Client	ENVIROWEST CONSULTING PTY LIMITED
Address	PO BOX 8158 NSW 2800
Telephone	61 2 63614954
Facsimile	(Not specified)
Email	tiffany@envirowest.net.au
Project	**11460-2**
Order Number	**11460-2**
Samples	3

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE218566 R0**
Date Received	14/4/2021
Date Reported	21/4/2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Bennet LO
Senior Organic Chemist/Metals Chemist

Kamrul AHSAN
Senior Chemist

Shane MCDERMOTT
Inorganic/Metals Chemist

pH in soil (1:5) [AN101] Tested: 16/4/2021

PARAMETER	UOM	LOR	LSC1 SOIL - 12/4/21 10:00 SE218566.001	LSC2 SOIL - 12/4/21 10:00 SE218566.002	LSC3 SOIL - 12/4/21 10:00 SE218566.003
pH	pH Units	0.1	**6.4**	**5.9**	**6.6**

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) [AN122] Tested: 16/4/2021

PARAMETER	UOM	LOR	LSC1 SOIL - 12/4/21 10:00 SE218566.001	LSC2 SOIL - 12/4/21 10:00 SE218566.002	LSC3 SOIL - 12/4/21 10:00 SE218566.003
Exchangeable Sodium, Na	mg/kg	2	52	22	250
Exchangeable Sodium, Na	cmol (+)/kg	0.01	0.23	0.10	1.1
Exchangeable Sodium Percentage*	%	0.1	1.2	0.9	12.6
Exchangeable Potassium, K	mg/kg	2	1200	720	370
Exchangeable Potassium, K	cmol (+)/kg	0.01	2.9	1.8	0.94
Exchangeable Potassium Percentage*	%	0.1	15.1	18.2	10.9
Exchangeable Calcium, Ca	mg/kg	2	2300	1200	860
Exchangeable Calcium, Ca	cmol (+)/kg	0.01	11	5.9	4.3
Exchangeable Calcium Percentage*	%	0.1	58.5	58.7	49.9
Exchangeable Magnesium, Mg	mg/kg	2	600	270	280
Exchangeable Magnesium, Mg	cmol (+)/kg	0.02	4.9	2.2	2.3
Exchangeable Magnesium Percentage*	%	0.1	25.3	22.2	26.6
Cation Exchange Capacity	cmol (+)/kg	0.02	20	10	8.6

Soluble Anions (1:5) in Soil by Ion Chromatography [AN245] Tested: 16/4/2021

PARAMETER	UOM	LOR	LSC1 SOIL - 12/4/21 10:00 SE218566.001	LSC2 SOIL - 12/4/21 10:00 SE218566.002	LSC3 SOIL - 12/4/21 10:00 SE218566.003
Sulfate	mg/kg	5	**170**	<5.0	**170**
Fluoride	mg/kg	0.1	-	-	-

Total Fluoride in Soil [AN142] Tested: 20/4/2021

PARAMETER	UOM	LOR	LSC1 SOIL - 12/4/21 10:00 SE218566.001	LSC2 SOIL - 12/4/21 10:00 SE218566.002	LSC3 SOIL - 12/4/21 10:00 SE218566.003
Total Fluoride	mg/kg	50	**140**	**120**	**97**

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES [AN040/AN320] Tested: 15/4/2021

PARAMETER	UOM	LOR	LSC1 SOIL - 12/4/21 10:00 SE218566.001	LSC2 SOIL - 12/4/21 10:00 SE218566.002	LSC3 SOIL - 12/4/21 10:00 SE218566.003
Aluminium, Al	mg/kg	50	**7300**	**7700**	**6600**
Cobalt, Co	mg/kg	0.5	**6.4**	**5.4**	**4.4**

Moisture Content [AN002] Tested: 15/4/2021

PARAMETER	UOM	LOR	LSC1 SOIL - 12/4/21 10:00 SE218566.001	LSC2 SOIL - 12/4/21 10:00 SE218566.002	LSC3 SOIL - 12/4/21 10:00 SE218566.003
% Moisture	%w/w	1	**8.8**	**6.8**	**8.5**

Sample Subcontracted [] Tested: 16/4/2021

PARAMETER	UOM	LOR	LSC1 SOIL - 12/4/21 10:00 SE218566.001	LSC2 SOIL - 12/4/21 10:00 SE218566.002	LSC3 SOIL - 12/4/21 10:00 SE218566.003
Sample Subcontracted*	No unit	-	Symbio	Symbio	Symbio

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN040	A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analysis by ASS or ICP as per USEPA Method 200.8.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl2) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN122	Exchangeable Cations, CEC and ESP: Soil sample is extracted in 1M Ammonium Acetate at pH=7 (or 1M Ammonium Chloride at pH=7) with cations (Na, K, Ca & Mg) then determined by ICP OES/ICP MS and reported as Exchangeable Cations. For saline soils, these results can be corrected for water soluble cations and reported as Exchangeable cations in meq/100g or soil can be pre-treated (aqueous ethanol/aqueous glycerol) prior to extraction. Cation Exchange Capacity (CEC) is the sum of the exchangeable cations in meq/100g.
AN122	The Exchangeable Sodium Percentage (ESP) is calculated as the exchangeable sodium divided by the CEC (all in meq/100g) times 100. ESP can be used to categorise the sodicity of the soil as below: ESP < 6% non-sodic ESP 6-15% sodic ESP >15% strongly sodic Method is referenced to Rayment and Lyons, 2011, sections 15D3 and 15N1.-
AN142	Fluoride can be measured in soil as water extractable or 'total' by Ion Selective electrode. In this method the solid sample is weighed and then fused with sodium hydroxide at 600°C. The sample is carefully neutralise with hydrochloric acid and the solution of the melt is cooled and made up to volume. The final solution is then compared to synthetic Digestion Matrix standards with analysis by ISE electrode for a total fluoride result after being calculated back to original mass.
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B

FOOTNOTES

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		LNR	Sample listed, but not received.		

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Symbio LABORATORIES

CERTIFICATE OF ANALYSIS

Certificate Number	S1018063 [R00]	**Page**	1/2
Client	SGS Environmental Services - Sydney	**Registering Laboratory**	Sydney
Contact	Benjamin Aggar	**Contact**	Customer Service Team
Address	16/33 Maddox St Alexandria NSW 2015	**Address**	2 Sirius Rd, Lane Cove West, NSW 2066
		Email	admin@symbiolabs.com.au
Telephone	02 8594 0400	**Telephone**	1300 703 166
Order Number	---	**Date Samples Received**	14/04/2021
Project ID	Soil SE218566	**Date Analysis Commenced**	14/04/2021
Sampler	Customer	**Issue Date**	16/04/2021
Client Job Reference	SE218566	**Receipt Temperature (°C)**	7.0
No. of Samples Registered	3 | Sampler: Customer	**Storage Temperature (°C)**	4.0
Priority	Normal	**Quote Number**	---

Symbio LABORATORIES
Proudly AUSTRALIAN
ABN: 82 079 645 015

NATA
Accreditation No: 2455
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous revision with this reference. This document must not be reproduced, except in full. If samples were provided by the customer, results apply only to the samples 'as received' and responsibility for representative sampling rests with the customer. Water results are reported on an 'as is' basis. Soil and sediment results are reported on a 'dry weight' basis. For other matrices the basis of reporting will be confirmed in the 'Report Comments' section. Measurement Uncertainty is available upon request. If the laboratory was authorised to conduct testing on samples received outside of the specified conditions, all test results may be impacted. Details of samples received outside of the specified conditions are mentioned in the sample description section of this test report.

Definitions

| <: Less Than | >: Greater Than | RP: Result Pending | MPN: Most Probable Number | CFU: Colony Forming Units | ---: Not Received/Not Requested | NA: Not Applicable | ND: Not Detected | LOR: Limit of Reporting | [NT]: Not Tested |

| ~: Estimated | ^ Subcontracted Analysis | TBA: To Be Advised | ** Potential Holding Time Concern | * Test not covered by NATA scope of accreditation | # Result derived from a calculation and includes results equal to or greater than the LOR

Authorised By

Name	Position	Accreditation Category
Michael Chapman	Laboratory Manager – Microbiology	Environmental and Food Microbiology

Sample Information - *Client/Sampler Supplied*

Sample ID	S1018063/1	S1018063/2	S1018063/3
Sample Description	SE218566.001 LSC1	SE218566.002 LSC2	SE218566.003 LSC3
Sample Date/Time	2021-12-04 10:00	2021-12-04 10:00	2021-12-04 10:00
Sample Matrix	Soil	Soil	Soil

Client	SGS Environmental Services - Sydney	**Project ID**	Soil SE218566
Certificate Number	S1018063 [R00]	**Sampler**	Customer
Page	2/2	**Order Number**	---

Analytical Results

		Client Sample Description	SE218566.001 LSC1	SE218566.002 LSC2	SE218566.003 LSC3
		Client Sampling date/time	04/12/2021 10:00	04/12/2021 10:00	04/12/2021 10:00
Compound/Analyte	**LOR**	**Units**	**S1018063/1**	**S1018063/2**	**S1018063/3**
			Results	**Results**	**Results**
Micro General					
M8.5 - AS/NZS 4276.7					
Escherichia coli	1	CFU/100mL	<10	<10	100
Thermotolerant Coliforms	1	CFU/100mL	<10	<10	100
M8.5.1 - AS/NZS 4276.5					
Coliforms	1	CFU/100mL	<10	<10	120

Analysis Location

All in-house analysis was completed by Symbio Laboratories - Sydney.

Chain of Custody Form – Ref 11460-2

Ref: 11460-2
Investigator: Envirowest Consulting
9 Cameron Place
PO Box 8158
ORANGE NSW 2800
Telephone: (02) 6361 4954
Email: tiffany@envirowest.net.au
Contact Person: Tiffany Skinner
Invoice: accounts@envirowest.net.au

Laboratory: SGS SYDNEY
16/33 Maddox Street
ALEXANDRIA NSW 2015

Quotation #: Envir_70119_2019
Courier/CN:

Sample ID	Container*	Sampling Date/Time	Sample matrix: Water	Soil	Sludge	Sample preservation: Cool	HNO3/HCl	Unpreserved	Analysis (SGS Method Code): Total coliforms, Faecal coliforms, E.coli	Aluminium, Cobalt	Fluoride, Sulphate	CA5: Cation Exchange Capacity (CEC)	pH
LSC1	A, E	12/04/2021		X		X			X	X	X	X	X
LSC2	A, E	12/04/2021		X		X			X	X	X	X	X
LSC3	A, E	12/04/2021		X		X			X	X	X	X	X

SGS EHS Sydney COC
SE218566

Investigator: I attest that the proper field sampling procedures were used during the collection of these samples.

Sampler name: Tiffany Skinner
Date: 12/04/2021 Time: 1000

Relinquished by: (print and signature) Tiffany Skinner Date 12/04/2021 Time 14:00

Received by: (print and signature) Date Time 14/04/21 @ 7:15

Please return completed form to Envirowest Consulting, *A = Solvent rinsed glass jar with Teflon lined lid and green label, B= Plastic with green label, C= Amber with green label, D= Vial with white label, E= Plastic sterile with sodium thiosulphate

Appendix 4. Soil sampling protocols

1. Sampling

The samples will be collected from the auger tip, mattock, hand auger or excavator bucket immediately on withdrawal.

The time between retrieval of the sample and sealing of the sample container will be kept to a minimum.

The material will be collected using single use disposal gloves or a stainless-steel spade which represented material which has not been exposed to the atmosphere prior to sampling.

All sampling jars will be filled as close to the top as possible to minimise the available airspace within the jar.

2. Handling, containment and transport

Daily sampling activities will be recorded including sampling locations, numbers, observations, measurements, sampler, date and time and weather condition.

The sampling jars will be new sterile glass jars fitted with plastic lid and airtight Teflon seals, supplied by the laboratories for the purpose of collecting soil samples for analysis. Sample containers will be marked indelibly with the sample ID code to waterproof labels affixed to the body of the container.

All samples will be removed from direct sunlight as soon as possible after sampling and placed in insulated containers. Samples will be stored in a refrigerator at 4°C prior to transportation to the laboratory in insulated containers with ice bricks in accordance with AS4482.1.

Handling and transportation to the laboratory will be accompanied with a chain of custody form to demonstrate the specimens are properly received, documents, processed and stored.

Maximum holding time for extraction (AS4482.1) are:

Analyte	Maximum holding time
Metals	6 months
Mercury	28 days
Sulfate	7 days
Organic carbon	7 days
OCP, OPP, PCB	14 days
TRH, BTEX, PAH, phenols	14 days

3. Decontamination of sampling equipment

Sampling tools will be decontaminated between sampling locations by

- Removing soil adhering to the sampling equipment by scraping, brushing or wiping
- Washing with a phosphate-free detergent
- Rinsing thoroughly with clean water
- Repeating if necessary
- Collect rinsate per sampling time and preserve according to AS 2031.1
- Dry equipment with disposable towels or air