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Bairnsdale Composting Facility

Environmental Management Plan

Prepared for: East Gippsland Shire Council
17 January 2025

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1. Introduction

SMEC Australia Pty Ltd (SMEC) was engaged by East Gippsland Shire Council (Council) to prepare an Environmental Management Plan (EMP) for the proposed Bairnsdale Composting Facility (the Site), currently being designed. This Site is to be located at 200 Johnstons Road, Forge Creek, Victoria. as shown in Figure 1, Appendix A.

The Site is owned and managed by Council. The Site is located next to the Bairnsdale Landfill which holds an EPA permission operate under EPA licence OL000072826 as a landfill (A05a) to receive putrescible waste, solid inert waste, as well as reportable priority wastes (A01) i.e., asbestos.

SMEC understands this Environmental Management Plan (EMP) will support the Development Licence Application for the Site and to inform controls and management actions for the Site consistent with EPA Publication 1588.1 'Designing, Construction and Operating Composting Facilities'.

1.1 Objectives

The key objectives of this EMP are to:

- Demonstrate that the Site can be managed in accordance with EPA Victoria Guideline '*Design, construction and operating compositing facilities'* (Publications 1588.1, 2017);
- Identify, assess and address likely risks to human health and the environment arising from Site operations, in accordance with EPA Victoria Guideline *'Assessing and controlling risk: A guide for business'* (Publication 1695.1, 2019);
- Provide a framework to guide the long-term performance of the Site to operate within the conditions set out in future A07a permissions.

The key elements of the EMP are presented in the body of the report, with supporting information and data provided in the attached Appendices.

1.2 Scope

The scope of works to prepare this plan included:

- Undertake a review of the Site and existing activities.
- Prepare a summary of site conditions at the Site, including key information from the hydrogeological assessment at the neighbouring landfill. Site conditions to include aquifers, groundwater uses, environmental values and depth to groundwater.
- Prepare a conceptual site model to assess potential source, pathway and receptors of potential risks to human health and the environment.
- Identify potential receptors to impacts produced by the Site's proposed operation.
- Undertaking a preliminary risk assessment that considered the impact of:
  - Contact water
  - Surface Water
  - Groundwater
  - Odour
  - Dust and Air quality
  - Vermin and pests
  - Noxious weeds
  - Windblown litter

- Land contamination

1.3 Regulatory Framework

The legislation, regulations and guidelines relevant to the Site that have been considered in preparation of this EMP are presented in Table 1–1.

Table 1–1: Legislation, regulations and guidelines

Legislation	
Federal	*Environmental Protection and Biodiversity Conservation Act 1999* *Work Health and Safety Act 2011* *AS/NZS31000:2009: Risk Management – Principles and guidelines.*
State	*Catchment and Land Protection Act 1994* *Climate Change Act 2010* *Environment Effects Act 1978* *Environment Protection Act 2017* *Environment Protection (Industrial Waste) Act 1985* *Flora and Fauna Guarantee Act 1988* *Heritage Act 1995* *Land Act 1985* *Land Regulations 2006* *Planning and Environment Act 1987* *Pollution of Waters by Oil and Noxious Substances Act 1986* *Water Act 1989* *Water (Subdivisional Easements and Reserves) Regulations 2011*
Regulations and guidelines	
Waste management	*Industrial Waste Management Policy (Protection of the Ozone Layer) No. S193* *Environment Reference Standard (ERS), EPA, May 2021*
Water	*Australian Water Quality Guidelines for Fresh and Marine Water Quality, ANZG, 2018* *Water (Trade Waste) Regulations 2014* *Water (Resource Management) Regulations 2007* *Environment Reference Standard (ERS), EPA, May 2021*
Compost Facility	*Designing, constructing, and operating composting facilities, EPA Pub. 1588.1, June 2017* *AS 4454 -2012 – Composts, Soil Conditioners and Mulches*
Noise and Vibration	*Noise Control Guidelines, EPA Pub. 1254, October 2008* *Environment Protection (Residential Noise) Regulations 2008* *Environment Reference Standard (ERS), EPA, May 2021*
Air Quality	*National Environment Protection (Ambient Air Quality) Measure, NEPC, June 1998*

	Environment Reference Standard (ERS), EPA, May 2021
Licensing and Risk	*Assessing and controlling risk: A guide for business, EPA Pub. 1695.1, March 2019* *Licence assessment guidelines, EPA Pub. 1321.2, June 2011*

2. Site activity and background

2.1 Site details

The Site is located at 200 Johnstons Road, Forge Creek, Victoria. The site is Council owned and occupies 3.3 hectares (8.2 acres).

2.1.1 Description of Proposed Site Activities

The new proposed Site activity would involve the processing of Food Organics and Garden Organics (FOGO) material (W_4) onsite for use within the purpose build composting facility. The facility is proposed to conduct aerobic composting. The process will involve pasteurisation within a covered, forced aeration pad followed by windrow maturation. The site will require EPA permissions to undertake the activity as it will be classed as A07a *Organics Waste Processing-large*. The Site would be processing feedstocks ranked as medium to high risk, as per EPA Publication 1558.1.

The Site will be designed with a proposed feedstock throughput of 25,000 tonnes of municipal FOGO each year; it is projected that the site would generate approximately 40,000 m^3 of compost product. A summary of the processes is provided below:

- Kerbside municipal FOGO is unloaded within the incoming shed
- Manual contamination (i.e. general waste and plastics) removal by site staff
    - This waste will then be taken to the landfill site to the east for lawful disposal
- Cleaned feedstock is loaded into forced aeration bays and covered for the pasteurisation phase of the compost process.
    - Moisture, temperature and oxygen are monitored while the compost is pasteurising
    - As required by Publication 1558.1, the material will be held at over 55°C for a minimum of three days.
- Following the pasteurisation, compost will be loaded into windrows and periodically turned until mature; the Site will be designed on a 16-week maturation phase.
- Following maturation, the compost will be passed through a trommel to appropriately size the material ready for use as a mature compost product.

In conjunction with this composting, the Site will have a contact water pond and contact water management system.

2.1.2 Site history

There is limited historical data available for this Site, however based on information presented in the most recent 53v Landfill Aftercare Audit for the adjacent landfill site (Nolan Consulting, 2021), it is inferred that historically the area was used for agricultural purposes.

2.1.3 Surrounding Land Uses

The Site is currently zoned within the Farming Zone (FR1) – Schedule 1. The site is bounded by agricultural land to the south and west, with Johnstons Road to the north. To the east there is the active Bairnsdale Landfill. See Appendix A for map of sensitive receptors and their proximity to the Site.

Table 2–1: Surrounding Land Uses

Direction	Description
North	Johnstons Road bounding the Site. Agricultural land and a quarry further northeast. Hollis Creek is to the north of the site.
East	Bairnsdale Landfill immediately east. Further east is McDonalds Road, a wildlife reserve (Macleod Morass) and Jones Bay. Skeene Creek enters the site from the east along McDonalds Road. The creek extends through the southern portion of the parcel south of the active landfill and proposed compost site boundary.
West	Agricultural land and a residential property approximately 530m from the Site boundary. Further west is Forge Creek Road.
South	Agricultural land, and residential property approximately 1 km from the Site boundary. Further south is Forge Creek Road.

2.1.4 Underground services

A Dial Before You Dig (DBYD) search was undertaken at the Site, and no existing services were identified within the Site extents.

2.2 Climate

The Site is located within a temperate climate region.

A review of the most recent climate data from the closest Bureau of Meteorology (BoM) weather station (ID:085279) indicates the following wind, rainfall and temperature data for the Site:

- Annually based on data between 1943 and 2023, the area experiences mean temperatures of 8.4 ℃ (min) to 20.2 ℃ (max).
- Annually based on data between 1943 and 2023, the area experiences a mean rainfall of 645.6 mm, with a mean number of 47 days yearly with rain > 1mm
- Annually based on data between 1943 and 2023, the mean 9am and 3pm wind speeds are 10.1 km/hr and 18.2 km/hr, respectively.

2.3 Geology

A review of VVG (2020) indicates the following regional geological units present in the study area are Quaternary Sediments with potential Haunted Hills Formation along the northern boundary.

Geology at the neighbouring landfill is Quaternary from 0.7 m below ground level (bgl) to 5.6 m bgl, underlain by sands and gravels (inferred Haunted Hills Formation) to 39.5 m bgl and deeper underlain by Boisdale Formation, underlain again by Gippsland Limestone (Golder, 2018).

Test pits and core samples were collected from the site in May 2023 which found that the site has generally 200 to 400 mm of topsoil which sits atop low permeability clay which was found to have a permeability of generally <1 x 10^{-9} m/s.

2.4 Hydrogeology

A review of the Visualising Victoria's Groundwater (VVG) database indicates that regional groundwater beneath the Site occurs at depths ranging between 20 to 50 metres below ground level (mBGL), dependent on localised topography (VVG, 2020).

Site observations from the neighbouring landfill frequently note that groundwater is observed to be 30 mBGL and lower than the base of surface water bodies (Golder, 2018 & Nolan Consulting, 2021).

The hydrogeological assessment conducted at the neighbouring landfill site (Golder, 2018) estimated south-easterly groundwater flow direction at the Site, changing to a north-easterly flow direction across the landfill extent.

2.4.1 Aquifers

Based on the geology present at the Site and regionally, there are potentially two aquifers present at the Site; the Quaternary Aquifer and the Haunted Hills Formation as an upper/quaternary aquifer.

2.4.2 Existing groundwater uses

There are no bores on the Site, however there are bores located at the neighbouring site of Bairnsdale Landfill.

A search of the Visualising Victoria's Groundwater database shows eight registered groundwater bores within 1 km of the Site. Four of the bores are observational bores related to the landfill itself, two are domestic and two unknowns. The bores are presented in Table 2–2.

Table 2–2: Existing, registered groundwater bores within 1km of the Site according to VVG (2020).

Bore ID	Direction from Site	Total Depth	Screened Depth	Screened Lithology
119506	East	22	19-22	Sandstones
119507	Southeast	31	21-30	Sand, gravelly clay
119508	Southeast	35	26-35	Sand and clay
120349	West	124	84-124	Shelly marl and limestone
141403	Southeast	39.1	35.2-38.2	Sands and interbedded layers
46982	West	118.8	Unknown	Unknown
46989	South	131	Unknown	Unknown
WRK964349	South	46.1	35.5 - 43	Sand

2.5 Topography and Drainage

The Site is located within the Gippsland Basin's northern edge, on a plateau. Further east and north of the Site, the plateau slopes down towards water bodies of Skeene Creek and the Macleod Morass. The neighbouring landfill has a topography that slopes approximately from the southwest to the northeast (Golder, 2018).

Several surface water bodies are nearby the Site, the closest are:

- Farm dams on neighbouring properties (south)
- Skeene Creek (south east)
- Hollis Creek (north west)
- Macleod Morass (east)
- Mitchell River (north east)
- Jones Bay (north east)

2.6 Separation distances

According to Publication 1588.1 (EPA, 2017) separation distances are the required gap that is needed between composting facilities and sensitive receptors. This is further enforced by Planning provision Notice 92 and Clause 53.10 of the Victorian Planning Provisions.

Due to the rural nature of the site the separation distances were calculated using Method 2 (*The rural Method*).

Under current EPA guidance minimum separation distances to sensitive receptors would be 800m based on Section 4-2 of Publication 1588.1. It is noted revised setbacks are included in EPA Draft Publication 1949 Appendix C, which indicates that future separation distances would be 750m.

Figure 2 of Appendix A visually represents the separation distance from the Site to sensitive receptors using Method 2. The distances to each identified sensitive receptor is summarised in Table 2–3 below.

Table 2–3: Summary of Sensitive receptor distances from the Site

Sensitive Receptor	Distance (m)	Direction
Residential Property	756	West
Residential Property	864	South-west
Residential Property	888	South-west
Residential Property	972	South
Residential Property	1125	South-east

2.7 Environmental Values

The *Environment Protection Act 2017* (the Act) is the overarching legislation governing the management of environmental resources in Victoria. The Act creates the framework whereby various aspects of the environment are managed. The Victoria Government Gazette Environment Reference Standard (ERS) (Victorian Government, 2021) is a subordinate legislation and outlines the environmental values of waters and other environmental aspects.

Under the Act, Council is obliged to adhere to the general environmental duty (GED). As such, Council must reduce the risk of harm from its activities to human health and the environment and from pollution or waste.

The ERS provides an approach for identifying the environmental values of the resource and identifies the guidelines against which the environmental values are to be assessed. The relevant environmental values are outlined below.

2.7.1 Groundwater

Groundwater quality segments are defined in terms of the concentration of Total Dissolved Solids (TDS) with the environmental values determined by the groundwater segment.

According to VVG (2020) groundwater salinity in the area is between 1,000 to 3,500 mg/L, which corresponds to groundwater Segment A2 of the ERS. However, a review of the hydrogeological assessment prepared for the adjacent landfill (Golder, 2018) considers the groundwater adjacent to the Site to be in Segment A1. Based on this information, the most conservative segment has been selected for the Site. The environmental values to be protected under Segment A1 are shown in Table 2–4.

Table 2–4: Environmental values that apply to the groundwater segments

Environmental Value	Segments (mg/L TDS)						
	A1	A2	B	C	D	E	F
	(0 – 600)	(601 – 1,200)	(1,201 – 3,100)	(3,101 – 5,401)	(5,401 – 7,100)	(7,101 – 10,000)	(>10,001)
Water dependent ecosystems and species	✓	✓	✓	✓	✓	✓	✓
Potable water supply (desirable)	✓						
Potable water supply (acceptable)		✓					
Potable mineral water supply	✓	✓	✓	✓			
Agriculture and irrigation (irrigation)	✓	✓	✓				
Agriculture and irrigation (stock watering)	✓	✓	✓	✓	✓	✓	

Environmental Value	Segments (mg/L TDS)						
	A1	A2	B	C	D	E	F
	(0 – 600)	(601 – 1,200)	(1,201 – 3,100)	(3,101 – 5,401)	(5,401 – 7,100)	(7,101 – 10,000)	(>10,001)
Industrial and commercial use	✓	✓	✓	✓	✓		
Water-based recreation (primary contact recreation)	✓	✓	✓	✓	✓	✓	✓
Traditional Owner cultural values	✓	✓	✓	✓	✓	✓	✓
Buildings and structures	✓	✓	✓	✓	✓	✓	✓
Geothermal properties	✓	✓	✓	✓	✓	✓	✓

2.7.2 Surface water

Within the larger precinct exists Skeene Creek, South of the Site which extends from east to west. The ERS (2021) categorises the Site to be within the "Central Foothills and Coastal Plains" surface water segment. The environmental values for this segment, as per Table 5.5 of the ERS (2021), are as follows:

- Water dependent ecosystems and species that are slightly to moderately modified.
- Human consumption after appropriate treatment.
- Agriculture and irrigation.
- Human consumption of aquatic foods.
- Aquaculture.
- Industrial and commercial.
- Water-based recreation (primary, secondary contact and aesthetic enjoyment).
- Traditional Owners cultural values.

The relevant quality objectives for the surface water onsite are set out below in Table 2–5.

Table 2–5: Surface water quality objectives

Analyte	Water dependent ecosystems[1]	Portable Water Supply[2]	Agriculture and Irrigation (Stock Watering)[3]	Agriculture and Irrigation (Irrigation[4]	Water based Recreation (Primary)[5]	Buildings and Structures[6]
Ammonia as N (mg/L)	0.69	0.41[(B)(C)]			0.41[(B)(C)]	

[1] ANZECC & ARMCANZ, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality – Volume 1*, October 2000.

[2] NHMRC, *National Water Quality Management Strategy, Australian Drinking Water Guidelines 6- Version 3.5*, 2011 (Updated August 2018) (**ADWG 2018**).

[3] Heads of EPA, *PFAS National Environment Management Plan*, January 2018. – Meinhardt notes that this document has since been superseded, however Victoria has not endorsed the new version.

[4] NHMRC, *Guidance on Per and Polyfluoroalkyl substances (PFAS) in Recreational Water*, 2019.

[5] Recreational guidance is based on ADWG 2018, multiplied by a factor of 10 for non-volatile contaminants to reflect the lower likelihood of water being ingested while partaking in recreational activities as per NHMRC, *Guidelines for Managing Risks in Recreational Water*, 2008.

[A] NIWA, *Memorandum – Subject Nitrate guideline values in ANZECC 2000*, 30 September 2002.

[B] Calculated using stoichiometry for conversion from total species concentration.

Analyte	Water dependent ecosystems[1]	Portable Water Supply[2]	Agriculture and Irrigation (Stock Watering)[3]	Agriculture and Irrigation (Irrigation[4]	Water based Recreation (Primary)[5]	Buildings and Structures[6]
Nitrate as N (mg/L)	7.2(A)	11.3(B)		90	113(B)	
Nitrite as N (mg/L)		0.91(B)		9.1	9.1(B)	
Total Dissolved Solids (mg/L)		600(C)		3,000	600(C)	
Aluminium (mg/L)				5.0		
Calcium (mg/L)				1,000		
Chloride (mg/L)		250(C)	175		250(C)	6,000
Magnesium (mg/L)				2,000		
Sodium (mg/L)		180(C)	115		180	
Sulphate as S (mg/L)		83((B)C)		333(B)	83(B)(C)	330
Arsenic (mg/L)		0.01	0.1	0.5	0.1	
Cadmium (mg/L)	0.002	0.0002		0.01	0.02	
Chromium (mg/L)			0.1	1.0		
Copper (mg/L)	0.0014	1.0(C)	0.2	0.4	1.0(C)	
Iron (mg/L)		0.3(C)	0.2		0.3(C)	
Lead (mg/L)	0.0034	0.01		0.1	0.1	
Manganese (mg/L)	1.9	0.1(C)	0.2		0.1(C)	
Mercury (mg/L)		0.001	0.002	0.002	0.001	
Nickel (mg/L)	0.011	0.02	0.2	1.0	0.2	
Zinc (mg/L)	0.008	3.0(C)	2.0	20	3.0(C)	
Formaldehyde (mg/L)		0.5		5	0.5	
pH		6.5 – 8.5(C)	6.0 – 8.5		6.5 – 8.5(C)	<5.5

2.7.3 Land

In accordance with Table 4.2 of the ERS (2021), the land use category for the Site is Industrial. The environmental values for this segment are as follows:

- Land dependent ecosystems and species that are highly modified.
- Human health.

[C] Aesthetic value used for conservatism.

- Buildings and structures.

2.7.4 Noise

Within the ERS (2021), indicators and objectives of ambient noise emissions are specified by land-use categories. As per Table 3.2 of the ERS (2021), the Site is categorised within Category 1 and 2. Table 3.3 of the ERS (2021) specifies the indicators and objectives pertaining to each category, those relevant to the Site are summarised in Table 2–6.

Table 2–6: Adapted from ERA Table 3.3

Land-use category	Indicators	Objectives
Category 1	Outdoor $L_{Aeq,8h}$ from 10 p.m. to 6 a.m.	55 dB(A)
	Outdoor $L_{Aeq,16h}$ from 6 a.m. to 10 p.m.	60 dB(A)
Category 2	Outdoor $L_{Aeq,8h}$ from 10 p.m. to 6 a.m.	50 dB(A)
	Outdoor $L_{Aeq,16h}$ from 6 a.m. to 10 p.m.	55 dB(A)

2.7.5 Dust, Odour and Wind

In accordance with the ERS (2021), Council is legally obligated to manage the ambient air environment around the Site and ensure there are no adverse impacts resulting from dust, odour and wind at the Site.

There are no specific criteria related to these amenity impacts, however, as indicated in Table 2.1 in the ERS, there are several environmental impacts that are to be minimised within ambient air quality:

- Life, health and well-being of humans
- Life, health and well-being of other forms of life, including protection of ecosystems and biodiversity
- Local amenity and aesthetic enjoyment
- Visibility
- The useful life and aesthetic appearance of buildings, structures, property and materials
- Climate systems that are consistent with human development, the life, health and well-beings of humans and the protection of ecosystems and biodiversity.

According to wind rose based on five years of weather data collected by the Bairnsdale Airport Weather Station, there is a prevailing wind blowing to the sites east/south east (Figure 2–1). The nearest sensitive receptor to the south/southeast is located 1,125 m from the proposed operational area.

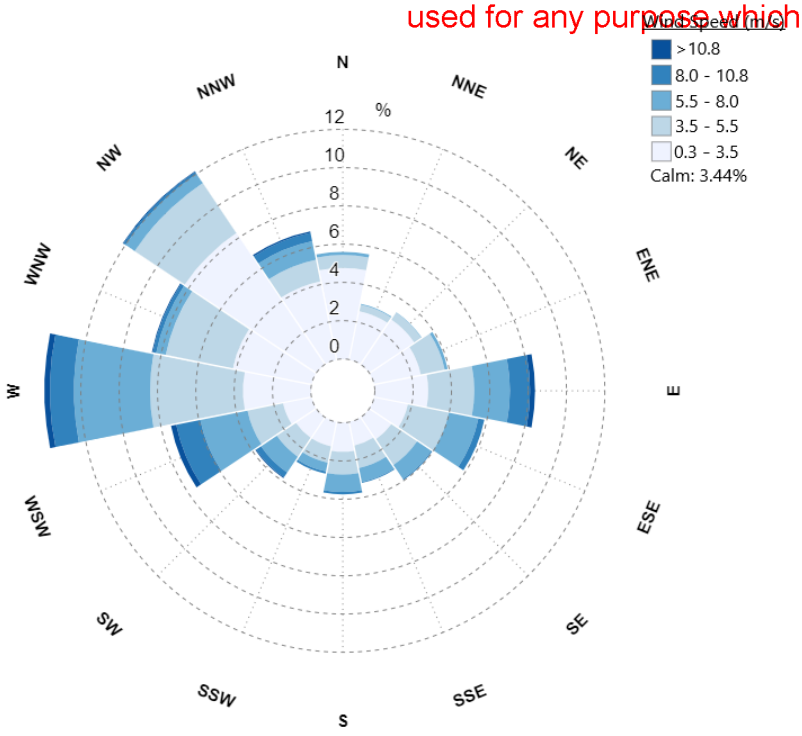


Figure 2–1: Wind Rose for Forge Creek for the Bairnsdale Airport weather station sourced from *Bureau of Meteorology*.

2.8 Weeds, Vermin and Pathogens

Council has a duty to ensure that human health, the environment and amenity are protected throughout the composting process. Due to the nature of the composting process, there are risks associated with the propagation of noxious weeds, vermin and pathogens within the compost stockpiles. Council is legally required, under the ERS to ensure that there are no adverse impacts resulting from these risks to the wider environment, human health or amenity.

2.9 Human and Fauna Health

Council is legally obligated to ensure that impact to human and fauna health at the Site is kept to a minimum. As there are inherent risks in handling food waste which could harbor pathogens, Council must ensure their staff are suitably trained and vaccinated prior to handling any feedstocks or composted products.

The composting process can produce dust and harbour pathogens that can be toxic if inhaled or transmitted by being physically touched. The key criterion for managing this risk is set out though the pasteurisation process required for high-risk organic wastes.

2.9.1 Pasteurisation

The feedstock entering the site will be predominately FOGO and as such be classed as a “higher risk material” as per AS-4454.2012 section 3.2. Due to the high-risk nature of the material being processed at the site it is critical the compost is sufficiently pasteurised to minimise risk to human and fauna health. As an enclosed facility EPA Publication 1588.1 requires that material of this nature is pasteurised by:

> *“The whole mass should be maintained at 55°C or higher for a minimum of three consecutive days. (To meet this, the material will need to be in the enclosed vessel for longer to ensure it gets to and maintains temperature.)”*

Furthermore Table 8 of EPA pub 1588.1 sets the service standards for pathogens and plant propagates as per Table 2–7 below.

Table 2–7: Pathogen and Plant standards from EPA pub 1588.1 Table 8

Parameter	Standard
Enteric Viruses	<1 PFU per 10 grams (dry weight)
Helminth ova (Ascaris sp. And Taenia sp.)	<1 per 4 grams total dry solids
E. coli	<100 MPN per gram (dry weight)
Faecal coliforms	<1,000 MPN per gram (dry weight)
Salmonella spp.	Absent in 50grams of final product (dry weight)
Destruction of noxious weeds (Viable plant materials and propagules)	Nil (germination) after 21 days incubation.

MPN: Most probable number

PFU: Plaque-forming unit

2.10 Product requirements

AS-4453.2012 sets out the physical and chemical requirements for the compost product to be a suitable product. Furthermore Tables 8 and 9 of EPA publication 1558.1 provide Victorian specific context on biological and chemical contaminants for Victoria. These are summarised below in Table 2–8.

Table 2–8: Physical and chemical requirement for composts and mulches extracted from Table 3.1(A) of AS-4454.2012 and Table 9 of EPA publication 1558.1

Characteristic	Pasteurised product	Composted product	Mature Compost
pH (pH units) [1]	>5 and <8 Units	>5 and <8 Units	>5 and <8 Units
Electrical Conductivity (dS/m)	>10 ds/m	>10 ds/m	>10 ds/m
Sodium (% dry mass)[2]	<1	<1	<1
Phosphorus, soluble (mg/L)	≤5	≤5	≤5
Phosphorus, (% dry)	≤0.1	≤0.1	≤0.1
Ammonium N (mg/L)	NA	<200	<100
Nitrogen Total (% dry)	≥0.8	≥0.8	≥0.8
Organic carbon (% dry)	≥20	≥20	≥20
Wettability (minutes)	<7	<5	<5
Pathogens	Refer to table 2-6	Refer to table 2-6	Refer to table 2-6
Arsenic (dry mg/kg)	<20	<20	<20
Cadmium (dry mg/kg)	<1	<1	<1
Boron (dry mg/kg)	<100	<100	<100
Chromium (dry mg/kg)	<100	<100	<100
Copper (dry mg/kg)	<150	<150	<150
Lead (dry mg/kg)	<150	<150	<150
Mercury (dry mg/kg)	<1	<1	<1
Nickel (dry mg/kg)	<60	<60	<60
Selenium (dry mg/kg)	<5	<5	<5
Zinc (dry mg/kg)	<300	<300	<300
DDT/DDD/DDE (dry mg/kg)	<0.5	<0.5	<0.5
Aldrin (dry mg/kg)	<0.02	<0.02	<0.02

Characteristic	Pasteurised product	Composted product	Mature Compost
Dieldrin (dry mg/kg)	<0.02	<0.02	<0.02
Chlordane (dry mg/kg)	<0.02	<0.02	<0.02
Heptachlor (dry mg/kg)	<0.02	<0.02	<0.02
HCB (dry mg/kg)	<0.02	<0.02	<0.02
Lindane (dry mg/kg)	<0.02	<0.02	<0.02
BHC (dry mg/kg)	<0.02	<0.02	<0.02
PCBs (dry mg/kg)	Not detectable limit (0.2mg/kg)	Not detectable limit (0.2mg/kg)	Not detectable limit (0.2mg/kg)
Moisture Content (%)[3]	<25	<25	<25
Glass (dry % w/w)	≤0.5	≤0.5	≤0.5
Plastics (dry % w/w)	≤0.05	≤0.05	≤0.05
Stones and lumps (dry % w/w)	≤5	≤5	≤5
Maturity Index	1	2	3
1: if pH is >8.0 then compost may be suitable depending on $CaCO_3$ Content refer to AS-4454.2012 Appendix H 2: if not <1 then at least 7.5_{mol} calcium plus magnesium for each mole of sodium in dry matter 3: Note maximum of 40 is dependent on organic matter content- (if OM >40% then Max= OM+6), if (OM< 40% then Max= OM+10)			

2.10.1 Particle sizes

Depending on which product is being created, soil conditioners, coarse mulch and fine mulches particle sizes will vary. Please refer to Table 3–1 of AS-4454.2012. For mature composts the following size gradings should be reached.

Table 2–9: Summary of particle sizes for mature composts products

Product	Sizing
Soil conditioner	Not more than 20% by mass in the shortest dimension to be retained by 16 mm sieve
Coarse mulch	Equal to or more than 70% by mass in the shortest dimension to be retained by the 16mm sieve
Fine mulch	Less than 20% by mass passing 5mm sieve and less than 20% by mass in the shortest dimension to be retained by the 16mm sieve.

3. Conceptual Site Model

A critical element of any risk assessment is the development of a Conceptual Site Model (CSM). The CSM describes the environmental setting, identifies contaminant sources (potential areas of concern and associated contaminants), modes of contaminant movement (migration pathways), the person/ecosystem components/environmental values potentially affected by the contamination (potential receptors) and how exposure may occur (exposure routes).

The development of the CSM is an iterative process, whereby the initial CSM is developed in the first stage of site assessment and revised as more detailed information on the site and the nature of contamination becomes available. The CSM is used to identify risks to human health, the environment and environmental values, as well as uncertainties or critical gaps in information that need to be addressed in subsequent stages.

The objective of the CSM is to summarise and encapsulate pertinent information derived from the many studies undertaken at the site and surrounding areas into a document which clearly identifies the following, and how they inter-relate:

- The history of activities and land development at the Site and surrounding properties, including potentially contaminating activities and land uses
- The progression and scope of investigation works undertaken by the client and other consultants about groundwater, surface water and amenities
- The environmental setting at the Site and surrounding properties
- The inferred sources, nature and extent of contamination, including the various media potentially affected by the contamination
- The mechanisms for transport and attenuation of the contaminants, and exposure of identified receptors to the contamination
- The potential health and environmental risks which the identified contamination is inferred to pose
- The potential contamination threat to the proposed future use based on results of environmental investigation work.
- For a risk to be present, a complete pathway must exist between the source of contamination and the receptor (i.e. complete source-pathway-receptor linkage).

3.1 Potential sources

The potential sources of environmental impact at the Site include the following:

- Organic stockpiles: dust, vermin attraction, sediment wash-off, propagation of odour, weeds, pathogens, and spontaneous combustion.
- Contact water pond and contact water.
- Litter
- Noise from facility operation

Contamination of the organic material: PFAs, chemicals, non-organic waste, high nutrient loads.

3.2 Potential migration pathways

The migration pathway is the mechanism by which a potential source of environmental impact can get from A to B; in this case from the source to the receptors. A summary of the potential migration pathways is provided in the following.

Exposure pathways are the mechanism by which the environmental impact enters the receptor.

3.2.1 Contact Water

Potential contact water migration pathways include:

- Vertical migration through contact water pond into groundwater table
- Overland flow into surface water
- Washing down of machinery
- Spills from machinery

Potential groundwater exposure pathways include:

- Uptake by flora
- Ingestion
- Impacts on livestock drinking water
- Impacts on Irrigation water

3.2.2 Litter

Potential litter migration pathways include:

- Litter leaving the Site through airborne migration.
- Litter leaving the Site through physical movement.

3.2.3 Noise

Potential noise migration pathways include:

- Propagation of noise offsite through airborne migration
- Entry and exit by vehicles on site

3.2.4 Organic stockpiles

3.2.4.1 Vermin and Weeds

Potential vermin and weed migration pathways include:

- Physical movement
- Airborne migration
- Washdown of stockpiles
- Dust carried propagates

3.2.4.2 Dust and sediments

Potential dust and sediment migration pathways include:

- Spills from machinery.
- Airborne migration.
- Physical movement.

Potential biological exposure pathways to humans and fauna include:

- Inhalation
- Dermal contact

3.2.4.3 Odour

Potential odour migration pathways include:

- Airborne migration
- Fire (from spontaneous combustion)

3.2.4.4 Pathogens

Potential pathogen migration pathways include:

- Airborne migration.
- Physical movement.
- Dermal contact.
- Fauna and vermin interaction with stockpiles and windrows
- Washdown of stockpile

Potential biological exposure pathways to humans and fauna include:

- Inhalation
- Dermal contact

3.3 Potential Receptors

Table 3–1 identifies the potential receptors that may be impacted by the identified environmental contaminants.

Table 3–1: potential receptors

Potential Receptor	On/offsite
Flora and Fauna	Onsite and offsite
Surface water	Offsite
Groundwater	Offsite
Land	Onsite and offsite
Residential properties	Offsite
Humans (residents, workers)	Offsite
Human (staff, visitors, maintenance/construction workers)	Onsite

4. Risk Assessment

The risk assessment approach applied in this analysis has been completed utilising SMEC's risk register template and in general accordance with EPA publication 1695.1 assessment guidelines and Australia and New Zealand standard on risk management AS/NZS31000:2009: Risk Management – Principles and guidelines.

This risk assessment reviews the potential risk related to human health, surrounding surface water, groundwater, atmosphere, land, and local communities posed by the introduction of a new prescribed activity to blend organics with soil onsite.

A multi-criteria analysis has been applied to provide a semi-quantitative assessment. Risks have been assessed on the basis of consequence if uncontrolled, risk under existing control measures and the residual risk. The assessment applied rates factors of likelihood and consequence on scales of 1-5, resulting in a 5 by 5 risk matrix, as shown in Table 4–1 below. The resulting risks are ranked from Low, Medium, High and Critical.

Table 4–1: Risk Assessment Matrix

Likelihood	Severity of Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Certain	Medium	High	High	Extreme	Extreme
Very likely	Medium	Medium	High	High	Extreme
Likely	Low	Medium	Medium	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Medium	Medium

Table 4–2: Likelihood definitions, based on EPA Guideline 1695 Risk Matrix

Likelihood	Definition
Certain	Expected to happen regularly under normal circumstances
Very likely	Expected to happen at some time
Likely	May happen at some time
Unlikely	Not likely to occur in normal circumstances

Rare	May happen but probably never will

Table 4–3: Consequence Definitions based on EPA Guideline 1695 Risk Matrix

Consequence	Impact
Insignificant	No or minimal environmental impact, or no health and wellbeing impacts
Minor	Low level environmental impact / low potential for health and wellbeing impacts
Moderate	Medium level of harm to health and wellbeing of the environment over an extended period of time
Major	Serious environmental harm / high-level harm to health and wellbeing
Severe	Permanent or long-term serious environmental harm/life threatening or long-term harm to health and wellbeing

Table 4–4: Risk Score actions levels based on EPA Guideline 1695 Risk Matrix

Risk Level	Description
Critical	Totally unacceptable level of risk. Stop work and/or act immediately.
High	Unacceptable level of risk. Controls must be put in place to reduce to lower levels.
Medium	Can be acceptable if controls are in place. Attempt to reduce to low.
Low	Acceptable level or risk. Attempt to eliminate risk but higher risk levels take priority

4.1 Risk Register

The Site's existing risk register was updated to include the hazards and subsequent risks identified through the risk assessment process. The 24 hazards and risks identified, and the subsequent assessment is provided Appendix B.

It should be noted that the hazards that were assessed as 'Critical' were due to the consequences of such risks being severe or major (e.g., death or injury via fire). The high-risk outcome will therefore always be present using such a risk assessment matrix. The risk level of high does not necessarily indicate an imminent environmental hazard is present in this situation. Nor does it imply that the health and safety of people onsite or offsite is in immediate danger. However, in accordance with EPA guidance, some risks were found to be very high or high for the Site.

4.1.1 Critical

The qualitative risk assessment identified no hazards with an inherent critical rating prior to implementation of any controls all relating to potential for fires onsite.

4.1.2 High

The qualitative risk assessment has assessed eight hazards having an inherent high-risk level rating prior to implementation of any controls. These high risks relate to potential biological hazards, fire, contact water migration and odour. Following the implementation of controls outlined in Section 5 these hazardous are reduced to medium or low risk with no high risk's hazards remaining.

It is a recommendation that a detailed fire assessment and emergency management plan is generated prior to site operation to minimise these risks.

4.1.3 Medium

The qualitative risk assessment has assessed 12 hazards having an inherent medium-risk level rating. The medium level risks related to injury/illness to onsite workers and visitors, dust, litter, vermin, weeds, land contamination and sediment contamination of waterways.

Further detail of the assessed risks and implemented controls are described in the risk register. Following implementation of controls a total of ten medium risks are present, the other two were reduced to low risks.

Further detailed studies into potential noise and odour impacts are recommended to confirm the predicted low risks to surrounding receptors.

4.1.4 Low

The qualitative risk assessment has assessed three hazards having an inherent low-risk level rating. The low-level risks related to noise, air pollution and greenhouse gas emissions. Following the implementation of controls of medium and high risks, four higher rated risks were reduced to low risk.

5. Management Controls and Monitoring

The following management controls and ongoing monitoring should be implemented to mitigate the potential risk associated with operations of the facility and monitoring for potential impacts.

5.1 Controls

5.1.1 Engineering Control

- Installation of a weather sock and weather station to help inform site activities through site specific weather data.
- Control airflow and moisture levels in pasteurisation.
- Installation of fire water tanks at the perimeter of the maturation pad and near sorting shed, with number, volume and location of tanks informed by a detail fire risk assessment.
- Maturation pad and compost windrow configuration has been designed to allow for 7.5m of access between windrow batches for emergency vehicles.
- Maturation pad to be constructed from low permeability (< 1 x 10^{-9}m/s) clay surface.
- Contact water is captured and contained in an appropriately lined pond and not allowed to discharge from the site.
- Maturation pads to be graded between 1-4% to allow for stormwater flow to contact pond.
- False floor on pasteurisation unit to capture pasteurisation contact water.
- Design of receival building to minimise unnecessary access to pad.
- Bunding to prevent cross flow of stormwater into product area and incoming shed.
- Water from incoming sorting shed to be directed to contact water pond.
- Stormwater management controls, bund around the pad to minimise stormwater interaction.
- Vegetation buffer at perimeter of the site boundary

5.1.2 Process control

- Only feedstock of the waste characterisation code: municipal FOGO and Green waste, is allowed to enter the composting facility.
  - Significantly contaminated loads to be rejected and diverted to landfill.
- Monitoring temperature, airflow and moisture levels in pasteurisation system through telemetry systems.
- During high wind events odour and dust generating activities should be minimised where possible these include:
  - Turning maturation pads

  - Unloading pasteurisation pads
  - Screening of product
- Recording and management of compost progress through site utilising Compost Batch Sheet (Form 3)
- Daily and monthly activity records for site operation to manage environmental risks (Form 1 and 2)
- Mature compost that is ready to be issued as a product must be tested and sample sheets collected (Form 4)

5.2 Monitoring

5.2.1 Operational

Daily and monthly activity check lists (Form 1 & 2) have been created to provide an ongoing monitoring of the environmental and safety performance of the site. These must be completed by the site manager to monitor operation of the facility.

5.2.2 Feedstock

Incoming loads of FOGO feedstock to be inspected for hazardous contaminants (i.e. asbestos, glass, chemicals etc.) via visual inspections and manual sorting, before the feedstock is allowed to enter the composting tunnels. Contaminants are to be loaded into the provided skip bin for disposal at the adjacent landfill.

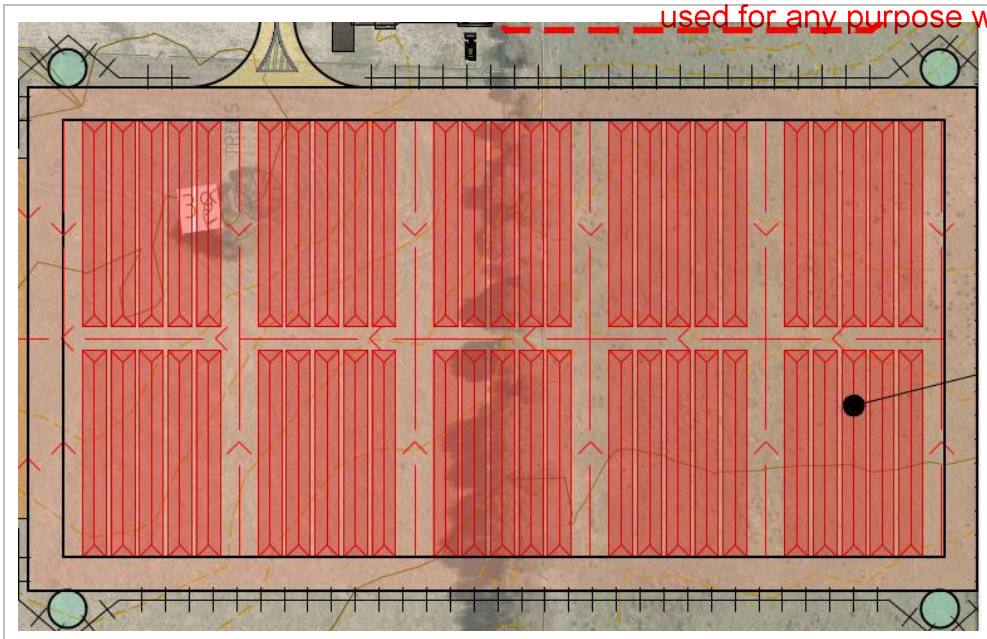
5.2.3 Facility

The facility is to be inspected daily for odour, noise, litter, vermin, dust and weeds, as per the daily monitoring checklist (Form 1). The contact water and stormwater collection system, contact water pond and facility infrastructure need to be inspected monthly (Form 2) and after significant storm events. Inspection sheets can be seen in Appendix C.

5.2.4 Compost

As part of the Site permission, the Site will be issued a standard condition, REG_WM04, that will require all materials to be managed in line with EPA Publication 1667.2. . This requires that access to all compost stockpiles for emergency vehicles is maintained and that compost piles do not exceed 4m in height and must allow for access from multiple angles. Temperatures within all composts must be maintained below 70°C to ensure the composting process is undertaken correctly and minimise risk of fires.

To allow for sufficient access the orientation of the compost windrows has been recommended in a grid array of 5 windrows, this array is indicated below in Figure 5–1. These windrows would be the following:



Design configuration

Array: 5 Rows

Height: 2.2 m

Length: 58 m

Windrow Width: 5m

Internal Gap: 1m

Traffic Gap: 7.5m

Boundary Gap: 7.5m

Total windrows: 50

Figure 5–1: Recommended Windrow Orientation.

Each batch of compost must have its process through the site recorded to manage product quality and minimise risk of environmental impacts via the Batch Record (Form 3).

5.2.4.1 Pasteurization

During the pasteurization phase after the material is loaded into the covered bunkers the telemetry monitoring systems should be connected and log a record of the following:

- Batch ID
- Temperature
- Airflow
- Moisture

When each pad is loaded staff must note down the following details for the Batch Record Appendix C (Form 3):

- Batch ID
- Date loaded
- Volume
- Daily Temperatures
- Observations
  - Odour
  - Contamination

5.2.4.2 Maturation

Daily monitoring of the temperature of the maturing compost is to be undertaking to manage the risk of combustion in the maturing material. The firefighting water tanks located at the perimeter of the maturation pad must be kept at sufficient level and inspected monthly and after each use to manage firefighting capacity.

When each batch is loaded onto the maturation pad the records of the pasteurisation phase must be updated to allow for tracking of the compost's progress. The following parameters must be noted for each batch during the maturation phase.

- Date placed on maturation pad
- Daily Temperature (Form 1)
- Date of turnings
- Water application
- Observations
  - Odour
  - Contamination

5.2.4.3 Product

Once the compost has reached sufficient maturity then it should be screened at 12 mm by trommel; the product details should be recorded on the batch field sheet.

Prior to sale all product batches should be sampled and tested against the criteria set out in Table 2–6 and Table 2–7. Procedure for sampling must be done in line with AS-4454.2012 Appendix A.

Field records for samples from each Batch as per Appendix C (Form 4).

Parameters to be recorded should include but not be limited to:

- Date, site ID and time,
- Weather conditions at time of sampling,
- Sample ID and Record of each sample collected,
- Batch details including
  - Batch Volume
  - Max Particle Size
  - Feedstock information where possible,
  - Identified maturity provided by processor,
- Odour field observations,
- Visual observation of contamination, and
- Relevant photograph ID tag

Field records have been developed to record relevant environmental data during sampling. Compost sampling field sheets should be developed with reference to:

- *AS 4454-2012: Australian Standard Composts, soil conditioners and mulches*
- *IWRG701: Sampling and analysis of waters, wastewaters, soils and wastes*
- *IWRG702: Soil sampling*

5.2.5 Environmental Sampling and RMMP

When the site is approaching operation consideration for progressing this EMP document towards a Risk Management and Monitoring Program (RMMP) should be undertaken in line with EPA guidance. This RMMP will need to include considerations for the following:

- Stormwater ponds on site will need to be monitored to manage potential impacts to the regional environmental values. As the site will be a net water user recovery of suitable water should be targeted where possible. The contact water pond can be recirculated to maintain hydration in the pasteurisation phase of the composting however ongoing monitoring of the quality will be required. monitoringA quality assurance and quality control (QA/QC) plan will need to be developed to meet the data quality indicators (DQIs) for the sampling works on site.

6. Management Framework

6.1 Roles and Responsibilities

The roles and responsibilities to enable effective implementation and ongoing maintenance of the EMP are presented in Table 6–1. The roles and responsibilities are likely to change throughout the lifecycle of the facility and should be updated following facility opening and any major changes in Council structure.

Table 6–1: Roles and Responsibilities

Role	Responsibilities
Manager	• Awareness and understanding of EPA Licence and all relevant environmental regulations and conditions, enabling implementation at lower levels • Develop, review and update Environmental Objectives • Authorisation of this EMP • Ensuring compliance with this EMP by conducting or commissioning regular audits
Site Manager (the responsible person may vary between construction, commissioning, and operational phases)	• Ensuring integration of EMP requirements during construction, commissioning, and normal operation of the facility • Coordination of necessary training to ensure EMP requirements are achieved (including site environmental induction) • Monitoring, review, and update of the EMP • Ensure environmental controls are in place and operating as required • Conducting regular monitoring and maintenance of plant and environmental controls • Reporting all non-conformances to the Manager and undertake corrective actions where required
Site Workers	• All site workers will be responsible for the implementation of environmental controls in accordance with this EMP • Conduct regular monitoring and maintenance of plant and environmental controls • Report non-conformances and undertake corrective action where necessary
Sub-contractors	• All sub-contractors will be responsible for the implementation of environmental controls in accordance with this EMP • Sub-contractors will be required to complete a site environmental induction • Report any environmental issues observed to Site Manager

6.2 Environmental Training, Awareness and Competence

All persons working onsite must be aware of their environmental responsibilities and receive training to help them meet those responsibilities.

Training can take various forms including site induction, toolbox talks and meetings.

6.2.1 Site environmental induction

The Site Manager will ensure all personnel working on site have completed the site environmental induction as part of the general induction to the site. The induction will include an overview of environmental aspects, responsibilities of personnel and reporting procedures. Additionally, all personnel will be made aware of all emergency response procedures and responsibilities.

Environmental emergency (spill) response training should also be provided for site staff.

6.2.2 Activity specific training

All personnel conducting work that poses a risk to the environment or operating or maintaining environmental controls will be required to complete additional training. Tasks requiring additional training are:

- Feedstock inspection and handling;
- Maintenance and management of compost stockpiles;
- Storage and disposal of waste;
- Environmental inspections; and
- Maintenance of plant and equipment.

6.2.3 Training and Induction Matrix

The Site Manager will maintain a Site Training and Induction Matrix to summarise training and inductions required for specific tasks. The matrix will include names and details of training and inductions once completed, including expiry and renewal dates. The Site Manager will be responsible for verifying competency of all personnel.

6.3 Documentation and Records Management

Council will maintain records that demonstrate that the environmental objectives and obligations are being met and verify the status of those matters.

Documentation in this EMP refers to all environmental management records and includes but is not limited to the following:

- Records of inspections, non-conformances;
- Corrective actions;
- Audits, and the EMP itself with the associated control plans;
- Training records (including training and induction matrix);
- Monitoring data;
- Complaint and incident reports;
- Licences and permits; and
- Any other relevant documents and reports as required.

The Site Manager will be responsible for ensuring all documentation is appropriately stored and available for operations essential to the effective functioning of the EMP. The EMP is a live document and will be reviewed and updated regularly as required.

6.4 Reporting

Council will routinely report to the EPA results of environmental monitoring programs, environmental incidents and any non-conformances in accordance with the EPA Licence (once issued), Development Licence and associated environmental conditions. A reporting register and monitoring checklists will be developed and maintained by the Site Manager to assist with managing ongoing reporting requirements.

6.5 Review

The EMP will be reviewed every 12 months or at any change to operations that may alter the environmental impacts identified.

6.6 Environmental Incident Management and Reporting

In the event of any incident, the first priority shall be the safety of all personnel, including site workers, visitors and the community in the immediate vicinity. Following this, all practical measures will be taken to minimise the risk of further environmental damage as soon as possible after the event through the implementation of appropriate incident management or contingency plan procedures.

Environmental incidents are any breach of the management procedures detailed in the EMP or unplanned actions (or actions within an unplanned location) which are detrimental to the environment. Examples of environmental incidents may include:

- Environmental pollution, spillages or contamination or damage; and
- Unapproved emissions (dust, sediment, pollution) to land, air or water.

Any environmental incidents or complaints on site should be reported to the Site Manager. The incidents or complaints will be recorded and followed up to ensure the tasks are allocated to appropriate, responsible personnel and corrective actions are identified and completed within the agreed time frames. This should also include any non-conformances with targets, or EPA licence conditions identified during routine monitoring and reporting, and during the audit and review process.

Environmental incidents may also be reportable to external stakeholders in accordance with legislative requirements. All incident reports should be made formally in writing to external stakeholders with copies sent to applicable staff members.

6.7 Complaints Management

All complaints should be managed in line with East Gippsland Shire Council Complaints Management Policy (2018). As such complaints must be responded to by the reasonable role within two working days for verbal complaints and 10 for written complaints.

6.8 Communications

All environmental issues specific to the project (e.g. incidents, complaints) will be communicated through regular site and toolbox meetings. Records of communications will be documented in a Project File.

7. References

Australian Standards (2012) AS 4454-2012 Compost, soil conditions and mulches, February 2012

EPA Victoria (2017), Designing, constructing and operating composting facilities, Publication 1588.1, June 2017

EPA Victoria (2019), Assessing and controlling risk: A Guide for business, Publication 1695.1, March 2019

EPA Victoria (2021), Management and Storage of Combustible Recyclable and Waste Materials- Guidelines, Publication 1667.3, July 2021

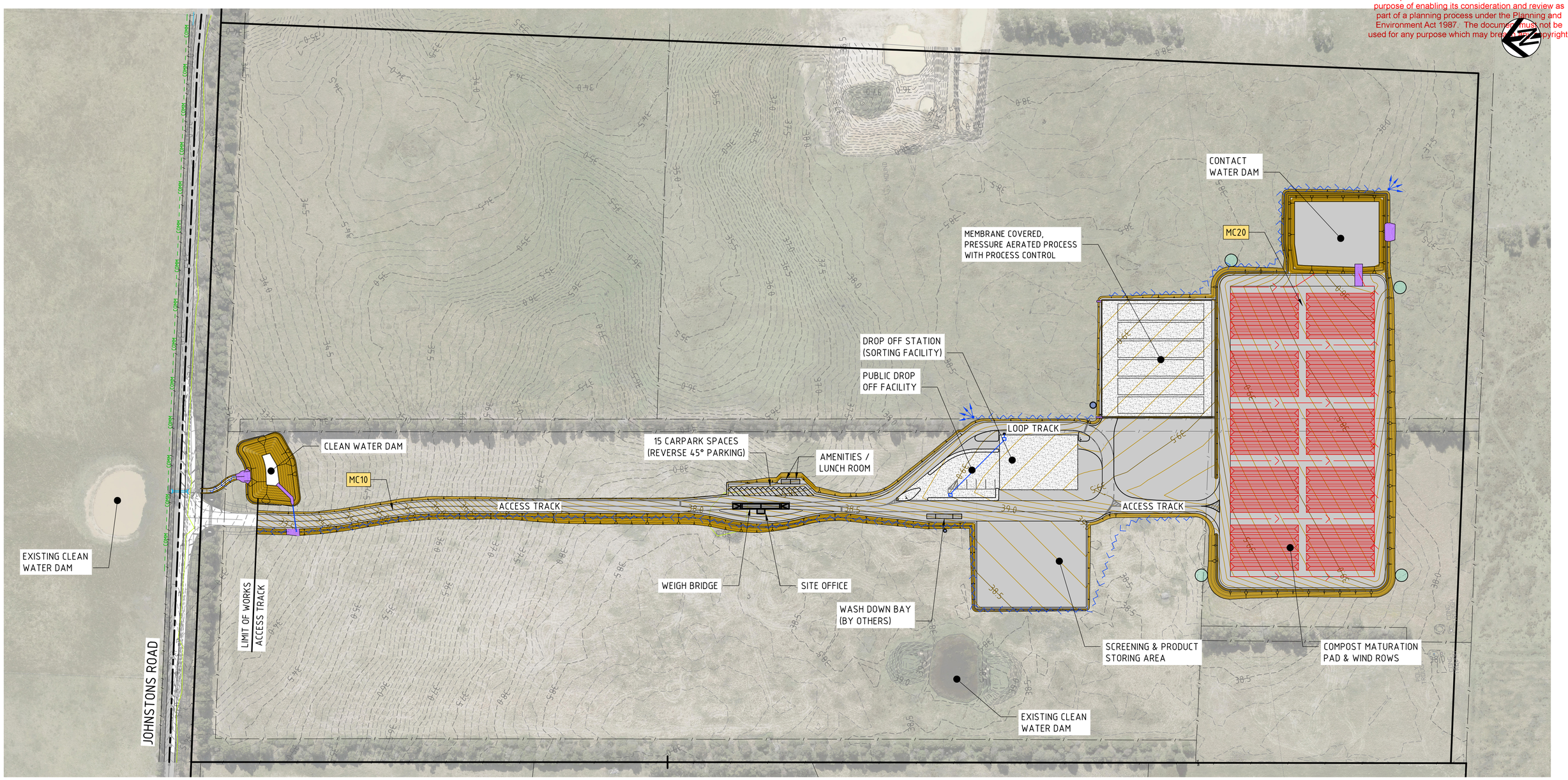
EPA Victoria (2022), Draft Separation distance guidelines, Publication 1949, December 2022

Golder (2018), *Hydrogeological assessment (HA) – Bairnsdale Landfill*, 5th September 2018

Nolan Consulting (2021), *Section 212 Audit – Audit of Landfill Operation 200 Johnstons Road*, Bairnsdale, September 2021

Appendix A

Figures



LEGEND

DESIGN

- MC10 — CONTROL ALIGNMENT
- 182.0 — MAJOR CONTOURS (0.5m INTERVAL)
- MINOR CONTOURS (0.1m INTERVAL)
- PAVEMENT AREAS
- CONCRETE HARDSTAND AREAS
- RIP-RAP AREAS (FOR DETAILS REFER DRG'S 241 TO 244)
- CLEAN WATER SWALE DRAIN
- STORMWATER CULVERTS & HEADWALLS
- LINE MARKING
- FIRE WATER TANKS BY OTHERS
- WIND ROWS
- INDICATIVE DRAINAGE FLOWS

EXISTING

- 182.0 — MAJOR CONTOURS (0.5m INTERVAL)
- MINOR CONTOURS (0.1m INTERVAL)

NOT FOR CONSTRUCTION

SCALE 1:1250 12.5 0 25 50

AT A1 SIZE DRAWING

DRAWING FILE LOCATION / NAME
V:_Vault\Projects\3004\30049148\110_CADD\CAD\Info_Docs\250114_EGCF_NH - Design Layout EPA_Rev02\30049148_250114_EGCF_REV2_NH - DESIGN LAYOUT.dwg

EAST GIPPSLAND COMPOST FACILITY
DESIGN LAYOUT
CIVIL WORKS PLAN

INFORMATION DOCUMENT

30049148_250114_EGCF_REV2_NH

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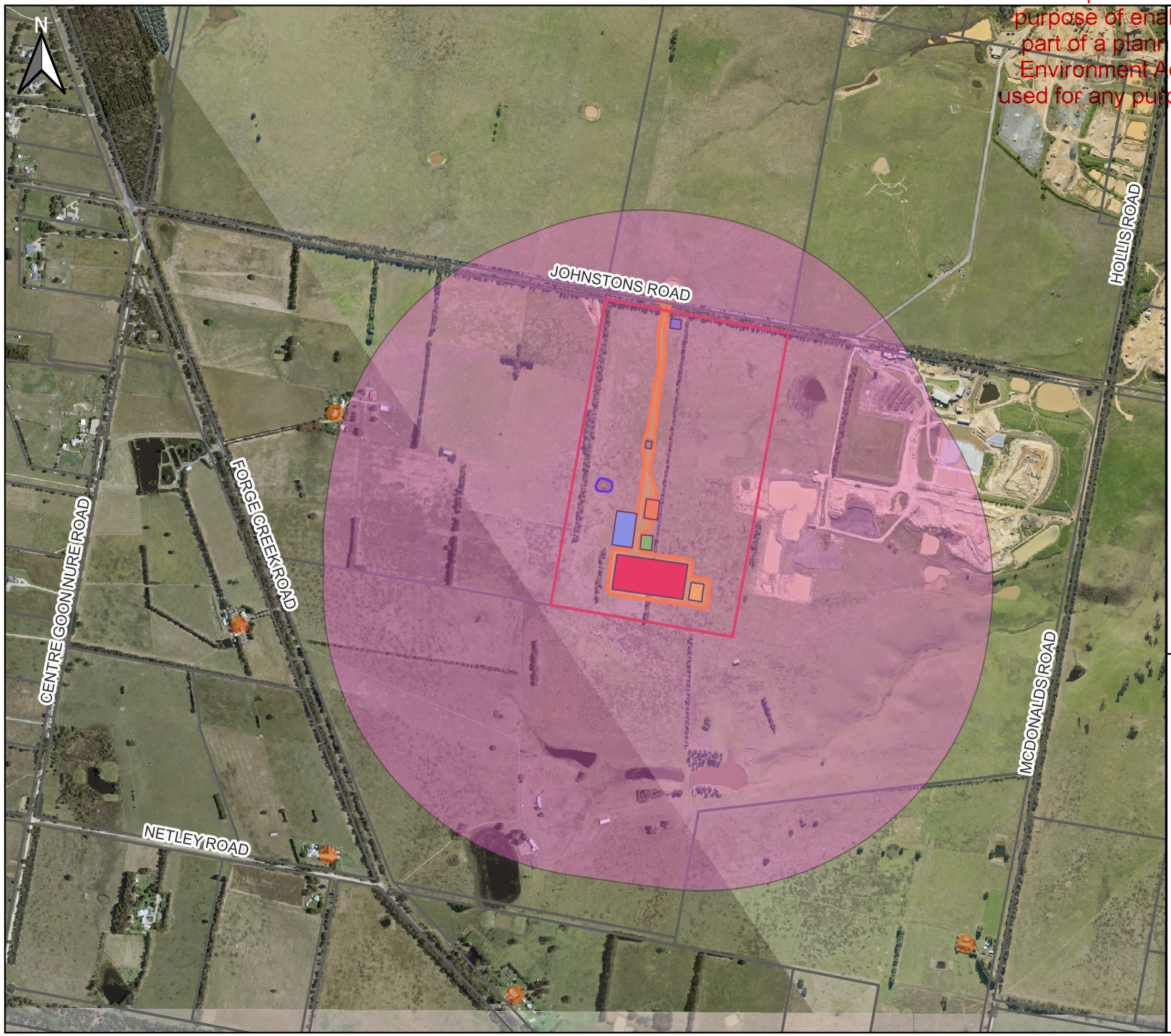
TOWER 4, LEVEL 20, 727 COLLINS STREET
DOCKLANDS VIC 3008



0 250 500 m

PAGE SIZE A4

Legend

Sensitive Receptors
Sensitive Receptors

Buffer Distance
Buffer (750 m)

Site Boundary
Site Boundary

FIGURE TITLE	Sensitive Receptors
PROJECT TITLE	EGSC Composting Faciltiy Concept Design
PROJECT NO.	30049148
DRAWING NO.	2
DATE	14-06-2024
CREATED BY	PP17364
SOURCES	ESRI

SMEC
Member of the Surbana Jurong Group

SMEC AUSTRALIA PTY LTD
ABN 47 065 475 149

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, this map contains data from a number of sources - no warranty is given that the information contained on this is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it. This map is not a design document.

Filepath: X:\Projects\300491\30049148 - EGSC Composting Facility\04 Technical\GIS\GIS newer\EGSC Composting Facility.qgz

Appendix B

Risk Assessment

Environmental Element	Environmental Aspects/Hazards (Source)	Pathways	Receptors	On/Off Site	Potential Environmental Impacts	Likelihood (Of hazard)	Consequence/ Severity (Of impacts)	Risk Level & Score	Suggested Controls	Likelihood (Of hazard) following Controls	Revised Consequence/ Severity (Of impacts)	Risk Level & Score
Aesthetics	Dust	Wind blown dust; Dust generation from turning plant; Dust from unloading and loading of vehicles; Dust from maturation and pasteurisation windrows;	Workers, Flora and Fauna, site visitors, surface water, public roads, nearby residents, construction and maintenance workers	On site and off site	Plant and animal health Injury or illness to nearby residents site workers, site visitors, construction and maintenance workers	Likely	Moderate	Medium	Dust monitoring checks conducted by staff at the boundary (as part of the Site Monitoring). Monitoring dust generation during the screening of products by site operators. Daily records of dust generation in daily sheets (Form 1). Controlled unloading by vehicles. Regular wet downs of unsealed roadways. Maintain consistent moisture in maturation windrows. Operating to wind conditions with high dust generation activity to be avoided on high wind days. Vegetation at boundary of site will reduce dust mobility. Windrow moisture to be maintained.	Rare	Moderate	Low
Aesthetics	Odour	Wind blown odour from the Incoming material shed, pasteurising and maturing composts.	Nearby residents, workers, fauna, site visitors, public roads, construction and maintenance workers	On site and off site	Impact to nearby residents, workers, site workers, site visitors, construction and maintenance workers	Certain	Minor	High	Avoiding Anaerobic conditions in compost through regular turning and aeration; Incoming materials will be loaded into the pasteurisation bunker within 24 hours of arrival. Feedstocks are to be received in the incoming shed undercover. The use of covered bunker pasteurisation has been demonstrated as suitable for reducing odour generation. Telemetry monitoring of conditions in bunkers, and daily monitoring of maturing compost. Daily odour checks to be recorded in daily activity sheets: Operate dependent on wind conditions: Regular maintenance and inspection of pump systems. Aeration of the Contact Water Pond. Vegetation at the site boundary will minimise cross winds and reduce odour transport. Regular turning of maturing compost to risk anaerobic conditions in windrows. Odour modelling is to be undertaken to confirm minor risks to surrounding receptors. Development of Vegetation buffer around the site.	Likely	Minor	Medium
Aesthetics	Noise	Operational noise generation - i.e. shredder/grinder, air blowers; Loading and unloading of vehicles; Unloading and loading of compost bunkers.	Workers, site visitors, public roads, nearby residents, construction and maintenance workers	On site and off site	Injury or illness to nearby residents site workers, site visitors, construction and maintenance workers	Likely	Minor	Medium	Noise assessments including modelling to confirm low risk. Occupational Hygiene - Noise monitoring of plant and operation. Relevant plant are fitted with noise-reducing features and undergo regular maintenance. Limited operational hours of 7am to 4pm Monday -Friday. Daily monitoring and recording by team lead with excessive noise events recorded in daily activity sheet (Form 1). Turning off vehicles and plant when not in use. Controlled unloading. Use of noise PPE when operating Plant.	Unlikely	Minor	Low
Aesthetics	Noise	Truck Movements incoming and outgoing	Nearby residents	Off site	Disruption of Environmental Value for aesthetics and noise to nearby residents.	Likely	Insignificant	Low	Noise assessments including modelling to confirm low risk. Adoption of minimum arrival times for collection vehicles.	Likely	Insignificant	Low
Groundwater	Contact Water migration	Migration of Contact Water from maturation and pasteurisation phases into groundwater from organics stockpiles;	Ground Water usurers and Groundwater dependent ecosystems	On and off site	Pollution of ground water nearby residents; Flora and Fauna	Certain	Moderate	High	All incoming material is contained in a hardstand location, with Contact Water capture. Regular inspections of the site for Contact Water flow and blockages. All immature and non-pasteurized compost must be stored in the vessels with contact water directed to lined dam constructed inline with EPA pub 1588.1 recommendations. Contact water from maturation captured on low permeability surface and directed to the lined pond. Implementing a RMMP following construction inclusive of Groundwater monitoring. Daily and monthly inspection of contact water. Separation of contact water and stormwater. Biannual quality monitoring of contact water quality.	Rare	Moderate	Low
Surface water	Contact Water migration	Migration of Contact Water into surface water from incoming waste and compost interaction of storm water, any stockpiles or spills in expanded boundary, wind blow litter entering storm water, interaction of storm water with windrows and mature compost.	Local water bodies and associated users.	On and Offsite	Pollution of local surface water bodies	Certain	Moderate	High	Feedstock and unpasteurised materials contained on concrete hardstand. All immature compost is contained in a covered, clay-lined hardstand location. Contact Water pond, pump and treatment. bunding and channelling of maturation pad to direct Contact Water to ponds. Stormwater landing on hardstand captured as Contact Water. Contact water pond designed to manage a 1:20 storm as per EPA recommendations.	Rare	Insignificant	Low

Environmental Element	Environmental Aspects/Hazards (Source)	Pathways	Receptors	On/Off Site	Potential Environmental Impacts	Likelihood (Of hazard)	Consequence/ Severity (Of impacts)	Risk Level & Score	Suggested Controls	Likelihood (Of hazard) following Controls	Revised Consequence/ Severity (Of impacts)	Risk Level & Score
Air	Air pollution	Air contaminates from operation	Flora and Fauna, site visitors, surface water, public roads, nearby residents, construction and maintenance workers	On and Offsite	Pollution of air, impact on neighbours, workers	Unlikely	Insignificant	Low	Dust management included in site operation. Machinery and plant turned off when not in use. Regular litter picks undertaken at site boundary. Contact water from mature compost captured and contained onsite. Surface water to be captured.	Unlikely	Insignificant	Low
Aesthetics	Amenity	Litter leaving site through wind	Flora and Fauna, site visitors, surface water, public roads, nearby residents, construction and maintenance workers	On and Offsite	Plant and animal health, regional amenity	Likely	Minor	Medium	Daily site litter picks. Sufficient chain-link fence surrounding site. Waste materials unloaded in the unloading shed to minimise wind. Loads covered when exiting site. Litter picks on incoming loads prior to pasteurisation. Wind minimisation through vegetation buffer.	Unlikely	Minor	Low
Land	Contamination	Litter leaving site, Contaminated surface water or ground water leaving site	Flora and Fauna, site visitors, surface water, public roads, nearby residents, construction and maintenance workers	On and Offsite	Contamination of land, reduction in benefitable use	Unlikely	Major	Medium	Daily site litter picks. Waste materials are unloaded and stored at the rear of the site. Loads covered when exiting the site.	Rare	Major	Medium
Fire	Fire	Spontaneous combustion from biological runaway	Facility	Onsite	Damage to Facility, nearby prosperities. Regional amenity.	Unlikely	Severe	High	Controlled continual aeration, moisture and temperature during pasteurisation. regular temperature checks on incoming feedstock, pasteurisation and maturation materials. Sprinkler system in incoming shed. Have onsite fire fighting equipment and plan. Good management of oversized product following screening. Daily monitoring of temperatures in windrows (Form 1).	Rare	Severe	Medium
Fire	Fire	Spontaneous combustion from biological runaway	Site visitors, site workers, construction workers, maintenance workers, fauna and flora	On site and off site	Severe injury or death, to nearby residents site workers, site visitors, construction and maintenance workers. Plant and animal health.	Unlikely	Severe	High	Develop emergency management plan. Controlled continual aeration, moisture and temperature during pasteurisation. Regular temperature checks on incoming feedstock, pasteurisation and maturation materials. Sprinkler system in incoming shed. Develop emergency management plan. Daily monitoring of temperatures in windrows (Form 1). Maintaining firefighting water tank levels. Have onsite fire fighting equipment and plan.	Rare	Severe	Medium
Air	Smoke/fumes	Spontaneous combustion from biological runaway creating smoke, that is then carried by wind	Site workers, Flora and Fauna, site visitors, surface water, public roads, nearby residents, construction and maintenance workers	On site and off site	Severe illness or death to nearby residents site workers, site visitors, construction and maintenance workers. Plant, water and animal health, regional amenity.	Unlikely	Major	Medium	Controlled continual aeration, moisture and temperature during pasteurisation. Regular temperature checks on incoming feedstock, pasteurisation and maturation materials. Sprinkler system in incoming shed. Have onsite fire fighting equipment and plan. Develop emergency management plan.	Rare	Major	Medium
Health	Biological	Inhalation of dust from organics stockpile	Site workers, site visitors, construction and maintenance workers	On site	Severe illness or death to site workers, site visitors, construction and maintenance workers.	Likely	Severe	High	Ensure sufficient pasteurisation is achieved. Pasteurise under cover. Minimise handling of unpasteurised material ware possible. Ensure training in use of PPE and PPE is provided when handlining composts. Dust management. Dust PPE for site workers, visitors, construction and maintenance workers. Ensure all staff have required vaccinations to handle material.	Rare	Severe	Medium
Health	Biological	Physical contact with dust from organics stockpile	Site workers, site visitors, construction and maintenance workers, Fauna	On site	Severe illness or death to site workers, site visitors, construction and maintenance workers. Spread of zoonotic diseases to wildlife and humans.	Likely	Severe	High	Ensure sufficient pasteurisation is achieved. pasteurise under cover. Minimise contact with unpasteurised materials. Ensure all staff are trained with and provide PPE for handling composts. Dust management. Dust PPE for site workers, visitors, construction and maintenance workers. Ensure all staff have required vaccinations to handle material. Have active vermin and pest management.	Rare	Severe	Medium
Air	Biological	Dust from organics stockpile being carried by the wind	Flora and Fauna, site visitors, surface water, public roads, nearby residents, construction and maintenance workers	On site and off site	illness or death to nearby residents site workers, site visitors, construction and maintenance workers. Plant, water and animal health.	Unlikely	Major	Medium	Dust management. Ensure sufficient pasteurisation is achieved. pasteurise under cover.	Rare	Major	Medium
Flora	Weeds	Spreading of noxious weeds from weed propagates within the organic stockpile	Flora and Fauna, nearby residents,	On site and off site	Plant and animal health. Reduced regional amenity. Impact to local agricultural operations.	Unlikely	Moderate	Medium	Wind barrier around stockpile. Ensure control on incoming feedstocks within shed. Ensure pasteurisation of material. Weed management around site. Regular weed inspections. Bioassay tests on products.	Rare	Moderate	Medium
Fauna	Vermin	Organic stockpile attracting and propagating Vermin on site	Flora and Fauna	On site and off site	Plant and animal health. Reduced regional amenity. Impact to local agricultural operations.	Likely	Moderate	Medium	Vermin and pest management. Ensure FOGO streams are loaded to pasteurisation within 24hrs. Pasteurisation under covered vessel limiting access for vermin.	Unlikely	Moderate	Medium
Health	Biological	Pathogens (bacteria, viruses, protozoa and helminths) spread offsite through wind, vermin, water and birds	Flora and Fauna, site visitors, site workers, nearby residents, construction and maintenance workers	On site and off site	Severe illness or death to site workers, site visitors, construction and maintenance workers, flora and fauna. Biosecurity risk.	Likely	Severe	High	Pathogen reduction measures. Pasteurisation undercover limiting exposure to staff. Pathogen testing of products. Staff to make use of proper PPE and Hygiene practices.	Rare	Severe	Medium

Environmental Element	Environmental Aspects/Hazards (Source)	Pathways	Receptors	On/Off Site	Potential Environmental Impacts	Likelihood (Of hazard)	Consequence/ Severity (Of impacts)	Risk Level & Score	Suggested Controls	Likelihood (Of hazard) following Controls	Revised Consequence/ Severity (Of impacts)	Risk Level & Score
Land	Land contamination	organics waste stockpile interacting with natural soils on site through wind, accidental movement	Soil around the site, groundwater, surface water, fauna and flora	On site and off site	Reduced health of groundwater and surface water. Illness or death to flora and fauna.	Unlikely	Major	Medium	Boot wash zones for workers and visitors around the stockpile. Wheel wash on vehicles leaving site.	Rare	Major	Medium
Aesthetics	Amenity	Plastics and other contamination impacting land amenity	Flora and Fauna, site visitors, surface water, public roads, nearby residents, construction and maintenance workers	On site and off site	Plant, water and animal health, regional amenity.	Unlikely	Major	Medium	Placement of skip on-site for the collection of rejected material. Regular litter picks. Litter capture fencing.	Rare	Major	Medium
Atmosphere	Green House Gas emissions	Green house gas emissions from machinery and vehicles operating on site. Emissions from the energy used for facility automation and aeration.	Atmosphere	Off site	Contributes to the pollution of the atmosphere	Likely	Insignificant	Low	Net emissions from operations are less then current practices. Possible use of decarbonised fuel sources for plant/machinery. Turning of plant items when not in use.	Likely	Moderate	Low
Land	Litter	Windblown litter from incoming materials and windrows	Flora, Fauna, surrounding land users, land, water ways	Off site	Litter blowing out of site impacting environmental values offsite	Likely	Major	Medium	Daily inspections for litter by team (Form 1). Collection of contamination in incoming shed prior to composting. inspection of batches post pasteurisation and while on maturation pad for litter.	Likely	Moderate	Low
Groundwater	Spills	Spills from the machinery during operation, including loading and unloading.	Site workers, site visitors, construction and maintenance workers, Groundwater, surface water	On site	Injury or illness to site workers, site visitors, construction and maintenance workers	Unlikely	Major	Medium	Ensure workers are away that all works must be completed on the hardstand. Regular maintenance of machinery. Spill kits to be set up at refiling and maintenance areas.	Rare	Major	Medium
Water	Waterways	Sediment contamination of stormwater, from fines washed off mature compost.	Flora and fauna, local waterways, surface and groundwater	On site and off site	Damage to the stormwater drainage system, reduced health of waterways, surface and groundwater and their receptors. Illness or death to flora and fauna.	Unlikely	Major	Medium	Contact Water management. Sediment filtration. Stormwater capture and retention onsite.	Rare	Major	Medium

Environmental Element	Environmental Aspects/Hazards (Source)	Pathways	Receptors	On/Off Site	Potential Environmental Impacts	Likelihood (Of hazard)	Consequence/ Severity (Of impacts)	Risk Level & Score	Suggested Controls	Likelihood (Of hazard) following Controls	Revised Consequence/ Severity (Of impacts)	Risk Level & Score

Likelihood	Severity of Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Certain	Medium	High	High	Extreme	Extreme
Very likely	Medium	Medium	High	High	Extreme
Likely	Low	Medium	Medium	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Medium	Medium

Likelihood	Definition	Description
Certain	Expected to happen regularly under normal circumstances	Totally unacceptable level of risk.
Very likely	Expected to happen at some time	Stop work and/or take action immediately.
Likely	May happen at some time	Unacceptable level of risk. Controls must be put in place to reduce to lower levels.
Unlikely	Not likely to occur in normal circumstances	Can be acceptable if controls are in place. Attempt to reduce to low.
Rare	May happen but probably never will	

Risk Level/Score

Low Risk; Manage with standard operating procedure
Moderate Risk; Can be acceptable if controls in place
High Risk: Management required from senior staff
Extreme- Unacceptable level of risk.

Risk Ratings reference: Assessing and controlling risk for business. Publication 1695.1. EPA Victoria. August 2018

Appendix C

Inspection Forms

Daily Activities Checklist

Site: Bairnsdale Compost Facility

Checks	Day / Date	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Comments/Actions
Site									
Weather Conditions									
Wind Speed/Direction									
Temperature- Pasteurisation									
Temperature- Windrows									
Rain (mm)									
Site Secure (Fences/gates)									
WB clean/operating									
WB office clean/tidy									
Drains clean									
Signs/Barriers in place									
Litter picked up									
Contact Water Pond below 500mm freeboard									
Weeds controlled									
Stockpiles									
Sign of Vermin on site									
Stockpiles contained									
Records									
Takings/Day sheets totalled									
Weekly cash reconciliation complete									
Account receipts checked									
Incidents/Complaints recorded									
OH&S Checks									
Foot protection									
Hi Visibility Clothing									
Gloves									
Hearing protection									
Breathing protection									
Eye Protection									
Fire extinguishers									
First Aid Kit									
Register of Injuries									

Form 2

Monthly Activates Checklist Bairnsdale Composting Facility

Site: Bairnsdale Composting Facility	Date:		Name:
Signed	Yes	No	Comment
Was **odour** managed at the site, with offensive odours not discharged beyond the premises boundaries?			
Was **water** managed in such a way to prevent contaminated water or leachate from leaving the site?			
Is the **stormwater** management infrastructure on the site in good working order?			
Were there no reports of **contaminated water** leaving the site?			
Was **dust** effectively managed on the site, with no dust leaving the site?			
Was there no material **burned** on site?			
Was **Litter** effectively managed on the site, with no litter blowing off the site?			
Were **fences and gates** maintained in good working order?			
Was **contact water** infrastructure in good working order? I.e. leachate pond			
Was there no sign of **contact water** seepage onsite?			
Are there no strong **odours** coming from the facility?			
Is the site **tidy** and safe for use?			
Are **roads** around the site maintained?			
Is **weighbridge data** entering and leaving the site being reported?			
Are Operators **inspecting** Loads?			
Were only **acceptable** FOGO wastes received? I.e. no chemicals, hazardous wastes, liquid wastes, putrescible wastes			
Are **Vermin** controlled?			
Are **Noxious Weeds** controlled?			
Was there No illegal **dumping** in past month?			
Are **First aid boxes, Fire Extinguishers and Snake bite kits** in date and in working order?			
Are **Fire Breaks** maintained?			
Are **Water tanks** at sufficient levels?			
Windrows and Stockpiles free form large physical **contamination**?			
Do windrows comply with **Combustible Recycling Guidelines**? (e.g. .distances apart, etc)			
Have Compost **Batch Sheets** been completed?			
Have **Daily Activity Sheets** been completed?			

Compost Monitoring Procedure
Batch record

Site Bairnsdale Composting Facility Start date _____ Mat Start date: _____

Material _____ Screen date _____ Test date _____
Volume _____ Batch ID _____

Age	Temp	Water	Turn	Age	Temp	Water	Turn	Age	Temp	Water	Turn
1 (Vessel)				32				63			
2 (Vessel)				33				64			
3 (Vessel)				34				65			
4 (Vessel)				35				66			
5 (Vessel)				36				67			
6				37				68			
7				38				69			
8				39				70			
9				40				71			
10				41				72			
11				42				73			
12				43				74			
13				44				75			
14				45				76			
15				46				77			
16				47				78			
17				48				79			
18				49				80			
19				50				81			
20				51				82			
21				52				83			
22				53				84			
23				54				85			
24				55				86			
25				56				87			
26				57				88			
27				58				89			
28				59				90			
29				60				91			
30				61				92			
31				62				93			

Observations: _____

_____

Form 4

Compost and Organics Sampling Field Sheet

PROJECT NAME:		SITE CODE:	
PROJECT NUMBER:		DATE & TIME OF HOMOGONISATION:	OPERATOR SIGNITURE
CLIENT:		DATE:	

Field Observations

Sample ID	Batch Feedstock	Batch Volume (m3)	Max Particle Size (mm)	Sub Samples	Indicated Age (weeks)	Image Code	Visual Contamination	Batch Odour

SAMPLING DETAILS **LABORATORY ANALYSIS DETAILS-**

Sample ID for Expanded Testing:	
Equipment: Dedicated/Disposable: □ Decontaminated: □	
General Site Odour:	
Visual Contamination: Low □ Medium □ High □	

GENERAL ENVIRONMENTAL CONDITIONS

Temp: Cold (<5°C) □ Cool (<15°C) □ Mild (<25°C) □ Warm (<35°C) □ Hot (<45°C) □		Air: Dry □ Medium □ Humid □ Rain □	
Wind: Still □ Slight Breeze □ Windy □ Strong Wind □	Sky: Clear □ Scattered □ Cloudy □	Barometric Pressure:	

Other comments:

Sampler Name:

Appendix D

Hydrogeological Assessment (Bairnsdale Landfill)

Nolan Consulting

Nolan Consulting Pty Ltd
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5th September 2018

Ms Elizabeth Modrich
Waste Management Coordinator
East Gippsland Shire Council
PO Box 1618
Bairnsdale, VIC, 3875

Dear Elizabeth

Re: Bairnsdale landfill - Auditor verification of Hydrogeological Assessment

1 Background

East Gippsland Shire Council (EGSC) is required to operate the Bairnsdale landfill in accordance with Licence 74237, Premises 72826, as amended on 20th February 2017. The landfill is located approximately 6 km south of the Bairnsdale town centre.

2 Auditor verification objectives

Reporting requirement 3.1 of Pollution Abatement Notice (PAN) 90009081 (Attachment 1) dated 15th August 2018 states:

> *By 17 September 2018 you must provide to EPA a hydrogeological assessment for the premises that:*
>
> a) *is in accordance with Hydrogeological Assessment (Groundwater Quality) Guidelines (EPA Publication 668, released September 2006);*
>
> b) *specifies the maximum leachate management level for all unlined and partially lined cells which protects beneficial uses of groundwater and allows for the effective management of landfill gas; and*
>
> c) *is verified by a person who has been appointed as an environmental auditor under the Environment Protection Act 1970.*

The reporting requirement is identical to Condition LI_L4.3 of Licence 74237 Premises 72826, amended on 20th February 2017, except that the reporting date has been superseded by the PAN 90009081 dated 17th September 2018 and '*for the premises*' has been replaced by '*for all unlined and partially lined cells*'.

I have been engaged by EGSC as the Auditor to verify the Hydrogeological Assessment (HA) in accordance with PAN 90009081.

The HA has been prepared by Golder (the Assessor). The final HA report is attached to this letter (Attachment 2).

The HA notes that while the PAN requirement applies only to Cell 1 at the site as Cells 2 and 3 are fully lined, the licence requires the specification of the maximum leachate management level for the premises. In order to meet both requirements maximum leachate management levels are specified for all existing cells.

3 Conducting the HA verification

The key steps in the HA verification process have been:

- Golder submitted the 1st draft HA report – 30th July 2018;
- Auditor review register on 1st draft HA report submitted to Golder and EGSC– 8th August 2018;
- Golder submitted 2nd draft HA report – 21st August 2018;
- Auditor provided comments on 2nd draft report to Golder – 3rd September 2018;
- Golder submitted final HA report – 4th September; and
- Auditor acceptance of final HA report for verification – 5th September 2018.

The Auditor's review register with Golder's responses is included as Attachment 3. This includes the Auditor's comment on the first and second drafts and the Assessor's (Golder) feedback on the Auditor's comments. The Auditor is satisfied that the final HA report addresses all Auditor comments.

The final HA report which is subject to this letter of verification is titled Golder (2018) "*Hydrogeological Assessment for Bairnsdale Landfill*", dated 4th September 2018 (File name: 1789713-002-R-Rev2).

4 Auditor comments and recommendations

The Auditor in his review of the draft HA proposed a number of amendments which have been considered and where appropriate have been incorporated into the final HA (Attachment 3).

Key Auditor considerations in verifying the HA have been:

1. The groundwater is within Segment A1.
2. the landfill has been constructed with Cells 1, 1A, 2 and 3, of which Cells 1 and 1A are partially lined and Cells 2 and 3A-1 are fully lined and S53V construction audits have been undertaken.
3. Filling of Cell 1, Cels 1A and Cell 2 have been completed. Final capping of these cells is scheduled to occur in two stages.
4. All cells are serviced by leachate sumps with Cell 1 and Cell 1A being serviced by the Cell 1 Sump, Cell 2 by the Cell 2 sump and Cell 3A-1 by the Cell 3 sump. The top of drainage aggregate at Sump 1 is 22.45 m AHD and base of sump is 20.25 m AHD. Hyder (2011) states the Cell 2 floor level grades from about 18 m AHD in the south-west to about 15 m in the north-east.
5. Groundwater flow across the scheduled premises is towards the south-east along the western boundary changing direction to the north-east along the eastern boundary.
6. With a level of less than 3.5 m AHD, the regional groundwater is at least 10 m below the base of the waste.
7. The nearest hydraulically connected surface water bodies are Macleods Morass and the Mitchell River with some local discharge to Skene Creek approximately 900 m to the east-northeast of the site.
8. Down-gradient of the scheduled premises the nearest registered groundwater bore with a consumptive use domestic and stock bore WRK038121 (1.9 km north-east of the site) and there are no known registered bores with a consumptive use up-gradient of the McLeods Morass.

9. Possible indicators of leachate impact on groundwater are found to the north-east of Cell 1 where elevated nitrate concentrations have been found. This does not pose a significant existing risk to beneficial uses as the concentration is below relevant water quality objectives and is not increasing.

The final HA includes recommended maximum leachate management levels (Section 7) and general recommendations in Section 8 to manage the potential risks to groundwater. In addition, the Auditor makes the following recommendation:

1. Review the Stage 2 and Stage 3A-1 as constructed surveys to determine the lowest point of the liner surface of these cells and set the maximum leachate management levels for these cells to be consistent with that specified in Table 12.

Given the above and subject to:

- implementing the Golder general recommendations presented in Section 8 of the HA and the above Auditor recommendation

the HA can be verified (see Section 5 below).

5 Auditor verification statement

I, John Nolan of Nolan Consulting, an Environmental Auditor (appointed pursuant to the *Environment Protection Act* 1970), having:

1. been requested by East Gippsland Shire Council (the notice holder) to verify the HA report prepared by Golder, dated 4th September 2018, and titled "*Hydrogeological Assessment for Bairnsdale Landfill*":
   - has been prepared in accordance with Hydrogeological Assessment (Groundwater Quality) Guidelines (EPA Publ. 668); and
   - specifies the maximum leachate management level for all unlined and partially lined cells which protects beneficial uses of groundwater and allows for the effective management of landfill gas
2. having had regard to, amongst other things, the *Waste Management Policy*, *the State environment protection policy (Groundwaters of Victoria)*, the *State environment protection policy (Prevention and Management of Contaminated Land)*, the *State environment protection policy (Air Quality Management)* and the *State environment protection policy (Waters of Victoria)*
3. and considered the following documents:

(i) the Golder HA, dated 4th September 2018, and titled "*Hydrogeological Assessment for Bairnsdale*";

(ii) *Best Practice Environmental Management; Siting, Design, Operation and Rehabilitation of Landfills* (EPA Publ. 788.3);

(iii) *Landfill Licencing Guidelines* (EPA Publ. 1323.3); and

(iv) *Hydrogeological Assessment (Groundwater Quality) Guidelines* (EPA Publ. 668)

Hereby declare that I am of the opinion that:

(i) the Golder "*Hydrogeological Assessment for Bairnsdale Landfill*" dated 4th September 2018 contains adequate information of suitable quality to meet the Authority's requirements (that is, that the maximum leachate levels recommended in Table 12 of the report allows for the protection of groundwater beneficial uses and for the effective management of landfill gas; and that where the leachate level exceeds the maximum level, appropriate action will be undertaken to achieve the maximum leachate levels taking into account the significance of the risks to the environment).

(ii) the HA recommendations (Section 8 of the HA) and the Auditor's recommendations presented in Section 4 above should be implemented as soon as practicable.

6 Limitations

This letter report, including the Auditor verification statement, has been prepared by Nolan Consulting for EGSC and may only be used and relied on by EGSC and EPA Victoria for the purpose agreed between Nolan Consulting and EGSC as set out in Section 2 of this letter report.

Nolan Consulting otherwise disclaims responsibility to any person other than EGSC arising in connection with this letter report. Nolan Consulting also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by Nolan Consulting in connection with preparing this letter report were limited to those specifically detailed in the letter report and are subject to the scope limitations set out in the letter report.

The opinions, conclusions and any recommendations in this letter report are based on conditions encountered and information reviewed at the date of preparation of the letter report. Nolan Consulting has no responsibility or obligation to update this letter report to account for events or changes occurring subsequent to the date that the letter report was prepared.

The opinions, conclusions and any recommendations in this letter report are based on assumptions made by Nolan Consulting described in this letter report. Nolan Consulting disclaims liability arising from any of the assumptions being incorrect.

Nolan Consulting has prepared this letter report on the basis of information provided by EGSC and others who provided information to Nolan Consulting (including Government authorities), which Nolan Consulting has not independently verified or checked beyond the agreed scope of work. Nolan Consulting does not accept liability in connection with such unverified information, including errors and omissions in the letter report which were caused by errors or omissions in that information.

Yours sincerely

John Nolan
Environmental Auditor (appointed pursuant to the *Environment Protection Act* 1970)

Attachments
1 Pollution Abatement Notice 90009081 of 15th August 2018 (Attachment 1)
2 Golder "*Hydrogeological Assessment for Bairnsdale Landfill*" dated 4th September 2018
3 Auditor Review Register of Hydrogeological Assessment

Attachment 1

Bairnsdale Landfill

Pollution Abatement Notice 90009801 (15th August 2018)

East Gippsland Shire Council

EPA VICTORIA

VICTORIA State Government

ENVIRONMENT PROTECTION ACT 1970
SECTION 31A

POLLUTION ABATEMENT NOTICE

Gary Gaffney
EAST GIPPSLAND SHIRE COUNCIL
273 MAIN ST
BAIRNSDALE VIC 3875

TO:	EAST GIPPSLAND SHIRE COUNCIL
ADDRESS:	273 MAIN ST, BAIRNSDALE VIC 3875
PREMISES:	200 JOHNSTONS RD, FORGE CREEK VIC 3875
LEGAL REFERENCE:	EP Act 1970 s.31A(1) Remedial notice required to address current or likely pollution, environmental hazard, or non-compliance

Who we are: Environment Protection Authority (EPA) Victoria is an independent statutory authority established under the *Environment Protection Act 1970* (the EP Act). Our purpose is to protect and improve our environment by preventing harm to the environment and human health.

Why we serve remedial notices: Remedial notices are served to prevent or remedy actual or likely pollution, environmental hazards and a range of non-compliances with the EP Act.

What you are required to do: Section 31A(2) of the EP Act requires you to comply with the requirements in this notice with one or more actions to prevent or remedy an actual or likely non-compliance. Under section 60A(1), if someone plans to take control of your premises, you must notify them of this notice and your progress towards compliance.

When you are required to act: 30 days from the date below.

If you want compliance dates extended: An application to extend a compliance date listed in Section 3 of this notice must be received *at least 10 working days prior to the compliance date*. Application forms, available at **www.epa.vic.gov.au/business-and-industry/forms** must be addressed to the Manager of the EPA office listed on this notice with the subject line: “Notice amendment application”. Your served notice remains legally binding until EPA advises of any change. Refer to the Remedial notices policy (publication 1418) for further information on amendment applications.

What happens if you do not comply: If found guilty of contravening a requirement of this notice, you may be ordered to pay a fine of up to 2400 penalty units ($386,856) and an additional penalty of up to 1200 penalty units for each day the offence continues ($193,428 a day).

What your review rights are: An application for review of this notice can be made to EPA and/or the Victorian Civil Administrative Tribunal (VCAT). Applications for an EPA review must be made within 7 calendar days from the notice issue date (below). VCAT applications must be made within 21 days of the notice issue date. Application forms for an EPA review are available at **www.epa.vic.gov.au/business-and-industry/forms**, or from our offices. For more information on your review rights, refer to the Remedial notice review policy (publication 1531) or contact us on 1300 EPA VIC (1300 372 842).

For the purpose of this notice 'You' means the recipient of this notice or your authorised representative and 'Premises' means the site at the premises address, as identified above.

Alisha Brown

DELEGATE OF THE ENVIRONMENT PROTECTION AUTHORITY

DATE OF ISSUE: 15/08/2018

NOTICE STRUCTURE

1 EPA OBSERVATIONS

This section details what was observed during the inspection.

2 REASONS FOR VIEW FORMED

This section interprets the observations and articulates why the authorised officer believes a pollution abatement notice should be issued in accordance with section 31A of the EP Act.

3 REQUIREMENTS - WHAT OUTCOMES ARE REQUIRED TO COMPLY?

Considering the view that has been formed, this section lists the requirements or actions to address the environmental risk(s) or impact(s).

4 AN EXAMPLE OF HOW YOU CAN COMPLY

This section provides an example of how you may achieve compliance with the requirements of this notice.

1 EPA OBSERVATIONS

1.1 The premises known as Bairnsdale Landfill located at 200 Johnstons Road FORGE CREEK VIC 3875, operates as a landfill under EPA Licence 74237 premises reference 72826 and is licensed to accept solid inert waste, putrescible waste, shredded tyres and prescribed industrial waste.

1.2 Licence condition LI_L4.3 states “By 30 June 2018 you must provide to EPA a hydrogeological assessment for the premises that
a) is in accordance with Hydrogeological Assessment (Groundwater Quality) Guidelines (EPA Publication 668, released September 2006);
b) specifies the maximum leachate management level for all unlined and partially lined cells which protects beneficial uses of groundwater and allows for the effective management of landfill gas; and
c) is verified by a person who has been appointed as an environmental auditor under the Environment Protection Act 1970.

1.3 On 3 July 2018 EPA emailed EGSC asking to provide a status update on the submission of a hydrogeological assessment for Bairnsdale Landfill.

1.4 On 4 July 2018 EGSC responded to EPA’s email stating that there had been confusion with the due date.

1.5 On 6 July 2018 EPA received an email from EGSC seeking an extension to provide the hydrogeological assessment to EPA.

2 REASONS FOR VIEW FORMED

The premises known as Bairnsdale Landfill located at 200 Johnstons Road Forge Creek VIC 3875 is operating as a landfill accepting solid inert waste, putrescible waste, shredded tyres and prescribed industrial waste under EPA licence 74237 premises reference 72826. Licence condition LI_L4.3 requires a hydrogeological assessment be provided to EPA by 30 June 2018. EPA has not received the hydrogeological assessment to date. East Gippsland Shire Council has requested an extension of the due date.

On this basis, and considering the observations previously stated, I have formed a view and I am satisfied that:

- a process or activity which is being carried on at the premises

has caused or is likely to cause a failure to comply with a condition in a licence or permit, as per section 31A (1)(b)(iv) of the EP Act.

In order to address this, you must meet the requirements listed in this notice.

.....

Alisha Brown
AUTHORISED OFFICER
EPA Gippsland
EPA Victoria
DATE OF ISSUE: 15/08/2018

3 REQUIREMENTS - WHAT OUTCOMES ARE REQUIRED TO COMPLY?

General Requirements

This notice does not have any general requirements.

Reporting Requirements

3.1 By 17 September 2018 you must provide to EPA a hydrogeological assessment for the premises that:

a) is in accordance with Hydrogeological Assessment (Groundwater Quality) Guidelines (EPA Publication 668, released September 2006);

b) specifies the maximum leachate management level for all unlined and partially lined cells which protects beneficial uses of groundwater and allows for the effective management of landfill gas; and

c) is verified by a person who has been appointed as an environmental auditor under the Environment Protection Act 1970.

4 AN EXAMPLE OF HOW YOU CAN COMPLY

One way of achieving compliance with this notice would be to:
4.1 Engage a suitably qualified environmental person to prepare a hydrogeological assessment in accordance with the latest version of EPA Publication 668 Hydrogeological Assessment (Groundwater Quality) Guidelines (September 2006).

4.1.1 Engage an EPA appointed Environmental Auditor to carry out verification of this hydrogeological assessment methodology and findings to confirm it has been conducted in accordance with the above guidelines.

4.1.2 Submit an Auditor-verified hydrogeological assessment report to EPA by the due date.

Attachment 2

Bairnsdale Landfill

Golder "*Hydrogeological Assessment for Bairnsdale Landfill*" dated 4th September 2018

East Gippsland Shire Council

GOLDER

REPORT

Hydrogeological Assessment for Bairnsdale Landfill

Bairnsdale Hydrogeological Assessment

Submitted to:

Elizabeth Modrich
East Gippsland Shire Council
P.O. Box 1618
BAIRNSDALE VIC 3875

Submitted by:

Golder
Building 7, Botanicca Corporate Park 570 – 588 Swan Street Richmond, Victoria 3121
Australia

+61 3 8862 3500

1789713-002-R-Rev2

4 September 2018

Distribution List

East Gippsland Shire Council - 1 copy pdf

Nolan Consulting Pty Ltd - 1 copy pdf

Golder - 1 copy pdf

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1.0 INTRODUCTION

1.1 Background

Golder Associates Pty Ltd (Golder) was engaged by East Gippsland Shire Council (EGSC) to undertake a hydrogeological assessment (HA) for Bairnsdale Landfill, located at 200 Johnstons Road, Bairnsdale, Victoria ("the site").

The HA was required to be undertaken in response to licence condition LI_L4.3 (Licence no. 74237, Premises 72826 and as amended on 20th February 2017) issued to the site by the Environment Protection Authority Victoria (EPA) to produce a hydrogeological assessment that:

a) is in accordance with Hydrogeological Assessment (Groundwater Quality) Guidelines (EPA Publication 668, released September 2006);

b) specifies the maximum leachate management level for the premises which protects beneficial uses of groundwater and allows for the effective management of landfill gas; and

c) is verified by a person who has been appointed as an environmental auditor under the Environment Protection Act 1970."

In addition, Reporting requirement 3.1 of Pollution Abatement Notice (PAN) 90009081 dated 15th August 2018 states:

By 17 September 2018 you must provide to EPA a hydrogeological assessment for the premises that:

a) is in accordance with Hydrogeological Assessment (Groundwater Quality) Guidelines (EPA Publication 668, released September 2006);

b) specifies the maximum leachate management level for all unlined and partially lined cells which protects beneficial uses of groundwater and allows for the effective management of landfill gas; and

c) is verified by a person who has been appointed as an environmental auditor under the Environment Protection Act 1970.

It is noted that while the PAN requirement applies only to Cell 1 at the site as Cells 2 and 3 are fully lined, the licence requires the specification of the maximum leachate management level for the premises. In order to meet both requirements the maximum leachate management level will be specified for all existing cells.

1.2 Objective

The objective to prepare a hydrogeological assessment in accordance with licence condition LI _L4.3 of Licence no. 74237, Premises 72826 and as amended on 20th February 2017.

1.3 Scope

To meet the stated objective, the following scope of works was undertaken:

- Collate and review available monitoring data.
- Collate and review available geological and hydrogeological information.
- Prepare a conceptual hydrogeological model (CHM).
- Assess potential risks to groundwater beneficial uses associated with the landfill.
- Prepare a HA report presenting the CHM, potential risks to environment and recommendations for additional management measures.
- Specify the maximum leachate management level for the premises which protects beneficial uses of groundwater and allows for effective management of landfill gas.

1.4 Important Information

Your attention is drawn to the document titled - “Important Information Relating to this Report”, which is included in Appendix D of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

2.0 SITE OVERVIEW

2.1 Description

The site is a landfill located in a predominantly rural area in southeast Victoria approximately 6 km to the south of Bairnsdale town centre. The site address is 200 Johnstons Road and is bounded to the north by Johnstons Road and to the east by McDonalds Road. The current landfill area is 5 ha, within the scheduled premises area ("site") of the property at 24 ha and the full works approval area of 68 ha (Figure 1).

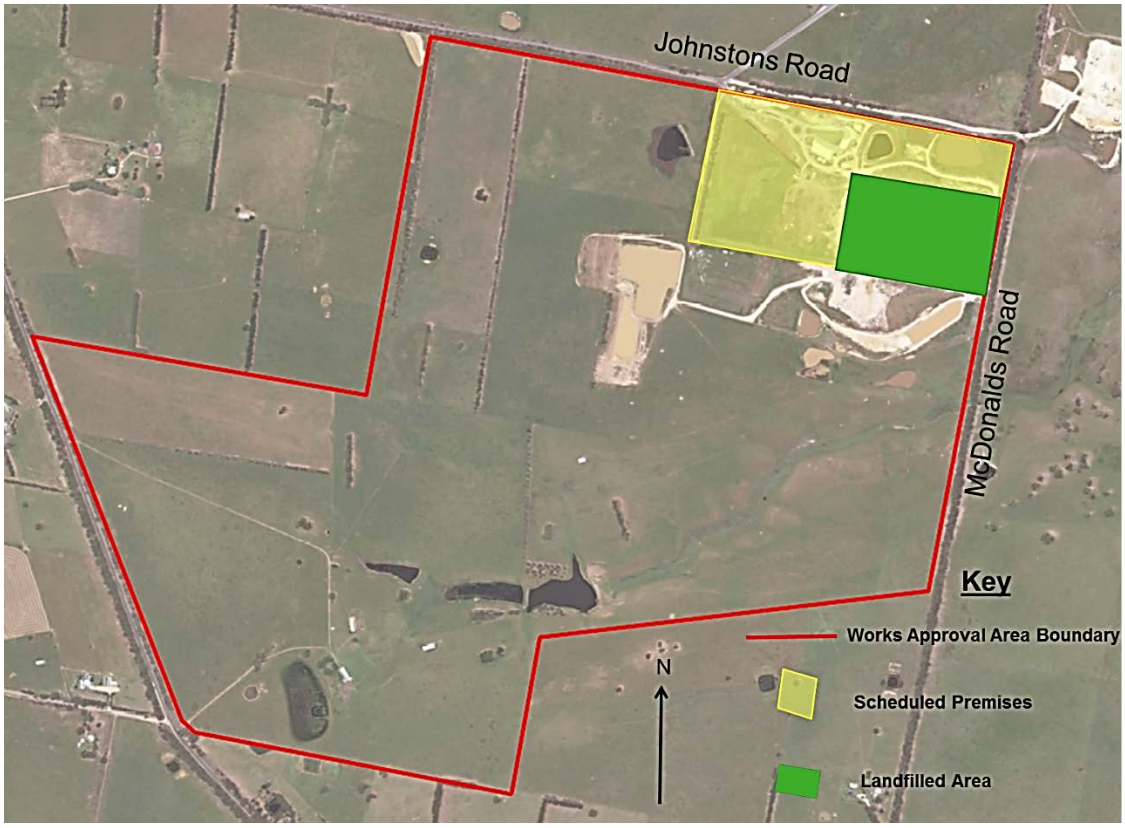

Figure 1: Site Boundaries

The entrance to the site is from Johnstons Road at the northwest corner of the site, with a road leading to the recycling centre, transfer station, tip shop, weighbridge and offices located close to the central part of the northern boundary (Figure 2).

Figure 2: Site Layout

Continuing along the northern boundary from the weighbridge area are a Leachate Dam, Fire Dam and Stormwater Pond. To the south of these water bodies is the landfilled area. To the south of the landfilled area and to the south of the scheduled premises is a soil stockpile and Sedimentation Pond, as well as another small pond or dam. The western part of the site includes an irrigation area (using leachate) and green waste mulching area.

2.2 Site Setting

2.2.1 Climate

The site is located within a temperate region typically experiencing hotter summers and cooler winters.

Rainfall and temperature data from the closest bureau of meteorology (BOM) weather station (085279) located approximately 5 km to the west of the site in Bairnsdale is available from 1942 to 2017. The data indicates that annual rainfall for the site ranges between approximately 400 mm and 900 mm falling relatively constantly during the year with slightly higher rainfall in spring. Average rainfall and temperatures are shown on Figure 3.

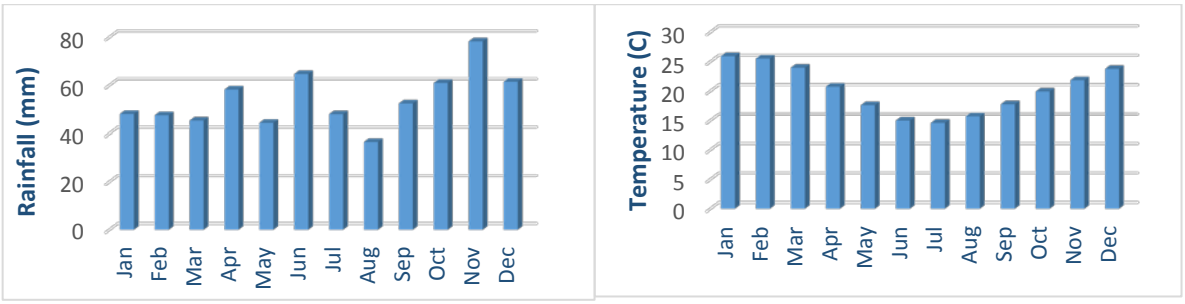

Figure 3: Mean Monthly Rainfall (1943-2017) and Mean Maximum Monthly Temperature (1943-2017)

2.2.2 Topography

The site is on the northern edge of the Gippsland Basin, which is bordered by the Australian Alps to the north and the Bass Coast to the south.

The site is located towards the eastern edge of a plateau with higher, hilly land to the southwest. The edge of the plateau slopes down to water bodies to the north and east, intersected by river and creek valleys draining to the water bodies (Figure 4). The land around the site slopes gently from the west (approximately RL 40 m AHD) to the east or southeast towards Skeene Creek (approximately RL 15 m AHD) and Macleod Morass (Morass) at sea level, (Figure 4).

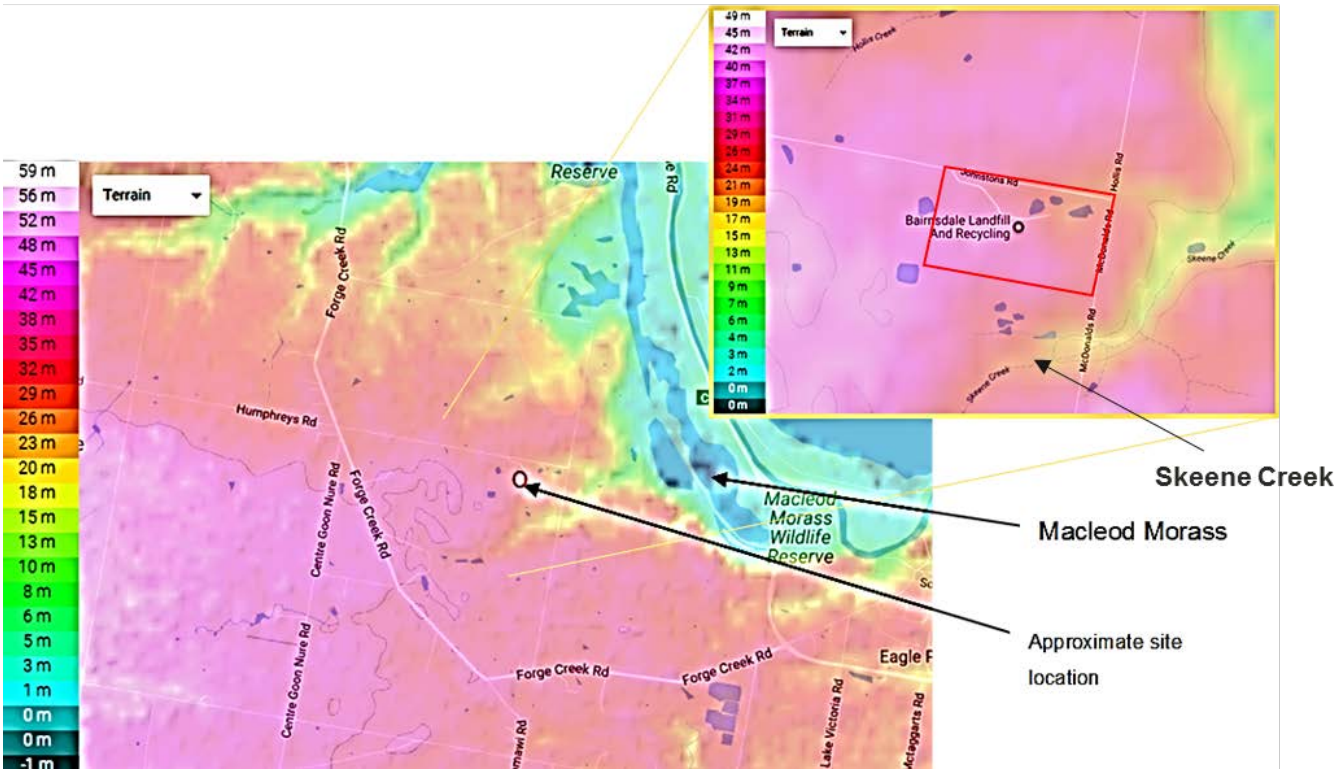

Figure 4: Regional Topography

The site generally slopes from southwest to northeast although, bunds, stockpiles, quarrying and landfilling have changed the original topography of the site. As shown on Figure 5 the highest area of the site is associated with the bund in the southwest corner where elevations of approximately 39 m AHD are reached. The lowest area of the site (approximately 19 m AHD) is the northeast corner.

The eastern part of the site generally slopes from 39 m AHD in the southwest to 27 m AHD near to the Leachate Pond. The western part of the site is more complex with the base of Cell 3 excavated to approximately 16 m AHD and Cell 1 capped to 36 m AHD. The northwest of the surrounding the Stormwater Pond and Fire Dam is at a lower elevation of around 22 m AHD. The southeast corner of the site, outside the landfilled area is at an elevation of approximately 28 m AHD.

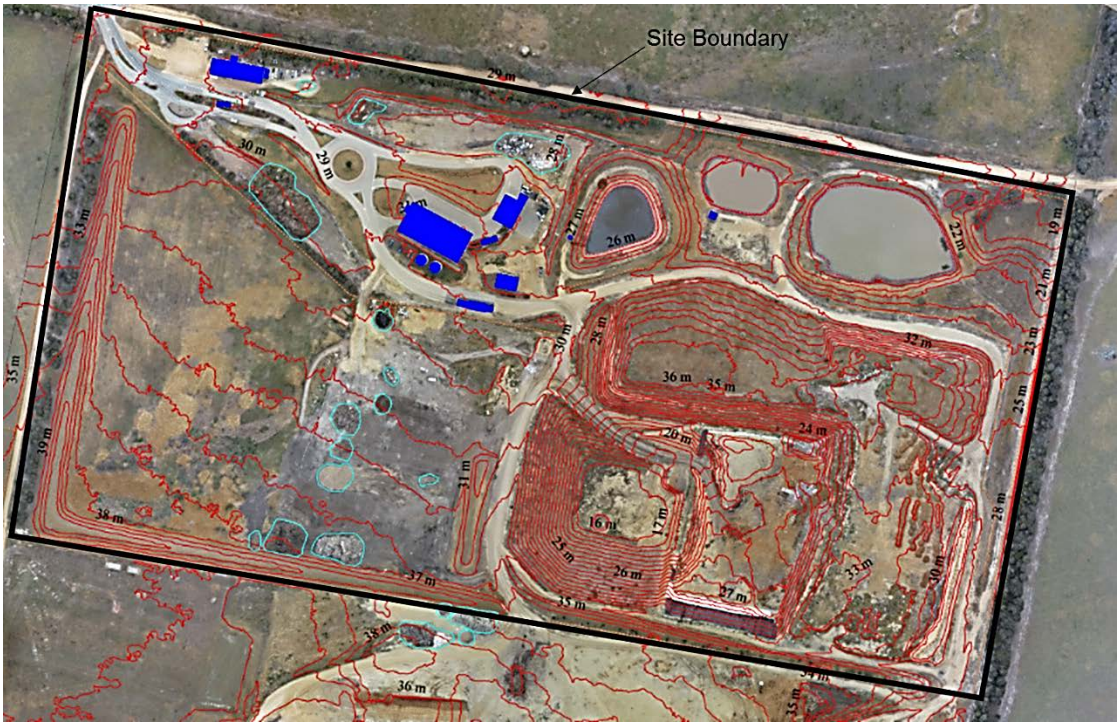

Figure 5: Site Topography (2017 site survey supplied by UAV Operations)

2.2.3 Surface Water Drainage

The site lies within the Mitchell-Thompson River Region which includes an extensive surface water drainage system regionally. There are numerous surface water bodies, the closest to site are:

- Skeene Creek (120 m southeast of site)
- Surface water ponding associated with a quarry (460 m north of the site)
- Hollis Creek, which runs through the above quarry (600 m north west of site)
- Macleod Morass (800 m east of site)
- Mitchell River (1.8 km north east of site)
- Jones Bay (2.25 km north east of site)

At its closest point Skeene Creek passes approximately 120 m to the southeast of the southeast corner of the site. Multiple tributaries of Skeene Creek capture runoff from agricultural land to the south of the site. Skeene Creek flows to the northeast into the Morass.

The Morass is a deep freshwater marsh fed by flood waters from the nearby Mitchell River and local catchment runoff. The Morass is a wildlife reserve covering approximately 520 ha, and is about 900 m wide in the area of the site.

Beyond the Morass to the east is Mitchell River which flows south and then east to the coast in Jones Bay.

To the north of site Hollis Creek flows to the northeast into the lake system feeding the Morass, Mitchell River and eventually Jones Bay.

Within the site boundary are the following surface water features:

- Leachate Dam (see Section 4.4)
- Fire Dam (see Section 2.2.4)
- Stormwater Pond (see Section 2.2.4)
- Sedimentation Pond (see Section 2.2.4).

2.2.4 Stormwater Management

The non-operational part of the site (western area) slopes to the northeast. To prevent surface water runoff across the site a bund is located at the western and southern boundaries of the operational areas. (Figure 2)

Surface water received on the paved areas around the recycling centre, transfer station, tip shop, weighbridge and office is collected in the Fire Dam located north of the landfilled area, near the northern site boundary, between the Leachate Dam and Stormwater Pond. A number of fire hydrants around the site are also connected to the Fire Dam. The Fire Dam is maintained at capacity with overflow discharging to the Stormwater Pond.

Surface water runoff from the remainder of the operational areas is collected in the Stormwater Pond located to the north of the landfilled area in the northeast corner of the site. On request from the quarry owners, water from the Stormwater Pond is pumped to Whelan Quarry to the north and Brownlow Quarry to the northeast for use in quarry operations. Excess surface water beyond that required by the quarries is discharged by the landfill to Skeene Creek. Discharge to Skeene Creek does not occur in some years.

Runoff from a spoil heap located to the south of Cells 2 and 3 is collected in a Sedimentation Pond. Overflow from the Sedimentation Pond is discharged to the Brownlow Quarry or Skeene Creek.

2.2.5 Vegetation and Landuse

The site is in a coastal rural area. The main landuses are agricultural with some extractive industry also present. Based on the review of available data[1] the land uses surrounding the site are as follows:

- **North** bounded by Johnstons Road to the north, beyond which is mainly agricultural land and a quarry approximately 450 m to the north.
  - (Farming Zone (FZ1) with EMO)
- **East** bounded by McDonald's Road to the east, beyond which is a slope down towards the Macleod Morass, a wildlife reserve approximately 800 m away and beyond that is Jones Bay.
  - (an area of FZ1 land that is subject to ESO1-40. The Morass to the northeast is zoned as a public conservation and resource zone (PCRZ) with an environmental significance overlay (ESO1-40), an inundation overlay (LSIO), and a salinity management overlay (SMO))
- **South** by a bund and then agricultural land.
  - (Farming Zone (FZ1) with EMO)
- **West** by a bund and then agricultural land.
  - (Farming Zone (FZ1) with EMO).

Each planning overlay specifies conditions which must be met by properties within the overlay. It is not the purpose of this report to assess compliance with these conditions.

2.3 History

An overview of the site history is provided in Table 1.

Table 1: Summary of Site History

Date	Landuse	Source
Pre-2003	Agricultural / gravel quarry	(Williams 1999, Nolan 2017)
2003	Landfilling began at the site. The site is licenced to receive putrescible waste, solid inert waste, asbestos and shredded tyres.	Licence no. 74237

The site was licenced for landfilling in July 2003. Based on current landuse in the area most of the site is likely to have been agricultural prior to landfilling. The location of the initial cell, Cell 1 is reported to have been a gravel quarry (Williams, 1999).

2.4 Landfill Engineering

The engineering of the cells at the site is as described below:

- Cell 1 – low permeability (< 10^{-9} m/s) clay liner, no sidewall liner
- Cell 1A – 1 m compacted clay, 0.3 m filter blanket with 110 mm PE drains, no sidewall liner
- Cell 2 - base and sidewalls, < 1 m compacted low permeability (< 10^{-9} m/s) clay, HDPE membrane, 0.3 m filter blanket with 110 mm HDPE drains for leachate collection.

[1] Interactive Map Land Channel (www.land.vic.gov.au), planning scheme data (last updated on December 2017).

- Cell 3 - base and sidewalls, < 1 m compacted low permeability (< $1e^{-9}$ m/s) clay, 2mm HDPE geomembrane, 3.8 mm cushion, 0.3 m filter blanket with 160 mm HDPE drains, 1.2 mm separation geotextile.

Current Cell

Cell 3A-1 is accepting waste. Cell 3A-2 and 3B are scheduled to be ready to start accepting waste in late 2018.

Future Cells

There are plans for Cells 4 and 5 to the west of Cell 3 scheduled for construction in 2020/21 and 2023/24 respectively. It is expected that at least 12 cells with be constructed at the site (Nolan 2017).

Table 2: Groundwater and Leachate Monitoring Locations

Monitoring Location ID	Easting	Northing	Top of Casing Elevation (m AHD)	Total Depth of Borehole (m)	Depth of Screen (m bgl)	Screened Aquifer	Location Description
119506#	554549.69	5807232.905	33.89	34.8	28.0 – 35.0	Haunted Hills Formation	Off-site to the west
119507#	554927.31	5806429.73	32.81	34.4	26.0 – 34.0	Haunted Hills Formation	Off-site to the south
141402 (BH5)	555683.5	5807034.1	28.76	29.6	24.1 – 30.0	Haunted Hills Formation	On eastern boundary of site
141403 (BH6)	554538.5	5806614.1	38.75	39.2	35.3 - 38.2	Haunted Hills Formation	Off-site to the south-west
9022881/1 (MW1)	-*	-*	24.80	23.6	35.3 – 38.2	Haunted Hills Formation	North-east portion of site
9022881/2 (MW2)	-*	-*	19.28	18.0	14.0 – 17.0	Haunted Hills Formation	North-east corner of site
JRLD (Leachate Dam)	N/A	N/A	N/A	N/A	N/A	N/A	Leachate Dam, north-central portion of site
JRLP (Leachate Sump)	-	-	34.91	Base is at 20.25 m AHD		Waste	Leachate Sump, serves Cells 1 and 1A.

"N/A" not applicable, "- "not provided", *the Auditor has requested this information is obtained.
the details of these bores do not match the details held in the www.vvg.org.au database

2.5 Previous Studies

The following reports have been provided to Golder to inform this HA:

- Section 53V Audit - Audit of Landfill Operation, 200 Johnstons Road, Bairnsdale, Service Order No. 8005330. Nolan Consulting Pty Ltd, October 2017. (Environmental Audit)
- 2017 Annual Monitoring Report, Bairnsdale Landfill, 200 Johnstons Road, Bairnsdale, Vic, 214088 Report10.1. Cardno Victoria Pty Ltd, May 2017. (Annual Report)

Environmental Audit

John Nolan of Nolan Consulting Pty Ltd undertook an Environmental Audit of the site in 2017. The stated objective of the audit was to '*identify and, where possible, quantify the risk of any possible harm or detriment to a segment of the environment caused by operation of the landfill*.'

The Audit reported the following findings that are relevant to this HA:

- The risk of seepage of leachate through the landfill floor and impacting on groundwater beneficial uses is considered medium
- The risk of seepage of contaminated stormwater through landfill floor and other areas and impacting groundwater beneficial uses is considered low to medium
- The risk of contaminated runoff from landfill and non-landfill operating areas impacting surface water beneficial uses is considered medium

Interpretation of monitoring results – groundwater

- Local groundwater flow direction is considered to be to the north east.
- Possible nitrate impacts in groundwater are found to the north-east of Cell 1 but as it is below water quality criteria and not increasing the Auditor does not consider it to be a significant risk

Interpretation of monitoring results – surface water

- Onsite stormwater if discharged to Skeene Creek may exceed beneficial use criteria for phosphorus and turbidity
- Impact of overburden stockpiles on turbidity of Skeene Creek is unknown as outflow from the sedimentation pond is not monitored

Annual Report

Cardno undertook two groundwater monitoring events (GMEs), in October 2016 and April 2017, the methodologies, results and comparison to assessment criteria have been provided in the Annual Report.

- Groundwater is inferred to flow to the northeast across the site
- Standing water levels across the site are generally decreasing apart from well 902281/1 which is increasing
- The wells were sampled using the low flow sampling technique. Field measurements of dissolved oxygen (DO), electrical conductivity (EC), pH, oxygen reduction potential (ORP), and temperature were recorded as well as standing water levels
- Groundwater samples were analysed for "Suite 1" - pH, total dissolved solids (TDS), total organic carbon (TOC), Total Kjeldahl Nitrogen (TKN), chemical oxygen demand (COD), total petroleum hydrocarbons (TPH), benzene, toluene, ethylene, xylene (BTEXs), volatile fatty acids (VFA), total nitrogen (as N), ammonia (as N), bicarbonate, chloride, sulphate, sodium, potassium, total phosphorus, calcium, magnesium, iron (dissolved) and manganese (dissolved)

- Groundwater TDS concentrations were recorded between 113 mg/L to 1,489 mg/L and which is protective of Segment A1 under the State Environmental Protection Policy (SEPP) Groundwaters of Victoria (SEPP Groundwater)
- Exceedances of iron, manganese, phosphorous, chloride, pH, sodium, and TDS in groundwater were recorded above the adopted assessment criteria on at least one occasion.
- With respect to groundwater beneficial uses, maintenance of aquatic ecosystems and stock watering do not have any observed exceedances. In the instance of potable water supply, agriculture parks and gardens, industrial water use, primary contact recreation and building and structures, these beneficial uses are considered unlikely to be realised and therefore not considered precluded at the site.
- Surface water samples were analysed for Suite 1 – pH, TDS, TOC, TKN, COD, TPH/BTEXs, VFA, total nitrogen (as N), ammonia (as N), bicarbonate, chloride, sulphate, sodium, potassium, total phosphorous, calcium, magnesium, iron (dissolved) and manganese (dissolved)
- Based on the SEPP Waters of Victoria the site is within the Cleared Hills and Coastal Plains Segment
- With respect to surface water beneficial uses, maintenance of aquatic ecosystems does not have any observed exceedances. In the instance of potable water supply, agriculture parks and gardens, stock watering, industrial water use, primary contact recreation and building and structures, these beneficial uses are considered unlikely to be realised and therefore not considered precluded at the site.
- This is with the proviso that water is not overflowing from the off-site stormwater pond into Skeene Creek, and recommended excess water be pumped to the leachate dam or reused.

3.0 METHODOLOGY

3.1 Desk Study

Fieldwork has not been undertaken as part of this HA. The report relies upon information collected during previous field works and studies as described in Section 2.5. However, for completeness and ease of reference a description of the groundwater, leachate and surface water sampling locations and methodologies has been included here. A description of the monitoring network is provided in Section 4.2.

Annual Monitoring (Groundwater, Surface Water, Leachate)

Groundwater monitoring at the site began in 1997 in groundwater wells 119506 and 119507. Groundwater wells 141402 and 141403 were added in April 2000, and groundwater wells 9022881/1 and 902881/2 were added in 2005. Groundwater gauging, sampling and analysis is undertaken on an approximately quarterly basis.

Leachate sampling in waste has been undertaken at one location, JRLP (leachate sump for Cell 1 and 1A) at approximately 6 monthly intervals since 2003. Sampling is not currently undertaken at Cell 2 Sump or Cell 3 Sump however the most recent Audit (Nolan, 2017) recommends the addition of these sumps to the monitoring program.

Surface water sampling has been undertaken at:

- JND (off-site dam on Skeene Creek to the east of the site) since 2000
- JRCREEK 1 (Skeene Creek downstream) since 2012
- JRCREEK 2 (Skeene Creek upstream) since 2012
- JRSWD (Stormwater dam) since 2012
- Fire Dam (on-site dam) since 2016. Gauging of water levels is also undertaken at this location.

The monitoring locations are shown on Figure 8.

Methods

Groundwater monitoring events (GMEs) were undertaken in October 2016 and April 2017 in accordance with a verified monitoring program as updated in the previous Environmental Audit (Nolan 2015).

The procedures used are summarised below:

- Groundwater wells
  - The water level in the wells was gauged using an oil/water interface probe
  - Wells were sampled using the ‘micropurge’ low flow sampling technique until field parameters (DO, EC, pH, ORP) had stabilised.
- Surface water
  - Samples were collected directly into the sample bottles or where that was not possible, using a plastic water scoop with a telescopic arm.
  - For deeper waters samples were taken 100 mm below the water surface, away from the edge of the water body. Shallow water bodies were sampled so as to avoid the disturbance of sediment.
  - Observations were made with respect to the presence or absence of NAPL.
  - A water quality meter was used to measure EC, pH, DO, redox potential and temperature.

- Leachate well
  - The leachate well was sampled using a plastic bailer equipped with a low flow bottom emptying device.
  - Observations were made with respect to the presence or absence of NAPL.
  - A water quality meter was used to measure EC, pH, DO, redox potential and temperature.

General

- Water samples were sent to NATA accredited laboratories in appropriate containers for analysis.
- Samples (leachate, groundwater and surface water) were analysed for pH, TDS, TOC, TKN, COD, TPH/BTEXs, VFA, total nitrogen (as N), ammonia (as N), bicarbonate, chloride, sulphate, sodium, potassium, total phosphorous, calcium, magnesium, iron (dissolved) and manganese (dissolved).
- The field forms were not included with the monitoring report, therefore an assessment of methodology against EPA publication 669 has not been undertaken.

4.0 CONCEPTUAL SITE MODEL

4.1 Geology and Aquifers

4.1.1 Regional Geological Setting and Hydrogeological Setting

The site is located within the Gippsland Basin on the Lakes Entrance Platform, north of the Lake Wellington Fault system. Surface and subsurface geology on the platform exhibits layers of Latrobe, Seaspray, and Sale Group sediments. The regional geology surrounding the site is presented on the 1:250,000 Geological Survey Map (1:250,000 Bairnsdale sheet) and shown on Figure 6.

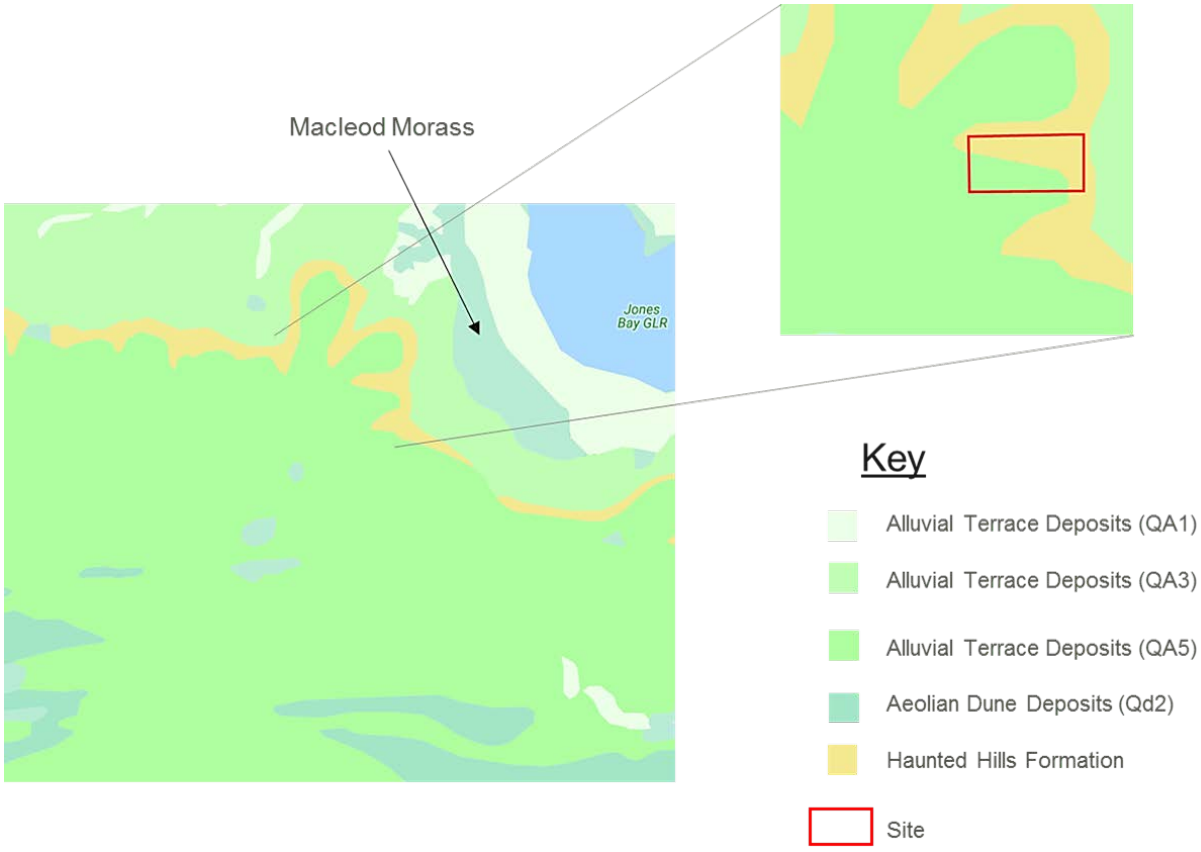

Figure 6: Regional Geology

The area in the vicinity of the site is largely covered by Quaternary alluvial terraces (gravels, sands, silts and clays). The terraces (QA3) to the east of the site are typically Pleistocene in age with younger terraces (QA1) closer to the coast. The higher terraces to the west of the site (QA5) are Pliocene to Pleistocene in age, underlain Pliocene to Pleistocene by non-marine gravels (Haunted Hills Gravels).

Based on the published geological map for the area and the bioregional assessment for Gippsland[2] and data from Geoscience Victoria[3] the geological formations present in the broader area of the site are (youngest to oldest):

- Quaternary age sediments – alluvium, colluvium, gravels, sands and clays

[2] http://www.bioregionalassessments.gov.au/assessments/gippsland-basin-bioregion, April 2016

[3] via www.vvg.org.au

- Quaternary/Tertiary age Haunted Hills Formation – fluvial sediments, cross-bedded lenticular gravels, sands and clays
- Tertiary age Boisdale Formation – fine to medium sands with occasional gravel beds
- Tertiary age Gippsland Limestone Formation – fine sands and clays, limestone
- Tertiary age Latrobe Group - dominated by non-marine, fine- to medium-grained siliciclastics interspersed with coal horizons.

Regionally the main hydrostratigraphic units are considered to be the:

- Quaternary sediments as the Quaternary Aquifer (QA)
- Haunted Hills Formation as the Upper/Quaternary Aquifer (UTQ)

4.1.2 Site Geology

The site geology is based on information provided on the published geological maps including the seamless geology map presented on www.vvg.org.au (Geoscience Victoria), the bore logs of 8 boreholes drilled at the site (119506, 119507, 119508, 119509, 141402, 141403, 9022881/1 and 9022881/2) and the Audit.

In the vicinity of the site Quaternary sediments generally form a thin cover over the Haunted Hills Formation (Birch et al., 2003). Specific to the site, based on the Geoscience Victoria map the Haunted Hills Formation is expected to outcrop along the northern and eastern site boundary with the remainder of the site covered by Quaternary sediments, (Figure 7).

The site bore logs consistently show clay overlying sands and gravels. The thickness of the clay ranges from 0.7 m (9022881/1) to 5.6 m (119506) (Figure 7). The distribution of clay recorded at the site does not exactly correlate to the expected distribution shown on Figure 7 of Haunted Hills Formation and Quaternary sediments. However, based on the expected thickness of the Quaternary sediments where indicated to be present at the site (Geoscience Victoria, Table 3) it is inferred that the clays are likely to be Quaternary sediments while the underlying sands and gravels represent the Haunted Hills Formation.

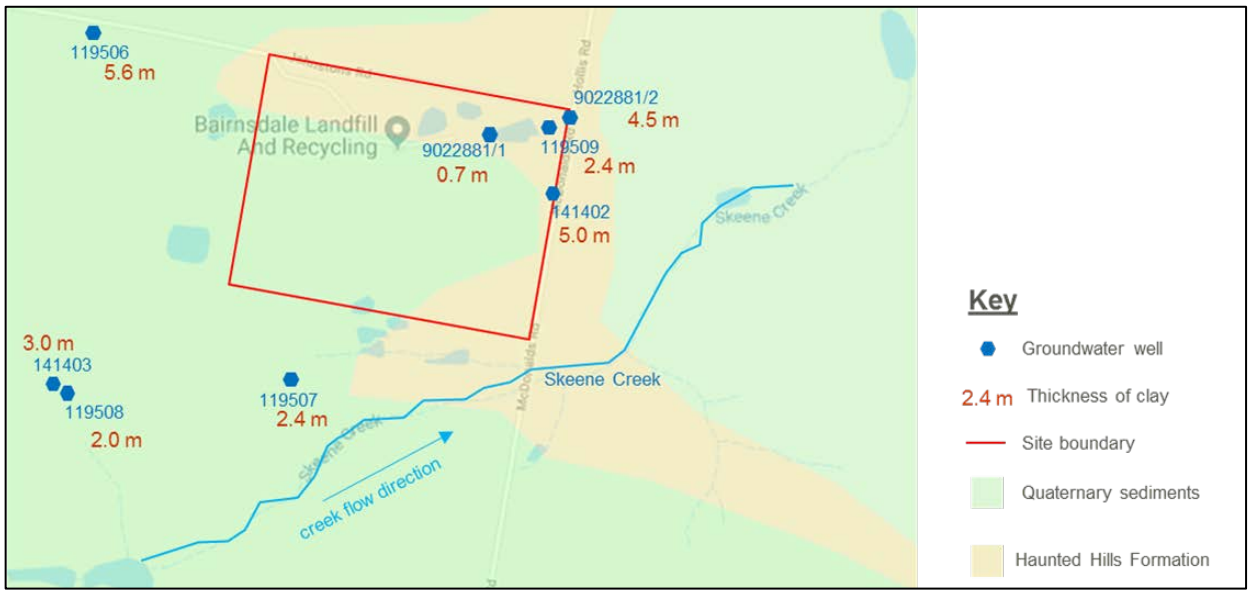

Figure 7: Distribution of surface sediments (Geoscience Victoria) and showing actual depth to clay

Table 3: Virtual Borelog from the Site (Geoscience Victoria)

Aquifer	Local Geological Unit	Attribute	Value (east area of site)	Value (west area of site)	Units
Quaternary Aquifer	Quaternary sediments	Top Elevation	31	37	m AHD
		Thickness Elevation of base	3 28	7 30	m m AHD
Upper Tertiary-Quaternary Aquifer	Haunted Hills Formation	Thickness Elevation of base	40 -12	44 -14	m m AHD
Upper Tertiary Aquitard	Boisdale Formation	Thickness Elevation of base	23 -35	26 -40	m m AHD
Upper-Mid Tertiary Aquitard	Gippsland Limestone	Thickness Elevation of base	349 -384	339 -379	m m AHD

Clay - Quaternary sediments

Clay is present in all bores at the site from at or close to the surface, ranging in thickness from 0.7 m (9022881/1) to 5.6 m (119506). The clay is described in the bore logs variously as clay, silty, sandy or gravelly clay, soft to hard, dry to moist, grey, brown, orange, red and yellow. In general sand and gravels form a greater proportion of the sediments with increasing depth.

Sands and Gravels - Haunted Hills Formation

The Haunted Hills Formation is present in all bore logs with a maximum depth of 39.5 m bgl or thickness of 36.5 m recorded (141403). The Haunted Hills Formation was not fully penetrated by any of the on-site boreholes. Described in the bore logs variously as gravelly clay, gravelly sand, clayey sand and sand, with quartz often noted to varied degrees. Size and colour of particles are highly variable across the site.

Deeper Geology

The details of borehole 120349 are provided in an online database (www.vvg.org.au). Borehole 120349 is located approximately 1,400 m to the west of the site and was drilled to a depth of 124 m bgl. The recorded lithology is shown in APPENDIX A and confirms the presence of a silty formation underlying the sands at 49 m bgl (inferred Boisdale Formation, Nolan, 2017), and marls and limestones from 66 m bgl (inferred Gippsland Limestone) as expected based on the information provided in Table 3.

The confirmed geology encountered beneath the site can be described as follows:

- A clay layer (Quaternary sediments) over the site ranging in thickness from 0.7 m bgl to 5.6 m bgl. The clay description is highly variable indicating the presence of high proportions of silts, sands and gravels, particularly towards the base.
- Underlying the clay are sands and gravels (inferred Haunted Hills Formation) to a confirmed depth of 39.5 m bgl or thickness of 36.5 m. The site boreholes did not fully penetrate the unit, however the seamless geology map from Geoscience Victoria indicates a likely depth of thickness of approximately 40 m at the site. The sediments vertically and spatially variable across the site described in the logs as gravelly clay, gravelly sand, clayey sand and sand with a high quartz component.

The deeper geology (not proved at the site) is expected to comprise the Boisdale Formation, typically a silty formation underlying the Haunted Hills Formation, underlain in turn by the Gippsland Limestone.

4.1.3 Site Hydrostratigraphic Units

A summary of the identified hydrostratigraphic units at the site is presented in Table 4 with further discussion below.

Table 4: Site Hydrostratigraphy (from the surface)

Victorian Aquifer Framework Aquifer	Aquifer	Flow type	Typical Hydraulic Conductivity/ Specific Yield	Comments
Quaternary Aquifer	Quaternary sediments (clay layer)	Porous media	Hydraulic conductivity - $6e^{-5}$ m/s to $3e^{-4}$ m/s specific yield - 0.1 to 0.2 (DSE, 2010)	While the sediments are logged as a clay, there are high proportions of silts, sands and gravels. The literature hydraulic conductivity values are considered to be high, when compared to the clayey nature of the lithology provided in the bore log descriptions for the site. Groundwater was not recorded during the drilling of boreholes through this layer.
Upper Tertiary/ Quaternary Aquifer	Haunted Hills Formation	Porous media	0.5 m/day to 5/day ($5e^{-6}$ m/s to $5e^{-5}$ m/s) (Nolan, 2017) Up to 100 m/day ($1e^{-3}$ m/s) (Schaeffer, 2008) Specific yield of 0.1 (Schaeffer, 2008)	Unconfined in the area of the site.

Quaternary Aquifer

Groundwater was not encountered during drilling in the Quaternary Aquifer comprising the top up to 6 m at the site. Where saturated, possibly downgradient of the site, flow is through unconfined porous media with velocities expected to be variable due to the highly heterogeneous nature of the sediments. Recharge is likely to occur through the Quaternary Aquifer to the underlying groundwater.

Hydraulic testing at the site has not been undertaken, however a typical range of 5 to 30 m/day ($6e^{-5}$ m/s to $3e^{-4}$ m/s) is reported (DSE, 2010), with a specific yield of 0.1 to 0.2.

Haunted Hills Formation Aquifer

All of the monitoring wells at the site are screened in the Haunted Hills Formation Aquifer. Groundwater was encountered in all wells however in 2011 wells 119508 and 119509 were dry and are no longer monitored.

Flow within the Haunted Hills Formation is through an unconfined porous media. Due to the heterogeneous nature of the Haunted Hills Formation sediments, flow velocity is likely to be highly variable.

Site specific hydraulic testing has not been undertaken however literature values and values captured in the Audit report suggest hydraulic conductivities ranging between $5e^{-5}$ m/s and $1e^{-3}$ m/s, and a specific yield of 0.1.

4.2 Monitoring Network

The monitoring network includes six groundwater wells, a leachate sump, and the Leachate Dam. The monitoring locations are shown on Figure 8. Wells 119506, 119507 and 141403 and some surface water monitoring locations are located off-site but for the purposes of this report will be referred to as site boreholes or wells as they are part of the monitoring program. Details of the monitoring locations are provided in Table 2 and bore logs are provided in APPENDIX A.

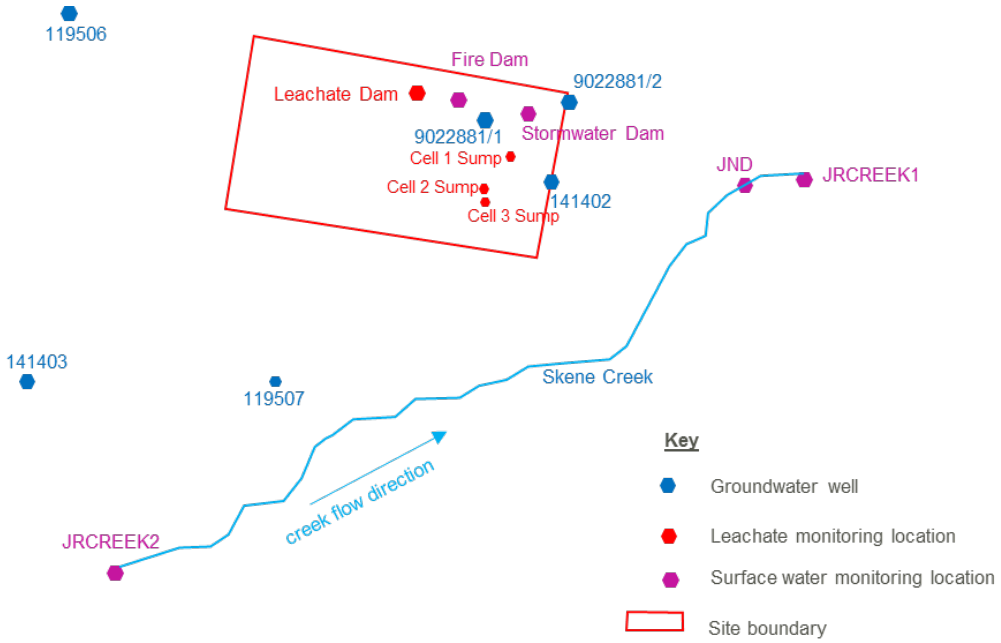

Figure 8: Sketch Map of Monitoring Locations

It is noted that the details for boreholes 119506 and 119507 in Table 2 taken from the borelogs provided do not match those contained in www.vvg.org.au (FedUni, 2015). The field sheets are not provided in the monitoring report (Cardno, 2017). Appendix B of the monitoring reports indicates the base of the wells based on expected rather than measured depths. It is recommended that the base of the well is dipped and compared to the expected well details to confirm that the well details are correct.

4.2.1 Groundwater Levels and Flow

Groundwater levels have been gauged at the site since 1997. Groundwater levels from the most recent monitoring event (April 2017) are presented in Table 5. Monitoring data for the period 2014 to 2017 is presented on Figure 9 and Figure 10 in the text below. A4 versions and tabulated data are provided in APPENDIX C.

Table 5: Groundwater Levels

Well ID	Monitored Aquifer	Water Level in April 2017 (m AHD)
119506	Haunted Hills Formation	3.67
119507	Haunted Hills Formation	3.22
141402	Haunted Hills Formation	3.03
141403	Haunted Hills Formation	3.30
9022881/1	Haunted Hills Formation	3.03
9022881/2	Haunted Hills Formation	2.92

For the electronic data provided (April 2014 to April 2017) groundwater levels at the site have ranged between 2.86 m AHD (well 9022881/2, north eastern site boundary) and 3.73 m AHD (well 119506, west of the north western site boundary). Within each groundwater well, groundwater levels have been consistent with less than 0.2 m between the maximum and minimum recorded groundwater level. Historical groundwater level data (pre-2014) is shown on Figure 10.

Based on water levels recorded in the Haunted Hills Formation the following is noted:

- Groundwater levels at the site during the most recent monitoring events were consistent with the 2014 to 2017 monitoring data. The lowest groundwater levels are in the northeastern parts of the site (9022881/1 and 9022881/2), increasing southwards and westwards with the highest levels recorded to the northwest of the site (119506).
- A similar trend is observed in all of the groundwater wells with groundwater levels decreasing until about 2009 and then increasing to 2017. This trend coincides with the start and end of the Millennium Drought which occurred in Victoria between 1996 and 2010[4] (Figure 10). Groundwater levels have not yet recovered to pre-drought levels. A slight decrease in water levels is present in most of the groundwater wells from approximately 2015 to the present however the longer term overall trend remains increasing.
- Groundwater levels appear to be recovering more quickly in downgradient wells 141402, 9022881/1 and 9022881/2, particularly 9022881/1. This may be due to leakage from the Fire Dam and Stormwater Pond, irrigation at the site, or seepage from the landfill.
- Groundwater levels are consistently > 10 m below the base of the landfill site.

[4] http://www.bom.gov.au/climate/updates/articles/a010-southern-rainfall-decline.shtml

- There is no evidence of mounding beneath the site.

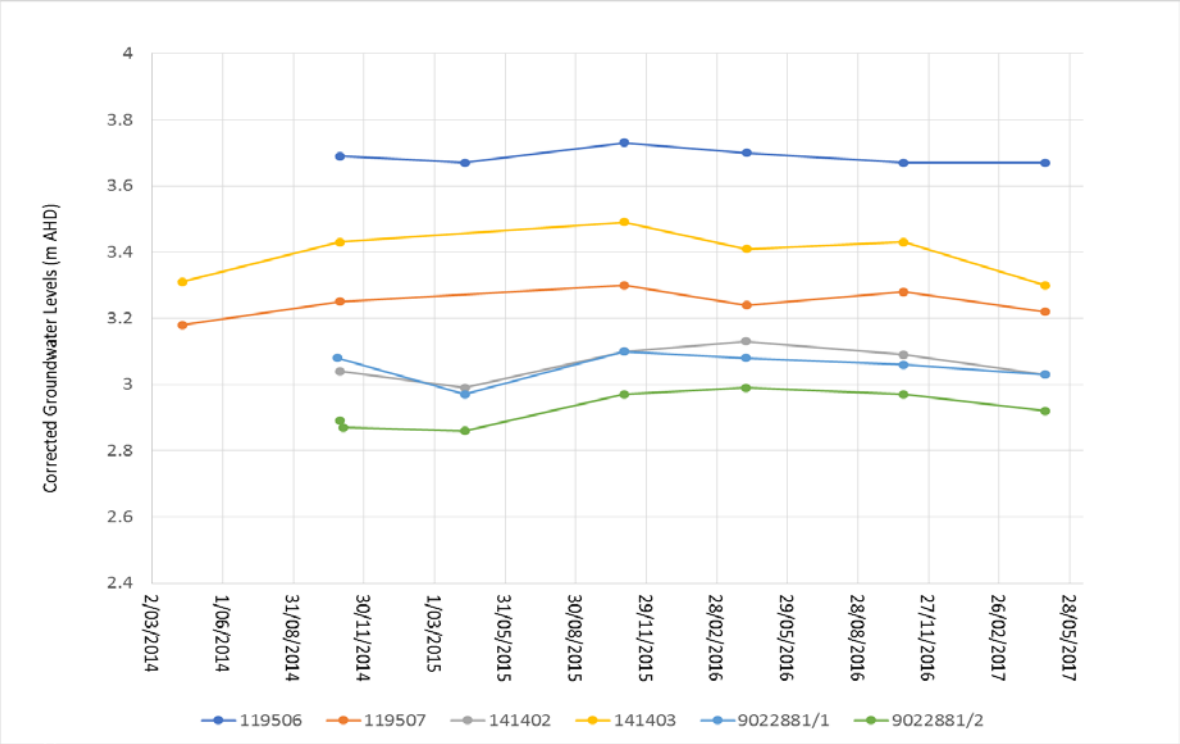

Figure 9: Groundwater Levels (2014-2017)

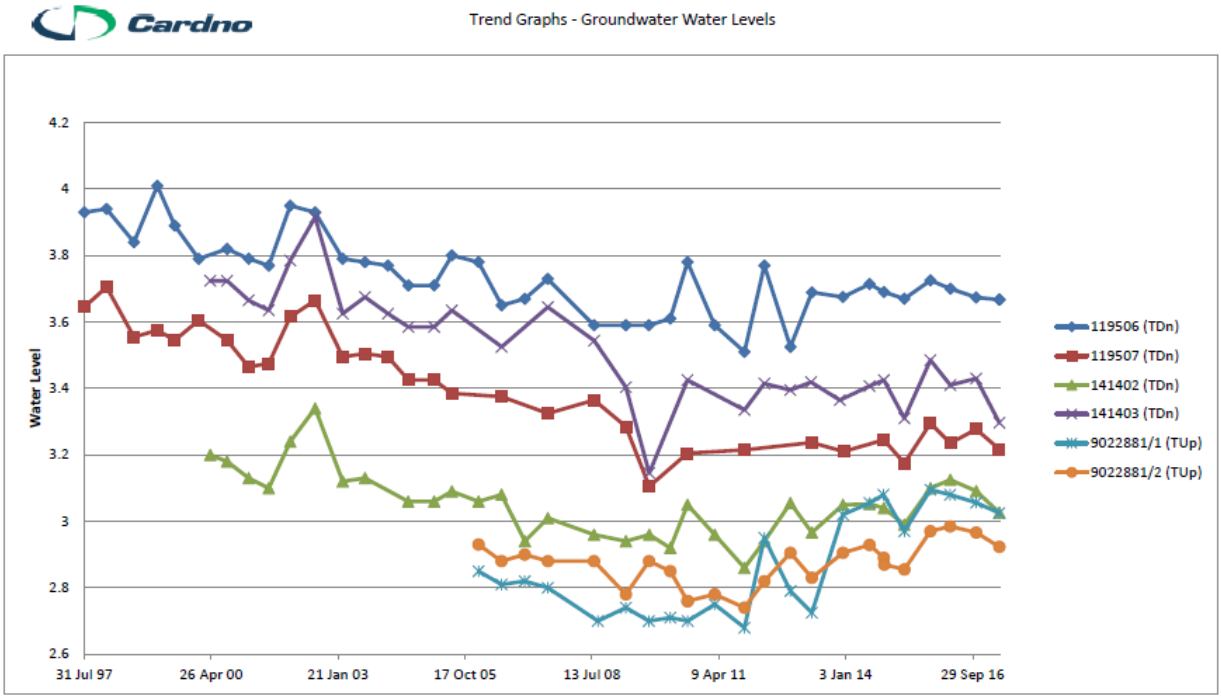

Figure 10: Groundwater levels (1997 - 2014) (from Cardno, 2017)

Groundwater flow off-site to the west is towards the southeast turning to the northeast across the site. The change in flow direction may be due to the proximity of the Morass. Given the current coverage of monitoring locations we consider an additional groundwater well installed into the Haunted Hill Formation to the south of 141402 would be useful to further delineate groundwater flow and act as a downgradient well for Cell 2.

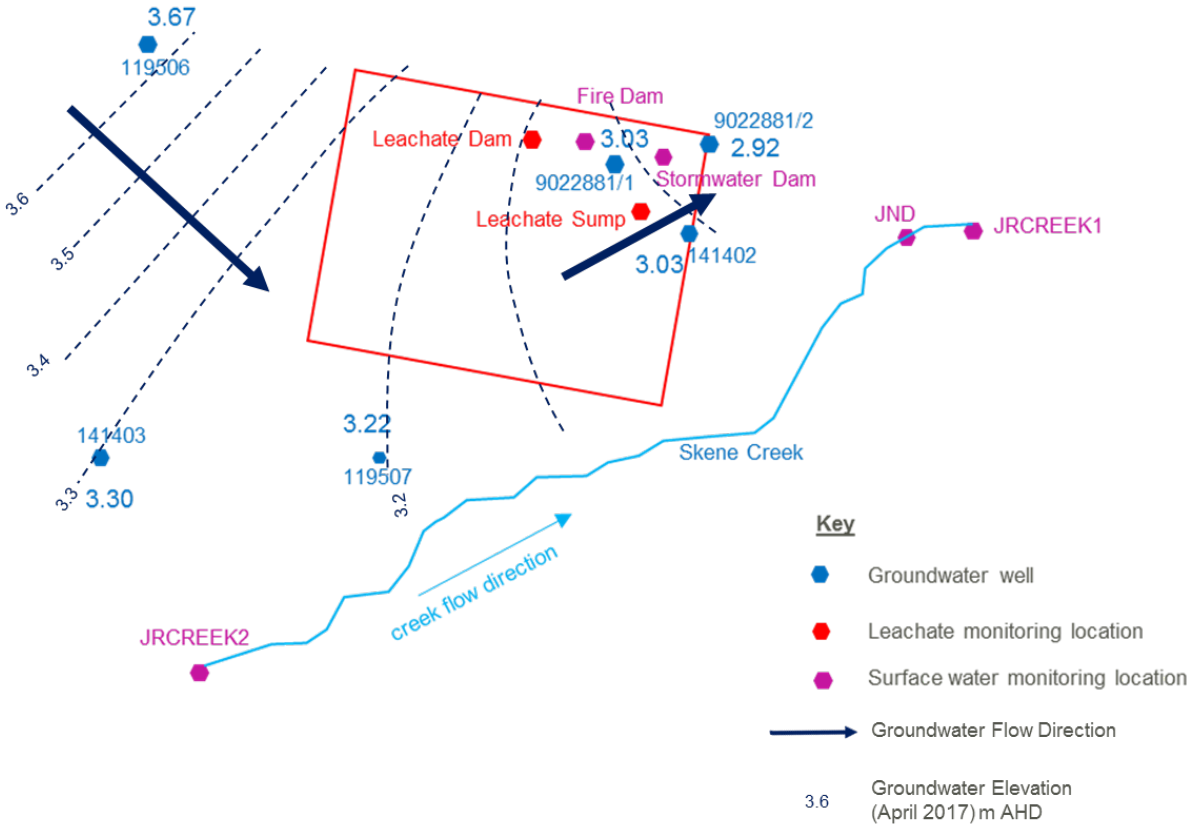

Figure 11: Groundwater Flow

Horizontal groundwater velocity at the site through the aquifer was estimated using the formula:

$$v = \frac{Ki}{n}$$

Where v = velocity (m/s)

K = hydraulic conductivity (m/s)

i = hydraulic gradient (unitless)

n = effective porosity (fraction)

using the following values:

- hydraulic conductivities of $5e^{-6}$ m/s and $1e^{-3}$ m/s
- hydraulic gradients of 0.003 to 0.008
- an effective porosity of 0.05 to 0.2 (unitless).

This results in velocities of between $1e^{-7}$m/s and $1e^{-4}$ m/s (0.006 m/day to 13.8 m/day). The hydraulic conductivities rely on literature values as site specific data is not available. However, the maximum value used, ($1e^{-3}$ m/s) is considered representative of gravels. While some gravelly materials are present at the site they are not extensive and are present in silty or clayey materials which will significantly reduce the hydraulic

conductivity. A velocity of 13.8 m/day while possibly valid for some areas of the Haunted Hill Formation is therefore considered to be unrealistic (i.e. conservative) in the context of the site. If a risk assessment is undertaken that is reliant on groundwater velocity hydraulic testing should be undertaken to obtain site specific hydraulic conductivities and the velocity recalculated.

The time taken for any leachate from the landfill to reach receiving waters is the time for leachate to infiltrate from the base of the landfill through the unsaturated zone to the water table of the Haunted Hills Formation aquifer plus the time for horizontal flow through the aquifer. A useful and realistic estimate of vertical groundwater velocity cannot be made based on the available data therefore groundwater velocity estimate only considers the horizontal flow component the total travel time will be greater after allowing for unsaturated zone infiltration.

4.3 Groundwater and Surface Water Interaction

As discussed in Section 2.2.3 the site lies within an extensive surface water drainage system with numerous surface water bodies. Figure 12 shows a cross-section indicating the location of groundwater relative to the surface water bodies at and downgradient of the site.

Groundwater is at approximately RL 3.5 m AHD to the west of the site and approximately RL 3 m AHD to the east of the site. Based on the nearmap data the off-site downstream dam on Skeene Creek is at 10 m AHD (14 m AHD based on google data). The other surface water bodies in the vicinity of the site are at higher elevations. Groundwater is several metres (>5 m) below surface water bodies in the vicinity of the site, passing beneath them before eventually discharging into the Morass about 800 m to the east of the site.

While seepage from the surface water bodies may recharge the underlying aquifer, groundwater will not discharge into the water bodies on the site, or into Skeene Creek and associated dams in the immediate vicinity of the site.

Figure 12: Surface Water and Groundwater

4.4 Leachate Management

Leachate collection systems are located in the base of each cell:

- Cell 1 and 1A – piped leachate collection system in a drainage blanket to a 1.2 m concrete leachate sump located in the centre of west of Cell 1. The design base of the sump is at RL 20.25 m AHD.
- Cell 2 – leachate collection drains grade to a 1.2 m diameter leachate sump located in the north west corner of Cell 2. The Auditor has recommended that the base of the sump be surveyed (Nolan, 2017).
- Cell 3A-1 – has a leachate sump located in the north west corner. There is a riser pipe in the sump which then runs along the side liner. The Auditor has recommended that the base of the sump be surveyed (Nolan, 2017).

The sumps are fitted with Airwell pumps, fitted with a sensor programed to begin pumping when there is 300 mm or more of leachate above the lowest point on the drainage layer. The leachate is pumped to the Leachate Dam from the western side via an independent metered pipeline.

The Leachate Dam is currently located to the north west of Cell 1A with a capacity of 9 ML. It is lined with 1.2 m of clay with a maximum design hydraulic conductivity of $1e^{-9}$ m/s and bunded to prevent runoff entering the dam.

When the Leachate Dam is 500 mm from the freeboard level, the leachate is used to irrigate an area of about 2 ha, (the pasture irrigation area, and green waste mulching area).

4.4.1 Leachate Levels

In-waste leachate levels are currently reported for only the leachate sump in Cell 1, JRLP. The monitoring levels are provided in Table 6. The leachate elevation is calculated based on a top of well elevation of 34.91 m AHD (Cardno, 2017). The head of leachate is calculated based on the design level of the drainage layer of 22.45 m AHD indicated in the Audit Report (Nolan, 2017). Based on these calculations, the head of leachate is below the design level of the liner and contained with the leachate sump. This is compliant with the Landfill BPEM requirement (EPA, 2015) that leachate does not exceed 0.3 m above the lowest point on the liner.

Table 6: Leachate Levels in JRLP (Cell 1 Leachate Sump)

Date	Depth to Leachate (m btoc)	Leachate Elevation (m AHD)	Head of Leachate on liner (m)
2/11/2015	12.98	21.93	Below liner
5/04/2016	13.70	21.21	Below liner
26/10/2016	13.73	21.18	Below liner
26/04/2017	13.74	21.17	Below liner

As discussed above the sumps are all fitted with Airwell pumps, fitted with a sensor programed to begin pumping when there is 300 mm or more of leachate above the lowest point on the drainage layer. There is no data available with respect to leachate levels in the leachate sumps in Cells 2 and 3. The leachate levels in Cells 2 and 3 should be ascertained and the leachate on the base of the liner calculated.

4.5 Water Chemistry

Groundwater monitoring at the site began in 1997 in groundwater wells 119506 and 119507. Groundwater wells 141402 and 141403 were added in April 2000, and groundwater wells 9022881/1 and 902881/2 were added in 2005. Groundwater gauging, sampling and analysis is undertaken on an approximately quarterly basis. The available data is tabulated in APPENDIX C and discussed below. The monitoring network is described in Section 4.2.

4.5.1 Water Types

The water type for the monitoring locations was determined based on the October 2016 and April 2017 data, the results are presented in Table 7. Ion balance error calculations were undertaken and were found to be within an acceptable range for all samples except 9022881/1 (Oct 2016), 141402 (Oct 2016) and JRCREEK 1 (April 2017).

A Piper plot was constructed based on the results of the October 2016 and April 2017 monitoring event. The Piper plot, and versions showing only groundwater, leachate or surface water are presented in APPENDIX C.

Table 7: Water Types and Ion Balance Error

Location	Monitoring Location	Date	IBE	Water Type
Groundwater				
119506	west of site	27-Oct-16	-7.80	Na/Cl
119506	west of site	27-Apr-17	-0.14	Na/Cl
119507	south of site	27-Oct-16	-9.26	Na/Cl
119507	south of site	27-Apr-17	0.34	Na/Cl
141402*	eastern site boundary	27-Oct-16	-11.14	NaMg/Cl
141402	eastern site boundary	27-Apr-17	-4.61	NaMg/Cl
141403	SW of site	27-Oct-16	-8.87	Na/Cl
141403	SW of site	27-Apr-17	-3.74	Na/Cl
9022881/1*	NE corner of site	27-Oct-16	-13.80	NaMg/HCO3Cl
9022881/1	NE corner of site	27-Apr-17	5.81	NaMg/HCO3Cl
9022881/2	NE corner of site	27-Oct-16	-8.30	NaMg/ClHCO3SO4
9022881/2	NE corner of site	27-Apr-17	-1.14	NaMg/ClHCO3SO4
Leachate				
JRLD (Leachate (Dam)	NE corner of site	27-Oct-16	-4.52	Na/HCO3Cl
JRLD (Leachate Dam)	NE corner of site	27-Apr-17	-2.37	Na/ClHCO3
JRLP (Leachate Sump)	NE part of landfilled area	27-Oct-16	-6.09	NaNH4/HCO3Cl
JRLP (Leachate Sump)	NE part of landfilled area	27-Apr-17	1.06	NaNH4/HCO3Cl
Surface Water				
Fire Dam	central northern area of site	26-Oct-16	-5.12	NaK/ClHCO3
Fire Dam	central northern area of site	26-Apr-17	-1.27	Na/ClHCO3
JND	downstream dam on Skeene Creek	26-Oct-16	1.73	NaMg/HCO3Cl

Location	Monitoring Location	Date	IBE	Water Type
JND	downstream dam on Skeene Creek	26-Apr-17	9.81	NaMg/HCO3Cl
JRCREEK 1	Downstream on Skeene Creek	26-Oct-16	-4.61	Na/HCO3Cl
JRCREEK 1*	Downstream on Skeene Creek	26-Apr-17	19.73	MgNa/HCO3Cl
JRCREEK 2	upstream on Skeene Creek	26-Oct-16	-2.68	MgNa/HCO3Cl
JRCREEK 2	upstream on Skeene Creek	26-Apr-17	6.02	MgNa/HCO3Cl
JRSWD	NE corner of site	26-Oct-16	8.21	MgNa/ClHCO3
JRSWD	NE corner of site	26-Apr-17	9.70	MgNa/ClHCO3

*not plotted on the Piper plot due to high ion balance error.

Based on the Piper plot (Figure 13) the following groups of water types have been identified:

- Group 1 - Upgradient wells 119506, 119507, 141403 and downgradient well 141402 area closely grouped and have a similar water type, with sodium or sodium and magnesium identified as the dominant cations and chloride the dominant anion.
- Group 2 - Downgradient wells 9022881/1 and 9022881/2, upstream on the creek (JRCREEK 2), the dam downstream on the creek (JND) and the Stormwater Pond are characterised by higher proportions of magnesium and bicarbonate.
- Group 3 - The leachate sump and Leachte Dam plot with a greater carbonate to chloride ratio than other locations.
- Group 4 – The Fire Dam and down stream location plot between the other surface water bodies and the leachtate due to their higher proportions of sodium or potassium compared to magnesium.

Group 1 is considered to be representative of background water across the site, while Group 2 is indicative of leachate quality at the site. Downgradient wells 9022881/1 and 9022881/2 which plot between the two groups may be indicative of leachate impact, or given the location of the wells and additional information such as the TDS and chloride concentrations discussed below, of leakage from the Fire Dam and Stormwater Pond.

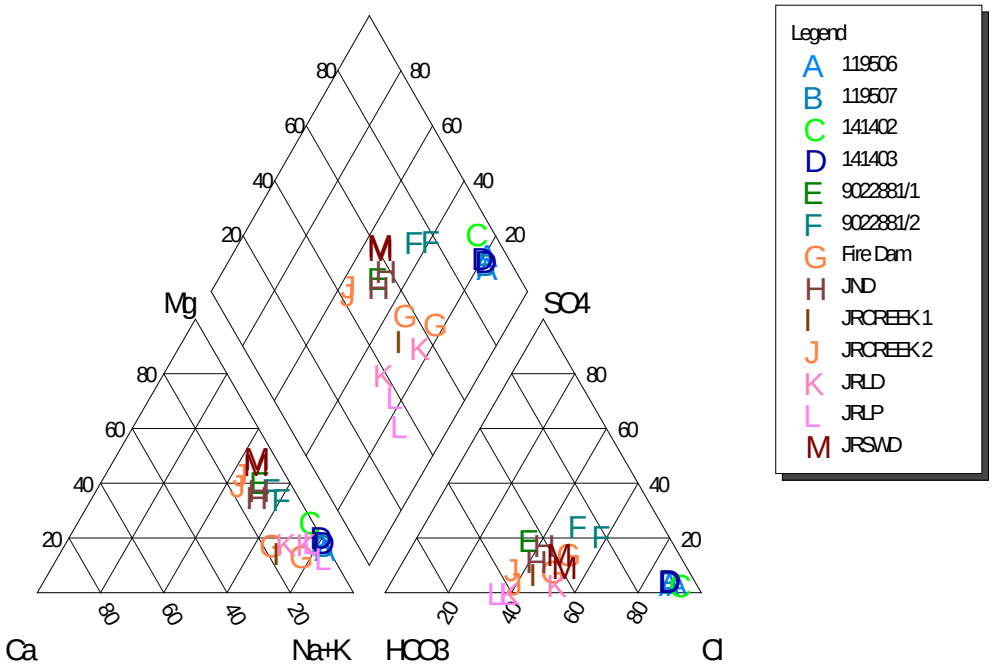

Figure 13: Piper Plot

A discussion of key contaminants in groundwater, leachate and surface water is provided below. Graphs of the data are provided at the bottom of each section to illustrate the observations made.

4.5.2 Total Dissolved Solids

Long term data for Total Dissolved Solids (TDS) concentrations for groundwater, leachate and surface water is on Figure 14, Figure 15 and Figure 16 respectively. A4 versions are presented in APPENDIX C. The start of landfilling operations is indicated on each graph.

Groundwater

The following points are noted:

- TDS concentrations across the site range from 148 mg/L (9022881/1) to 1,800 mg/L (141403). A value of 2,900 mg/L was recorded for well 141403 in December 2013 but is considered to be an outlier based on the long term data for the site. Typically groundwater concentrations are below 1,400 mg/L.
- The highest TDS concentrations are recorded in groundwater wells 119506, 119507 and 141403. They typically range between 1,000 mg/L and 1,400 mg/L since landfilling began. Since landfilling operations began TDS concentrations at these locations do not show an overall increasing or decreasing trend. These wells are located off-site and up gradient to the site.
- TDS concentrations in groundwater well 141402 typically range between 600 m/L and 800 mg/L with no overall trend observed. 141402 is located on the eastern site boundary, down gradient of the waste.
- TDS concentrations are lowest in groundwater wells 9022881/2 and 9022881/2.
  - TDS concentrations in 9022881/2 are generally stable or slightly increasing, ranging between 200 mg/L and 300 mg/L. 9022881/2 is located in the northeast corner of the site.
  - TDS concentrations in groundwater well 9022881/1 decreased from > 400 mg/L before 2010 to less than 200 mg/L since 2016. 9022881/1 is located to the north of the landfilled area.

- There are no consistent temporal trends in TDS concentrations observed between groundwater locations.
- No seasonal trends in TDS concentrations have been observed, however this may be due to the limited number of monitoring events each year.

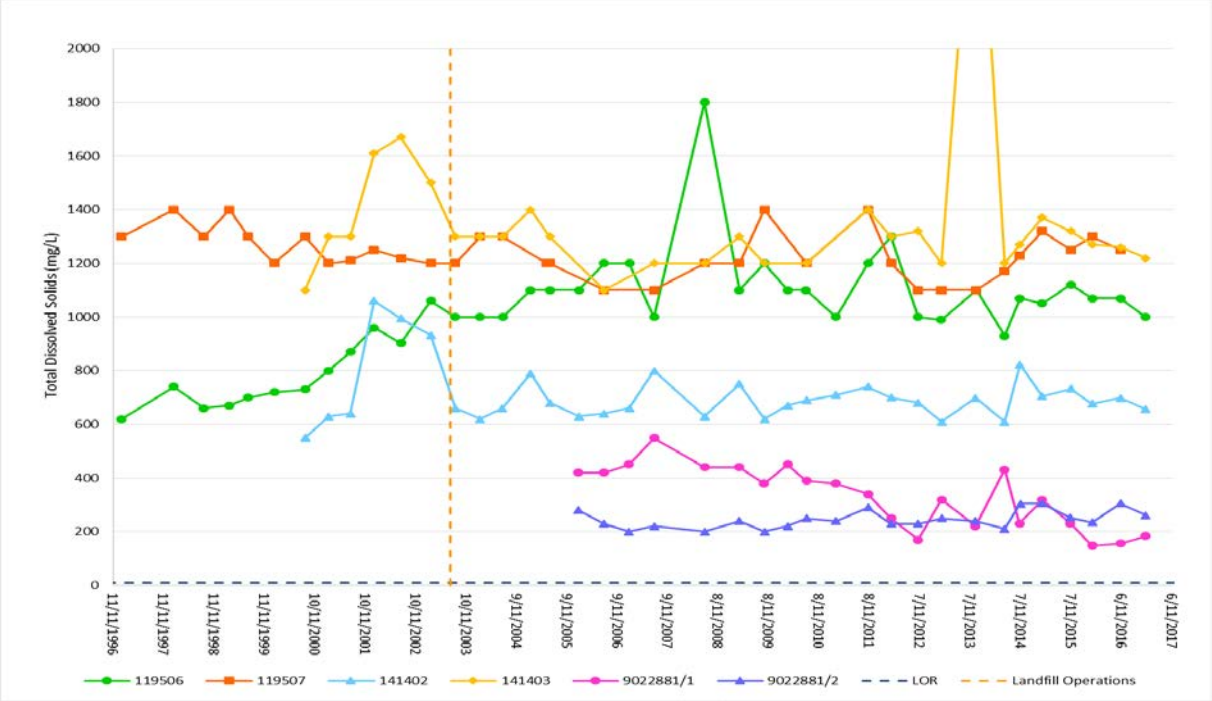

Figure 14: Long Term Total Dissolved Solids Concentrations in Groundwater

Leachate

The following points are noted:

- TDS concentrations in the leachate sump (JRLP) range between 550 mg/L to 9,800 mg/L. There was a step change in leachate concentrations after 2006 since when TDS concentrations have typically been greater than 5,000 mg/L.
- Overall TDS concentrations in JRLP while variable between approximately 5,000 mg/L and 10,000 mg/L do not appear to show an overall increasing or reducing trend.
- Long term TDS concentrations in the leachate dam (JRLD) have shown an increasing trend from 380 mg/L in 2004 to greater than 2,000 mg/L since 2015. The fluctuations observed in TDS concentrations since 2009 approximate the fluctuations recorded in the leachate sump.

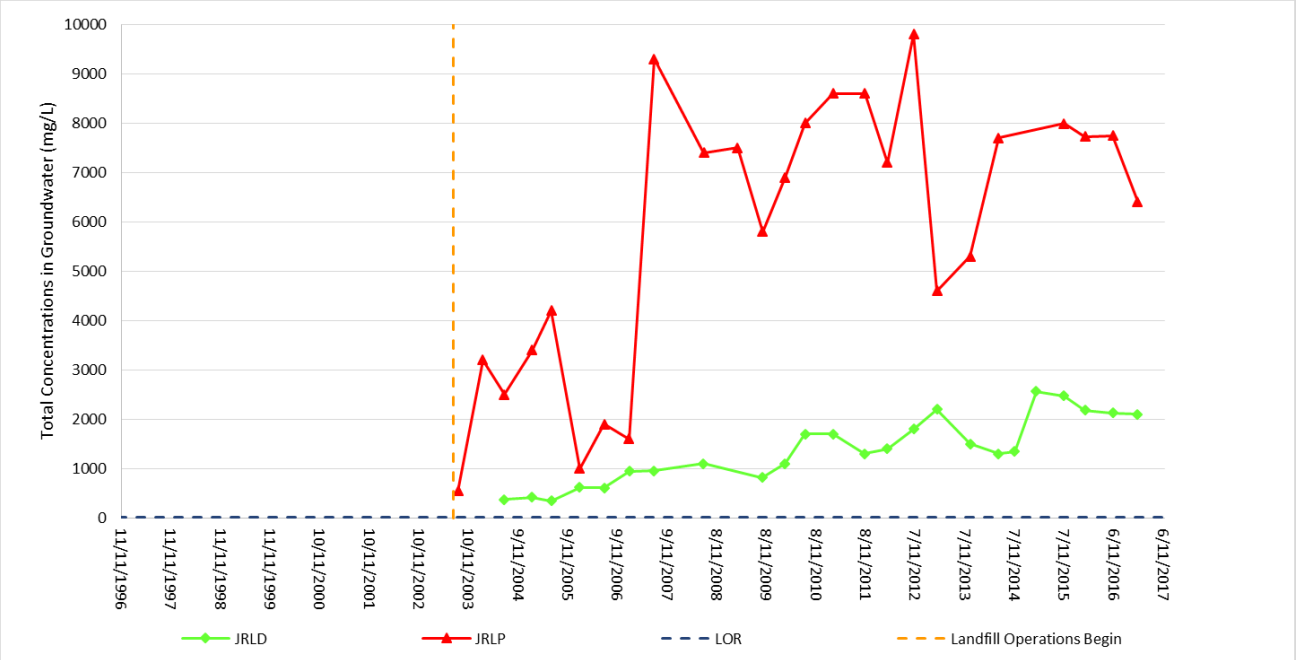

Figure 15: Long Term Total Dissolved Solids Concentrations in Leachate

Surface Water

The following points are noted:

- TDS concentrations in the off-site dam downstream on Skeene Creek (JND) spiked to 3,500 mg/L prior to landfill operations beginning at the site. Since landfilling began concentrations at JND have remained below 500 mg/L.
- The highest TDS concentrations (up to 865 mg/L) are consistently recorded in the Stormwater Pond (JRSWD) located in the northeast corner of the site.
- TDS concentrations are typical lowest in the creek ranging from 99 mg/L to 240 mg/L upstream of the site (JRCREEK2), and 104 mg/L to 330 mg/L downstream of the site (JRCREEK1).

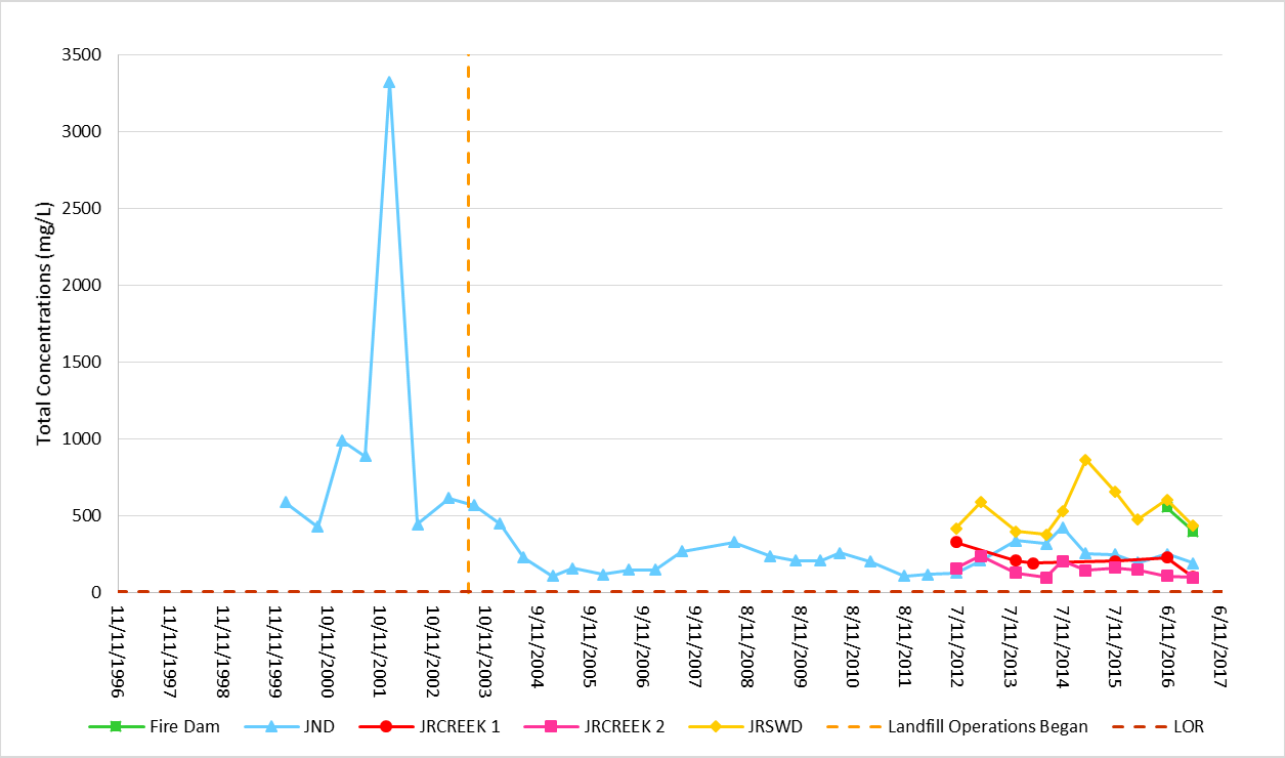

Figure 16: Long Term Total Dissolved Solids Concentrations in Surface Water

4.5.3 Chloride

Long term chloride concentrations for groundwater, leachate and surface water are shown on Figure 17, Figure 18 and Figure 19 respectively. A4 versions are provided in APPENDIX C.

Groundwater

The following points are noted:

- The distribution of chloride concentrations across the site mirrors the distribution of TDS concentrations across the site.
- The highest chloride concentrations are recorded in the in off-site, up gradient groundwater wells (119506, 119507 and 141403). Concentrations in these wells range typically range between 450 mg/L and 800 mg/L and have remained relatively stable since approximately 2006. Prior to 2006 chloride concentrations in 119506 were increasing.
- Chloride concentrations in groundwater well 141402 typically range between 300 m/L and 400 mg/L. 141402 is located on the eastern site boundary, down gradient of the waste. A slight increasing trend began before landfilling began and continued during landfilling.
- The lowest chloride concentrations are consistently recorded in groundwater wells 9022881/1 and 9022881/2 located in the northeast corner of the site, downgradient of the waste mass.
  - Chloride concentrations in 9022881/1 show an overall decreasing trend with concentrations since 2016 being around 30 mg/L or less. This might reflect seepage from the adjacent Fire Dam and Stormwater Pond.
  - Chloride concentrations in 9022881/2 are stable at around 30 mg/L to 90 mg/L.

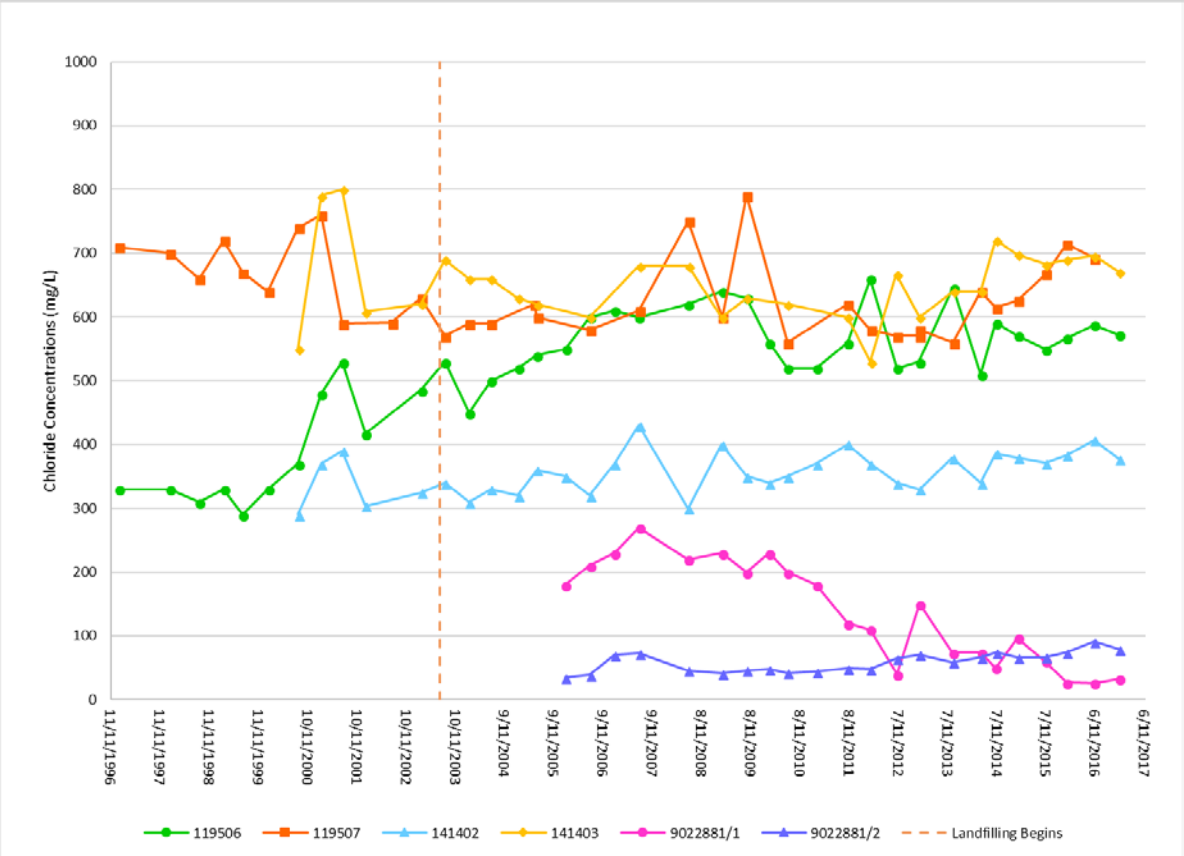

Figure 17: Long Term Chloride Concentrations in Groundwater

Leachate

The following points are noted:

- The relative changes in chloride concentration in leachate approximate the changes in TDS concentration.
- Chloride concentrations in the leachate sump (JRLP) are increasing overall with a step increase from less than 1,000 mg/L to greater than 1,500 mg/L in 2006. A steadier increase has been observed between 2013 and 2017 with concentrations currently exceeding 2,000 mg/L.
- Long term chloride concentrations in the leachate dam (JRLD) have shown an increasing trend since 2004.

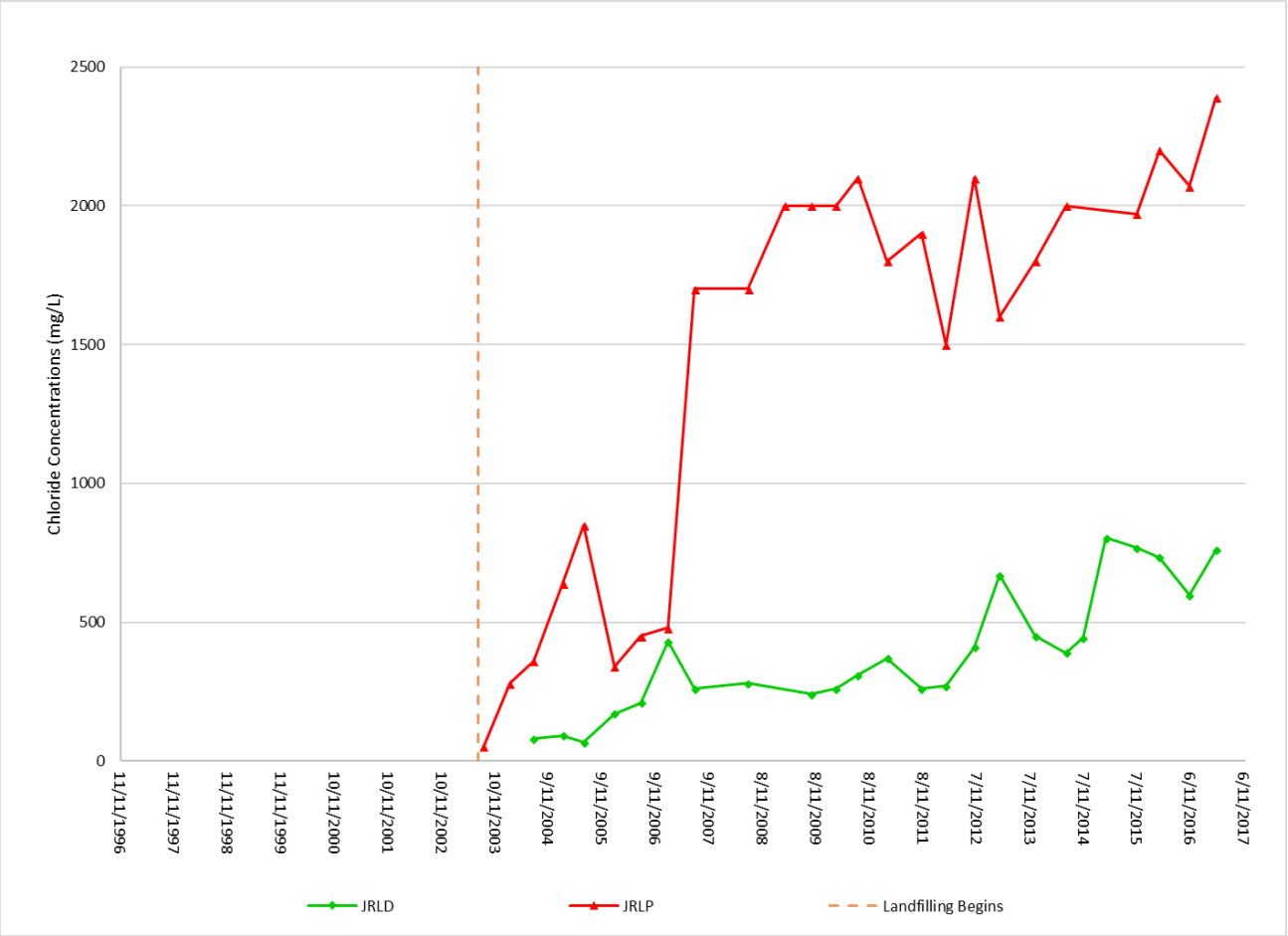

Figure 18: Long Term Chloride Concentrations in Leachate

Surface Water

The following points are noted:

- Chloride concentrations in the off-site downstream dam (JND) provides the longest data set including pre-landfilling. Chloride concentrations are variable however, no seasonal pattern has been observed, however this may be due to the limited number of monitoring events each year. Nor has an overall trend has been observed. Since monitoring has begun at other locations concentrations at the monitored locations are showing similar fluctuations to each other. This includes the upstream monitoring location suggesting that the observed changes in concentration are not caused by activities at the site.
- The highest concentrations are usually recorded in the Stormwater Pond (JRSWD), with the lowest concentrations usually recorded in the creek upstream of the site (JRCREEK2).

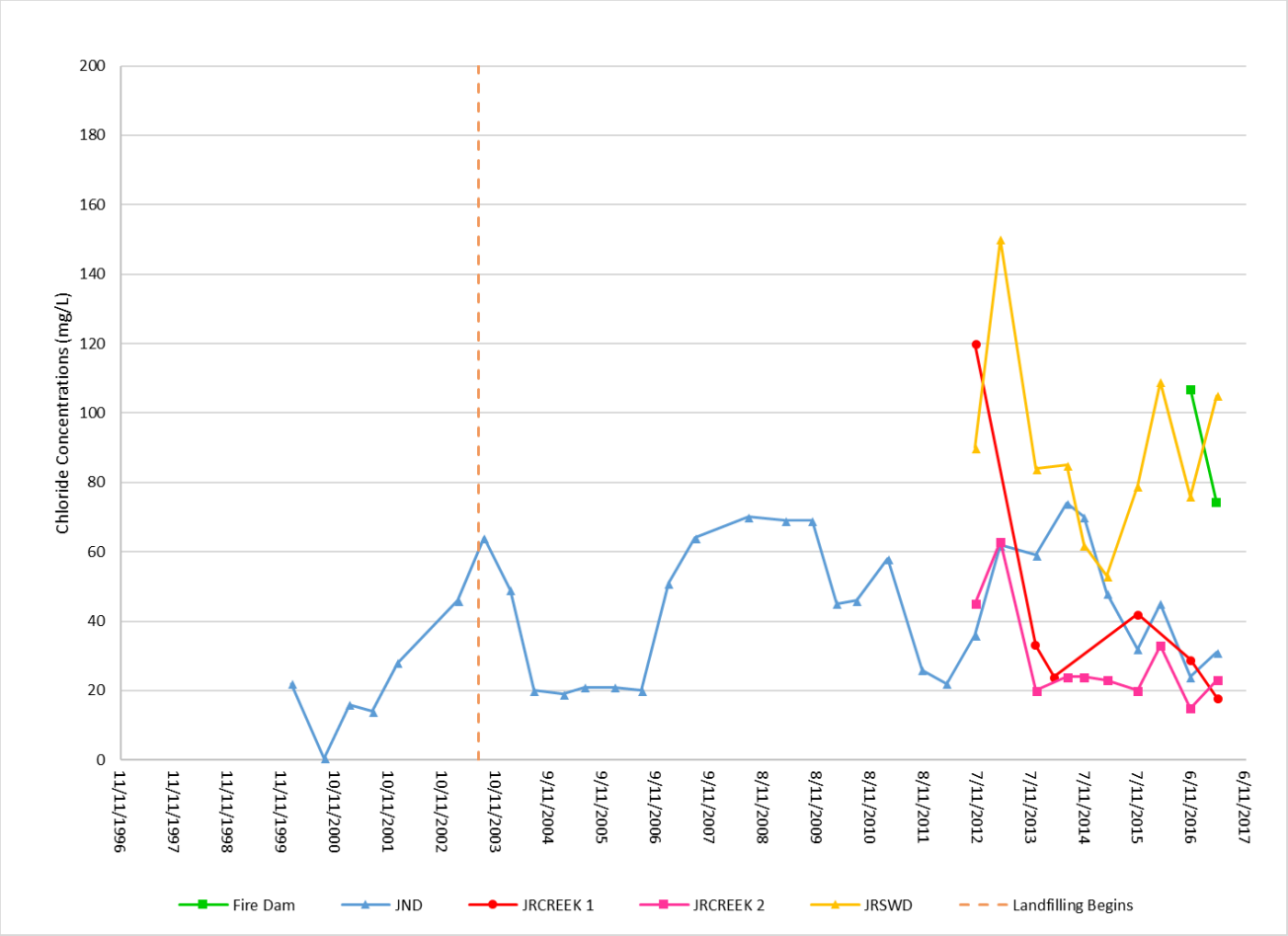

Figure 19: Long Term Chloride Concentrations in Surface Water

4.5.4 Ammonia as N

Long term ammonia (as N) concentrations for groundwater, leachate and surface water are shown on Figure 20, Figure 21, Figure 22 respectively. A4 versions are provided in APPENDIX C.

Groundwater

The following points are noted:

- Ammonia (as N) concentrations were recorded for off-site groundwater wells 119506, 119507 and 141403 prior to landfilling beginning at the site to provide background conditions. Ammonia (as N) concentrations have ranged between below the limit of reporting (LOR) (0.01 mg/L) and 2.5 mg/L (119507).
- Groundwater well 141402 is located at the eastern site boundary adjacent and downgradient to the landfilled area and has been monitored prior to landfilling beginning at the site. Ammonia (as N) concentrations are typically recorded at or close to the LOR with a maximum concentration of 0.5 mg/L recorded. No changes in ammonia (as N) concentrations before and after landfilling have been noted.
- Monitoring of groundwater wells 9022881/1 and 9022881/2 located in the northeast corner of the site began after landfilling began at the site. Ammonia (as N) concentrations in are typically around or below the LOR with occasional higher concentrations recorded. The maximum ammonia as (N) recorded for 9022881/1 is 3.4 mg/L and for 9022881/2 is 4.5 mg/L.

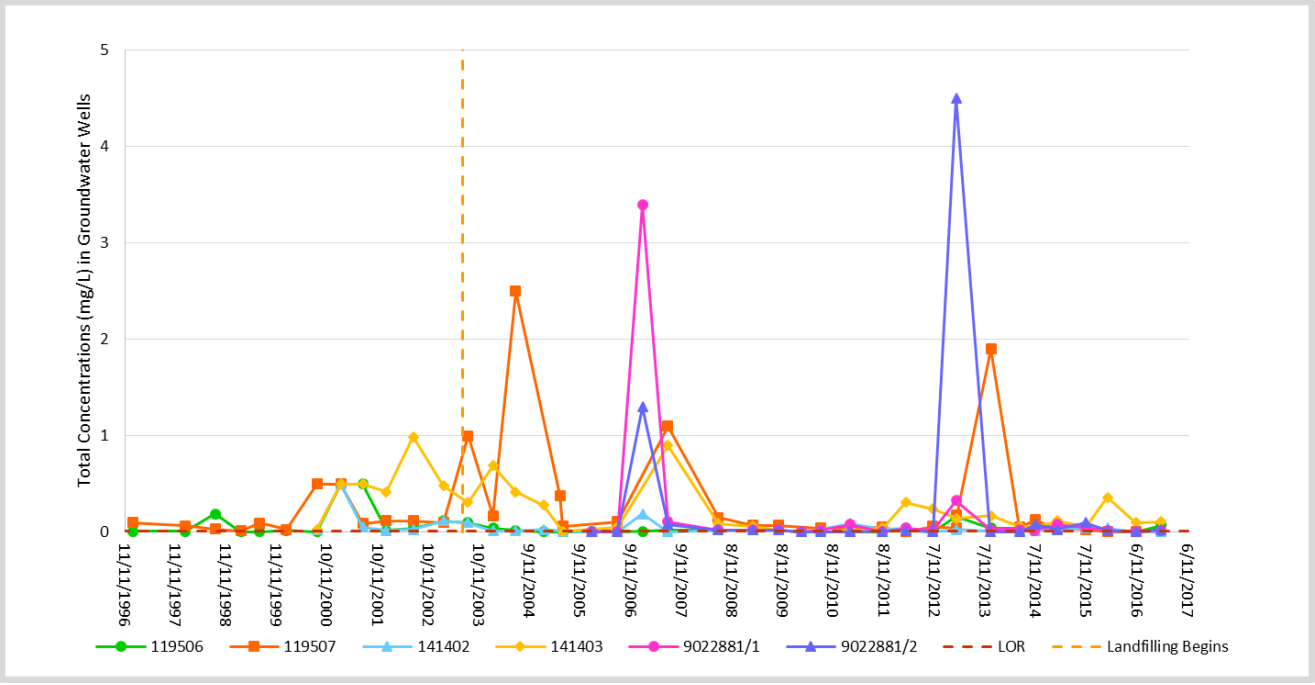

Figure 20: Ammonia (as N) Concentrations in Groundwater

Leachate

The following points are noted:

- Within the leachate sump (JRLP), as seen for TDS and chloride there is a step increase in ammonia (as N) concentrations after 2006.
- Ammonia (as N) concentrations in the leachate sump (JRLP) are variable but typically range between 200 mg/L and 700 mg/L.
- Ammonia (as N) concentrations are showing an overall increasing in the leachate dam (JRLD) with a maximum concentration of 104 mg/L recorded.

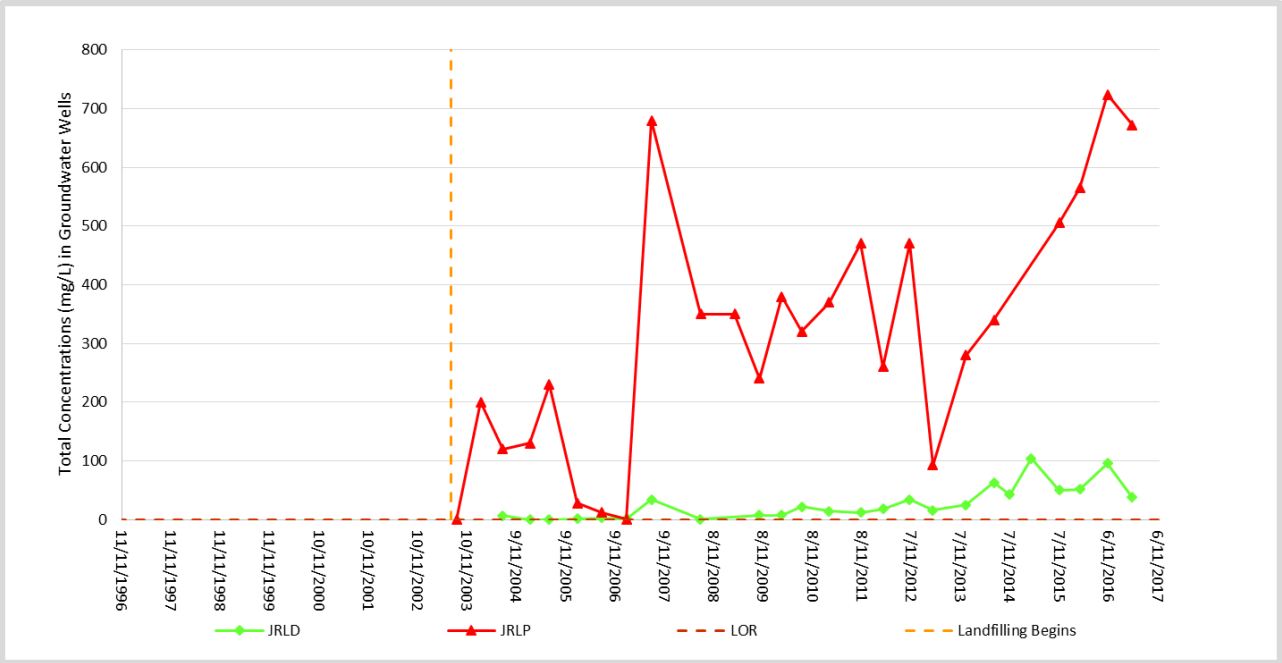

Figure 21: Ammonia (as N) Concentrations in Leachate

Surface Water

The following points are noted:

- Monitoring of the off-site downstream dam (JND) was undertaken both before and after landfilling began at the site. Ammonia (as N) concentrations are typically recorded close to the LOR, but have increased on some occasions both before and after landfilling began at the site.
- Ammonia (as N) concentrations have been monitored since 2012 at off-site locations upstream and downstream on Skeene Creek. The ammonia (as N) concentrations at both locations are typically close to the LOR, and are usually lower at the downstream location.
- Ammonia (as N) concentrations have been monitored at the on-site Stormwater Pond since 2012. Although the highest concentrations of ammonia (as N) as usually recorded at this location, an initial elevated concentration of 1.5 mg/L has not been repeated, concentrations are usually less than 1 mg/L.

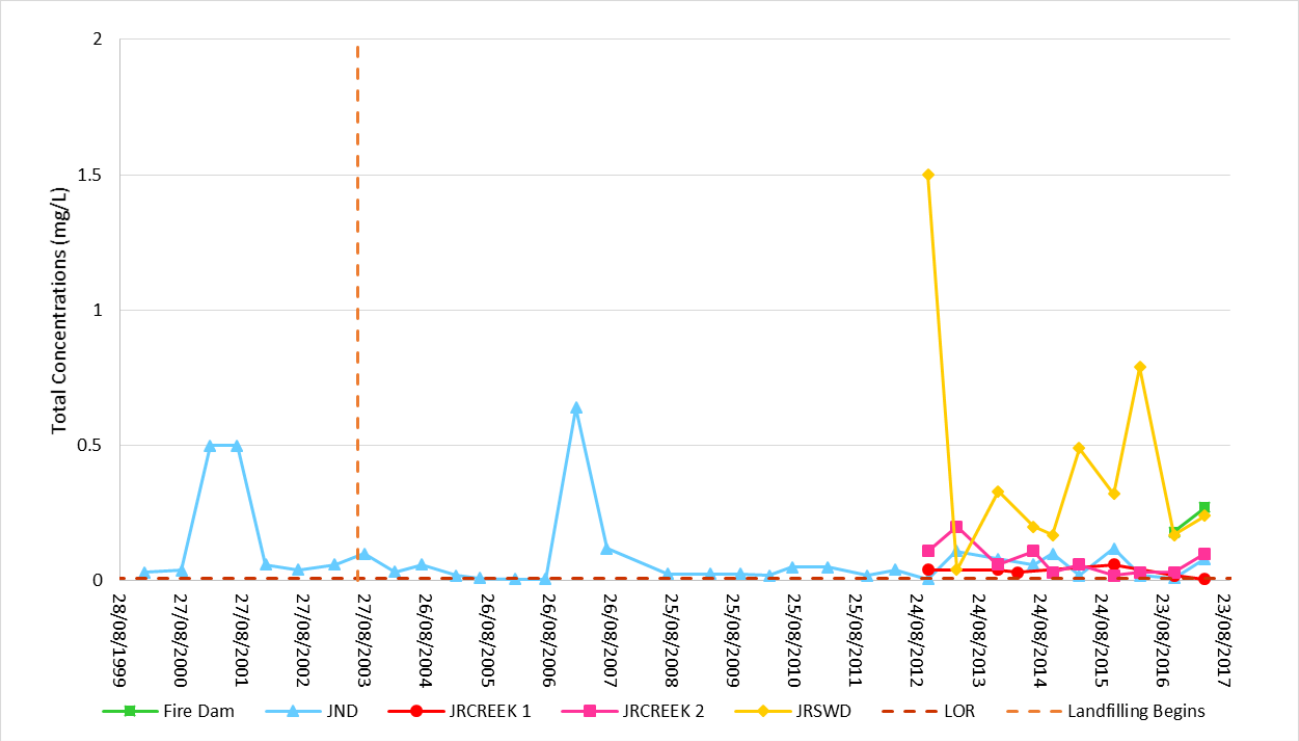

Figure 22: Ammonia (as N) Concentrations in Surface Water

4.5.5 Nitrite

Long term nitrite concentrations are shown on Figure 23. A4 versions are provided in APPENDIX C. The following points are noted:

- Nitrite concentrations in groundwater are typically below or slightly above the LOR. A maximum concentration of 0.03 mg/L (141403) was recorded in groundwater at the site.
- Nitrite concentrations in the leachate sump (JRLP) were below the LOR with the exception of one occasion in July 2014 when a nitrite concentration of 12 mg/L was recorded.
- Nitrite concentrations in the leachate dam (JRLD) range between the LOR and 3.7 mg/L.

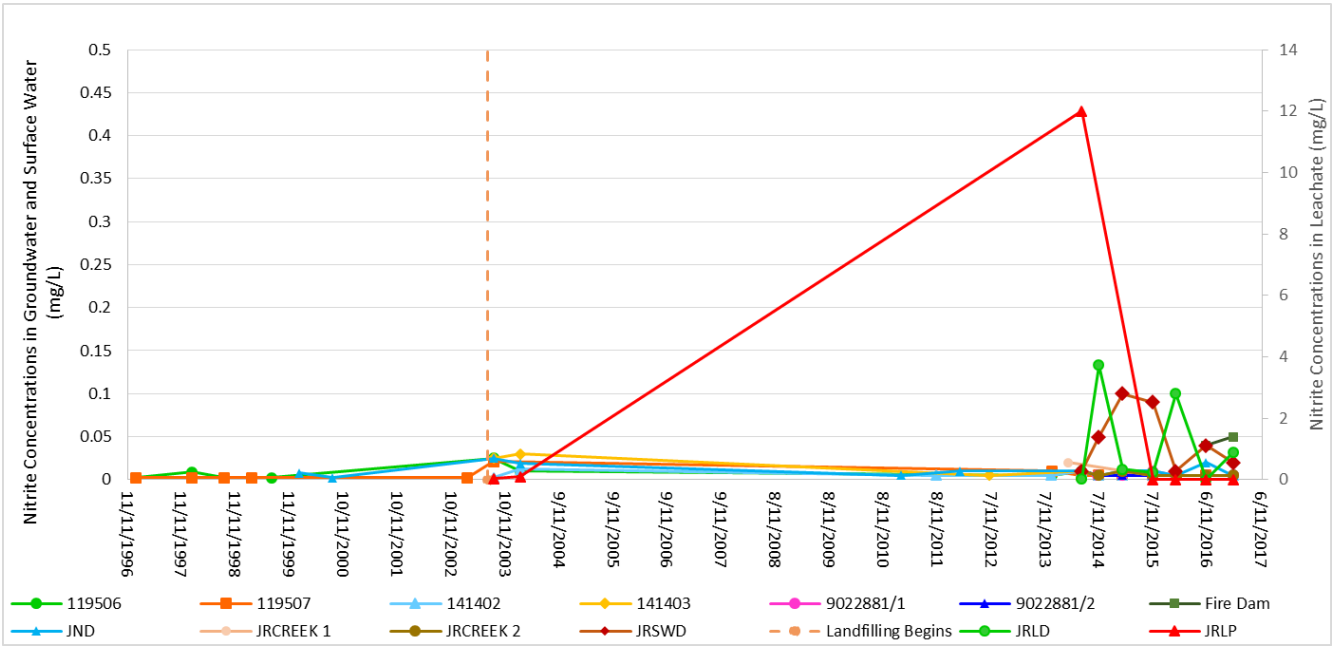

Figure 23: Long Term Nitrite Concentrations

4.5.6 Nitrate

Long term nitrate concentrations are shown on Figure 24. A4 versions are provided in APPENDIX C.

Groundwater and Leachate

The following points are noted:

- Nitrate concentrations at the site have been below 5 mg/L since 2014. Historically concentrations of up to 7.4 mg/L have been recorded in groundwater at the site (pre-landfilling) and 5.9 mg/L since landfilling began.
- Nitrate concentrations were recorded for off-site locations 119506, 119507, 141403 both before and after landfilling was undertaken at the site. These locations are up gradient of the site and are not expected to be impacted by landfilling at the site.
  - Nitrate concentrations in 119506 showed an increasing trend between 1996 and 2007, after which a slightly decreasing trend in nitrate concentrations is observed.
  - Nitrate concentrations in 119507 and 141403 are usually below 1 mg/L and typically at or close to the LOR (0.01 mg/L).
- Nitrate concentrations in downgradient groundwater well 141402 were recorded prior to landfilling beginning at the site. An increasing trend in nitrate concentration at this location has been observed. However, the maximum recorded concentration is 3.4 mg/L, which is to be compared to the lowest of the selected criteria of 7.2 mg/L (ANZECC 2000, 95% ecosystem maintenance) (Section 4.6). There is insufficient data from prior to landfilling to understand whether the trend began pre or post landfilling.
- Nitrate concentrations have been recorded in wells 9022881/1 and 9022881/2 since 2005 located in the northeast corner of the site, downgradient of the waste mass but also close to the Stormwater Pond.
  - Nitrate concentrations in 9022881/1 have been variable but have shown an overall decreasing trend.
  - Nitrate concentrations in 9022881/2 have been variable but have not shown an overall increasing or decreasing trend.
- A spike in nitrate concentration was seen in 119506 and 141402, 141403 prior to landfilling beginning at the site in 2000. Concentrations between these locations are not usually observed to follow the same pattern.
- Nitrate in leachate has typically been below or close to the LOR with the exception of one reading of 55 mg/L in the leachate sump (JRLP, April 2013).

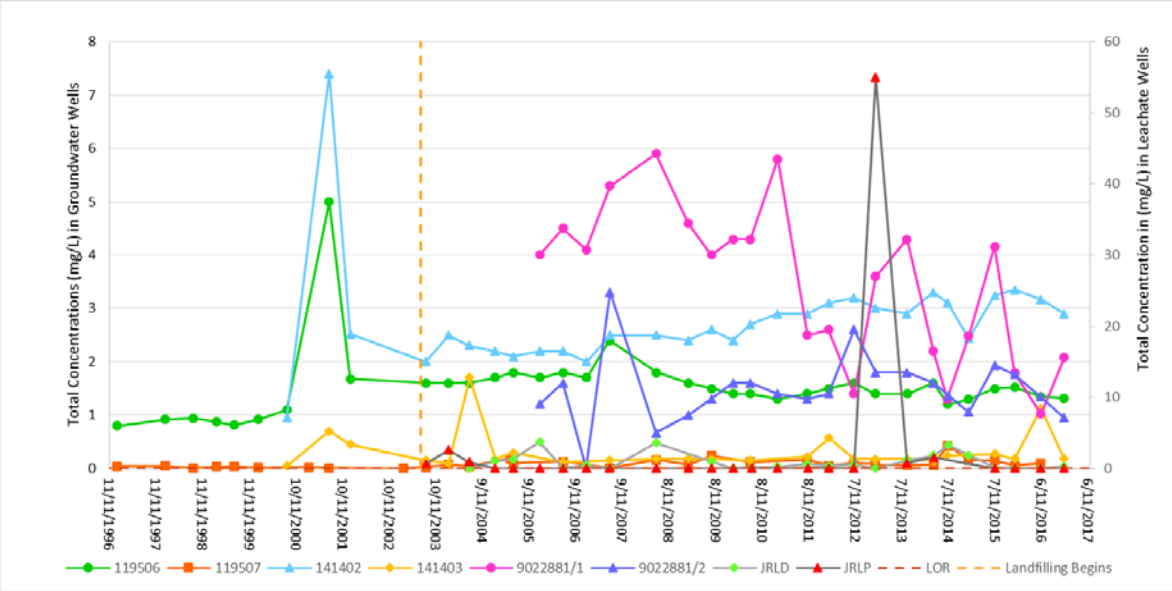

Figure 24: Long Term Nitrate Concentrations in Groundwater and Leachate

Surface Water

The following points are noted:

- Nitrate concentrations of up to 1.54 mg/L (Stormwater Pond, JRSWD) have been recorded in surface water at or near the site.
- Nitrate concentrations in the off-site dam (JND) downstream of the site have decreased since landfilling began.
- The highest nitrate concentrations are typically recorded in the Stormwater Pond which is located in the northeast corner of the site.
- The lowest nitrate concentrations are usually recorded in Skeene Creek, with similar concentrations being recorded both up and downstream of the site.

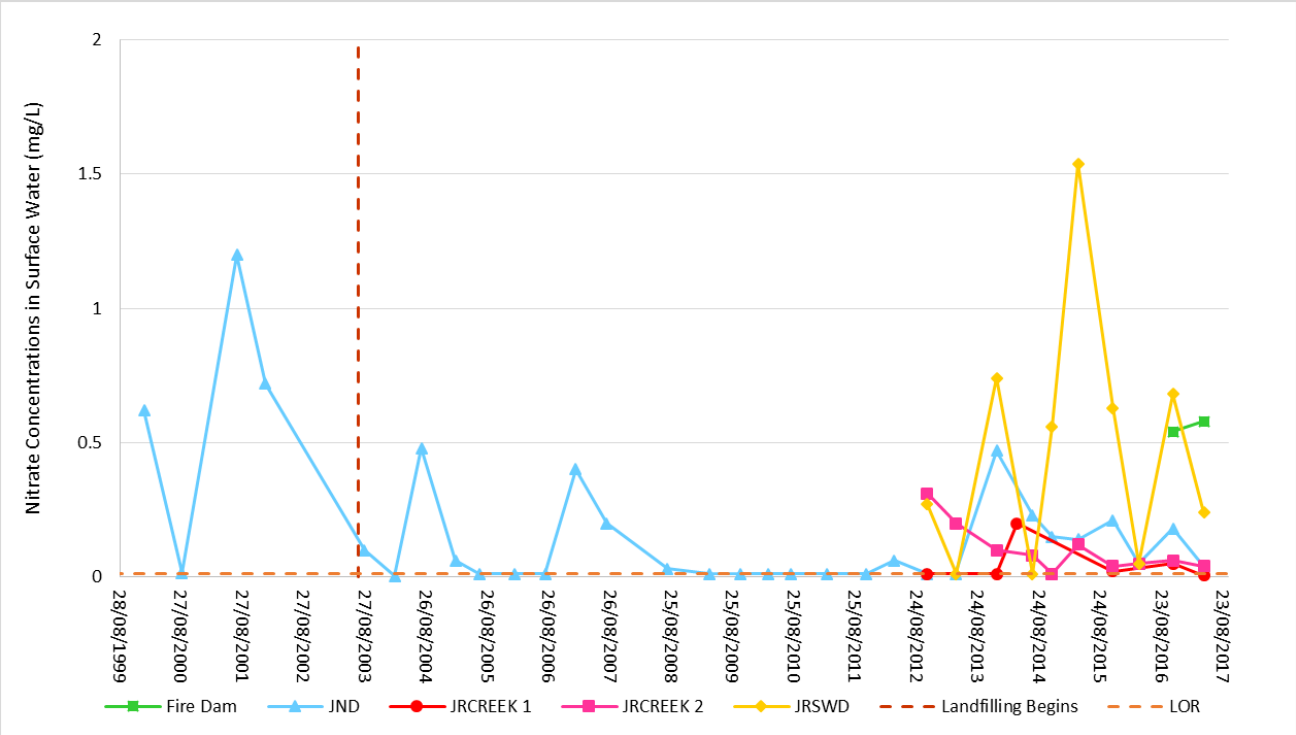

Figure 25: Long Term Nitrate Concentrations in Surface Water

4.5.7 Volatile Fatty Acids

Volatile fatty acids (VFA) have been analysed for at the site since 2004 in the leachate sump, 2010 in the leachate dam and since 2014 in groundwater and surface water.

The following points are noted:

- VFA concentrations in groundwater are typically less than 50 mg/L, with a maximum concentration of 105 mg/L recorded in 119507 (upgradient).
- VFA concentrations in surface water range between 7 mg/L and 24 mg/L with similar concentrations recorded at all locations.
- VFA concentrations in the leachate sump are typically below 500 mg/L. An outlier of 2,500 mg/L recorded in 2007 is considered likely to be erroneous and has not been repeated. Concentrations are variable with no pattern observed in the data.
- A maximum VFA concentration of 158 mg/L has been recorded in the leachate dam. Concentrations are variable with no pattern observed in the data, and no correlation with the leachate sump observed.

VFAs, while present at elevated concentrations in the leachate, are also present in upgradient and upstream locations at the site. Based on the currently available data there is no indication that VFAs from the leachate are impacting on groundwater and surface water in the vicinity of the site.

4.5.8 Hydrocarbons

Hydrocarbons in form of benzene, toluene and xylene, and total recoverable hydrocarbons (TRH) fractions have regularly been detected in the leachate sump and leachate dam.

Hydrocarbons have been recorded above the LOR in groundwater on the following occasions:

- BTEX
  - 119507 (upgradient) – 2 µg/L toluene (10/7/2014)
  - 141403 (upgradient) – 3 µg/L toluene (18/12/2013), 4 µg/L toluene (6/4/2016)
  - 9022881/2 (downgradient) – 6 µg/L toluene (27/4/2017)
- TRH
  - 119506 (upgradient) (30/10/2014) – 100 µg/L C10-C14, 200 µg/L C15-C28, 310 µg/L C16-C34.

While hydrocarbons have occasionally been identified in groundwater at the site, the locations indicate that the site was not the source of the groundwater contamination. The presence of NAPL has not been reported during sampling at the site.

Hydrocarbons have been recorded above the LOR in surface water on the following occasions:

- BTEX – not detected
- TRH
  - JRCREEK1 (10/4/14) (downstream on Skeene Creek) - 110 µg/L C16-C34
  - JRCREEK1 (26/4/17) (downstream on Skeene Creek) - 190 µg/L C15-C28, 180 µg/L C16-C34
  - JRSWD (12/4/13) (Stormwater Pond) - 60 µg/L C10-C14, 600 µg/L C15-C28, 600 µg/L C29-C36, 70 µg/L C10-C16, 1,000 µg/L C16-C34, 300 µg/L C34-C40.

- JRSWD (12/12/13) (Stormwater Pond) - 200 µg/L C16-C34.
- JRSWD (3/11/14) (Stormwater Pond) - 130 µg/L C15-C28, 260 µg/L C29-C36, 410 µg/L C16-C34.
- JRSWD (10/4/15) (Stormwater Pond) - 160 µg/L C15-C28, 100 µg/L C29-C36, 240 µg/L C16-C34.

The source of TRH in Skeene Creek is unknown, particularly as hydrocarbons have not been detected in the off-site dam (JND) immediately upstream of JRCREEK1. The source of TRH in the Stormwater Pond is considered likely to be contaminated site runoff as the dam is recharged only by rainfall and runoff.

4.5.9 Turbidity

Surface Water and Leachate

The following points are noted:

- Turbidity has been recorded at the site since 2013 in surface water and 2014 in the Leachate Dam (JRLD)
- The lowest readings are typically recorded at the upstream monitoring location on Skeene Creek (JRCREEK2) (< 35 NTU).
- The highest readings are typically recorded in the Stormwater Pond (JRSWD) with values of greater than 100 NTU typically recorded and a maximum value of 230 NTU.
- A similar trend in concentrations is observed since 2015 in the Stormwater Pond (JRSWD), the dam on Skeen Creek downstream of the site (JND), the Leachate Dam (JRLD), and possibly downstream in the creek (JRCREEK1) although there is less data available for this location. There is insufficient data to assess trends from the leachate sump (JRLP) or the Fire Dam. An inverse trend, i.e. low concentration correlate with high correlations between the upstream monitoring location on Skeene Creek and the other surface water locations was observed.
- While the Stormwater Pond may on occasion discharge to Skeene Creek when the pond is full, this did not occur in the 2016/2017 monitoring period (Nolan, 2017). This suggests that the trend observed in 2016/2017 is not due to the release of water from the Stormwater Pond to Skeene Creek.

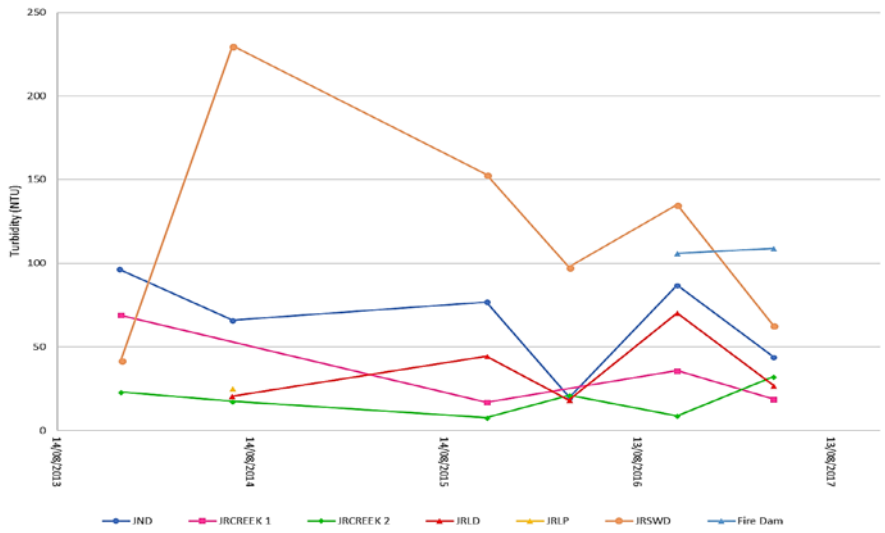

Figure 26: Turbidity in Surface Water and Leachate

4.5.10 Background Groundwater Quality

Groundwater flow off-site to the west is towards the southeast turning to the northeast across the site. Groundwater wells 119506, 119507 and 141403 are considered to be upgradient of the site.

- The highest TDS groundwater concentrations are consistently recorded in these wells, which correlates with the distribution of chloride concentrations across the site.
- Nitrate concentrations are consistently elevated at in 119506, but only occasionally recorded above the LOR in 119507 and 141403.
- The maximum concentration of VFAs in groundwater at the site was recorded in 119507 (105 mg/L).
- BTEX/TRH have been recorded on occasion in all of the upgradient wells.

Water type data as displayed on the Piper plot indicates:

- The background groundwater wells 119506, 119507, 141403 and downgradient well 141402 plot together.
- The leachate sump and Leachate Dam data plot together.
- The groundwater wells 9022881/1 and 9022881/2 plot between the two groups, possibly suggesting impact from the landfill but plot with the adjacent Fire Dam and Stormwater Pond with low concentrations of the conservative tracer chloride. It is likely that water quality in 9022881/1 and 9022881/2 are influenced by the Fire Dam and Stormwater Pond.

TDS concentrations at the site in groundwater range between approximately148 mg/L (9022881/1) to 1,800 mg/L (141403). The highest TDS concentrations are recorded upgradient of the site. TDS concentrations in leachate range between 380 mg/L to 9,800 mg/L.

The groundwater quality upgradient of the site is well established through the monitoring of three upgradient wells 119506, 119507, 141403. These wells have the highest TDS and chloride values in groundwater at the site, as well as elevated nitrate, VFAs and hydrocarbons on occasion.

A slight increasing trend in nitrate concentrations in groundwater well 141402 has been observed, suggesting potential impact from the landfill. However, the concentrations remain below the adopted criteria.

There is no clear indication the leachate from the site is impacting groundwater quality.

Since landfilling began at the site, TDS concentrations in surface water have consistently been recorded below 1,000 mg/L and with off-site locations below 500 mg/L.

The highest TDS concentrations are recorded in the Stormwater Pond which collects surface water runoff from the site.

A similar trend in turbidity is observed since 2015 in the Stormwater Pond (JRSWD), the dam on Skeen Creek downstream of the site (JND), the Leachate Dam (JRLD), and possibly downstream in the creek (JRCREEK1) although there is less data available for this location. There is insufficient data to assess trends from the leachate sump (JRLP) or the Fire Dam. An inverse trend, i.e. low concentrations correlate with high correlations between the upstream monitoring location on Skeene Creek and the other surface water locations was observed.

While the Stormwater Pond may on occasion discharge to Skeene Creek when the pond is full, this did not occur in the 2016/2017 monitoring period (Nolan, 2017). This suggests that the trend observed in 2016/2017 is not due to the release of water from the Stormwater Pond to Skeene Creek.

4.6 Protected Beneficial Uses

The State Environment Protection Policy (Groundwaters of Victoria) (SEPP GoV, 1997) classifies groundwater into five segments on the basis of background total dissolved solids concentrations and each segment has defined beneficial uses for protection. This classification may consider spatial and temporal variation within the aquifer. The range of beneficial uses to be protected for each segment are summarised in Table 8.

Table 8: Protected Beneficial Uses of Groundwater

Beneficial Uses	Segment A1 (0 - 500 mg/L TDS)	Segment A2 (501 -1,000 mg/L TDS)	Segment B (1001 – 3,500 mg/L TDS)	Segment C (3501 – 13,000 mg/L TDS)	Segment D (greater than 13,000 mg/L TDS)
Maintenance of Ecosystems	✓	✓	✓	✓	✓
Potable Water Supply (desirable)	✓	-	-	-	-
Potable Water Supply (acceptable)	-	✓	-	-	-
Potable Mineral Water Supply	✓	✓	✓	-	-
Agriculture, Parks and Gardens	✓	✓	✓	-	-
Stock Watering	✓	✓	✓	✓	-
Industrial Water Use	✓	✓	✓	✓	✓
Primary Contact Recreation (e.g. bathing and swimming)	✓	✓	✓	✓	-
Buildings and Structures	✓	✓	✓	✓	✓

Groundwater TDS concentrations at the site range between 148 mg/L and 2,900 mg/L. The groundwater at the site is therefore considered to be Segment A1 with the following beneficial uses to be considered:

- maintenance of ecosystems
- potable water supply (desirable)
- potable mineral water supply
- agriculture, parks and gardens
- stock watering
- industrial water use
- primary contact recreation (e.g. bathing, swimming)
- buildings and structures.

The State Environment Protection Policy (Waters of Victoria) (SEPP GoV, 2003) indicates that the site and surrounding area are located in the *Cleared Hills and Coastal Plains* segment. The aquatic ecosystem is considered to be slightly to moderately modified. As such the following Beneficial Uses apply:

- Primary contact recreation

- Aesthetic enjoyment
- Agriculture and irrigation
- Industrial and commercial use
- Human consumption (after appropriate treatment)
- Indigenous and non-indigenous spiritual and cultural values.

To assess the protection of these Beneficial Uses, the water quality data was assessed against the following criteria:

- ADWG 2011 (Australian Drinking Water Guidance)
- ANZECC 2000 (Ecosystem Maintenance 95%)
- ANZECC 2000 (Agricultural Use – Irrigation)
- ANZECC 2000 (Agricultural Use – Stock watering)
- GMRRW 2008 (Guidelines for Managing Risk in Recreational Water)
- AS2159-200 Piling – Design and Installation (Buildings and Structures).

Exceedance of the criteria are shown in Table 9 for groundwater and in Table 10 for surface water. The adopted criteria where exceeded in indicated in the table for example ✓(I, 0.3) indicates that the irrigation criteria of 0.3 mg/L was exceeded.

Table 9: Summary of Groundwater Exceedances (adapted from Cardno, 2017) (criteria in mg/L)

Determinant	Location of Exceedance	ANZECC 2000 Freshwater (95%)	ADWG 2011 Health (H) or Aesthetic (A)	ANZECC 2000 Irrigation (I), Long term (L) or Short term (S) trigger	ANZECC 2000 Livestock Drinking Water	GMRRW, 2008 Health (H) or Aesthetic (A)	Buildings and Structures (AS2159-2009)
Chloride	119506 119507 141402 141403		✓ (A, 250)	✓ (I, 175)		✓ (H, 250)	
Iron	119507		✓ (H, 0.3)	✓ (I, 0.2)		✓ (H, 0.3)	
Phosphorus	141403			✓ (I, 0.05)			
Sodium	119506 119507 141402 141403		✓ (A, 180)	✓ (I, 115)		✓ (H, 180)	
TDS	119506 119507 141402 141403		✓ (A, 600)		✓ (3,000)		
pH	119506 119507 141402 141403 9022881/1 9022881/2		✓ (A, 6.5-8.5)				✓ (5.5-12.0)

The groundwater exceedances detailed above suggests that all beneficial uses may be precluded at one or more locations at the site. However, the exceedances primarily occur in upgradient wells 119506, 119507 and 141403 indicating that the exceedances do not originate from the seepage of leachate from the site.

Table 10: Summary of Surface Water Exceedances (adapted from Cardno, 2017) (criteria in mg/L)

Determinant	Location of Exceedance	ANZECC 2000 Freshwater (95%)	ADWG 2011 Aesthetic	ANZECC 2000 Irrigation (I), Long term (L) or Short term (S) trigger	ANZECC 2000 Livestock Drinking Water	GMRRW, 2008 Health (H) or Aesthetic (A)	Buildings and Structures (AS2159-2009)
Iron	JND JR Creek1 JR Creek2 Fire Dam		✓ (0.3)	✓ (I, 0.2)		✓ (A, 0.3)	
Manganese	Fire Dam		✓ (0.1)			✓ (A, 0.1)	

Phosphorus	JR Creek1 JR Creek2 JRSWD Fire Dam			✓ (S, 0.8) (L, 0.05)		✓ (H, 6.5-8.5)	
TDS	JRSWD		✓ (600)				
Turbidity	JND JR Creek1 JR Creek2 JRSWD Fire Dam		✓ (5)				
pH (field)			✓ (6.5-8.5)				

Exceedances of iron, turbidity and phosphorus have been recorded in the Fire Dam on-site but also in both the up and down gradient monitoring locations on the creek and the downgradient dam on the creek. There is no evidence that the source of iron, turbidity or phosphorus in the creek is linked to the landfill site.

Manganese concentrations exceed criteria in the Fire Dam on-site and TDS concentrations exceed criteria in the Stormwater Pond on-site but there is no evidence that the creek has been impacted. As there is potential for water from these surface water bodies to discharge to the creek, concentrations in the creek should continue to be monitored and assessed.

4.7 Groundwater Resource Utilisation

A search of the Water Management Information System (WMIS) identified 11 bores listed within a 2 km radius of the site licensed for groundwater extraction. Details are provided in Table 11 and the locations are shown on Figure 27.

Table 11: WMIS Groundwater Bores

WMIS number	Depth (m)	Elevation (m AHD)	Screen (m bgl)	Approximate distance from the site	Usage
WRK964349	46.1	37.42	5.6-46.1	950 m southwest	Domestic and Stock
46989	131.0	36.92	unknown	950 m southwest	Domestic and Stock
120349	124.0	39.95	84.0-124.0	1.2 km west	Domestic
46982	118.8	40.0	unknown	1.3 km west	Domestic and Stock
WRK962950	40.1	31.9	32.15-36.15	1.0 km south	Domestic and Stock
47029	118.87	39.47	unknown	1.8 km	Domestic and Stock
46979	12.1	8.65	unknown	1.3 km north	Stock
WRK038121	21.0	1.31	18.5-21.0	1.9 km northeast	Domestic and Stock
WRK077113	27.0	unknown	18.0-21.0	2.0 km northeast	Domestic and Stock
WRK077114	24.8	unknown	17.0-20.0	1.9 km northeast	Domestic and Stock
WRK038389	24.0	2.68	21.0 to 24.0	2.0 km northeast	Irrigation

51963 blue indicates the wells are located on the coastal side of the Morass.

Figure 27: Licensed Groundwater Abstraction within 2 km of the Site

Based on the information available abstracted groundwater use is limited within the immediate area of the site. The closest registered groundwater well for consumptive use (domestic and stock) is bore WRK038121 located approximately 1.9 km to the northeast of the site. Bore WRK038121 is located on the distant (eastern) side of the Morass to the site making it unlikely that groundwater from the site would be extracted from this bore. Downgradient of the site there are no existing wells registered between the site and the Morass.

5.0 GROUNDWATER CONTAMINATION ASSESSMENT

As part of the groundwater contamination assessment the current site conditions were reviewed to identify potential sources of groundwater contamination resulting from landfill activities at the site, potential receptors that could be impacted by the source and the potential for active pathways to exist between the source and receptor.

Source(s)

The following contamination sources have been identified at the site:

- Leachate stored within the waste mass
- Leachate stored in the Leachate Dam
- Irrigation of leachate on eastern area of site

Receptor(s)

Potential receptors identified through the specified beneficial uses for the site as indicated in Table 8 in Section 4.6.

Pathway(s)

Leachate within the waste – to reach a receptor the leachate within the waste would need to leak through the basal liner of the landfill. In Cell 1 the leachate could also rise above the liner up the sidewall and leave the landfill laterally. In Cells 2 and 3 there are sidewall liners in place which would limit lateral movement from the landfill. Where perched leachate is present leachate may overtop the cell where it could infiltrate the ground, or be captured as runoff by the site stormwater system. Incidences of overtopping from the landfill have not been reported.

Leachate within the Leachate Dam – the dam is lined and bunded. To enter the environment leachate would need to seep through the liner or overtop the bund of the dam. Leachate is removed from the dam when 500 mm of freeboard remains to prevent overtopping.

Leachate is applied by irrigation to the eastern area of the site (Figure 2) when the Leachate Dam is 500 mm from the freeboard level. The frequency and volumes of leachate were recorded for the period July 2015 to November 2017 with the exception of January 2016. During this period leachate was applied to the site as irrigation on one occasion (6/8/2017).

Runoff from the area where leachate is applied as irrigation is collected in the Stormwater Pond which may overflow to the Skeene Creek. Irrigated leachate is also expected to seep into the ground and be taken up by plants. If sufficient leachate is applied this may infiltrate the unsaturated zone and enter the underlying aquifer.

Once in the ground from the landfill, dam or irrigation, the leachate would need to travel vertically through the unsaturated zone (>10 m) to the groundwater in the Haunted Hills Formation. While the groundwater is considered a receptor it would also act as a pathway to downgradient receptors should as groundwater users and groundwater fed surface water bodies.

Assessment of Impacts

The following considerations have been taken into account prior to completing the risk assessment:

- Maintenance of Aquatic Ecosystems - there were no groundwater or surface water concentrations recorded above the adopted criteria (ANZECC 2000, 95% freshwater) therefore the Maintenance of Aquatic Ecosystems is not considered to be precluded.
- Potable Water Supply

- -There are currently no groundwater abstraction wells between the Morass and the site, nor any residential or agricultural buildings reducing the likelihood of future groundwater wells. Given the current land use in this area (quarry) and the proximity to the Morass it is considered unlikely that future groundwater abstraction for human consumption will be undertaken in this area. Potable water supply is therefore not considered to be precluded by contamination of groundwater.
- There are no exceedances of health criteria in surface water although aesthetic criteria are exceeded, however the individual consumer will judge whether this is acceptable. Upstream creek concentration exceeded pH criteria on one occasion however this is not likely due to landfill activities at the site. Potable water supply is therefore not considered to be precluded by contamination of surface water.

- Potable Mineral Water Supply – the groundwater is not located in a recognised mineral water province, nor does it meet the definition for mineral water (SEPP GoV). Potable mineral water supply is therefore not considered to be precluded.
- Agriculture, Parks and Gardens - this groundwater use was not indicated for wells within 2 km of the site (Figure 27) and given the land use and proximity of the Morass is not likely to be realised down gradient of the site. Agriculture, Parks and Gardens is therefore not considered to be precluded by contamination of groundwater.
- Stock Watering
  - groundwater concentrations at the site do not exceed the adopted criteria (ANZECC 2000 livestock drinking water) therefore Stock Watering is not considered to be precluded by contamination by groundwater.
  - Elevated phosphorus and iron have been recorded both up and down stream in the creek indicating that site activities were not responsible. No other concentrations exceed the Agriculture and Irrigation (including Stock Watering) criteria is therefore not considered to be precluded by contamination of surface water.
- Industrial Water Use
  - No industrial groundwater uses have been identified within 2 km of the site. The location of the site and it's agricultural setting makes Industrial Water Use unlikely to be realised, as does the salinity and background water quality. It is not considered to be precluded by contamination of groundwater.
  - The relatively low flow of the creek, the location of the site and it's agricultural setting makes Industrial Water Use unlikely to be realised, as does the salinity and background water quality. It is not considered to be precluded by contamination of surface water.
- Primary Contact Recreation (e.g. bathing and swimming)
  - As discussed in Section 4.3 groundwater does not supply surface water bodies at or close to the site. In the context of the site this beneficial use is therefore being considered in respect to groundwater extraction to fill swimming pools only. Iron, chloride and sodium have been recorded above the adopted aesthetic criteria GMRRW 2008 with elevated chloride and sodium being consistent with background water quality. The individual consumer will judge whether this is acceptable. All other contaminant concentrations are below the adopted criteria. Primary Contact Recreation is not considered to be precluded by contamination by groundwater.
- Building and Structures
  - Groundwater at the site is more than 15 m below ground level. There are currently no buildings downgradient of the site and given the landuse and proximity to the Morass is it considered unlikely

that any will be built. In addition, the adopted criteria (AS2159-2009) is exceeded across the site and is therefore considered to be the background water quality. Primary Contact Recreation is not considered to be precluded by contamination by groundwater.

Beneficial Uses for groundwater or surface water are not currently considered to be precluded at the site.

With regard to the potential for future Beneficial Uses to be precluded due to contamination from the site the following considerations have been taken into account:

- As discussed above, due to the location of the site, the background water quality and the proximity of the Morass it is considered unlikely that the following beneficial uses will be realised in the future: Potable Water; Potable Mineral Water Supply, Agriculture, Parks and Gardens; Industrial Water Use; Primary Contact Recreation (e.g. bathing and swimming); and Building and Structures.
- There is potential for Stock Watering to be realised downgradient of the site. However, to date groundwater concentrations at the site do not exceed the adopted criteria (ANZECC 2000 livestock drinking water). A slight increasing trend in nitrate concentrations has been observed in groundwater well 141402. It is unlikely that the concentrations will continue to rise for a significant time period as:
  - Leachate levels in Cell 1 (partially) lined are now managed to minimise leachate leakage from the site. A capping design has been submitted to EPA and capping is expected to be undertaken within the next few years further limiting leachate generation at the site.
  - Cells 2 and 3, and future cells will be fully lined to minimise the potential for leachate leakage from the site.
  - The Audit and this HA have recommended that operating rules should be stabilised to prevent discharge of water from the Stormwater Pond to the tributary of Skeene Creek that exceeds receiving water beneficial use criteria to further manage the potential for impact to Skeene Creek. However, under current conditions Stock Watering not considered to be precluded by contamination of surface water (see above).

Under current operating conditions it is not considered likely that future Beneficial Uses of groundwater or surface water will be precluded by contamination from the site.

6.0 LANDFILL GAS MANAGEMENT

A landfill gas collection system will be installed at the site comprising:

- polyethylene pipes surrounded by aggregate in a horizontal trench. The trench is overlain with a separation geotextile to prevent soil from the clay components of the cap clogging the trench.
- well banks to allow for the future construction of vertical gas collection wells installed into the waste mass should it be required.
- landfill gas collection cleanout pipes.
- riser pipe penetrating the landfill cap allowing for the controlled capture and management of collected landfill gas.

The final treatment (e.g. flare or bio filter) will be dependent on flow in the riser pipe.

Due to the height of leachate at the base of the waste and the requirements from the BPEM guidelines (EPA, 2015) that vertical wells are to be installed to within 3 – 5 m of the base of the waste, efficient gas extraction should be achievable from the site should it be attempted. It is not anticipated that leachate will prevent the extraction of landfill gas from the site.

7.0 RECOMMENDATION FOR MAXIMUM LEACHATE LEVEL

This risk assessment is based on the current leachate levels in Cell 1 sump, JRLP. Leachate levels are currently compliant with the Landfill BPEM requirement (EPA, 2015) that leachate does not exceed 0.3 m above the lowest point on the liner. The risk of leachate levels at the site exceeding this level has not been assessed. It is therefore recommended that a maximum leachate level in line with BPEM is maintained at the site (Table 12).

Once reporting the survey details as requested by the Auditor have been confirmed for the sumps in Cells 2 and 3, and leachate levels are reported for these sumps it is recommended that target levels of 0.3 m above the base of the liner in these cells are set.

Table 12: Proposed Target Leachate Levels

Cell	Sump	Maximum leachate management level (m AHD)		
		(m AHD)	(m bTOC)	Level above lowest point of the liner surface (excluding leachate aggregate layer) outside of sump
1/1A	Leachate Sump 1 (JRLP)	≤ 22.75	≥ 12.16	-
2	Leachate Sump 2	TBC	TBC	0.3 m
3	Leachate Sump 3	TBC	TBC	0.3 m

Notes to Table: TBC – To be confirmed

Leachate levels are likely to reduce following complete capping of the site.

Should the leachate level(s) exceed the maximum leachate management level for more than two consecutive measurements in any cell or if increasing trends in landfill contaminants are recorded in groundwater at the site reassess the risk of harm and if considered to be unacceptable due to leachate impacts, review and revise within waste leachate monitoring points and maximum leachate management target leachate level(s).

8.0 GENERAL RECOMMENDATIONS

Recommendations for the site are as follows:

- As stated in the verified Monitoring Program the following should be undertaken:
  - Weekly monitoring of level and flows from all leachate sumps and the Leachate Dam with plotting of levels against maximum leachate levels
  - Upgrade plan of monitoring sites to include locations of Leachate Sump 2, Leachate Sump 3, new groundwater bore and new surface water monitoring site for Cells 2 and 3.
- A groundwater monitoring well should be installed near to the southeast corner of Cell 2a
- A surface water monitoring location on Skeene Creek, downstream of the sediment pond should be established
- Survey levels (m AHD) should be provided groundwater monitoring wells 141402, 141403, 9022881/1, 9022881/2 and the recommended new bore, and for the as constructed Cells 1, 2 and 3 top of leachate sump and base of
- Operating rules should be established to prevent discharge of water from the Stormwater Pond to the tributary of Skeene Creek that exceeds receiving water beneficial use criteria

9.0 SUMMARY

Bairnsdale Landfill has been established at the site of a former gravel quarry and agricultural land. The site is located towards the eastern edge of a plateau with higher, hilly land to the west. The edge of the plateau slopes down to water bodies to the north and east, intersected by river and creek valleys draining to lakes and the coast. The site generally slopes from gently west to east.

The site currently consists of three engineered cells, Cell1, Cell 2 and Cell 3 as well as a recycling centre, transfer station, tip shop, weighbridge and offices. Land uses in the vicinity of the site is predominantly agricultural and quarrying.

The site is underlain by Quaternary sediments, clays with a high proportion of silts, sands and gravels which are underlain by the Haunted Hills Gravels Formation to a depth of > 36 m bgl. The water table is located at an elevation of approximately 3 m AHD (> 25 m bgl) within the Haunted Hills Formation.

Groundwater flow off-site to the west is towards the southeast turning to the northeast across the site with groundwater levels across the site rebounding following the drought that finished in 2010. Surface water bodies in the vicinity of the site are not groundwater fed with their basal elevation several metres above groundwater.

Water type data as displayed on the Piper plot indicates:

- The background groundwater wells 119506, 119507, 141403 and downgradient well 141402 plot together.
- The leachate sump and Leachate Dam data plot together.
- The groundwater wells 9022881/1 and 9022881/2 plot between the two groups, possibly suggesting impact from the landfill but given the low concentrations of the conservative tracer chloride may suggest impact from the adjacent Fire Dam and Stormwater Pond.

TDS concentrations at the site in groundwater range between approximately148 mg/L (9022881/1) to 2,900 mg/L (141403). The highest TDS concentrations are recorded upgradient of the site. TDS concentrations in leachate range between 380 mg/L to 9,800 mg/L.

The groundwater quality upgradient of the site is well established through the monitoring of three upgradient wells 119506, 119507, 141403. These wells have the highest TDS and chloride values in groundwater at the site, as well as elevated nitrate, VFAs and hydrocarbons on occasion.

Leachate levels in Cell 1 are compliant with the Landfill BPEM requirement (EPA, 2015) that leachate does not exceed 0.3 m above the lowest point on the liner. Leachate levels for Cells 2 and 3 have not been reported.

Under current site conditions, beneficial uses at the site are not considered to be precluded by groundwater or surface water contamination at the site. Leachate levels are currently maintained at or below 0.3 m above the lowest point of the liner. It is recommended that leachate continues to be managed in line with current operations at or below 0.3 m above the lowest point of the liner.

Under current operating conditions it is not considered likely that future Beneficial Uses of groundwater or surface water will be precluded by contamination from the site.

10.0 REFERENCES

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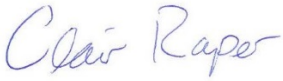

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APPENDIX A

Borelogs

SOIL CLASSIFICATION LEGEND

	GRAPHIC SYMBOL	GROUP SYMBOL	DESCRIPTION
GRAVEL		GW	GRAVEL – WELL GRADED
		GW	GRAVEL MIXTURES – WELL GRADED Sandy Gravel
		GP	GRAVEL – POORLY GRADED
		GP	GRAVEL MIXTURES – POORLY GRADED Sandy Gravel
		GC	Clayey Gravel
SAND		SW	SAND – WELL GRADED
		SW	SAND MIXTURES – WELL GRADED Gravelly Sand
		SP	SAND – POORLY GRADED
		SP	SAND MIXTURES – POORLY GRADED Gravelly Sand
		SC	SAND Clayey Sand
		SM	SAND Silty Sand
SILT		ML	SILT
		ML	SILT Sandy Silt
		ML	SILT Clayey Silt
CLAY		CL	CLAY – LOW TO MEDIUM PLASTICITY Clay
		CL	Silty Clay
		CL	Sandy Clay
		CL	Gravelly Clay
		CH	CLAY – HIGH PLASTICITY

BOREHOLE LOG REPORT

CAMP SCOTT FURPHY

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH1	Borehole depth:	22.0 m	Contractor:	RWC
Date hole commenced:	20/4/93	R.L casing:	19.267 m	Driller:	Dave Grimstead
Date hole completed:	22/4/93	R.L surface:	18.479 m	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD					SILTY CLAY;CL, low plasticity, brown/grey, dry, firm to hard, friable.		
			1.0		medium plasticity light brown, dry to moist		
			2.0		SANDY CLAY;CL, medium plasticity, fine to medium sand interspersed in clay, moist, soft to firm.		
					SILTY CLAY;CL, low to medium plasticity, grey/ brown, moist, soft to firm.		
			3.0		SANDY GRAVEL;GW, Fine to coarse, rounded gravel, coarse sands, well graded, brown.		particle size range 2 mm – 45 mm
					CLAYEY SAND;CS, fine to coarse, brown/grey, cemented, hard, dry, tight.		
			4.0				
			5.0		occasional well rounded, coarse gravel & cobbles in cemented clay/sand matrix.		particle size range 25 mm – 75 mm
			6.0		becoming more silty no gravel present predominantly fine to medium sand, light brown.		
			7.0				
			8.0		becoming fine to coarse, sand generally well rounded.		

BOREHOLE LOG REPORT

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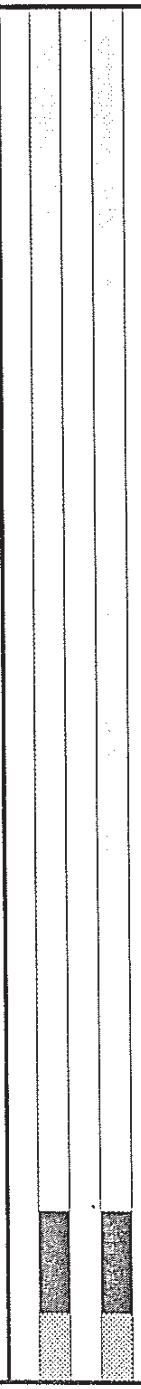
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD			9.0		CLAYEY SAND;SC, fine to coarse, brown, rounded.		
			10.0		SILTY SAND;SM, fine to medium, light brown, minor coarse sand, soft.		
			11.0		predominantly fine, minor medium sand.		
			12.0		predominantly medium sand, becoming more clayey.		
			13.0				
			14.0				
			15.0		CLAYEY SAND;SC, fine to medium, light brown, low plasticity, soft to firm.		
			16.0				

BOREHOLE LOG REPORT

CAMP SCOTT FURPHY

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

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Date hole commenced:	20/4/93	R.L casing:	19.267 m	Driller:	Dave Grimstead
Date hole completed:	22/4/93	R.L surface:	18.479 m	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD		–	17.0		CLAYEY SAND;SC, fine to medium, light brown, low plasticity clay, soft to firm.		
			18.0		GRAVEL;GP, fine to medium gravels, poorly graded, well rounded		particle size range 5 mm – 10 mm
			19.0		CLAYEY SAND;SC, medium to coarse, light brown, low plasticity, soft, wet.		
			20.0		becoming more clayey.		
			21.0		predominantly fine sand.		
			22.0		Borehole Terminated at 22.0m.		
			23.0				
			24.0				

BOREHOLE LOG REPORT

CAMP SCOTT FURPHY

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH2	Borehole depth:	35.0 m	Contractor:	RWC
Date hole commenced:	26/4/93	R.L casing:	33.688 m	Driller:	Dave Grimstead
Date hole completed:	29/4/93	R.L surface:	33.085 m	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD			1.0		SILTY CLAY;CL, low plasticity, brown, dry, hard to very hard		
			2.0		CLAYEY SILT;ML, light grey/brown, dry, very hard, low plasticity clay, light brown		
			3.0				
			4.0				
			5.0		SILTY CLAY;CL, low plasticity, brown, dry, hard to very hard		
					GRAVELLY CLAY;CL, medium to high plasticity, brown, fine to medium gravel, moist, soft		particle size range 2 mm – 15 mm
			6.0		CLAYEY GRAVEL;GC, low plasticity, grey, fine to coarse gravels, moist, minor fine sands		
					GRAVEL;GP, medium, poorly graded,well rounded		particle size range 10 mm – 15 mm
			7.0		SANDY GRAVEL;GW, medium to coarse, medium sands, well graded, brown/grey, minor silts and clays as binders		particle size range 0.6 mm – 45 mm
			8.0		GRAVEL;GP, medium to coarse, poorly graded, well rounded		particle size range 15 mm – 45 mm

BOREHOLE LOG REPORT

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH2	Borehole depth:	35.0 m	Contractor:	RWC
Date hole commenced:	26/4/93	R.L casing:	33.688 m	Driller:	Dave Grimstead
Date hole completed:	29/4/93	R.L surface:	33.085 m	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
					GRAVEL;GP, medium to coarse, poorly graded, well rounded		
			9.0		GRAVELLY SAND;GW, fine to medium, brown, fine to medium gravel, well graded, minor clay binder		particle size range 0.06 mm – 35 mm
					GRAVEL;GW, fine to coarse, well graded, well rounded		particle size range 2 mm – 35 mm
			10.0		SILTY SAND;SM, fine to medium, brown, moist, cemented – minor fine gravels		
			11.0		SAND;SP, medium, poorly graded, rounded		particle size range 0.2 mm – 0.6 mm
			12.0		– minor clay binder		
			13.0		SILTY SAND;SM, fine to medium, brown, moist, cemented		
			14.0		SAND;SP, fine to medium, poorly graded		
			15.0				
			16.0				

BOREHOLE LOG REPORT

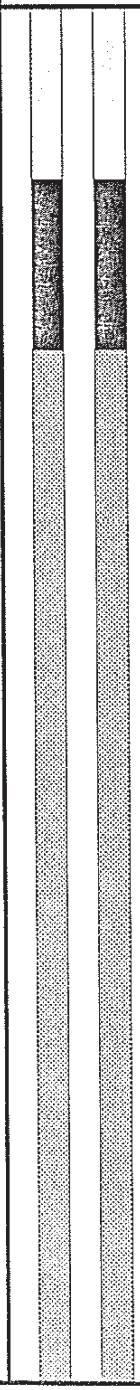
CAMP SCOTT FURPHY

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH2	Borehole depth:	35.0 m	Contractor:	RWC
Date hole commenced:	26/4/93	R.L casing:	33.688 m	Driller:	Dave Grimstead
Date hole completed:	29/4/93	R.L surface:	33.085 m	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD			17.0 18.0 19.0 20.0		CLAYEY SAND;SC, fine to medium, brown, low plasticty clay binder		
			21.0		SILTY SAND;SM, fine to medium, brown, moist		
			22.0 23.0 24.0		SAND;SP, fine to medium, poorly graded, grey – minor clay binder		

BOREHOLE LOG REPORT

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH2	Borehole depth:	35.0 m	Contractor:	RWC
Date hole commenced:	26/4/93	R.L casing:	33.688 m	Driller:	Dave Grimstead
Date hole completed:	29/4/93	R.L surface:	33.085 m	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD		–	25.0		SILTY SAND;SM, fine to medium, brown, moist		
			26.0		CLAYEY SAND;SC, fine to medium, brown, low plasticty clay binder		
			27.0				
			28.0		SILTY SAND;SM, fine to coarse, brown, moist – minor fine gravel		
			29.0		SAND;SP, medium to coarse, grey, poorly graded, well rounded		particle size range 0.2 mm – 2 mm
			30.0		CLAYEY SAND;SC, fine to medium, brown, low to medium plasticity, soft		
			31.0				
			32.0		SAND;SP, fine to medium, grey, poorly graded, well rounded		

BOREHOLE LOG REPORT

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH2	Borehole depth:	35.0 m	Contractor:	RWC
Date hole commenced:	26/4/93	R.L casing:	33.688 m	Driller:	Dave Grimstead
Date hole completed:	29/4/93	R.L surface:	33.085 m	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD			33.0		SAND;SP, fine to medium, grey, poorly graded, well rounded		
			34.0		CLAYEY SAND;SC, fine to medium, brown, low to medium plasticity, soft		
			35.0		Borehole Terminated 35.0 m		
			36.0				

BOREHOLE LOG REPORT

CAMP SCOTT FURPHY

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH3	Borehole depth:	31.0 m	Contractor:	RWC
Date hole commenced:	4/5/93	R.L casing:	38.271 m	Driller:	Dave Grimstead
Date hole completed:	7/5/93	R.L surface:	37.694 m	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD			1.0		SILTY CLAY;CL, low plasticity, brown, dry, hard to firm		
			2.0		GRAVELLY CLAY;CL, medium to high plasticity, brown, fine to medium gravels, dry to moist firm to hard		
			3.0		GRAVEL;GP, medium to coarse, well rounded poorly graded – medium gravel 2.5 m – 3.4 m		particle size range 10 mm – 35 mm particle size range 10 mm – 20 mm
			4.0		SANDY GRAVEL;GW, medium to coarse, medium sands, brown/grey, well graded, minor silts and clays as binders		
			5.0				particle size range 0.2 mm – 35 mm
			6.0		GRAVELLY SAND;SW, medium to coarse, brown, fine to medium gravel, well graded, minor clay binder		particle size range 0.2 mm – 15 mm
			7.0				
			8.0		CLAYEY SAND;SC, fine to medium, brown, low plasticity, moist, soft		

BOREHOLE LOG REPORT

CAMP SCOTT FURPHY

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH3	Borehole depth:	31.0 m	Contractor:	RWC
Date hole commenced:	4/5/93	R.L casing:	38.271 m	Driller:	Dave Grimstead
Date hole completed:	7/5/93	R.L surface:	37.694 m	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD					CLAYEY SAND;SC, fine to medium, brown, low plasticity, moist, soft		
			9.0		GRAVELLY SAND;SW, medium to coarse, brown, fine to medium gravel, well graded, minor clay binder		particle size range 0.06 mm – 15 mm
			10.0		CLAYEY SAND;SC, fine to medium sand, brown, low to medium plasticity, moist, soft		
			11.0		– occassional fine to medium gravels between 11.0 m – 17.0 m		
			12.0		– minor clay binder		
			13.0				
			14.0		– minor clay binder		
			15.0				
			16.0				

BOREHOLE LOG REPORT

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH3	Borehole depth:	31.0 m	Contractor:	RWC
Date hole commenced:	4/5/93	R.L casing:	38.271 m	Driller:	Dave Grimstead
Date hole completed:	7/5/93	R.L surface:	37.694 m	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD			17.0		CLAYEY SAND;SC, fine to medium sand, brown, low to medium plasticity, moist, soft		
			18.0		– grey/brown		
			19.0				
			20.0				
			21.0				
			22.0				
			23.0		– sand fine to coarse, well graded		
			24.0				

BOREHOLE LOG REPORT

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH3	Borehole depth:	31.0 m	Contractor:	RWC
Date hole commenced:	4/5/93	R.L casing:	38.271 m	Driller:	Dave Grimstead
Date hole completed:	7/5/93	R.L surface:	37.694 m	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD			25.0		CLAYEY SAND;SC, fine to medium, brown, low plasticty clay binder		
			26.0		– sands fine to coarse from 25.5 m – 27.0 m		
			27.0		SAND;SP, fine to medium, poorly graded, light grey		
			28.0		– minor clay – low plasticity		
					– occasional fine to medium gravels		
			29.0				
			30.0		– becoming brown		
			31.0		Borehole Terminated 31.0 m		
			32.0				

BOREHOLE LOG REPORT

CAMP SCOTT FURPHY

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH4	Borehole depth:	35.0 m	Contractor:	RWC
Date hole commenced:	30/4/93	R.L casing:	32.778	Driller:	Dave Grimstead
Date hole completed:	3/5/93	R.L surface:	32.251	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD					SANDY CLAY;CL,low to medium plasticity, brown/ grey, fine sand, moist to dry, hard		
			1.0		SILTY CLAY;CL, low plasticity, brown, dry, hard to very hard		
			2.0		CLAYEY SILT;ML, light grey/brown, dry, very hard, low plasticity clay, light brown – becoming sandy (fine)		
					SANDY CLAY;CL, low to medium plasticity, brown, to medium sand, moist, moft to firm		
			3.0		GRAVEL;GW, fine to coarse, well rounded, well graded – gravels fine to medium 2.5 m – 3.0 m – gravels fine to coarse 3.0 m – 3.4 m		particle size range 3 mm – 15 mm particle size range 3 mm – 45 mm
			4.0		GRAVELLY SAND;GW, fine to coarse, brown, fine to medium gravels, minor silts and clays acting as binders, very hard		particle size range 0.06 mm – 10 mm
			5.0		CLAYEY GRAVEL;GC, low plasticity, grey, fine to coarse gravels, moist, minor fine sands		particle size range 3 mm – 45 mm
					CLAYEY SAND;SC, fine to coarse, brown, low to medium plasticity, minor fine gravels		
			6.0		GRAVEL;GP, medium, poorly graded, well rounded		particle size range 10 mm – 15 mm
			7.0		– becoming more clayey		
					CLAY;CL, low plasticity, grey, moist, hard		
			8.0		CLAYEY SAND;SC, fine to medium, brown, medium plasticity, moist, soft		

BOREHOLE LOG REPORT

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH4	Borehole depth:	35.0 m	Contractor:	RWC
Date hole commenced:	30/4/93	R.L casing:	32.778	Driller:	Dave Grimstead
Date hole completed:	3/5/93	R.L surface:	32.251	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD			9.0		CLAYEY SAND;SC, fine to medium, brown, medium plasticity, moist, soft		
			10.0		SILTY SAND;SM, fine to medium, brown, low to medium plasticity, moist, soft – sand fine to coarse 9.5 m – 11.5 m		particle size range 0.06 mm to 2.0 mm
			11.0				
			12.0		– sand fine to medium 11.5 m – 15.4 m		
			13.0				
			14.0		– becoming more clayey		
			15.0		– minor fine gravel		
			16.0		SANDY GRAVEL;GW, fine to coarse, brown, fine to coarse sands, well graded, moist, firm to hard		particle size range 5 mm – 25 mm

BOREHOLE LOG REPORT

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH4	Borehole depth:	35.0 m	Contractor:	RWC
Date hole commenced:	30/4/93	R.L casing:	32.778	Driller:	Dave Grimstead
Date hole completed:	3/5/93	R.L surface:	32.251	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD					SANDY GRAVEL;GW, fine to coarse, brown, fine to coarse sands, well graded, moist, firm		
			17.0		SILTY SAND;SM, fine to coarse, brown, moist		
			18.0		SAND;SP, medium, light brown, poorly graded		
			19.0		– minor silts & clays		
			20.0		SILTY SAND;SM, medium, brown, moist		
			21.0				
			22.0				
			23.0		CLAYEY SAND;SC, fine to medium, brown, low to medium plasticity, moist, soft		
			24.0				

BOREHOLE LOG REPORT

CAMP SCOTT FURPHY

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH4	Borehole depth:	35.0 m	Contractor:	RWC
Date hole commenced:	30/4/93	R.L casing:	32.778	Driller:	Dave Grimstead
Date hole completed:	3/5/93	R.L surface:	32.251	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD					CLAYEY SAND;SC, fine to medium, brown, low to medium plasticity, moist, soft		
			25.0				
			26.0		– predominantly fine sands		
			27.0		GRAVELLY SAND;SW, medium to coarse, brown, medium gravel, well graded, moist, firm		particle size range 0.6mm – 15 mm
			28.0		SILTY SAND;SM, fine to coarse, brown, moist		
			29.0		SAND;SP, medium to coarse, grey, well rounded poorly graded		particle size range 0.6 mm – 2.0 mm
			30.0		CLAYEY SAND;SC, fine to medium, brown, low to medium plasticity, soft		
			31.0		SAND;SW, fine to coarse, grey, well rounded well graded		particle size range 0.6 mm – 2.0 mm
			32.0				

BOREHOLE LOG REPORT

CAMP SCOTT FURPHY

Client: Bairnsdale Waste Management Group

Job Name: Johnston Rd – Groundwater Investigation

Job Number: CM631801IN

Borehole location:	BH4	Borehole depth: 35.0 m		Contractor:	RWC
Date hole commenced:	30/4/93	R.L casing:	32.778	Driller:	Dave Grimstead
Date hole completed:	3/5/93	R.L surface:	32.251	Drill rig:	Borne C500
Logged by:	APN	Datum:	AHD	Drilling fluid:	Water
Checked by:	PFB				

Drilling Method	Peizometer Construction Details	SWL	Depth (m)	Graphic Log	Material Description	Field Sample	PID Readings / Other Notes
6" CABLE TOOL HEAD					CLAYEY SAND;SC, fine to medium, brown, low plasticity, moist, soft		
			33.0		– becoming more clayey		
			34.0		GRAVELLY SAND;SW, medium, grey/brown, fine to medium gravel, well graded, moist		particle size range 0.6 mm – 10 mm
					Borehole Terminated 34.0 m		
			35.0				
			36.0				

GEO-ENG PTY LTD ACN 052 859 122
Locked Bag 5 • Morwell 3840 • Australia
Phone +61 (0)3 5133 9514 Fax +61 (0)3 5133 9579
Web: http://www.geo-eng.com.au

Our Ref: 1576/9540/05
Your Ref: STOR-124698

23 February 2000

Mr Tilo Junge
East Gippsland Shire Council
PO Box 80
Lakes Entrance VIC 3909

Dear Tilo

JOHNSTONS ROAD BAIRNSDALE PROPOSED LANDFILL – GROUNDWATER MONITORING BORES

East Gippsland Shire Council (EGSC) commissioned Geo-Eng Pty Ltd (Geo-Eng) to conduct drilling and installation of two groundwater monitoring bores at the proposed landfill on Johnstons Road, Bairnsdale. The purpose of the project was to install groundwater bores suitable for environmental monitoring to supplement the existing monitoring bore network, based on the recommendations of Geo-Eng report 1576/52273/6 *Johnstons Road Landfill – Review of Groundwater Monitoring* (November 1999).

The scope of works conducted by Geo-Eng as part of the project included:

- Sampling and geological logging of cuttings during drilling to establish suitable construction depths for the monitoring bores.
- Installation of two 50mm uPVC groundwater bores (BH-5 and BH-6) suitable for environmental monitoring.
- Preparation of detailed lithologic logs and bore completion reports.

A site map is attached as Appendix 1 and shows the approximate location of monitoring bores BH-1 to BH-6.

Field activities were conducted from 11 February to 18 February 2000. A cable tool drilling rig was utilised for the drilling to allow accurate disturbed sediment samples to be collected.

Bore logs are attached in Appendix 2. The logs provide a lithologic description of the sediments encountered and bore construction details. Bore details are summarised in Table 1 below.

SUPPORTING THE MINING, CIVIL, WATER AND ENVIRONMENTAL INDUSTRIES

1/14

CLIENTS PEOPLE PERFORMANCE

Waste - Landfill
Johnstons Rd
T Junge - EGSC

PLAN A.		26 AUG 2005
PLAN R.		
BUIL A.		
BUIL R.		

19 August 2005

Our ref: 31/17063/5288
Your ref:

East Gippsland Shire Council
PO Box 1618
Bairnsdale VIC 3875

Attn: Tilo Junge

Dear Tilo

Johnstons Road Landfill, Bairnsdale
New Groundwater Monitoring Bores

East Gippsland Shire Council (EGSC) commissioned GHD to conduct drilling and installation of two groundwater monitoring bores at the Johnstons Road Landfill in Bairnsdale. The purpose of this project was to install groundwater bores suitable for environmental monitoring of the water table to supplement the existing monitoring bore network, based on the recommendations of the URS Environmental Audit Report 54338/001 (URS 2004).

The scope of works conducted by GHD as part of the project included:

- Sampling and geological logging of cuttings during drilling and monitoring standing water levels to establish suitable construction depths for the monitoring bores,
- Installation of two 50mm uPVC groundwater bores (MW1 and MW2) suitable for environmental monitoring of the water table, and
- Preparation of detailed lithologic logs and bore completion reports.

A site map is attached as Appendix 1 and shows the approximate location of all monitoring bores at the site, including the two new bores.

Field activities were conducted from 20 July to 3 August 2005. A cable tool drilling rig was utilised for the drilling to allow accurate disturbed sediment samples to be collected.

Bore logs are attached in Appendix 2. The logs provide a lithologic description of the sediments encountered and bore construction details. Bore details are summarised in Table 1 below.

Table 1 Groundwater Monitoring Bore Construction Details Summary

Bore ID	Drilled Depth (m)	Screen Interval (m)		SWL* (m)
		From	To	
MW1	23	19	23	21.015
MW2	17	14	17	15.5

* SWL – Standing Water Level from ground surface

Bores were developed on 16 August 2005 for approximately 2 hours each with an air compressor. As a steady flow of water could not be removed from the bores during development, they were flushed with clean rainwater, provided on site, until fines were removed and the water appeared clear.

GHD Pty Ltd ABN 39 008 488 373 Cnr Hazelwood Drive & Lignite Court Morwell VIC 3840 Locked Bag 5 Morwell 3840 VIC Australia
T 61 3 5133 9511 F 61 3 5133 9579 E mwlmail@ghd.com.au W www.ghd.com.au

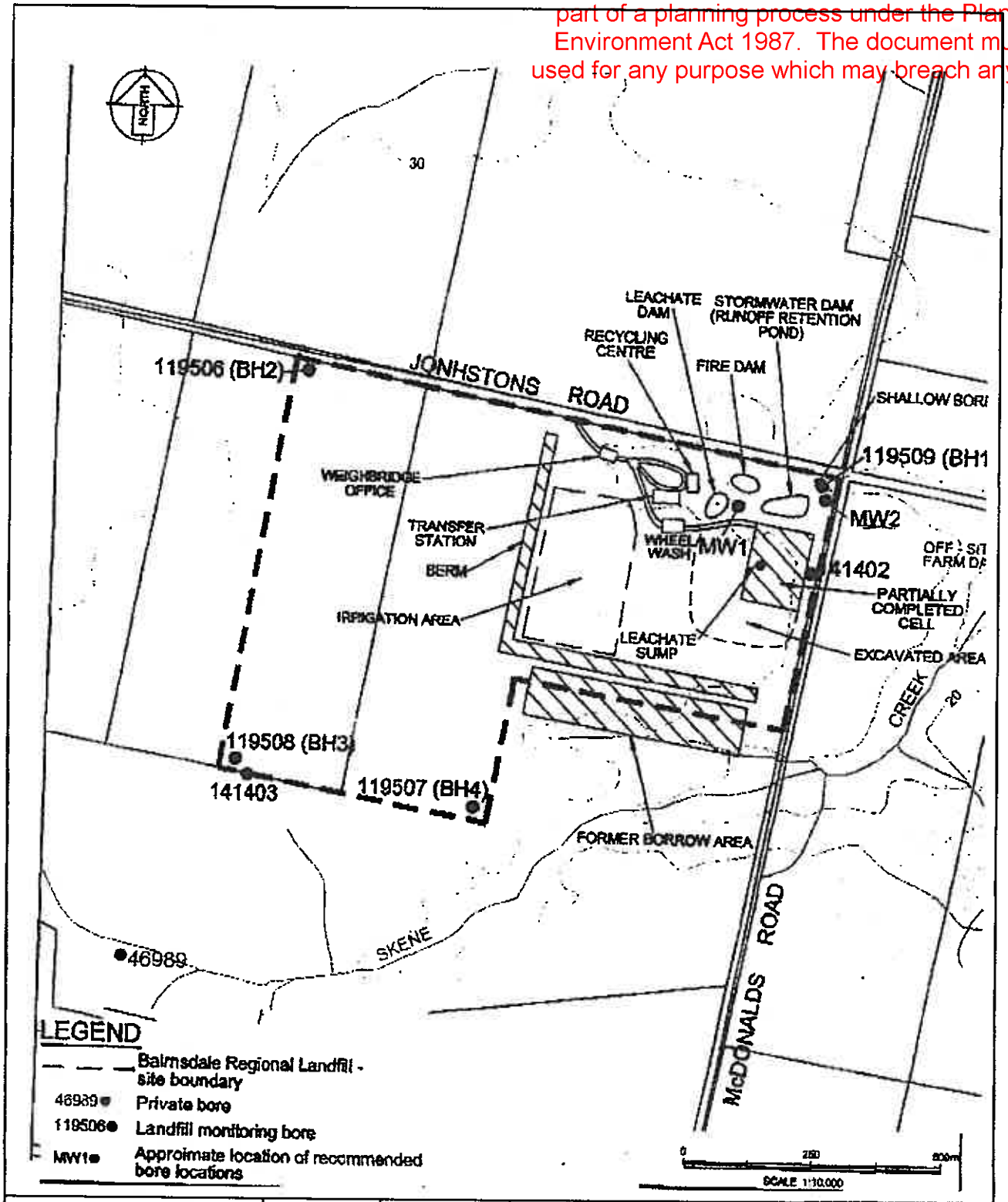
A Bore Construction Licence (No. 9022881) was obtained by GHD on behalf of EGSC from Southern Rural Water, authorising the construction of the two groundwater monitoring bores. A copy of the Bore Construction Licence is attached as Appendix 3.

GHD appreciates the opportunity of working with East Gippsland Shire Council on this project. If you have any questions please contact the undersigned on (03) 5133 9511.

Yours faithfully
GHD Pty Ltd

Sabina Fahrner
Environmental Engineer
03 5133 9511

Attachment: Appendix 1 – Site Map
Appendix 2 – Lithologic logs and bore completion reports
Appendix 3 – Bore Construction Licence



GHD	Created By SF	Checked GF	Approved GF
	Date 05/08/05	File location 31/17063/Tech/MW Locations.ppt	East Gippsland Shire Council Johnstons Road Landfill Baimsdale Regional Landfill **Monitoring Well Location Plan**
	Revision 0	Source URS 54338-001 Figure 6	**Appendix 1**

GHD MANAGEMENT ENGINEERING ENVIRONMENT

GROUNDWATER BORE LOG

Bore No.: MW1

CLIENT: **East Gippsland Shire Council** | COMMENCED: **27/07/05**

PROJECT: **Bairnsdale Regional Landfill Drilling** | JOB No.: **31/17063** | COMPLETED: **02/08/05**

LOCATION: **Johnsons Road Landfill, Bairnsdale** | LOGGED BY: **SF**

CONTRACTOR: **Action Water Boring** | EQUIPMENT: **Cable Tool Rig** | CHECKED BY: **GF**

R.L. SURFACE (m): | R.L. TOC (m): | TOTAL DEPTH (m): **23 m**

EASTING: | NORTHING: | DIAMETER (mm): **50 mm**

Depth (m)	Method	Depth / Elevation	LITHOLOGICAL DESCRIPTION@#AS1726 Soil Group Symbol, soil types, particle characteristics or fines plasticity, matrix type, porosity, secondary and minor components.	Water	Casing Details	Graphic Log	Depth (m)
			Ground Surface				
0		0.00	**Sandy CLAY** Dark yellowsih orange, stiff, dense, CH, sand ranges from medium to gravel size, quartz gravel to 50mm, clay drier and crumbly - CI				0
1		0.70	**Clayey SAND** Light brown clayey sand with gravel. Gravel - multicoloured quartz, to 70mm, subrounded to angular, poorly sorted. Clay - CI Clay has higher plasticity (CH)				1
2			Sand fraction becoming coarser with gravel to 100mm				2
3		2.50	**SAND** Sand with minor clay. Sand - clear and white quartz, contains small black particles, coarse to very coarse, subrounded to subangular, uniformly graded, very soft, S2. Sand is slightly coarser, rounded to subangular, lower clay fraction.				3
4							4
5		5.00					5

GHD MANAGEMENT ENGINEERING ENVIRONMENT

GROUNDWATER BORE LOG

Bore No.: MW1

CLIENT: **East Gippsland Shire Council** | COMMENCED: **27/07/05**

PROJECT: **Bairnsdale Regional Landfill Drilling** | JOB No.: **31/17063** | COMPLETED: **02/08/05**

LOCATION: **Johnsons Road Landfill, Bairnsdale** | LOGGED BY: **SF**

CONTRACTOR: **Action Water Boring** | EQUIPMENT: **Cable Tool Rig** | CHECKED BY: **GF**

R.L. SURFACE (m): | R.L. TOC (m): | TOTAL DEPTH (m): **23 m**

EASTING: | NORTHING: | DIAMETER (mm): **50 mm**

Depth (m)	Method	Depth / Elevation	LITHOLOGICAL DESCRIPTION@#AS1726 Soil Group Symbol, soil types, particle characteristics or fines plasticity, matrix type, porosity, secondary and minor components.	Water	Casing Details	Graphic Log	Depth (m)
			SAND with minor clay Dark yellowish orange sand with minor clay, sand is coarse to very coarse, subrounded to subsangular, quartz, well graded, SC				
6			Sand becoming finer - medium to coarse, clay has low plasticity (Cl)				6
7			Clay content increasing				7
8			Sand is medium to very coarse, some black particles in quartz sand, subrounded to angular				8
9			Sand becoming finer - fine to medium (70%) to coarse (30%), subrounded to subangular, clay is greyish orange in colour				9
10		10.00					10

GHD MANAGEMENT ENGINEERING ENVIRONMENT

GROUNDWATER BORE LOG

Bore No.: MW1

CLIENT: East Gippsland Shire Council
PROJECT: Bairnsdale Regional Landfill Drilling
JOB No.: 31/17063
LOCATION: Johnsons Road Landfill, Bairnsdale
CONTRACTOR: Action Water Boring
EQUIPMENT: Cable Tool Rig

COMMENCED: 27/07/05
COMPLETED: 02/08/05
LOGGED BY: SF
CHECKED BY: GF

R.L. SURFACE (m):
R.L. TOC (m):
TOTAL DEPTH (m): 23 m
EASTING:
NORTHING:
DIAMETER (mm): 50 mm

Depth (m)	Method	Depth / Elevation	LITHOLOGICAL DESCRIPTION@#AS1726 Soil Group Symbol, soil types, particle characteristics or fines plasticity, matrix type, porosity, secondary and minor components.	Water	Casing Details	Graphic Log	Depth (m)
			SAND with minor clay As above but coarse fraction becoming less (~10%)				
11			Change in colour of clay - light brown				11
12			Clay lightening - dark yellowish orange, sand increase in fine particule size, only trace medium sand				12
13			Poorly sorted sand, very fine to coarse grain size				13
14			Uniformity of sand increasing, predominantly fine to medium size				14
15		15.00					15

GHD | MANAGEMENT ENGINEERING ENVIRONMENT

GROUNDWATER BORE LOG

Bore No.: MW1

CLIENT: **East Gippsland Shire Council** — COMMENCED: **27/07/05**
PROJECT: **Bairnsdale Regional Landfill Drilling** — JOB No.: **31/17063** — COMPLETED: **02/08/05**
LOCATION: **Johnsons Road Landfill, Bairnsdale** — LOGGED BY: **SF**
CONTRACTOR: **Action Water Boring** — EQUIPMENT: **Cable Tool Rig** — CHECKED BY: **GF**
R.L. SURFACE (m): — R.L. TOC (m): — TOTAL DEPTH (m): **23 m**
EASTING: — NORTHING: — DIAMETER (mm): **50 mm**

Depth (m)	Method	Depth / Elevation	LITHOLOGICAL DESCRIPTION@#AS1725 Soil Group Symbol, soil types, particle characteristics or fines plasticity, matrix type, porosity, secondary and minor components.	Water	Casing Details	Graphic Log	Depth (m)
			SAND Very pale orange sand, very fine to coarse (~10%), predominantly fine sand (>50%), rounded to subangular, moderately well sorted, cements when dried				
16			Contains less coarse material and more medium sand - more evenly graded				16
17			As above but predominantly medium sand				17
18			Becoming whiter in colour				18
19							19
20		20.00					20

GHD MANAGEMENT ENGINEERING ENVIRONMENT

GROUNDWATER BORE LOG

Bore No.: MW1

CLIENT: East Gippsland Shire Council
PROJECT: Bairnsdale Regional Landfill Drilling
JOB No.: 31/17063
LOCATION: Johnsons Road Landfill, Bairnsdale
CONTRACTOR: Action Water Boring
EQUIPMENT: Cable Tool Rig
R.L. SURFACE (m):
R.L. TOC (m):
EASTING:
NORTHING:

COMMENCED: 27/07/05
COMPLETED: 02/08/05
LOGGED BY: SF
CHECKED BY: GF
TOTAL DEPTH (m): 23 m
DIAMETER (mm): 50 mm

Depth (m)	Method	Depth / Elevation	LITHOLOGICAL DESCRIPTION@#AS1726 Soil Group Symbol, soil types, particle characteristics or fines plasticity, matrix type, porosity, secondary and minor components.	Water	Casing Details	Graphic Log	Depth (m)
21			**SAND** Very fine with minor medium to coarse sand, powders when dry				21
			Contains trace clay	02/08/05			
22			Sand becoming slightly coarser (medium grain size)				22
23			Sand becoming coarser, medium to coarse quartz, orange coloured quartz particles increasing in quantity				23
24							24
25		25.00					25

GHD MANAGEMENT ENGINEERING ENVIRONMENT

GROUNDWATER BORE LOG

Bore No.: MW2

CLIENT: **East Gippsland Shire Council** | COMMENCED: **20/07/05**

PROJECT: **Bairnsdale Regional Landfill Drilling** | JOB No.: **31/17063** | COMPLETED: **22/07/05**

LOCATION: **Johnsons Road Landfill, Bairnsdale** | LOGGED BY: **SF**

CONTRACTOR: **Action Water Boring** | EQUIPMENT: **Cable Tool Rig** | CHECKED BY: **GF**

R.L. SURFACE (m): | R.L. TOC (m): | TOTAL DEPTH (m): **17 m**

EASTING: | NORTHING: | DIAMETER (mm): **50 mm**

Depth (m)	Method	Depth / Elevation	LITHOLOGICAL DESCRIPTION@#AS1726 Soil Group Symbol, soil types, particle characteristics or fines plasticity, matrix type, porosity, secondary and minor components.	Water	Casing Details	Graphic Log	Depth (m)
			Ground Surface				
0		0.00	**CLAY** Brownish grey, contains roots & vegetation, moderately to highly plastic becoming mottled with depth (dark yellowish orange)				0
		0.50	**Silty CLAY** Dark yellowish brown, highly plastic but crumbly, contains minor moderate brown mottling Moderate yellowish brown in colour, crumbles easily Contains some fine black organic matter (1-2%) Moderate yellowish brown with pale yellowish brown mottling, crumbly				
1		1.80	**Sandy CLAY** Moderate yellowish brown with pale yellowish brown mottling, clay is highly plastic, sand is rounded to subangular, medium to coarse with trace gravel to 10mm (<1%), gravel is quartz, well rounded, poor sorting. Proportion of gravel increasing to 1-2%, size to <15mm.				1
2		3.50	**Sandy gravelly CLAY** Moderate yellowish brown sandy, gravelley clay, medium to coarse sand and gravel (to 50mm). Gravel is quartz (white & clear), well rounded (some sheared), gravel content ~15%. Gravel size to 80mm but proportion decrease to 10%.				2
3		4.50	**Clayey SAND/Gravel** Moderate yellowish brown clayey sand/gravel with light brown sandy clay and medium light grey clayey sand mottling. Sand is medium to coarse, gravel to 50mm which is quartz (white) and rounded material is poorly sorted, gravel content ~10%.				3
4							4
5		5.00					5

GHD MANAGEMENT ENGINEERING ENVIRONMENT

GROUNDWATER BORE LOG

Bore No.: MW2

CLIENT: **East Gippsland Shire Council** | COMMENCED: **20/07/05**

PROJECT: **Bairnsdale Regional Landfill Drilling** | JOB No.: **31/17063** | COMPLETED: **22/07/05**

LOCATION: **Johnsons Road Landfill, Bairnsdale** | LOGGED BY: **SF**

CONTRACTOR: **Action Water Boring** | EQUIPMENT: **Cable Tool Rig** | CHECKED BY: **GF**

R.L. SURFACE (m): | R.L. TOC (m): | TOTAL DEPTH (m): **17 m**

EASTING: | NORTHING: | DIAMETER (mm): **50 mm**

Depth (m)	Method	Depth / Elevation	LITHOLOGICAL DESCRIPTION@#AS1726 Soil Group Symbol, soil types, particle characteristics or fines plasticity, matrix type, porosity, secondary and minor components.	Water	Casing Details	Graphic Log	Depth (m)
			Contains only trace gravel (1%), gravel size to 40mm, clayey sand crumbles when dry but plastic when wet.				
			Gravel size decreasing (10mm) but proportion greater than above.				
6			Proportion of gravel decreasing to about 1-2%, sand grain size is medium to very coarse.				6
			No gravel present				
7		7.00	**SAND** Dark yellowish orange sand with trace clay, fine to coarse sand, subangular to subrounded, poorly sorted, contains clear, white and trace black particles, finer material more angular while coarser material more rounded.				7
8			Medium sized sand fraction absent (gap graded), sand particles predominantly white and clear but few trace black particles present.				8
9			Contains gravel (1-2%), quartz, white, rounded, to 10mm diameter.				9
10		10.00					10

GHD MANAGEMENT ENGINEERING ENVIRONMENT

GROUNDWATER BORE LOG

Bore No.: MW2

CLIENT: **East Gippsland Shire Council** | COMMENCED: **20/07/05**
PROJECT: **Bairnsdale Regional Landfill Drilling** | JOB No.: **31/17063** | COMPLETED: **22/07/05**
LOCATION: **Johnsons Road Landfill, Bairnsdale** | LOGGED BY: **SF**
CONTRACTOR: **Action Water Boring** | EQUIPMENT: **Cable Tool Rig** | CHECKED BY: **GF**
R.L. SURFACE (m): | R.L. TOC (m): | TOTAL DEPTH (m): **17 m**
EASTING: | NORTHING: | DIAMETER (mm): **50 mm**

Depth (m)	Method	Depth / Elevation	LITHOLOGICAL DESCRIPTION@#AS1726 Soil Group Symbol, soil types, particle characteristics or fines plasticity, matrix type, porosity, secondary and minor components.	Water	Casing Details	Graphic Log	Depth (m)
			SAND As above Gravel absent (possibly due to sample recovery technique?)				
11			Greyish orange sand, medium to coarse, particles are white, clear, orange and trace black (like beach sand). Contains trace clay when bagged but settled in free standing sample.	Water added for drilling			11
12			Contains coarser sand (to 1mm) and medium sand fraction absent				12
13			Sand finer (like 11-12m sample)				13
14			Contains coarser sand (to 2mm), increased clay content.				14
15		15.00					15

GHD MANAGEMENT ENGINEERING ENVIRONMENT

GROUNDWATER BORE LOG

Bore No.: MW2

CLIENT: **East Gippsland Shire Council** | COMMENCED: **20/07/05**

PROJECT: **Bairnsdale Regional Landfill Drilling** | JOB No.: **31/17063** | COMPLETED: **22/07/05**

LOCATION: **Johnsons Road Landfill, Bairnsdale** | LOGGED BY: **SF**

CONTRACTOR: **Action Water Boring** | EQUIPMENT: **Cable Tool Rig** | CHECKED BY: **GF**

R.L. SURFACE (m): | R.L. TOC (m): | TOTAL DEPTH (m): **17 m**

EASTING: | NORTHING: | DIAMETER (mm): **50 mm**

Depth (m)	Method	Depth / Elevation	LITHOLOGICAL DESCRIPTION@#AS1726 Soil Group Symbol, soil types, particle characteristics or fines plasticity, matrix type, porosity, secondary and minor components.	Water	Casing Details	Graphic Log	Depth (m)
16			**SAND** As above Sand finer (like 11-12m sample)	22/07/05 in BH1			16
17							17
18							18
19							19
20		20.00					20

SOUTHERN Rural Water

SOUTHERN RURAL WATER
WATER ACT 1989
Section 67
BORE CONSTRUCTION LICENCE NO: 9022881
(Licence to construct and operate a bore)

Gippsland and Southern Rural Water (The Authority) authorises:

East Gippsland Shire Council C/- GHD Australia
Locked Bag 5
Morwell 3840

To Construct/Alter and operate a bore on the land described below and subject to the conditions stated.

Lot(s)		Plan of Subdivision No	
Allotment(s)	**Bairnsdale Regional Landfill**	Section	**Johnstons Road**
Parish	**Bairnsdale**	Township	**Bairnsdale**

For the purpose specified in the application namely: **Groundwater Investigation**

The Licence is valid until **22 June 2006**

CONDITIONS

1 This licence authorises the construction of TWO bore(s) only and has been assessed based on the location(s) specified in your application. When the bore(s) is / are drilled, if it / they is/ are considered unsatisfactory you may drill again at a location no greater than 20 metres from the authorised site(s).

2 At completion of the drilling, all but TWO bore(s) must be decommissioned in accordance with the Sect 18 of the Minimum Construction Requirements for Water Bores in Australia Edition 2.

3 The location of each bore must be given to the Authority as AMG co-ordinates listing 1:100,000 AMG map number, easting and northing.

4 The bore shall be constructed to a standard not less than the standard specified in the Minimum Construction Requirements for Water Bores in Australia (2nd Edition Revised September 2003), and to the satisfaction of the Authority.

5 Decommissioning of the bore(s) shall be undertaken as set out in section 18, 'Decommissioning of Bores (Abandonment) published within the book titled Minimum Construction Requirements for Water Bores in Australia, 2nd Edition Revised September 2003.'

6 The maximum depth for this bore is 40.0 metres. Any change to this must be approved by Southern Rural Water prior to drilling beyond this depth.

7 This bore must be constructed by or under the direct supervision of a Class 2 or Class 3 driller, licensed under the Water Act 1989.

8 Casing must be installed in the bore to a suitable depth and cemented where necessary to prevent the outbreak of pressure water. If pressure water is encountered a suitable valve must be fitted to the bore.

See over for further conditions and additional information

LICENSEES COPY

Mick Fennessy
Authorising Officer
Issued Date:22 June 2005

All communication should be addressed to: PO Box 153, MAFFRA VIC 3860

OTHER CONDITIONS

1. The well head of the bore shall be constructed in such a manner as to prevent the introduction of pollutants.

2. The Licensee must ensure that the bore is constructed at the site as indicated on the licence application form.

3. The location of the bore must be indicated on a map which will be sent to the Licensee after the bore has been constructed. The map must be promptly returned to the SRW.

4. The person responsible for the work is required to send a copy of a bore completion report to the SRW and to the Licensee within twenty eight (28) days after the bore is completed.

5. If the bore is to be located close to a septic tank system and is for domestic use the Licensee is advised to contact the local Municipal Authority to meet any requirements of that local Authority.

6. If a bore is unsuccessful, it is necessary to take action to protect the groundwater resource from wastage or pollution. This may be done by decommissioning the bore in accordance with approved methods.

7. If the bore has not been completed prior to the licence expiring the Licensee may apply to renew the licence.

8. This bore cannot be operated until such time as SRW acknowledges that a duly completed and acceptable Bore Completion Report has been received from you or your driller under the Water Act 1989.

9. Water taken under this licence should not be used for human consumption without appropriate treatment.

10. Bore casing wall thickness shall be sufficient to withstand the anticipated formation and hydrostatic pressures imposed on the casing during its installation, bore development and use – as set out in section 9 "Casing" published within the book titled 'Minimum Construction Requirements for Water Bores in Australia' Edition 2.

Disclaimer:

Due to varying environmental conditions the quality of water taken under this licence is not guaranteed. It is the responsibility of the licensee to establish the adequacy of the water quality as fit for the licensed purpose.

PLEASE NOTE:

It is an offence to operate a bore unless all conditions are met.

TABLE 1
BORE SUMMARY

Bore	Drilled Depth (m)	Screen From – To (m)	SWL* (m)
BH-5	30.0	24.1 – 30.0	25.1
BH-6	39.5	35.3 – 38.2	35.0

*SWL – Standing Water Level from top of pipe

A Bore Construction Licence (No. 55278) was obtained by Geo-Eng on behalf of EGSC from Southern Rural Water, authorising the construction of the two groundwater monitoring bores. A copy of the Bore Construction Licence is attached as Appendix 3.

Geo-Eng appreciates the opportunity of working with East Gippsland Shire Council on this project. If you have any questions please contact the undersigned on (03) 51339511.

Yours sincerely

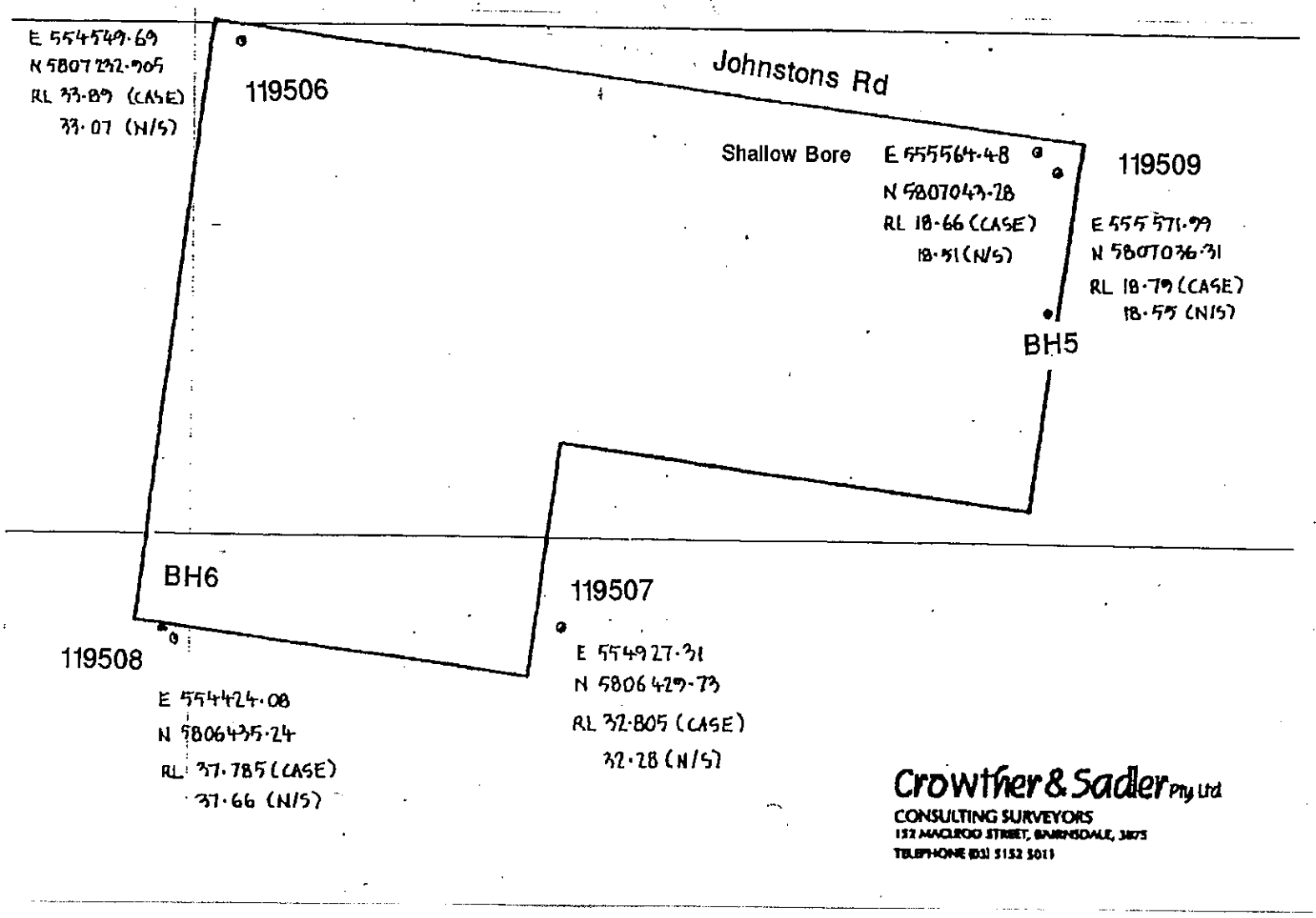
Anthony Feigl
Hydrogeologist

Reviewed by

Mark Pratt
Senior Hydrogeologist

Enclosures: Appendix 1 – Site Map
Appendix 2 – Lithologic logs and bore completion reports
Appendix 3 – Bore Construction Licence

APPENDIX 1
SITE MAP



GEO-ENG Supporting the Mining, Civil, Water and Environmental Industries	BY	FIGURE 1
	MP	JOHNSTONS ROAD REGIONAL LANDFILL
	1576/52273/4	REVIEW OF GROUNDWATER MONITORING
	23/11/99	MONITORING BORE LOCATIONS

APPENDIX 2
LITHOLOGIC LOGS AND BORE COMPLETION REPORTS

Geo-Eng Australia

BOREHOLE LOG **BORE: BH 5**

Client: East Gippsland Shire Council

Project: Johnstons Rd Bairnsdale Landfill Monitoring Bores

Job No. 1576/9540

Drill Type: Cable Tool Hole Diam: 152mm Coords: E
Drilling Method: Sand Pump N
Fluid: Water (to 24m) Date Drilled: 16/2/2000 - 17/2/2000

Dip: 90 RLNS:
RLTC:
Logged by: APF
Date: 18/02/00

Water Struck (m)	Moisture	Depth	Soil Classification	Sample / test	Material Description	Bore Construction
←			OL	D	Loamy silt, pale yellowish brown, to 0.2 m.	seal Cement 0.0 - 1.0 m
←		1	CL	D	Clay with minor silt, friable, mottled greyish orange and very pale orange.	
		2				
←		3	CL	D	Sandy and gravely clay with minor silt, sand fraction increasing with depth to 50% at 5.0m, friable, greyish orange.	
		4				
		5				cuttings 1.0 - 21.3 m
←		6	SC	D	Clayey quartz sand, fine to medium grains, moderate sorting, rounded, high sphericity, thin bands (10 mm) of micaceous silt.	
←		7	ML	D	Sandy silt and clay, micaceous, friable, mottled very light grey and pale yellowish orange.	
		8				casing 50mm uPVC CL12 24.1 - (+)1.0 m
←		9	SC	D	Gravelly quartz sand with minor clay (10%) and minor quartz cobbles (80 mm), fine to medium sand grains, moderate sorting, rounded, high sphericity, dark yellowish orange, thin bands of micaceous silt.	
		10				
		11				
		12				
←		13	SW	D	Quartz sand, minor (5%) clay, minor (5%) quartz cobbles (70mm) to 12.0 m, medium to coarse sand grains, well sorted, rounded, high sphericity, dark yellowish orange.	
		14				
		15				
		16				
←		17	SW	D	Quartz sand, minor (10%) clay, fine to medium sand grains, well sorted, rounded, high sphericity, dark yellowish orange, contains 30 mm bands of greasy mica-rich light grey silt.	
←		18	SW	D	Quartz sand, minor (5%) clay, fine to medium sand grains, well sorted, rounded, high sphericity, dark yellowish orange.	
		19				
		20				
		21				seal Bentonite clay 21.3 - 22.5 m
		22				
		23	SM	D	Silty quartz sand, minor clay (5%), minor quartz gravel (<30mm) above 22.0 m, fine to coarse sand grains, poorly sorted, subangular to rounded, high sphericity, coarse sand fraction decreasing with depth, dark yellowish orange.	gravel pack Maryvale 8/16 22.5 - 30.0 m
		24				
v 18/02/2000						

Water
- v 6/6/77 — Water Level & Date
- → Water Inflow
- ← Water Loss

Moisture
- Dr Dry
- M Moist
- W Wet
- S Saturated

Samples & Tests
- Uxx Undisturbed Sample & Diameter
- D Disturbed Sample
- N Std Penetration Test (SPT) & Value
- Nc Cone Penetrometer
- S Shear Vane Strength
- SP Split Spoon Sample
- Ws Water Sample

Notes and Comments

Drawn: AF
Approved: MP
Doc No: 9540/05

Water Struck (m)	Moisture	Depth	Soil Classification	Sample / test	Material Description	Bore Construction
		26				
		27				
		28				
→	S	29	SW	D	Silty quartz sand, minor clay (5%), fine sand grains, well sorted, subangular to subrounded, high sphericity, dark yellowish orange.	screen slotted 50mm uPVC CL12 24.1 - 30.0 m
		30			Borehole terminated at 30.0 metres.	
		31				
		32				
		33				
		34				
		35				
		36				
		37				
		38				
		39				
		40				
		41				
		42				
		43				
		44				
		45				
		46				
		47				
		48				
		49				
		50				
		51				
		52				
		53				
		54				
		55				
		56				
		57				

Water
- v 6/5/77 — Water Level & Date
- → Water Inflow
- ← Water Loss

Moisture
- Dr Dry
- M Moist
- W Wet
- S Saturated

Samples & Tests
- Uxx Undisturbed Sample & Diameter
- D Disturbed Sample
- N Std Penetration Test (SPT) & Value
- Nc Cone Penetrometer
- S Shear Vane Strength
- SP Split Spoon Sample
- Ws Water Sample

Notes and Comments

Bore developed by bailing at approx 0.1L/s for 0.5 hours.

Drawn: AF
Approved: MP
Doc No: 9540/05

Geo-Eng Australia

BOREHOLE LOG **BORE: BH-6**

Client: East Gippsland Shire Council

Project: Johnstons Rd Bairnsdale Landfill Monitoring Bores

Job No. 1576/9540

Drill Type: Cable Tool | Hole Diam: 152mm | Coords: E
Drilling Method: Sand Pump | N
Fluid: Water (to 26m) | Date Drilled: 11/2/2000 - 14/2/2000

Dip: 90 | RLNS: | RLTC:

Logged by: APF
Date: 11/2/2000 - 14/2/2000

Water Struck (m)	Moisture	Depth	Soil Classification	Sample / test	Material Description	Bore Construction
←			OL	D	Loamy silt, pale yellowish brown, to 0.2 metres.	seal Cement 0.0 - 1.0 m
←		1	CL	D	Silty clay, mottled light brown, red and grey, to 2.2 metres.	
←		2	CL	D	Silty clay with minor gravel (10%), mottled brown, red and grey.	
←			CL	D	Sandy clay with minor gravel (10%), mottled very light brown and white.	
		3				
		4				
←		5	SC	D	Clayey quartz sand with minor gravel, medium grain size, light brown.	cuttings 1.0 - 27.0 m
		6				
		7				
		8				casing 50mm uPVC CL12 35.3 - (+)1.0 m
		9				
		10				
←		11	SC	D	Clayey quartz sand, medium grain size, moderate brown.	
		12				
		13				
←		14	SW	D	Quartz sand, medium grain size, generally well sorted but minor coarse quartz sand.	
		15				
←		16	SC	D	Clayey quartz sand, medium grain size.	
		17				
		18				
		19				
←		20	SW	D	Quartz sand, medium grain size, well sorted at top of unit, minor coarse quartz sand increasing with depth.	
		21				
		22				
		23				
←		24	SW	D	Quartz sand, fine grains, well sorted.	

Water

- v 6/5/77 — Water Level & Date
- → Water Inflow
- ← Water Loss

Moisture

- Dr Dry
- M Moist
- W Wet
- S Saturated

Samples & Tests

- Uxx Undisturbed Sample & Diameter
- D Disturbed Sample
- N Std Penetration Test (SPT) & Value
- Nc Cone Penetrometer
- S Shear Vane Strength
- SP Split Spoon Sample
- Ws Water Sample

Notes and Comments

Drawn: AF
Approved: MP
Doc No: 9540/05

Water Struck (m)	Moisture	Depth	Soil Classification	Sample / test	Material Description	Bore Construction
	Dr	26	SW	D	Quartz sand, fine to medium grains, moderately sorted.	seal Bentonite clay 27.0 - 28.0 m
	Dr	28	SW	D	Quartz sand, minor clay, coarse grains, subrounded to subangular, light brown.	
	Dr	29	SP	D	Quartz sand, medium grain size, poorly sorted, subrounded to subangular, light brown.	
	Dr	30	SW	D	Quartz sand, minor clay, medium grain size, well sorted, subrounded to subangular, reddish brown.	gravel pack Maryvale 8/16 28.0 - 39.5 m
	Dr	32	SW	D	Quartz sand, medium grain size, moderately sorted, bands of mica-rich pale brown silty clay.	
	Dr	33				
v 18/02/2000		34	SP	D	Quartz sand, fine to coarse grains, poorly sorted, subangular to subrounded, contains thin bands of mica-rich pale brown silty clay.	screen slotted 50mm uPVC CL12 35.3 - 38.2 m
→	S	36				
		38				sump 50mm uPVC CL12 38.2 - 39.1 m
→	S	39	SM	D	Silty quartz sand, fine to coarse grains, poorly sorted, subangular to subrounded, moderate brown.	
		40			Borehole terminated at 39.5 metres.	

Water
- v 6/5/77 Water Level & Date
- → Water Inflow
- ← Water Loss

Moisture
- Dr Dry
- M Moist
- W Wet
- S Saturated

Samples & Tests
- Uxx Undisturbed Sample & Diameter
- D Disturbed Sample
- N Std Penetration Test (SPT) & Value
- Nc Cone Penetrometer
- S Shear Vane Strength
- SP Split Spoon Sample
- Ws Water Sample

Notes and Comments

Bore developed by bailing at approx 0.1L/s for 0.5 hours. Water level immediately after bailing was 34.5 m.

Drawn: AF
Approved: MP
Doc No: 9540/05

geo-eng

APPENDIX 3
BORE CONSTRUCTION LICENCE

9540/4

SOUTHERN
Rural Water

15 February 2000

Mark Pratt
Geo-Eng Australia Pty Ltd
Locked Bag 5
MORWELL VIC. 3875

Dear Mark

APPLICATION FOR A BORE CONSTRUCTION LICENCE

Thank you for your recent application on behalf of East Gippsland Shire Council. Enclosed is Bore Construction Licence No. 55278 which authorises you to construct 2 groundwater investigation bores at the Bairnsdale site indicated in your application (in the Parish of Bairnsdale). Please note that all the conditions of the licence must be adhered to.

We shall be grateful if you will provide us with a detailed site plan showing the exact location of the 2 bores when it is available **(including AMG Co-ordinates)** for the Groundwater Database records.

An official receipt in respect of the $341.50 received in payment for this Licence is enclosed, for your records.

If you have any further enquires then please do not hesitate to contact Anthony Moulton, Licensing Officer, on (03) 5139 3152.

Yours sincerely

DERIC LIDDELOW
per Business Manager Licensing & Eastern Operations

Head Office: PO Box 153, Maffra Victoria 3860
Telephone (03) 5139 3100 Facsimile (03) 5139 3150
E-mail: srw@srw.org.au

Southern Rural Water

WATER ACT 1989
Section 67

BORE CONSTRUCTION LICENCE No 55278
(Licence to construct and operate a bore)

Southern Rural Water authorises:

EAST GIPPSLAND SHIRE COUNCIL, C/O GEO-ENG AUSTRALIA PTY LTD
LOCKED BAG 5
MORWELL VIC. 3840

To Construct / Alter and operate a bore on the land described below and subject to the conditions stated.

Lot(s)	-	Plan of subdivision no.	-
Allotment(s)	JOHNSTONS ROAD	Section	NO SEC
Parish	BAIRNSDALE	Township	BAIRNSDALE

for the purpose specified in the application namely: Groundwater Investigation,

This licence is issued for a period of twelve months and expires on 14.02.2001
Date of issue 15.02.2000

CONDITIONS

1. The bore must be constructed by or under the direct supervision of a Class 2 or Class 3 driller licensed under the Water Act 1989.(C02)
   This bore shall be no greater than 200.000 metres.
2. If the bore is considered unsatisfactory, it may be decommissioned and a replacement bore may then be constructed provided that the unwanted bore is decommissioned prior to the drilling rig leaving the site.(C04)
3. The driller shall notify the relevant Drilling Inspector at least one day prior to work commencing on a bore(s), and shall also notify the relevant Drilling Inspector if work is to cease for an extended period during drilling.(C06)
4. This licence authorises the construction of 2 bore(s) at the site(s) provided by the licensee.(C09)
5. The location of each bore must be given to the Authority as AMG co-ordinates listing 1:100,000 AMG map number, easting and northing.(C10)
6. The bore must be constructed in such a manner as to prevent aquifer contamination caused by vertical flow outside the casing.(C12)
7. An airline or piezometer for the measurement of water levels must be installed in the bore.(C20)
8. The bore shall be constructed to a standard not less than the standard specified in the minimum construction requirements for water bores in Australia (ARMCANZ, 1997), and to the satisfaction of the Authority. (C23)
9. Decommissioning of the bore(s) shall be carried out in accordance with the "Standard for decommissioning test bores, partially completed and completed bores".(D01)

See over for further conditions and additional information. Authorising Officer

All communications should be addressed to :

Chief Executive Officer,
Southern Rural Water
PO Box 153, MAFFRA, 3860
Telephone (03) 51393 152
Fax (03) 51393 150

Licensee's Copy

ADDITIONAL CONDITIONS

1. The well head of the bore shall be constructed in such a manner as to prevent the introduction of pollutants.

2. The Licensee must ensure that the bore is constructed at the site as indicated on the licence application form.

3. The location of the bore must be indicated on a map which will be sent to the Licensee after the bore has been constructed. The map must be promptly returned to the Authority.

4. The person responsible for the work is required to send a copy of a bore completion report to the Authority and to the Licensee within fourteen (14) working days after the bore is completed.

OTHER CONDITIONS

1. If the bore is to be located close to a septic tank system and is for domestic use the Licensee is advised to contact the local Municipal Authority to meet any requirements of that local Authority.

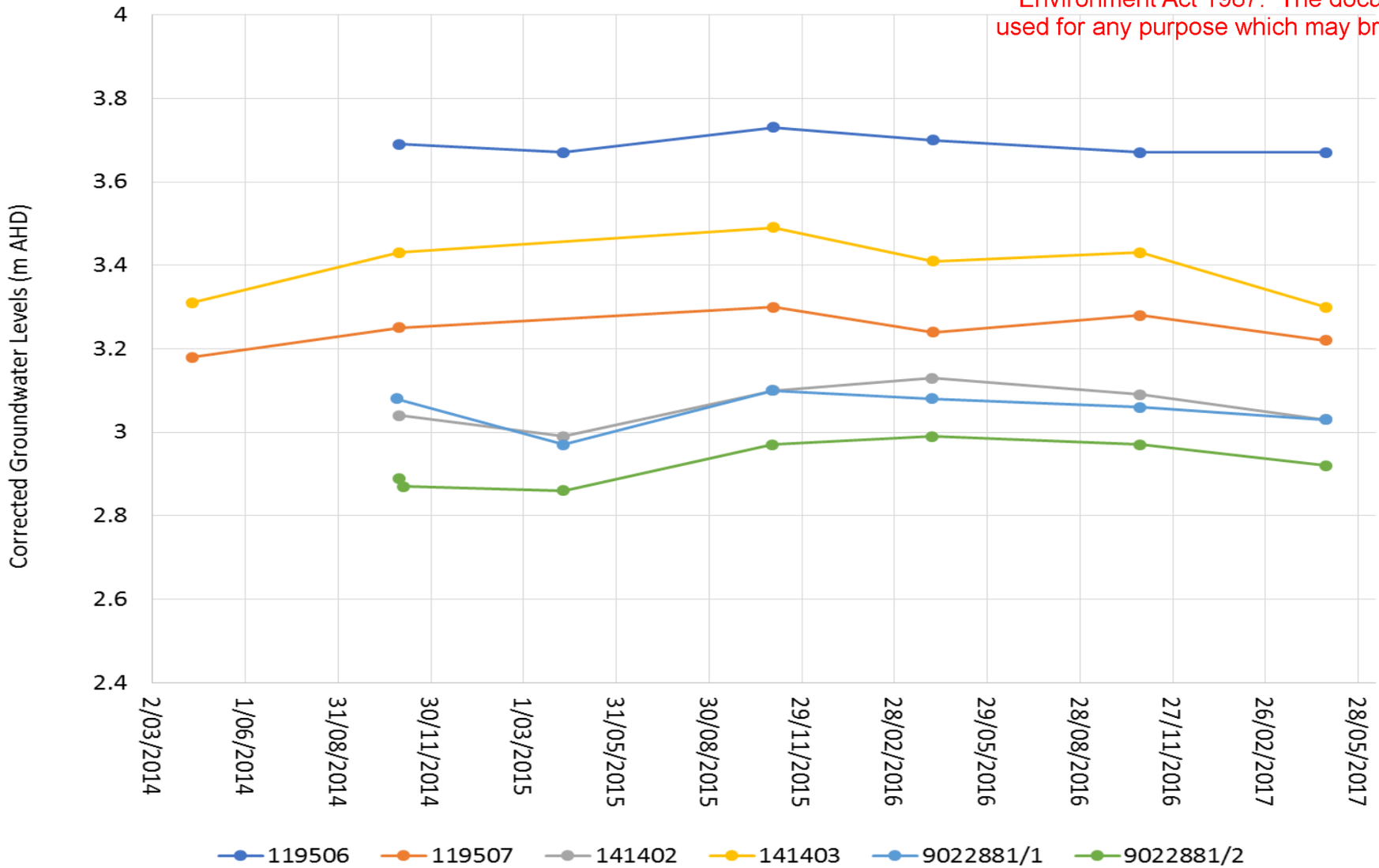
2. If a bore is unsuccessful, it is necessary to take action to protect the groundwater resource from wastage or pollution. This may be done by decommissioning the bore in accordance with approved methods.

3. If the bore has not been completed prior to the licence expiring the Licensee may apply to renew the licence.

APPENDIX B

Groundwater Levels

Well	10/04/2014	27/10/2014	30/10/2014	3/11/2014	9/04/2015	10/04/2015	31/10/2015	1/11/2015	2/11/2015	5/04/2016	6/04/2016	26/10/2016	26/04/2017
119506			3.69		3.67			3.73			3.7	3.67	3.67
119507	3.18		3.25					3.3			3.24	3.23	3.22
141402			3.04		2.99			3.1		3.13		3.09	3.03
141403	3.31		3.43					3.49			3.41	3.43	3.3
9022881/1		3.08			2.97		3.1			3.08		3.06	3.03
9022881/2			2.89	2.87	2.86		2.97			2.99		2.97	2.92

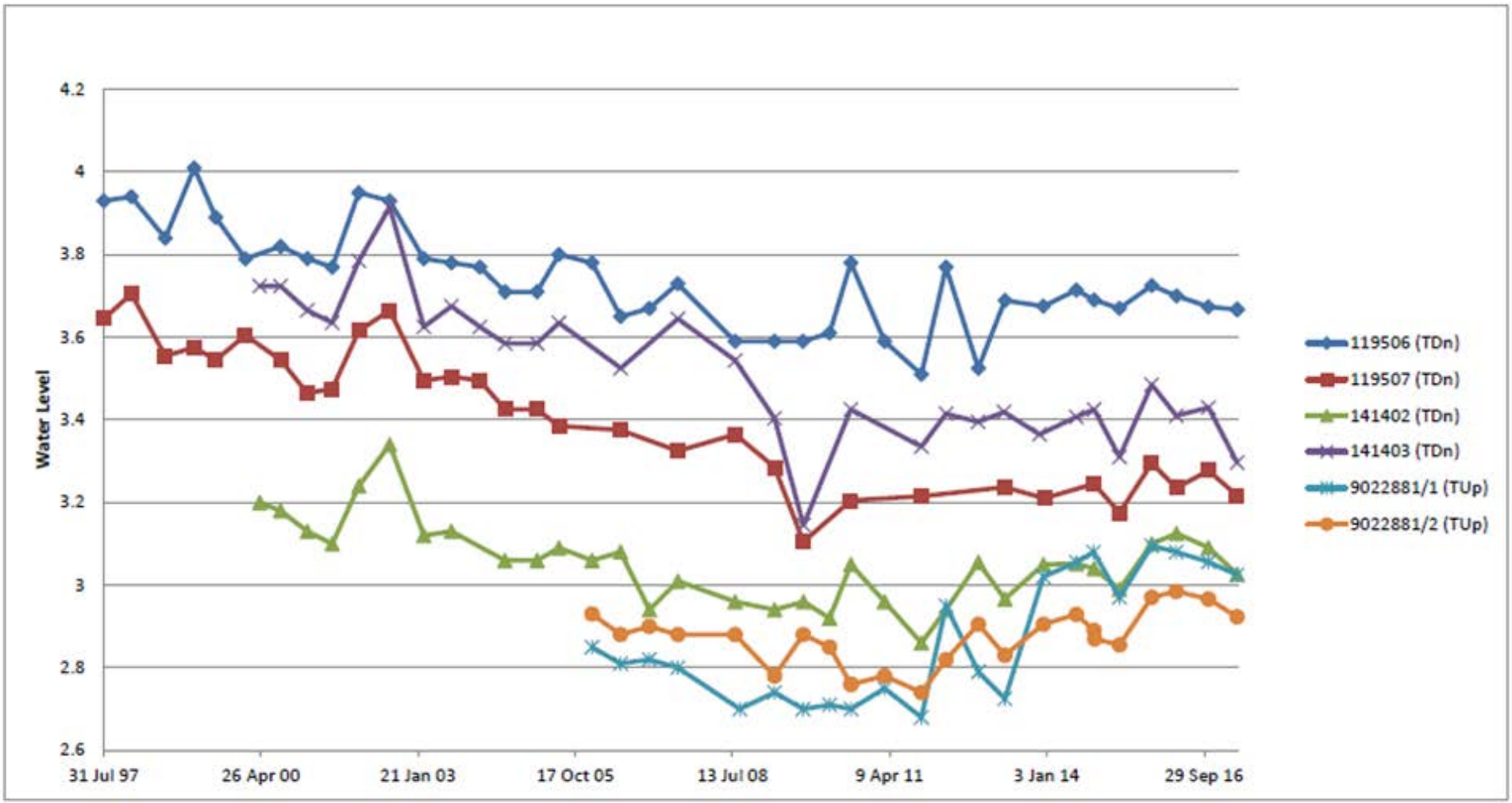


GOLDER

Drawn: EJK	Date:30/6/2018	**Water Levels - Bairnsdale Landfill**	
Checked: CLR	Date: 25/7/2018	**Haunted Hills Formation**	
Revision:	Date:		
Scale: As Shown	**A4**	Project No: 1789713-001	**Appendix A**

Cardno

Trend Graphs - Groundwater Water Levels



GOLDER

Drawn: EJK	Date:30/6/2018	**Long Term Groundwater Levels Haunted Hills Formation**	
Checked: CLR	Date: 25/7/2018		
Revision:	Date:		
Scale: As Shown	**A4**	Project No: 1789713-001	**Appendix A**

APPENDIX C

Groundwater, Surface Water and Leachate Chemistry

Location Type	Location Code	Sampled Date	Alkalinity (Bicarbonate as CaCO3) mg/L	Alkalinity (Carbonate as CaCO3) mg/L	Alkalinity (Hydroxide) as CaCO3 mg/L	Alkalinity (total) as CaCO3 mg/L	Ammonia as N mg/L
Groundwater	119506	8/01/1997	82	0.5		82	0.007
	119506	22/01/1998	82	0.5	0.5	82	0.01
	119506	26/08/1998	84	0.5		84	0.19
	119506	26/02/1999	84	0.5			0.0025
	119506	13/07/1999	81	0.5			0.0025
	119506	18/01/2000					0.018
	119506	29/08/2000					0.005
	119506	15/02/2001					0.5
	119506	24/07/2001					0.5
	119506	9/01/2002					0.02
	119506	24/07/2002					0.04
	119506	26/02/2003	74			74	0.12
	119506	22/08/2003	77			77	0.1
	119506	17/02/2004	88	0.5	0.5	88	0.041
	119506	28/07/2004	80				0.019
	119506	15/02/2005	80				0.005
	119506	5/07/2005	110				0.005
	119506	1/02/2006	78				0.005
	119506	1/08/2006	90				0.005
	119506	31/01/2007	78				0.01
	119506	30/07/2007	75				0.02
	119506	30/07/2008	100				0.025
	119506	6/04/2009	90				0.025
	119506	8/10/2009	56				0.025
	119506	22/03/2010				70	0.005
	119506	4/08/2010					0.005
	119506	8/03/2011	93				0.005
	119506	27/10/2011	95				0.005
	119506	10/04/2012				77	0.04
	119506	24/10/2012	81.97				0.005
	119506	8/04/2013	90.16				0.16
	119506	18/12/2013	80.3				0.04
	119506	18/12/2013	75.4				0.03
	119506	18/12/2013	69	0.5	0.5	69	0.04
	119506	9/07/2014	72				0.04
	119506	30/10/2014	70	0.5	0.5	70	0.05
	119506	9/04/2015	71	0.5	0.5	71	0.04
	119506	1/11/2015	75	0.5	0.5	75	0.06
	119506	6/04/2016	76	0.5	0.5	76	0.005
	119506	27/10/2016	74	0.5	0.5	74	0.005
	119506	27/04/2017	49	0.5	0.5	49	0.07

Location Type	Location Code	Sampled Date	Anions Total meq/L	Calcium Carbonate mg/L	Cations Total meq/L	Chloride mg/L	COD mg/L	Electrical conductivity *(lab) uS/cm	Ionic Balance %	Kjeldahl Nitrogen Total mg/L	Nitrate & Nitrite mg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L
Groundwater	119506	8/01/1997				330	50	1100		0.4		0.8	0.0025
	119506	22/01/1998				330	380	1200		1.9		0.92	0.009
	119506	26/08/1998				310	7.5	1200		1.2		0.94	0.0025
	119506	26/02/1999				330	110	1300		0.4		0.87	0.0025
	119506	13/07/1999				290	120	1300		0.4		0.81	0.0025
	119506	18/01/2000				330		1300		0.6		0.92	
	119506	29/08/2000				370		1400		0.4		1.1	
	119506	15/02/2001				480		1500		6			
	119506	24/07/2001				530		1500		0.5		5	
	119506	9/01/2002				417		1580		0.5		1.68	
	119506	24/07/2002						1790					
	119506	26/02/2003				485	74	1630		2.4	1.6		
	119506	22/08/2003				530	39	1800		0.1		1.6	0.025
	119506	17/02/2004				450	51	1900		1.3		1.6	0.01
	119506	28/07/2004				500	57	1900		16		1.6	
	119506	15/02/2005				520	19	1800		0.24		1.7	
	119506	5/07/2005				540	2.5	1900		0.1		1.8	
	119506	1/02/2006				550	2.5	1800		0.3		1.7	
	119506	1/08/2006				600	2.5	1900		0.05		1.8	
	119506	31/01/2007				610	2.5	2100		0.5		1.7	
	119506	30/07/2007				600	2.5	1900		0.05		2.4	
	119506	30/07/2008				620	2.5	3300		1.7		1.8	
	119506	6/04/2009				640	2.5	2200		1.6		1.6	
	119506	8/10/2009				630	2.5	2000		0.2		1.5	
	119506	22/03/2010				560	6.4	2000		0.4		1.4	
	119506	4/08/2010		82		520	2.5	1900		0.05		1.4	
	119506	8/03/2011				520	2.5	1700		0.1		1.3	
	119506	27/10/2011				560	2.5	1900		0.7		1.4	
	119506	10/04/2012				660	15	2300		0.9		1.5	
	119506	24/10/2012				520	8.8	1700		0.1		1.6	
	119506	8/04/2013				530	10	2000		0.2		1.4	
	119506	18/12/2013				550	10	2000		0.1		1.4	
	119506	18/12/2013				560	10	1900		0.1		1.4	
	119506	18/12/2013	20.3		18.4	646	5	2020	4.98	0.05		1.24	0.005
	119506	9/07/2014				510	10	1900		0.3		1.6	0.01
	119506	30/10/2014	18.7		17	591	15		4.56	0.2		1.2	0.005
	119506	9/04/2015	18.1		17.2	571	5		2.63	0.1		1.29	0.005
	119506	1/11/2015	17.6		17.1	549	5		1.32	0.05		1.5	0.005
	119506	6/04/2016	18.1		19.2	567	5		2.86	0.05		1.52	0.005
	119506	27/10/2016	18.7		16.1	588	5		7.49	0.05		1.35	0.005
	119506	27/04/2017	17.7		17.8	572	5		0.17	1		1.32	0.005

Location Type	Location Code	Sampled Date	Nitrate & Nitrite (as N) mg/L	Nitrogen (Total Oxidised) mg/L	Nitrogen (Total) mg/L	pH (Lab) pH Units	Phosphate total (P) mg/L	Sodium (Filtered) mg/L	Sulphate mg/L	Sulphate (Filtered) mg/L	Sulphate as S mg/L	Sulphate as S (Filtered) mg/L	TDS mg/L	TOC mg/L
Groundwater	119506	8/01/1997				6.4		230			5.333		620	
	119506	22/01/1998				6.3		190			6		740	
	119506	26/08/1998				6.4		190			6		660	
	119506	26/02/1999				6.4		190			5.333		670	
	119506	13/07/1999				6.4		240			5.667		700	
	119506	18/01/2000				6.4	0.06	230			5.667		720	
	119506	29/08/2000				6.8	0.12	250			6.333		730	
	119506	15/02/2001				6.6	0.025	240			5.667		800	
	119506	24/07/2001				6.7	0.025	230			6.667		870	
	119506	9/01/2002				6.07	0.39	279			8		960	
	119506	24/07/2002				6.64							903	
	119506	26/02/2003				6.59		287			9.667		1060	6
	119506	22/08/2003				6.3		290			10.67		1000	0.5
	119506	17/02/2004				6.6		320			6		1000	2.7
	119506	28/07/2004				6.5		290			11.67		1000	0.5
	119506	15/02/2005				6.4		310			11		1100	1
	119506	5/07/2005				6.5		320			10		1100	9
	119506	1/02/2006				6.4		310			9.8		1100	10
	119506	1/08/2006				6.6		350			11		1200	19
	119506	31/01/2007				6.9		360			12		1200	7
	119506	30/07/2007				6.2		350			12		1000	2.5
	119506	30/07/2008				6.6		370			11		1800	8.7
	119506	6/04/2009				6.9		380			12		1100	2.5
	119506	8/10/2009				6.7		350			12		1200	2.5
	119506	22/03/2010				6.7		300			13		1100	2.5
	119506	4/08/2010				6.6	0.025	330			11	11	1100	2.5
	119506	8/03/2011				6.9		320			10	10	1000	2.5
	119506	27/10/2011				6.6	0.26	340			12	12	1200	6.5
	119506	10/04/2012				6.9		420			10	10	1300	2.5
	119506	24/10/2012				6		300			12	12	1000	14
	119506	8/04/2013				6.6		290			9.8	9.8	990	2.5
	119506	18/12/2013		1.4	1.4			270			7.2	7.2	1100	2.5
	119506	18/12/2013		1.4	1.4			280			7.2	7.2	970	2.5
	119506	18/12/2013		1.24	1.2			340		10.67			1060	0.5
	119506	9/07/2014			1.9		0.025	290			9.1	9.1	930	10
	119506	30/10/2014		1.2	1.4	6.7		315		29	9.7		1070	3
	119506	9/04/2015		1.29	1.4	5.94		320		28	9.3		1050	0.5
	119506	1/11/2015		1.5	1.5	5.75		317		29			1120	0.5
	119506	6/04/2016		1.52	1.5	6.82		363		28			1070	0.5
	119506	27/10/2016		1.35	1.4	6.57		304		30	10		1070	0.5
	119506	27/04/2017		1.32	2.3	5.15		325		28			999	1

Location Type	Location Code	Sampled Date	Hardness as CaCO3 mg/L	Turbidity NTU	Sulfate as SO4 - Turbidimetric (Filtered mg/L	Volatile Fatty Acids (as Acetic Acid) mg/L	Nitrogen (Organic) mg/L	Volatile Fatty Acids mg/L
Groundwater	119506	8/01/1997	68					
	119506	22/01/1998	88					
	119506	26/08/1998	81					
	119506	26/02/1999	90					
	119506	13/07/1999	90					
	119506	18/01/2000						
	119506	29/08/2000						
	119506	15/02/2001						
	119506	24/07/2001						
	119506	9/01/2002						
	119506	24/07/2002						
	119506	26/02/2003	171					
	119506	22/08/2003						
	119506	17/02/2004	160					
	119506	28/07/2004						
	119506	15/02/2005						
	119506	5/07/2005						
	119506	1/02/2006						
	119506	1/08/2006						
	119506	31/01/2007						
	119506	30/07/2007						
	119506	30/07/2008						
	119506	6/04/2009						
	119506	8/10/2009						
	119506	22/03/2010						
	119506	4/08/2010						
	119506	8/03/2011						
	119506	27/10/2011						
	119506	10/04/2012						
	119506	24/10/2012						
	119506	8/04/2013						
	119506	18/12/2013						
	119506	18/12/2013						
	119506	18/12/2013						
	119506	9/07/2014		33.5			0.3	
	119506	30/10/2014						27
	119506	9/04/2015						16
	119506	1/11/2015						17
	119506	6/04/2016						10
	119506	27/10/2016			30	12		12
	119506	27/04/2017				85		85

Location Type	Location Code	Sampled Date	Alkalinity (Bicarbonate as CaCO3) mg/L	Alkalinity (Carbonate as CaCO3) mg/L	Alkalinity (Hydroxide) as CaCO3 mg/L	Alkalinity (total) as CaCO3 mg/L	Ammonia as N mg/L
Groundwater	119507	8/01/1997	110	0.5	0.5	110	0.098
	119507	22/01/1998	99	0.5		99	0.065
	119507	26/08/1998	96	0.5			0.032
	119507	26/02/1999	100	0.5			0.016
	119507	13/07/1999					0.096
	119507	18/01/2000					0.028
	119507	29/08/2000					0.5
	119507	15/02/2001					0.5
	119507	24/07/2001					0.09
	119507	9/01/2002					0.12
	119507	24/07/2002	127			127	0.12
	119507	26/02/2003	130			130	0.1
	119507	21/08/2003	150	0.5	0.5	150	1
	119507	17/02/2004	120				0.17
	119507	28/07/2004	140				2.5
	119507	15/06/2005	140				0.38
	119507	6/07/2005	130				0.06
	119507	1/08/2006	120				0.11
	119507	1/08/2007	140				1.1
	119507	31/07/2008	110				0.15
	119507	8/04/2009	120				0.07
	119507	7/10/2009					0.07
	119507	5/08/2010	120				0.04
	119507	27/10/2011	120	5		120	0.05
	119507	12/04/2012	114.8				0.005
	119507	23/10/2012	122.96				0.06
	119507	9/04/2013	122.95				0.04
	119507	12/04/2013	114.7				0.18
	119507	18/12/2013	130				1.9
	119507	10/07/2014	106	0.5	0.5	106	0.05
	119507	30/10/2014	105	0.5	0.5	105	0.13
	119507	10/04/2015	118	0.5	0.5	118	0.03
	119507	1/11/2015	106	0.5	0.5	106	0.03
	119507	6/04/2016	102	0.5	0.5	102	0.005
	119507	27/10/2016	84	0.5	0.5	84	0.01
Groundwater	141402	29/08/2000					0.025
	141402	15/02/2001					0.5
	141402	24/07/2001					0.05
	141402	9/01/2002					0.02
	141402	24/07/2002					0.03
	141402	26/02/2003	33			33	0.12
	141402	21/08/2003	32			32	0.1
	141402	17/02/2004	33	0.5	0.5	33	0.013
	141402	27/07/2004	34				0.016
	141402	15/02/2005	45				0.03
	141402	5/07/2005	36				0.01
	141402	31/01/2006	42				0.005
	141402	1/08/2006	46				0.005
	141402	31/01/2007	38				0.19
	141402	1/08/2007	44				0.005
	141402	29/07/2008	60				0.025
	141402	6/04/2009	40				0.025
	141402	6/10/2009	48				0.025
	141402	23/03/2010				44	0.005
	141402	5/08/2010					0.03
	141402	7/03/2011	60				0.09
	141402	27/10/2011	62				0.03

Location Type	Location Code	Sampled Date	Anions Total meq/L	Calcium Carbonate mg/L	Cations Total meq/L	Chloride mg/L	COD mg/L	Electrical conductivity *(lab) uS/cm	Ionic Balance %	Kjeldahl Nitrogen Total mg/L	Nitrate & Nitrite mg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L
	119507	8/01/1997				710	370	2500		1		0.04	0.0025
	119507	22/01/1998				700	7.5	2600		0.7		0.046	0.0025
	119507	26/08/1998				660	120	2500		0.3		0.006	0.0025
	119507	26/02/1999				720	54	2500		0.3		0.03	0.0025
	119507	13/07/1999				670		2500		0.6		0.039	
	119507	18/01/2000				640		2400		0.1		0.013	
	119507	29/08/2000				740		2210		0.5			
	119507	15/02/2001				760		2100		0.5		0.025	
	119507	24/07/2001				590		2290		0.5		0.005	
	119507	9/01/2002						2400					
	119507	24/07/2002				591	82	2060		0.5	0.04		
	119507	26/02/2003				630	52	2200		0.1		0.0025	0.0025
	119507	21/08/2003				570	190	2200		7.2		0.022	0.021
	119507	17/02/2004				590	160	2300		0.8		0.072	
	119507	28/07/2004				590	36	2000		2.5		0.04	
	119507	15/06/2005				620	6	2200		0.9		0.19	
	119507	6/07/2005				600	22	2000		0.1		0.1	
Groundwater	119507	1/08/2006				580	6.4	2300		0.1		0.13	
	119507	1/08/2007				610	64	2200		1.9		0.01	
	119507	31/07/2008				750	37	2400		0.7		0.16	
	119507	8/04/2009				600	2.5	2000		0.3		0.07	
	119507	7/10/2009		110		790	2.5	2600		0.05		0.24	
	119507	5/08/2010				560	2.5	2000		0.9		0.12	
	119507	27/10/2011				620	14	2200		0.1		0.16	
	119507	12/04/2012				580	7	1900		0.1		0.05	
	119507	23/10/2012				570	10	2200		0.1		0.1	
	119507	9/04/2013				570	23	2200		0.1		0.08	
	119507	12/04/2013				580	10	2100		0.1		0.05	
	119507	18/12/2013				560	10	2200		2		0.06	0.01
	119507	10/07/2014	21		19	640	5		5.1	0.05		0.07	0.005
	119507	30/10/2014	20.3		19.8	615	5		1.26	0.2		0.43	0.005
	119507	10/04/2015	20.8		20.5	626	5		0.73	0.05		0.16	0.005
	119507	1/11/2015	21.9		24.1	668	5		4.78	0.05		0.15	0.005
	119507	6/04/2016	23.1		19.2	714	5		9.21	0.05		0.05	0.005
	119507	27/10/2016	22.1		22.3	692	5		0.4	0.1		0.1	0.005
	141402	29/08/2000				290		1100		7.6		0.95	
	141402	15/02/2001				370		1140		3			
	141402	24/07/2001				390		1100		0.5		7.4	
	141402	9/01/2002				304		1020		6.9		2.52	
	141402	24/07/2002						1210					
	141402	26/02/2003				325	114	1040		3.1	2.22		
	141402	21/08/2003				340	53	1200		0.2		2	0.0025
	141402	17/02/2004				310	52	1100		1.1		2.5	0.012
	141402	27/07/2004				330	37	1200		1.3		2.3	
	141402	15/02/2005				320	17	1200		0.28		2.2	
	141402	5/07/2005				360	0.5	1200		1.7		2.1	
	141402	31/01/2006				350	2.5	1100		0.2		2.2	
	141402	1/08/2006				320	5	1000		0.05		2.2	
	141402	31/01/2007				370	2.5	1200		0.05		2	
	141402	1/08/2007				430	2.5	1400		0.05		2.5	
	141402	29/07/2008				300	2.5	1000		2.4		2.5	
	141402	6/04/2009				400	2.5	1200		1.5		2.4	
	141402	6/10/2009				350	2.5	1100		0.6		2.6	
	141402	23/03/2010				340	11	1200		1		2.4	
Groundwater	141402	5/08/2010		40		350	2.5	1300		0.6		2.7	
	141402	7/03/2011				370	6.9	1300		0.05		2.9	
	141402	27/10/2011				350	2.5	1100		2.2		2.9	

Location Type	Location Code	Sampled Date	Nitrate & Nitrite (as N) mg/L	Nitrogen (Total Oxidised) mg/L	Nitrogen (Total) mg/L	pH (Lab) pH Units	Phosphate total (P) mg/L	Sodium (Filtered) mg/L	Sulphate mg/L	Sulphate (Filtered) mg/L	Sulphate as S mg/L	Sulphate as S (Filtered) mg/L	TDS mg/L	TOC mg/L
	119507	8/01/1997				6.3		380			19		1300	
	119507	22/01/1998				6.4		350			19.33		1400	
	119507	26/08/1998				7.2		350			20		1300	
	119507	26/02/1999				6.4		440			17.67		1400	
	119507	13/07/1999				6.5	0.08	430			17.33		1300	
	119507	18/01/2000				6.8	0.05	450			15		1200	
	119507	29/08/2000				6.9	0.025	400			12.67		1300	
	119507	15/02/2001				6.7	0.025	370			22		1200	
	119507	24/07/2001				6.46	0.3	419			15		1210	
	119507	9/01/2002				6.68							1250	
	119507	24/07/2002				6		387			14.67		1220	6
	119507	26/02/2003				7.2		390			14.67		1200	2.2
	119507	21/08/2003				6.6		370			6.667		1200	2.4
	119507	17/02/2004				6.6		380			15.33		1300	0.5
	119507	28/07/2004				6.3		370			10		1300	35
	119507	15/06/2005				6.5		370			13		1200	7
	119507	6/07/2005				6.5		380			15		1200	10
Groundwater	119507	1/08/2006				6.3		370			16		1100	2.5
	119507	1/08/2007				6.6		400			12		1100	2.5
	119507	31/07/2008				6.6		450			17		1200	2.5
	119507	8/04/2009				6.6		360			16		1200	
	119507	7/10/2009				6.9	0.025	470			17	17	1400	2.5
	119507	5/08/2010				6.6	0.29	370			16	16	1200	2.5
	119507	27/10/2011				7.1		390			16	16	1400	2.5
	119507	12/04/2012				6.3		350			16	16	1200	2.5
	119507	23/10/2012				6.7		340			14	14	1100	2.5
	119507	9/04/2013				6.8		340			14	14	1100	2.5
	119507	12/04/2013		0.05	0.1			310			10	10	1100	2.5
	119507	18/12/2013			2.1		1	340			8.6	8.6	1100	16
	119507	10/07/2014		0.07	0.05	6.46		355		39	13		1170	0.5
	119507	30/10/2014		0.43	0.6	6.42		374		40	13.3		1230	0.5
	119507	10/04/2015		0.16	0.2	6.44		384		38			1320	0.5
	119507	1/11/2015		0.15	0.2	6.52		464		45			1250	2
	119507	6/04/2016		0.05	0.05	6.32		365		46	15.3		1300	0.5
	119507	27/10/2016		0.1	0.2	5.27		414		45			1250	0.5
	141402	29/08/2000				6.7	1.1	160			3.667		550	
	141402	15/02/2001				6.7	0.025	160			3.667		630	
	141402	24/07/2001				6.4	0.025	150			4.667		640	
	141402	9/01/2002				6.16	13.7	167			3.333		1060	
	141402	24/07/2002				6.33							995	
	141402	26/02/2003				6		174			3.667		932	6
	141402	21/08/2003				6		180			4.667		660	3.1
	141402	17/02/2004				6.2		170			3.333		620	2
	141402	27/07/2004				6.2		170			5		660	0.5
	141402	15/02/2005				6		170			4.8		790	10
	141402	5/07/2005				6.3		230			6.3		680	16
	141402	31/01/2006				6.3		190			3.2		630	13
	141402	1/08/2006				6.3		170			5.8		640	16
	141402	31/01/2007				6.6		180			5.5		660	7
	141402	1/08/2007				6.1		250			5.7		800	2.5
	141402	29/07/2008				6.3		170			6.3		630	21
	141402	6/04/2009				6.5		200			18		750	2.5
	141402	6/10/2009				6.5		180			6.1		620	
	141402	23/03/2010				6.5		160			8.4		670	2.5
Groundwater	141402	5/08/2010				6.4	0.025	190			5	5	690	2.5
	141402	7/03/2011				6.3		190			6.2	6.2	710	2.5
	141402	27/10/2011				6.4	0.025	190			8.7	8.7	690	2.5

Location Type	Location Code	Sampled Date	Hardness as CaCO3 mg/L	Turbidity NTU	Sulfate as SO4 - Turbidimetric (Filtered mg/L	Volatile Fatty Acids (as Acetic Acid) mg/L	Nitrogen (Organic) mg/L	Volatile Fatty Acids mg/L
	119507	8/01/1997	260					
	119507	22/01/1998	240					
	119507	26/08/1998	240					
	119507	26/02/1999	220					
	119507	13/07/1999						
	119507	18/01/2000						
	119507	29/08/2000						
	119507	15/02/2001						
	119507	24/07/2001						
	119507	9/01/2002						
	119507	24/07/2002	183					
	119507	26/02/2003						
	119507	21/08/2003	170					
	119507	17/02/2004						
	119507	28/07/2004						
	119507	15/06/2005						
	119507	6/07/2005						
Groundwater	119507	1/08/2006						
	119507	1/08/2007						
	119507	31/07/2008						
	119507	8/04/2009						
	119507	7/10/2009						
	119507	5/08/2010						
	119507	27/10/2011						
	119507	12/04/2012						
	119507	23/10/2012						
	119507	9/04/2013						
	119507	12/04/2013						
	119507	18/12/2013		13.1			0.1	
	119507	10/07/2014						41
	119507	30/10/2014						17
	119507	10/04/2015						9
	119507	1/11/2015						13
	119507	6/04/2016			46	14		14
	119507	27/10/2016				105		105
	141402	29/08/2000						
	141402	15/02/2001						
	141402	24/07/2001						
	141402	9/01/2002						
	141402	24/07/2002						
	141402	26/02/2003	136					
	141402	21/08/2003						
	141402	17/02/2004	140					
	141402	27/07/2004						
	141402	15/02/2005						
	141402	5/07/2005						
	141402	31/01/2006						
	141402	1/08/2006						
	141402	31/01/2007						
	141402	1/08/2007						
	141402	29/07/2008						
	141402	6/04/2009						
	141402	6/10/2009						
	141402	23/03/2010						
Groundwater	141402	5/08/2010						
	141402	7/03/2011						
	141402	27/10/2011						

Location Type	Location Code	Sampled Date	Alkalinity (Bicarbonate as CaCO3) mg/L	Alkalinity (Carbonate as CaCO3) mg/L	Alkalinity (Hydroxide) as CaCO3 mg/L	Alkalinity (total) as CaCO3 mg/L	Ammonia as N mg/L
	141402	27/10/2011	43	0.5	0.5	43	0.03
	141402	27/10/2011	64				0.03
	141402	10/04/2012				44	0.04
	141402	24/10/2012	48.36				0.005
	141402	11/04/2013	52.46				0.03
	141402	12/12/2013	40.2				0.005
	141402	12/12/2013	39.3				0.005
	141402	12/12/2013	35	0.5	0.5	35	0.01
	141402	9/07/2014	35				0.03
	141402	30/10/2014	33	0.5	0.5	33	0.02
	141402	30/10/2014	45				0.005
	141402	30/10/2014	33	0.5	0.5	33	0.02
	141402	9/04/2015	34	0.5	0.5	34	0.03
	141402	1/11/2015	35	0.5	0.5	35	0.04
	141402	5/04/2016	35	0.5	0.5	35	0.04
	141402	27/10/2016	32	0.5	0.5	32	0.005
	141402	27/04/2017	31	0.5	0.5	31	0.005
	141403	29/08/2000					0.03
	141403	15/02/2001					0.5
	141403	24/07/2001					0.5
	141403	9/01/2002					0.42
	141403	24/07/2002					0.99
	141403	26/02/2003	93			93	0.48
	141403	21/08/2003	92			92	0.31
	141403	17/02/2004	98	0.5	0.5	98	0.69
	141403	28/07/2004	97				0.42
	141403	15/02/2005	120				0.28
	141403	6/07/2005	110				0.01
	141403	1/08/2006	100				0.05
	141403	1/08/2007	110				0.9
	141403	31/07/2008	110				0.09
	141403	7/04/2009	88				0.06
	141403	7/10/2009	110				0.025
	141403	5/08/2010					0.005
	141403	27/10/2011	110				0.04
	141403	12/04/2012	100	5		100	0.31
	141403	23/10/2012	106.56				0.005
	141403	23/10/2012	119.56	0.5	0.5	98	0.24
	141403	23/10/2012	106.56				0.22
	141403	12/04/2013	106.56				0.14
	141403	18/12/2013	90.1				0.17
	141403	10/07/2014	83				0.06
	141403	30/10/2014	57	0.5	0.5	57	0.05
	141403	10/04/2015	85	0.5	0.5	85	0.12
	141403	1/11/2015	90	0.5	0.5	90	0.06
	141403	6/04/2016	97	0.5	0.5	97	0.36
	141403	27/10/2016	89	0.5	0.5	89	0.1
	141403	27/04/2017	91	0.5	0.5	91	0.11
Groundwater	9022881/1	30/01/2006	34				0.005
	9022881/1	1/08/2006	40				0.005
	9022881/1	30/01/2007	36				3.4
	9022881/1	1/08/2007	34				0.11
	9022881/1	29/07/2008	50				0.025
	9022881/1	6/04/2009	28				0.025
	9022881/1	5/10/2009	26				0.025
	9022881/1	23/03/2010	32				0.005
	9022881/1	6/08/2010					0.02

Location Type	Location Code	Sampled Date	Anions Total meq/L	Calcium Carbonate mg/L	Cations Total meq/L	Chloride mg/L	COD mg/L	Electrical conductivity *(lab) uS/cm	Ionic Balance %	Kjeldahl Nitrogen Total mg/L	Nitrate & Nitrite mg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L
	141402	27/10/2011	12.7		12.9	401	64	1310	0.52	1.5		2.55	0.005
	141402	27/10/2011				350	2.5	1200		1.1		2.8	
	141402	10/04/2012				370	10	1200		0.7		3.1	
	141402	24/10/2012				340	5.1	1000		0.1		3.2	
	141402	11/04/2013				330	10	1100		0.1		3	
	141402	12/12/2013				340	10	1100		0.1		2.9	
	141402	12/12/2013				340	10	1100		0.5		2.9	
	141402	12/12/2013	11.7		11	379	5	1090	3.32	0.05		2.8	0.005
	141402	9/07/2014				340	10	1200		0.3		3.3	0.01
	141402	30/10/2014	11.9		10.8	386	5		4.71	0.1		1.67	0.005
	141402	30/10/2014				350	10			0.8		3.1	
	141402	30/10/2014	11.8		10.7	384	5		4.96	0.05		1.61	0.005
	141402	9/04/2015	11.7		10.8	380	5		3.91	0.4		2.44	0.005
	141402	1/11/2015	11.4		10.7	371	5		3.42	0.05		3.24	0.005
	141402	5/04/2016	11.8		12.4	384	5		2.41	0.4		3.35	0.005
	141402	27/10/2016	12.4		10.2	407	5		10.2	0.05		3.17	0.005
	141402	27/04/2017	11.6		10.8	378	5		3.63	0.4		2.9	0.005
	141403	29/08/2000				550		2200		2.1		0.041	
	141403	15/02/2001				790		2120		4			
	141403	24/07/2001				800		2100		2		0.7	
	141403	9/01/2002				608		2220		6.3		0.45	
	141403	24/07/2002						2400					
	141403	26/02/2003				621	196	2050		4	0.19		
	141403	21/08/2003				690	42	2400		0.9		0.15	0.025
	141403	17/02/2004				660	48	2400		1.9		0.096	0.03
	141403	28/07/2004				660	190	2400		3.9		1.7	
	141403	15/02/2005				630	78	2300		0.28		0.17	
	141403	6/07/2005				620	2.5	2200		0.05		0.29	
	141403	1/08/2006				600	2.5	2000		0.2		0.12	
	141403	1/08/2007				680	8	2200		0.7		0.15	
	141403	31/07/2008				680	2.5	2300		1.7		0.18	
	141403	7/04/2009				600	11	2200		0.4		0.18	
	141403	7/10/2009				630	2.5	2600		0.3		0.17	
	141403	5/08/2010		94		620	2.5	2200		0.9		0.15	
	141403	27/10/2011				600	2.5	2300		1.9		0.22	
	141403	12/04/2012				530	17	2000		1.6		0.57	
	141403	23/10/2012				590	7	1900		0.1		0.04	
	141403	23/10/2012	21.8		23	667	17	2170	2.64	0.2		0.17	0.005
	141403	23/10/2012				550	7.4	1900		0.3		0.03	
	141403	12/04/2013				600	10	2300		0.5		0.17	
	141403	18/12/2013				640	10	2300		0.3		0.17	
	141403	10/07/2014				640	10	2400		0.1		0.14	0.01
	141403	30/10/2014	24.6		22.4	721	5		4.56	2.1		0.24	0.005
	141403	10/04/2015	22.4		21.6	698	5		1.88	0.2		0.25	0.005
	141403	1/11/2015	22.1		21.7	683	5		0.86	0.05		0.27	0.005
	141403	6/04/2016	22.4		24.2	690	5		4.02	0.4		0.18	0.005
	141403	27/10/2016	22.5		18.9	696	5		8.66	0.3		1.12	0.005
	141403	27/04/2017	21.7		20.2	671	5		3.68	0.3		0.18	0.005
Groundwater	9022881/1	30/01/2006				180	2.5	630		0.3		4	
	9022881/1	1/08/2006				210	2.5	730		0.6		4.5	
	9022881/1	30/01/2007				230	2.5	820		1.8		4.1	
	9022881/1	1/08/2007				270	2.5	930		0.05		5.3	
	9022881/1	29/07/2008				220	2.5	780		2.9		5.9	
	9022881/1	6/04/2009				230	2.5	720		4.3		4.6	
	9022881/1	5/10/2009				200	2.5	670		1		4	
	9022881/1	23/03/2010				230	2.5	850		0.5		4.3	
	9022881/1	6/08/2010		32		200	2.5	700		1.1		4.3	

Location Type	Location Code	Sampled Date	Nitrate & Nitrite (as N) mg/L	Nitrogen (Total Oxidised) mg/L	Nitrogen (Total) mg/L	pH (Lab) pH Units	Phosphate total (P) mg/L	Sodium (Filtered) mg/L	Sulphate mg/L	Sulphate (Filtered) mg/L	Sulphate as S mg/L	Sulphate as S (Filtered) mg/L	TDS mg/L	TOC mg/L
	141402	27/10/2011		2.55		6.32		224	9	9			740	2
	141402	27/10/2011				6.4	0.025	190			8.5	8.5	690	2.5
	141402	10/04/2012				6.6		200			6.2	6.2	700	2.5
	141402	24/10/2012				6.3		170			8.9	8.9	680	2.5
	141402	11/04/2013				6.4		160			2.5	2.5	610	2.5
	141402	12/12/2013		2.9	2.9			180			2.5	2.5	620	2.5
	141402	12/12/2013		2.9	3.4			170			2.5	2.5	610	2.5
	141402	12/12/2013		2.8	2.8			214		5.33			699	0.5
	141402	9/07/2014			3.6		0.025	160			5.4	5.4	610	2.5
	141402	30/10/2014		1.67	1.8	5.45		190		15	5		711	0.5
	141402	30/10/2014		3.1	3.9	5.8		170			2.5	2.5	650	7.5
	141402	30/10/2014		1.61	1.6	5.48		188		16	5.3		823	0.5
	141402	9/04/2015		2.44	2.8	6.29		184		15	5		705	0.5
	141402	1/11/2015		3.24	3.2	5.42		184		14			733	0.5
	141402	5/04/2016		3.35	3.8	5.71		217		15			677	2
	141402	27/10/2016		3.17	3.2	6.29		172		16	5.3		699	0.5
	141402	27/04/2017		2.9	3.3	6.37		177		16			657	0.5
	141403	29/08/2000				6.8	2.1	380			11.67		1100	
	141403	15/02/2001				7	0.025	360			11.67		1300	
	141403	24/07/2001				6.4	0.025	340			12		1300	
	141403	9/01/2002				6.33	5.84	393			14		1610	
	141403	24/07/2002				6.57							1670	
	141403	26/02/2003				6		360			11.67		1500	6
	141403	21/08/2003				6.2		390			13.33		1300	2.8
	141403	17/02/2004				6.4		400			13.33		1300	0.5
	141403	28/07/2004				6.5		360			15		1300	0.5
	141403	15/02/2005				6.1		350			14		1400	17
	141403	6/07/2005				6.3		350			13		1300	29
	141403	1/08/2006				6.3		340			13		1100	28
	141403	1/08/2007				6.3		400			13		1200	2.5
	141403	31/07/2008				6.5		360			14		1200	2.5
	141403	7/04/2009				6.3		370			15		1300	2.5
	141403	7/10/2009				6.6		350			16		1200	
	141403	5/08/2010				6.4	0.11	380			15	15	1200	7.8
	141403	27/10/2011				6.5	0.025	290			16	16	1400	2.5
	141403	12/04/2012				6.8		350			15	15	1300	6.5
	141403	23/10/2012				6.4		320			18	18	1100	2.5
	141403	23/10/2012		0.17		6.23		412	16	16			1320	0.5
	141403	23/10/2012				6.3		320			16	16	1100	2.5
	141403	12/04/2013				6.7		330			14	14	1200	2.5
	141403	18/12/2013		0.18	0.5			320			13	13	2900	2.5
	141403	10/07/2014			0.1		0.025	330			16	16	1200	9.3
	141403	30/10/2014		0.24	2.3	6.14		410		149	49.7		1270	1
	141403	10/04/2015		0.25	0.4	6.56		388		48	16		1370	0.5
	141403	1/11/2015		0.27	0.3	5.94		388		50			1320	0.5
	141403	6/04/2016		0.18	0.6	6.39		447		46			1270	2
	141403	27/10/2016		1.12	1.4	5.48		344		52	17.3		1260	2
	141403	27/04/2017		0.18	0.5	6.47		359		46			1220	0.5
Groundwater	9022881/1	30/01/2006				6.2		110			2.8		420	3
	9022881/1	1/08/2006				6.3		130			3.8		420	11
	9022881/1	30/01/2007				6.3		120			3.5		450	12
	9022881/1	1/08/2007				6.1		170			4.6		550	2.5
	9022881/1	29/07/2008				6.4		140			2.5		440	6.4
	9022881/1	6/04/2009				6.4		120			2.5		440	2.5
	9022881/1	5/10/2009				6.5		92			5.1		380	5
	9022881/1	23/03/2010				6.4		110			5.8		450	2.5
	9022881/1	6/08/2010				8.5	0.025	110			2.5	2.5	390	2.5

Location Type	Location Code	Sampled Date	Hardness as CaCO3 mg/L	Turbidity NTU	Sulfate as SO4 - Turbidimetric (Filtered mg/L	Volatile Fatty Acids (as Acetic Acid) mg/L	Nitrogen (Organic) mg/L	Volatile Fatty Acids mg/L
	141402	27/10/2011						
	141402	27/10/2011						
	141402	10/04/2012						
	141402	24/10/2012						
	141402	11/04/2013						
	141402	12/12/2013						
	141402	12/12/2013						
	141402	12/12/2013						
	141402	9/07/2014		13.1			0.3	
	141402	30/10/2014						75
	141402	30/10/2014						11
	141402	30/10/2014						51
	141402	9/04/2015						8
	141402	1/11/2015						15
	141402	5/04/2016						10
	141402	27/10/2016			16	2.5		2.5
	141402	27/04/2017				9		9
	141403	29/08/2000						
	141403	15/02/2001						
	141403	24/07/2001						
	141403	9/01/2002						
	141403	24/07/2002						
	141403	26/02/2003	245					
	141403	21/08/2003						
	141403	17/02/2004	270					
	141403	28/07/2004						
	141403	15/02/2005						
	141403	6/07/2005						
	141403	1/08/2006						
	141403	1/08/2007						
	141403	31/07/2008						
	141403	7/04/2009						
	141403	7/10/2009						
	141403	5/08/2010						
	141403	27/10/2011						
	141403	12/04/2012						
	141403	23/10/2012						
	141403	23/10/2012						
	141403	23/10/2012						
	141403	12/04/2013						
	141403	18/12/2013						
	141403	10/07/2014		103.1			0.1	
	141403	30/10/2014						26
	141403	10/04/2015						14
	141403	1/11/2015						22
	141403	6/04/2016						7
	141403	27/10/2016			52	27		27
	141403	27/04/2017				24		24
Groundwater	9022881/1	30/01/2006						
	9022881/1	1/08/2006						
	9022881/1	30/01/2007						
	9022881/1	1/08/2007						
	9022881/1	29/07/2008						
	9022881/1	6/04/2009						
	9022881/1	5/10/2009						
	9022881/1	23/03/2010						
	9022881/1	6/08/2010						

Location Type	Location Code	Sampled Date	Alkalinity (Bicarbonate as CaCO3) mg/L	Alkalinity (Carbonate as CaCO3) mg/L	Alkalinity (Hydroxide) as CaCO3 mg/L	Alkalinity (total) as CaCO3 mg/L	Ammonia as N mg/L
	9022881/1	8/03/2011	38				0.08
	9022881/1	27/10/2011	50				0.005
	9022881/1	10/04/2012				33	0.04
	9022881/1	24/10/2012	39.34				0.02
	9022881/1	11/04/2013	42.62				0.33
	9022881/1	12/12/2013	38.5				0.03
	9022881/1	9/07/2014	45				0.005
	9022881/1	9/07/2014	45				0.03
	9022881/1	9/07/2014	46	0.5	0.5	46	0.02
	9022881/1	27/10/2014	47	0.5	0.5	47	0.02
	9022881/1	9/04/2015	43	0.5	0.5	43	0.04
	9022881/1	9/04/2015	48				0.04
	9022881/1	9/04/2015	43	0.5	0.5	43	0.08
	9022881/1	31/10/2015	59	0.5	0.5	59	0.05
	9022881/1	31/10/2015				63	0.005
	9022881/1	31/10/2015	62	0.5	0.5	62	0.04
	9022881/1	5/04/2016	54	0.5	0.5	54	0.02
	9022881/1	27/10/2016	44	0.5	0.5	44	0.005
	9022881/1	27/10/2016	42	0.5	0.5	42	0.005
	9022881/1	27/10/2016	49				0.005
	9022881/1	26/04/2017	54	0.5	0.5	54	0.005
	9022881/1	26/04/2017	52	0.5	0.5	52	0.005
	9022881/1	26/04/2017	52				0.02
Groundwater	9022881/2	30/01/2006	56				0.01
	9022881/2	1/08/2006	38				0.005
	9022881/2	30/01/2007	30				1.3
	9022881/2	1/08/2007	24				0.08
	9022881/2	29/07/2008	38				0.025
	9022881/2	6/04/2009	32				0.025
	9022881/2	6/10/2009	28				0.025
	9022881/2	23/03/2010	30				0.005
	9022881/2	5/08/2010					0.005
	9022881/2	8/03/2011	45				0.005
	9022881/2	27/10/2011	55				0.01
	9022881/2	10/04/2012				39	0.02
	9022881/2	24/10/2012	44.26				0.005
	9022881/2	11/04/2013	57.38				4.5
	9022881/2	12/12/2013	45.1				0.005
	9022881/2	9/07/2014	41				0.005
	9022881/2	3/11/2014	42	0.5	0.5	42	0.08
	9022881/2	9/04/2015	36	0.5	0.5	36	0.03
	9022881/2	31/10/2015	51	0.5	0.5	51	0.1
	9022881/2	5/04/2016	55	0.5	0.5	55	0.02
	9022881/2	5/04/2016	61				0.005
	9022881/2	5/04/2016	52	0.5	0.5	52	0.005
	9022881/2	27/10/2016	46	0.5	0.5	46	0.005
	9022881/2	27/04/2017	60	0.5	0.5	60	0.03
	JRLD	27/07/2004	190				6.5
	JRLD	15/02/2005	140				0.03
	JRLD	6/07/2005	150				0.05
	JRLD	30/01/2006	160				1.4
	JRLD	1/08/2006	210				2.7
	JRLD	31/01/2007	400				0.92
	JRLD	1/08/2007	400				34
	JRLD	29/07/2008	530				0.39
	JRLD	5/10/2009	320				7.1
	JRLD	23/03/2010	520				7.1

Location Type	Location Code	Sampled Date	Anions Total meq/L	Calcium Carbonate mg/L	Cations Total meq/L	Chloride mg/L	COD mg/L	Electrical conductivity *(lab) uS/cm	Ionic Balance %	Kjeldahl Nitrogen Total mg/L	Nitrate & Nitrite mg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L
	9022881/1	8/03/2011				180	27	680		0.05		5.8	
	9022881/1	27/10/2011				120	2.5	500		2.2		2.5	
	9022881/1	10/04/2012				110	19	430		0.7		2.6	
	9022881/1	24/10/2012				40	2.5	250		0.2		1.4	
	9022881/1	11/04/2013				150	10	550		0.6		3.6	
	9022881/1	12/12/2013				74	10	380		0.1		4.3	
	9022881/1	9/07/2014				74	10	370		0.6		2.2	0.01
	9022881/1	9/07/2014				73	10	360		0.7		2.2	0.01
	9022881/1	9/07/2014	3.31		2.92	70	5	391	6.2	0.5		1.71	0.005
	9022881/1	27/10/2014	2.77		2.74	50	5		0.51	0.3		1.3	0.005
	9022881/1	9/04/2015	3.77		3.9	92	5		1.75	0.4		2.46	0.005
	9022881/1	9/04/2015				97	10			70			
	9022881/1	9/04/2015	3.88		4.12	96	5		3.01	0.6		2.48	0.005
	9022881/1	31/10/2015	2.85		3.11	40	5		4.35	0.5		4.16	0.005
	9022881/1	31/10/2015				60	10			0.3		3.4	0.01
	9022881/1	31/10/2015	2.83		3.11	38	5		4.65	0.4		4.12	0.005
	9022881/1	5/04/2016	2.17		2.07	27	5		2.57	0.05		1.79	0.005
	9022881/1	27/10/2016	1.66		1.31	21	5			0.05		1.01	0.005
	9022881/1	27/10/2016	1.64		1.31	21	5			0.1		1.02	0.005
	9022881/1	27/10/2016				26	12.5			1.5			
	9022881/1	26/04/2017	2.4		3.09	30	5			1.3		2.03	0.005
	9022881/1	26/04/2017	2.34		2.83	30	5			0.7		2.08	0.005
	9022881/1	26/04/2017				33	12.5			0.3			
Groundwater	9022881/2	30/01/2006				35	2.5	440		0.05		1.2	
	9022881/2	1/08/2006				39	2.5	360		1.1		1.6	
	9022881/2	30/01/2007				70	6	330		1.5		0.01	
	9022881/2	1/08/2007				73	2.5	390		0.05		3.3	
	9022881/2	29/07/2008				46	5.7	360		0.9		0.67	
	9022881/2	6/04/2009				41	8	370		0.3		0.99	
	9022881/2	6/10/2009				46	2.5	390		0.3		1.3	
	9022881/2	23/03/2010				48	2.5	380		0.025		1.6	
	9022881/2	5/08/2010		32		42	2.5	370		0.05		1.6	
	9022881/2	8/03/2011				44	17	400		0.05		1.4	
	9022881/2	27/10/2011				49	2.5	420		1.7		1.3	
	9022881/2	10/04/2012				48	14	380		0.025		1.4	
	9022881/2	24/10/2012				65	6	340		0.1		2.6	
	9022881/2	11/04/2013				71	10	420		0.4		1.8	
	9022881/2	12/12/2013				59	10	380		0.2		1.8	
	9022881/2	9/07/2014				66	10	380		0.6		1.6	0.01
	9022881/2	3/11/2014	3.86		3.56	74	5		4.08	0.5		1.36	0.005
	9022881/2	9/04/2015	3.54		3.61	66	5		1.04	0.3		1.05	0.005
	9022881/2	31/10/2015	3.74		3.98	67	35		3.01	0.2		1.93	0.005
	9022881/2	5/04/2016	2.24		2.11	28	5		3.09	0.05		1.76	0.005
	9022881/2	5/04/2016				41	10			0.5			
	9022881/2	5/04/2016	3.98		4.45	74	5		5.55	0.05		1.71	0.005
	9022881/2	27/10/2016	4.4		3.83	91	5		6.96	0.3		1.34	0.005
	9022881/2	27/04/2017	4.55		4.54	79	5		0.12	0.2		0.95	0.005
	JRLD	27/07/2004				81	65	670		8.8		0.013	
	JRLD	15/02/2005				92	28	610		1.1		1	
	JRLD	6/07/2005				68	27	510		1.5		1.3	
	JRLD	30/01/2006				170	27	890		1.8		3.7	
	JRLD	1/08/2006				210	37	1000		4.8		0.03	
	JRLD	31/01/2007				430	63	1600		3.4		0.45	
	JRLD	1/08/2007				260	300	1600		30		0.01	
	JRLD	29/07/2008				280	200	1900		21		3.6	
	JRLD	5/10/2009				240	59	1400		11		0.98	
	JRLD	23/03/2010				260	150	1800		14		0.01	

Location Type	Location Code	Sampled Date	Nitrate & Nitrite (as N) mg/L	Nitrogen (Total Oxidised) mg/L	Nitrogen (Total) mg/L	pH (Lab) pH Units	Phosphate total (P) mg/L	Sodium (Filtered) mg/L	Sulphate mg/L	Sulphate (Filtered) mg/L	Sulphate as S mg/L	Sulphate as S (Filtered) mg/L	TDS mg/L	TOC mg/L
	9022881/1	8/03/2011				6.4		100			2.5	2.5	380	2.5
	9022881/1	27/10/2011				6.4	0.025	61			6.1	6.1	340	2.5
	9022881/1	10/04/2012				6.4		74			2.5	2.5	250	2.5
	9022881/1	24/10/2012				6		46			10	10	170	2.5
	9022881/1	11/04/2013				6.5		81			2.5	2.5	320	2.5
	9022881/1	12/12/2013		4.3	4.3			39			8.7	8.7	220	12.5
	9022881/1	9/07/2014			2.8		0.025	53			7	7	200	2.5
	9022881/1	9/07/2014			2.9		0.025	52			7	7	200	2.5
	9022881/1	9/07/2014		1.71	2.2			46		6.67			432	1
	9022881/1	27/10/2014		1.3	1.6	6.47		40		20	6.7		231	1
	9022881/1	9/04/2015		2.46	2.9	6.53		66		15	5		319	0.5
	9022881/1	9/04/2015		2.9	73	6.4		59			5.1	5.1	240	2.5
	9022881/1	9/04/2015		2.48	3.1	6.59		68		15	5		292	1
	9022881/1	31/10/2015		4.16	4.7	5.87		36		26			214	1
	9022881/1	31/10/2015		3.4	3.7	6.3	0.025	36			7.7		170	2.5
	9022881/1	31/10/2015		4.12	4.5	5.69		36		25			231	2
	9022881/1	5/04/2016		1.79	1.8	7		27		16			148	2
	9022881/1	27/10/2016		1.01	1	6.85		19		9	3		156	1
	9022881/1	27/10/2016		1.02	1.1	6.69		19		10	3.3		121	1
	9022881/1	27/10/2016	1		2.5	7.3	0.1	21			2.5		100	2.5
	9022881/1	26/04/2017		2.03	3.3	5.41		34		23			166	1
	9022881/1	26/04/2017		2.08	2.8	5.42		31		22			184	1
	9022881/1	26/04/2017	1.9		2.2	5.5	0.025	26	24				160	12.5
	9022881/2	30/01/2006				6.5		52			33		280	12
	9022881/2	1/08/2006				6.2		48			27		230	7
	9022881/2	30/01/2007				6.1		44			17		200	2.5
	9022881/2	1/08/2007				6		56			33		220	2.5
	9022881/2	29/07/2008				6.4		62			26		200	5.8
	9022881/2	6/04/2009				6.4		40			28		240	2.5
	9022881/2	6/10/2009				6.3		39			26		200	
	9022881/2	23/03/2010				6.2		41			21		220	2.5
	9022881/2	5/08/2010				6.3	0.025	53			21	21	250	2.5
	9022881/2	8/03/2011				6.2		46			23	23	240	2.5
	9022881/2	27/10/2011				6.4	0.025	36			26	26	290	17
Groundwater	9022881/2	10/04/2012				6.5		47			22	22	230	2.5
	9022881/2	24/10/2012				6.3		42			18	18	230	12.5
	9022881/2	11/04/2013				6.5		47			13	13	250	2.5
	9022881/2	12/12/2013		1.8	2			44			16	16	240	12.5
	9022881/2	9/07/2014			2.2		0.025	44			16	16	210	2.5
	9022881/2	3/11/2014		1.36	1.9	6.16		47		45	15		304	2
	9022881/2	9/04/2015		1.05	1.4	6.33		52		46	15.3		306	1
	9022881/2	31/10/2015		1.93	2.1	5.4		51		40			252	1
	9022881/2	5/04/2016		1.76	1.8	7.14		28		17			136	1
	9022881/2	5/04/2016		1.6	2.1	7.7	0.025	32			5.8		150	2.5
	9022881/2	5/04/2016		1.71	1.7	6.41		60		41			235	2
	9022881/2	27/10/2016		1.34	1.6	5.57		52		44	14.7		306	2
	9022881/2	27/04/2017		0.95	1.2	6.46		56		54			261	2
	JRLD	27/07/2004				7.9		83			3		380	13
	JRLD	15/02/2005				7.5		82			4.9		420	44
	JRLD	6/07/2005				7.2		75			9.7		350	10
	JRLD	30/01/2006				7.1		140			11		620	15
	JRLD	1/08/2006				7.6		160			12		610	55
	JRLD	31/01/2007				8.2		270			9.1		950	13
	JRLD	1/08/2007				7.3		150			3.3		960	300
	JRLD	29/07/2008				8.6		290			5.8		1100	330
	JRLD	5/10/2009				8.1		210			11		820	44
	JRLD	23/03/2010				7.8		200			2.5		1100	2.5

Location Type	Location Code	Sampled Date	Hardness as CaCO3 mg/L	Turbidity NTU	Sulfate as SO4 - Turbidimetric (Filtered mg/L	Volatile Fatty Acids (as Acetic Acid) mg/L	Nitrogen (Organic) mg/L	Volatile Fatty Acids mg/L
	9022881/1	8/03/2011						
	9022881/1	27/10/2011						
	9022881/1	10/04/2012						
	9022881/1	24/10/2012						
	9022881/1	11/04/2013						
	9022881/1	12/12/2013						
	9022881/1	9/07/2014		18.6			0.6	
	9022881/1	9/07/2014					0.7	
	9022881/1	9/07/2014						
	9022881/1	27/10/2014						8
	9022881/1	9/04/2015						11
	9022881/1	9/04/2015						11
	9022881/1	9/04/2015						6
	9022881/1	31/10/2015						12
	9022881/1	31/10/2015						2.5
	9022881/1	31/10/2015						18
	9022881/1	5/04/2016						16
	9022881/1	27/10/2016			9	11		11
	9022881/1	27/10/2016			10	12		12
	9022881/1	27/10/2016				2.5		
	9022881/1	26/04/2017				54		54
	9022881/1	26/04/2017				42		42
	9022881/1	26/04/2017				13		
Groundwater	9022881/2	30/01/2006						
	9022881/2	1/08/2006						
	9022881/2	30/01/2007						
	9022881/2	1/08/2007						
	9022881/2	29/07/2008						
	9022881/2	6/04/2009						
	9022881/2	6/10/2009						
	9022881/2	23/03/2010						
	9022881/2	5/08/2010						
	9022881/2	8/03/2011						
	9022881/2	27/10/2011						
	9022881/2	10/04/2012						
	9022881/2	24/10/2012						
	9022881/2	11/04/2013						
	9022881/2	12/12/2013						
	9022881/2	9/07/2014		325			0.6	
	9022881/2	3/11/2014						40
	9022881/2	9/04/2015						9
	9022881/2	31/10/2015						22
	9022881/2	5/04/2016						6
	9022881/2	5/04/2016						7.4
	9022881/2	5/04/2016						9
	9022881/2	27/10/2016			44	12		12
	9022881/2	27/04/2017				13		13
	JRLD	27/07/2004						
	JRLD	15/02/2005						
	JRLD	6/07/2005						
	JRLD	30/01/2006						
	JRLD	1/08/2006						
	JRLD	31/01/2007						
	JRLD	1/08/2007						
	JRLD	29/07/2008						
	JRLD	5/10/2009						
	JRLD	23/03/2010						78

Location Type	Location Code	Sampled Date	Alkalinity (Bicarbonate as CaCO3) mg/L	Alkalinity (Carbonate as CaCO3) mg/L	Alkalinity (Hydroxide) as CaCO3 mg/L	Alkalinity (total) as CaCO3 mg/L	Ammonia as N mg/L
Leachate	JRLD	17/08/2010				920	22
	JRLD	8/03/2011	670				14
	JRLD	27/10/2011	490				12
	JRLD	3/11/2011					
	JRLD	10/04/2012				530	18
	JRLD	23/10/2012	688.52				34
	JRLD	12/04/2013	901.64				16
	JRLD	12/12/2013	696.5				25
	JRLD	9/07/2014	600				63
	JRLD	3/11/2014	655	22	0.5	677	42.3
	JRLD	10/04/2015	1250	44	0.5	1300	104
	JRLD	2/11/2015	1170	51	0.5	1220	50.3
	JRLD	5/04/2016	1010	50	0.5	1060	51.8
	JRLD	26/10/2016	1290	0.5	0.5	1290	95.4
	JRLD	26/04/2017	894	73	0.5	967	37.9
	JRLP	21/08/2003	23			23	0.1
	JRLP	17/02/2004	1700	0.5	0.5	1700	200
	JRLP	27/07/2004	2000			2000	120
	JRLP	15/02/2005	1800				130
	JRLP	6/07/2005	3000				230
	JRLP	30/01/2006	410				28
	JRLP	1/08/2006	1100				12
	JRLP	30/01/2007	1100				0.66
	JRLP	1/08/2007	5200				680
	JRLP	31/07/2008	3300				350
	JRLP	7/04/2009	3900				350
	JRLP	7/10/2009	2100				240
	JRLP	23/03/2010				4300	380
	JRLP	17/08/2010				4000	320
	JRLP	8/03/2011	3700				370
	JRLP	28/10/2011	3600				470
	JRLP	10/04/2012				2900	260
	JRLP	23/10/2012	4426.23				470
	JRLP	12/04/2013	1475.41				93
	JRLP	12/12/2013	2949.9				280
	JRLP	10/07/2014	2800				340
	JRLP	2/11/2015	4820	0.5	0.5	4820	505
	JRLP	5/04/2016	4860	0.5	0.5	4860	565
	JRLP	26/10/2016	5280	0.5	0.5	5280	724
	JRLP	27/04/2017	5180	0.5	0.5	5180	672
	Fire Dam	26/10/2016	105	0.5	0.5	105	0.18
	Fire Dam	26/04/2017	93	0.5	0.5	93	0.27
	JND	18/01/2000	67	0.5	0.5	67	0.03
	JND	29/08/2000	37			37	0.039
	JND	15/02/2001					0.5
	JND	24/07/2001					0.5
	JND	9/01/2002					0.06
	JND	24/07/2002					0.04
	JND	26/02/2003	11			11	0.06
	JND	21/08/2003	10			10	0.1
	JND	17/02/2004	39	0.5	0.5	39	0.033
	JND	28/07/2004	38			38	0.059
	JND	15/02/2005	45			45	0.02
	JND	6/07/2005	62			62	0.01

Location Type	Location Code	Sampled Date	Anions Total meq/L	Calcium Carbonate mg/L	Cations Total meq/L	Chloride mg/L	COD mg/L	Electrical conductivity *(lab) uS/cm	Ionic Balance %	Kjeldahl Nitrogen Total mg/L	Nitrate & Nitrite mg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L
	JRLD	17/08/2010				310	210	2700		43		0.04	
	JRLD	8/03/2011				370	180	2500		19		0.2	
	JRLD	27/10/2011				260	72	1900		20		0.61	
	JRLD	3/11/2011											
	JRLD	10/04/2012				270	100	2000		25		0.41	
	JRLD	23/10/2012				410	240	2600		31		0.49	
	JRLD	12/04/2013				670	150	4100		390		0.01	
	JRLD	12/12/2013				450	230	2600		37		1.1	
	JRLD	9/07/2014				390	140	2600		63		1.8	0.03
	JRLD	3/11/2014	26.9		24.3	443	212		5.11	47.3		3.28	3.73
	JRLD	10/04/2015	49.9		41.2	804	408		9.56	145		1.87	0.34
	JRLD	2/11/2015	47.2		43.7	767	30		3.82	70.2		0.07	0.24
	JRLD	5/04/2016	42.9		41.5	734	301		1.72	57.6		0.005	2.8
	JRLD	26/10/2016	42.6		44.3	597	394		1.91	169		0.01	0.005
Leachate	JRLD	26/04/2017	42		37.4	759	313		5.76	37.9		0.25	0.88
	JRLP	21/08/2003				53	16	760		1		0.62	0.025
	JRLP	17/02/2004				280	3300	4400		230		2.6	0.094
	JRLP	27/07/2004				360	390	4500		160		0.88	
	JRLP	15/02/2005				640	310	5500		140		0.01	
	JRLP	6/07/2005				850	340	7500		270		0.01	
	JRLP	30/01/2006				340	33	1800		18		0.01	
	JRLP	1/08/2006				450	140	3400		76		0.01	
	JRLP	30/01/2007				480	120	2900		71		0.01	
	JRLP	1/08/2007				1700	2800	13,000		610		0.01	
	JRLP	31/07/2008				1700	620	11,000		190		0.01	
	JRLP	7/04/2009				2000	660	13,000		310		0.01	
	JRLP	7/10/2009				2000	530	9900		250		0.01	
	JRLP	23/03/2010				2000	690	13,000		400		0.01	
	JRLP	17/08/2010				2100	590	13,000		390		0.03	
	JRLP	8/03/2011				1800	780	13,000		370		0.01	
	JRLP	28/10/2011				1900	2.5	14,000		520		0.07	
	JRLP	10/04/2012				1500	540	11,000		290		0.07	
	JRLP	23/10/2012				2100	980	15,000		74		0.01	
	JRLP	12/04/2013				1600	490	8600		200		55	
	JRLP	12/12/2013				1800	840	9700		420		0.72	
	JRLP	10/07/2014				2000	10	12,000		470		1.5	12
	JRLP	2/11/2015	152		144	1970	300		2.84	664		0.005	0.005
	JRLP	5/04/2016	159		158	2200	1230		0.54	584		0.005	0.005
	JRLP	26/10/2016	164		145	2070	1570		6.08	939		0.01	0.005
	JRLP	27/04/2017	171		175	2390	1620		1.08	616		0.005	0.005
	Fire Dam	26/10/2016	5.97		5.44	107	123		4.65	2.9		0.54	0.04
	Fire Dam	26/04/2017	4.3		4.25	74	68		0.61	1.7		0.58	0.05
	JND	18/01/2000				22	18	220		1.3		0.62	0.008
	JND	29/08/2000				0.5	45	140		2		0.014	0.0025
	JND	15/02/2001				16		170		2			
	JND	24/07/2001				14		120		1		1.2	
	JND	9/01/2002				28		113		4.6		0.72	
	JND	24/07/2002						640					
	JND	26/02/2003				46	51	736		0.9	0.005		
	JND	21/08/2003				64	46	820		0.7		0.1	0.025
	JND	17/02/2004				49	23	650		1.1		0.0025	0.019
	JND	28/07/2004				20	60	250		0.9		0.48	
	JND	15/02/2005				19	26	190		0.58		0.06	
	JND	6/07/2005				21	15	290		0.3		0.01	

Location Type	Location Code	Sampled Date	Nitrate & Nitrite (as N) mg/L	Nitrogen (Total Oxidised) mg/L	Nitrogen (Total) mg/L	pH (Lab) pH Units	Phosphate total (P) mg/L	Sodium (Filtered) mg/L	Sulphate mg/L	Sulphate (Filtered) mg/L	Sulphate as S mg/L	Sulphate as S (Filtered) mg/L	TDS mg/L	TOC mg/L
Leachate	JRLD	17/08/2010				7.6	0.19	290			6	6	1700	140
	JRLD	8/03/2011				8.5		330			6.5	6.5	1700	52
	JRLD	27/10/2011				8.4	0.025	220			12	12	1300	49
	JRLD	3/11/2011												
	JRLD	10/04/2012				8.6		260			8.9	8.9	1400	37
	JRLD	23/10/2012				8.7		300			9.7	9.7	1800	62
	JRLD	12/04/2013				8.7		730			12	12	2200	47
	JRLD	12/12/2013		5.8	43			330			9.1	9.1	1500	100
	JRLD	9/07/2014			65		0.39	290			11	11	1300	85
	JRLD	3/11/2014		7.01	54.3	8.39		309		41	13.7		1350	53
	JRLD	10/04/2015		2.21	147	8.39		680		60	20		2570	123
	JRLD	2/11/2015		0.31	70.5	8.43		630		55			2480	105
	JRLD	5/04/2016		2.8	60.4	8.42		684		51			2190	103
	JRLD	26/10/2016		0.01	169	8.11		445		0.5	0.15		2130	147
	JRLD	26/04/2017		1.13	39	8.52		565		61			2100	81
	JRLP	21/08/2003				6.9		43			100		550	5.3
	JRLP	17/02/2004				6.4		370			1		3200	920
	JRLP	27/07/2004				6.7		460			10		2500	63
	JRLP	15/02/2005				6.6		520			0.025		3400	300
	JRLP	6/07/2005				7.1		810			3.8		4200	260
	JRLP	30/01/2006				6.3		250			18		1000	130
	JRLP	1/08/2006				6.5		510			11		1900	150
	JRLP	30/01/2007				6.6		390			1.5		1600	56
	JRLP	1/08/2007				6.9		2400			13		9300	2900
	JRLP	31/07/2008				7.3		1300			110		7400	270
	JRLP	7/04/2009				7.3		1500			2.5		7500	160
	JRLP	7/10/2009				7.1		1400			2.5		5800	250
	JRLP	23/03/2010				7.6		1600			5		6900	97
	JRLP	17/08/2010				7.6	0.23	1800			12	12	8000	290
	JRLP	8/03/2011				7.6		1700			9.3	9.3	8600	250
	JRLP	28/10/2011				8.2	0.25	1600			20		8600	320
	JRLP	10/04/2012				8.4		1500			80	80	7200	220
	JRLP	23/10/2012				7.8		1600			31	31	9800	40
	JRLP	12/04/2013				8.5		1200			120	120	4600	140
	JRLP	12/12/2013		4.3	420			1300			83	83	5300	580
	JRLP	10/07/2014			480		0.59	1600			78	78	7700	410
	JRLP	2/11/2015		0.005	664	7.43		1740		0.5			7990	212
	JRLP	5/04/2016		0.005	584	7.45		1890		0.5			7730	279
	JRLP	26/10/2016		0.01	939	7.62		1610		3	1		7750	356
	JRLP	27/04/2017		0.005	616	7.62		2020		0.5			6410	459
	Fire Dam	26/10/2016		0.58	3.5	7.61		66		41	13.7		556	34
	Fire Dam	26/04/2017		0.63	2.3	7.78		44		17			398	20
	JND	18/01/2000				7.8	0.28	340			4		590	24
	JND	29/08/2000				7.4	0.23	16			1		430	21
	JND	15/02/2001				7.3	0.025	16			4.5		990	
	JND	24/07/2001				7.1	0.025	14			4.2		890	
	JND	9/01/2002				7.03	4.56	16			2		3320	
	JND	24/07/2002				6.94							444	
	JND	26/02/2003				6.98		55			111		614	10
	JND	21/08/2003				7.1		54			106.67		570	8.9
	JND	17/02/2004				8		48			73.333		450	18
	JND	28/07/2004				7.4		20			13.333		230	8.9
	JND	15/02/2005				7.2		18			13		110	0.5
	JND	6/07/2005				8.1		35			12		160	9

Location Type	Location Code	Sampled Date	Hardness as CaCO3 mg/L	Turbidity NTU	Sulfate as SO4 - Turbidimetric (Filtered mg/L	Volatile Fatty Acids (as Acetic Acid) mg/L	Nitrogen (Organic) mg/L	Volatile Fatty Acids mg/L
Leachate	JRLD	17/08/2010				41		
	JRLD	8/03/2011						2.5
	JRLD	27/10/2011						
	JRLD	3/11/2011						27
	JRLD	10/04/2012						17
	JRLD	23/10/2012						
	JRLD	12/04/2013						
	JRLD	12/12/2013						
	JRLD	9/07/2014		20.6			0.1	
	JRLD	3/11/2014						158
	JRLD	10/04/2015						30
	JRLD	2/11/2015		44.4				52
	JRLD	5/04/2016		18.3				50
	JRLD	26/10/2016		70.3	0.5	88		88
	JRLD	26/04/2017		27				87
	JRLP	21/08/2003						
	JRLP	17/02/2004						
	JRLP	27/07/2004						50
	JRLP	15/02/2005						360
	JRLP	6/07/2005						24
	JRLP	30/01/2006						5
	JRLP	1/08/2006						270
	JRLP	30/01/2007						37
	JRLP	1/08/2007						2500
	JRLP	31/07/2008						29
	JRLP	7/04/2009						10
	JRLP	7/10/2009						200
	JRLP	23/03/2010						66
	JRLP	17/08/2010				34		
	JRLP	8/03/2011						38
	JRLP	28/10/2011						16
	JRLP	10/04/2012						
	JRLP	23/10/2012						120
	JRLP	12/04/2013						85
	JRLP	12/12/2013						29
	JRLP	10/07/2014		25.1			130	69
	JRLP	2/11/2015						146
	JRLP	5/04/2016						107
	JRLP	26/10/2016			3	143		143
	JRLP	27/04/2017				319		319
	Fire Dam	26/10/2016		106	41	10		10
	Fire Dam	26/04/2017		109				10
	JND	18/01/2000						
	JND	29/08/2000	31					
	JND	15/02/2001						
	JND	24/07/2001						
	JND	9/01/2002						
	JND	24/07/2002						
	JND	26/02/2003	327					
	JND	21/08/2003						
	JND	17/02/2004	210					
	JND	28/07/2004						
	JND	15/02/2005						
	JND	6/07/2005						

Location Type	Location Code	Sampled Date	Alkalinity (Bicarbonate as CaCO3) mg/L	Alkalinity (Carbonate as CaCO3) mg/L	Alkalinity (Hydroxide) as CaCO3 mg/L	Alkalinity (total) as CaCO3 mg/L	Ammonia as N mg/L
Surface Water	JND	30/01/2006	50				0.005
	JND	1/08/2006	38				0.005
	JND	30/01/2007	42				0.64
	JND	1/08/2007	36				0.12
	JND	29/07/2008	110				0.025
	JND	7/04/2009	56				0.025
	JND	5/10/2009	28				0.025
	JND	23/03/2010				96	0.02
	JND	5/08/2010					0.05
	JND	8/03/2011	10				0.005
	JND	8/03/2011	49	23	0.5	72	0.05
	JND	8/03/2011	46				0.03
	JND	27/10/2011	49				0.02
	JND	10/04/2012				51	0.04
	JND	10/04/2012	43	0.5	0.5	43	0.04
	JND	10/04/2012				53	0.04
	JND	23/10/2012	44.26				0.005
	JND	9/04/2013	76.23				0.11
	JND	11/12/2013	50				0.08
	JND	10/07/2014	67				0.06
	JND	3/11/2014	63	0.5	0.5	63	0.1
	JND	10/04/2015	50	0.5	0.5	50	0.02
	JND	2/11/2015	47	0.5	0.5	47	0.12
	JND	6/04/2016	61	0.5	0.5	61	0.02
	JND	26/10/2016	34	0.5	0.5	34	0.01
	JND	26/04/2017	49	0.5	0.5	49	0.08
	JRCREEK 1	23/10/2012	48.36				0.04
	JRCREEK 1	11/12/2013	38.5				0.04
	JRCREEK 1	10/04/2014	16	0.5	0.5	16	0.03
	JRCREEK 1	2/11/2015	25	0.5	0.5	25	0.06
	JRCREEK 1	26/10/2016	43	0.5	0.5	43	0.02
	JRCREEK 1	26/04/2017	35	0.5	0.5	35	0.005
	JRCREEK 2	23/10/2012	56.56				0.11
	JRCREEK 2	12/04/2013	81.97				0.2
	JRCREEK 2	11/12/2013	39.3				0.06
	JRCREEK 2	10/07/2014	37				0.11
	JRCREEK 2	3/11/2014	29	4	0.5	33	0.03
	JRCREEK 2	10/04/2015	41	0.5	0.5	41	0.06
	JRCREEK 2	2/11/2015	50	0.5	0.5	50	0.02
	JRCREEK 2	6/04/2016	56	0.5	0.5	56	0.03
	JRCREEK 2	26/10/2016	32	0.5	0.5	32	0.03
	JRCREEK 2	26/04/2017	46	0.5	0.5	46	0.1
	JRSWD	23/10/2012	139.34				1.5
	JRSWD	12/04/2013	155.74				0.04
	JRSWD	12/12/2013	122.9				0.33
	JRSWD	10/07/2014	140				0.2
	JRSWD	3/11/2014	107	0.5	0.5	107	0.17
	JRSWD	10/04/2015	60	0.5	0.5	60	0.49
	JRSWD	2/11/2015	97	0.5	0.5	97	0.32
	JRSWD	5/04/2016	121	0.5	0.5	121	0.79
	JRSWD	26/10/2016	90	0.5	0.5	90	0.17
	JRSWD	26/04/2017	116	0.5	0.5	116	0.24

Location Type	Location Code	Sampled Date	Anions Total meq/L	Calcium Carbonate mg/L	Cations Total meq/L	Chloride mg/L	COD mg/L	Electrical conductivity *(lab) uS/cm	Ionic Balance %	Kjeldahl Nitrogen Total mg/L	Nitrate & Nitrite mg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L
Surface Water	JND	30/01/2006				21	25	200		0.3		0.01	
	JND	1/08/2006				20	21	230		0.7		0.01	
	JND	30/01/2007				51	30	260		1.4		0.4	
	JND	1/08/2007				64	51	450		1.4		0.2	
	JND	29/07/2008				70	29	600		1.5		0.03	
	JND	7/04/2009				69	9.6	370		1.9		0.01	
	JND	5/10/2009				69	37	360		1.1		0.01	
	JND	23/03/2010				45	34	400		1.1		0.01	
	JND	5/08/2010		68		46	29	370		1.4		0.01	
	JND	8/03/2011				2.5	2.5	5		0.05		0.01	
	JND	8/03/2011	3.06		3.23	46	42	303	2.56	1.2		0.005	0.005
	JND	8/03/2011				58	55	300		0.7		0.01	
	JND	27/10/2011				26	30	170		1.7		0.01	
	JND	10/04/2012				22	58	160		1		0.01	
	JND	10/04/2012	1.46		1.54	19	58	170	2.86	1.1		0.06	0.01
	JND	10/04/2012				20	57	160		1.2		0.01	
	JND	23/10/2012				36	49	190		1.3		0.01	
	JND	9/04/2013				62	66	270		2		0.01	
	JND	11/12/2013				59	51	310		1.2		0.47	
	JND	10/07/2014				74	50	390		1.3		0.23	0.01
	JND	3/11/2014	3.71		3.49	70	57		3.08	1.8		0.15	0.005
	JND	10/04/2015	2.73		2.6	48	48		2.41	1.2		0.14	0.01
	JND	2/11/2015	2.11		2.22	32	43		2.55	1.4		0.21	0.01
	JND	6/04/2016	2.72		2.75	45	42		0.57	0.7		0.05	0.005
	JND	26/10/2016	1.65		1.52	24	58		4.15	0.7		0.18	0.02
	JND	26/04/2017	2.1		2.39	31	34		6.33	0.9		0.04	0.005
	JRCREEK 1	23/10/2012				120	140	480		2.5		0.01	
	JRCREEK 1	11/12/2013				33	80	160		2.4		0.01	
	JRCREEK 1	10/04/2014	1.31		1.26	24	71		1.8	2.3		0.2	0.02
	JRCREEK 1	2/11/2015	1.93		2.11	42	84		4.27	2.2		0.02	0.005
	JRCREEK 1	26/10/2016	1.8		1.78	29	115		0.57	2.9		0.05	0.005
	JRCREEK 1	26/04/2017	1.21		1.34	18	107		5.21	2		0.005	0.005
	JRCREEK 2	23/10/2012				45	44	240		0.7		0.31	
	JRCREEK 2	12/04/2013				63	44	350		2		0.2	
	JRCREEK 2	11/12/2013				20	84	120		1		0.1	
	JRCREEK 2	10/07/2014				24	10	150		0.7		0.08	0.01
	JRCREEK 2	3/11/2014	1.54		1.5	24	20		1.34	2.2		0.01	0.005
	JRCREEK 2	10/04/2015	1.66		1.74	23	59		2.55	1.1		0.12	0.01
	JRCREEK 2	2/11/2015	1.75		1.76	20	23		0.26	0.6		0.04	0.005
	JRCREEK 2	6/04/2016	2.17		1.95	33	34		5.36	1		0.05	0.005
	JRCREEK 2	26/10/2016	1.17		0.94	15	36			0.9		0.06	0.005
	JRCREEK 2	26/04/2017	1.63		1.67	23	25		1.18	0.8		0.04	0.005
	JRSWD	23/10/2012				90	68	610		3		0.27	
	JRSWD	12/04/2013				150	87	940		23		0.01	
	JRSWD	12/12/2013				84	68	590		2.5		0.74	
	JRSWD	10/07/2014				85	10	660		2.1		0.01	0.01
	JRSWD	3/11/2014	4.72		4.41	62	39		3.36	2.1		0.56	0.05
	JRSWD	10/04/2015	3.26		3.14	53	104		1.78	6		1.54	0.1
	JRSWD	2/11/2015	4.9		4.76	79	67		1.38	2.5		0.63	0.09
	JRSWD	5/04/2016	5.97		5.39	109	57		5.1	1.7		0.05	0.01
	JRSWD	26/10/2016	4.61		4.19	76	92		4.76	1.6		0.68	0.04
	JRSWD	26/04/2017	5.84		5.69	105	79		1.34	2.2		0.24	0.02

Location Type	Location Code	Sampled Date	Nitrate & Nitrite (as N) mg/L	Nitrogen (Total Oxidised) mg/L	Nitrogen (Total) mg/L	pH (Lab) pH Units	Phosphate total (P) mg/L	Sodium (Filtered) mg/L	Sulphate mg/L	Sulphate (Filtered) mg/L	Sulphate as S mg/L	Sulphate as S (Filtered) mg/L	TDS mg/L	TOC mg/L
Surface Water	JND	30/01/2006				7.4		19			8.8		120	5
	JND	1/08/2006				7.3		22			16		150	10
	JND	30/01/2007				8.9		27			11		150	11
	JND	1/08/2007				7.1		47			20		270	25
	JND	29/07/2008				8.1		66			34		330	17
	JND	7/04/2009				8.3		29			11		240	15
	JND	5/10/2009				9.2		35			18		210	27
	JND	23/03/2010				8.4		35			9.7		210	22
	JND	5/08/2010				7.6	0.025	34			12	12	260	12
	JND	8/03/2011				5.5		0.025			2.5	2.5	5	2.5
	JND	8/03/2011		0.005		9.18		34	5.33	5.33			202	17
	JND	8/03/2011				9		30			5.7	5.7	180	22
	JND	27/10/2011				7.2	0.06	17			2.5	2.5	110	17
	JND	10/04/2012				6.9		16			2.5	2.5	110	21
	JND	10/04/2012		0.07		7.14		14	1	1			120	15
	JND	10/04/2012				7		16			2.5	2.5	110	22
	JND	23/10/2012				6.9		20			2.5	2.5	130	14
	JND	9/04/2013				7.9		34			2.5	2.5	210	15
	JND	11/12/2013		0.49	1.7			31			6.1	6.1	340	13
	JND	10/07/2014			1.5		0.12	39			9.8	9.8	320	21
	JND	3/11/2014		0.15	2	8.15		41		23	7.7		426	20
	JND	10/04/2015		0.15	1.4	7.29		32		18	6		256	16
	JND	2/11/2015		0.22	1.6	7.53		27		13			250	16
	JND	6/04/2016		0.05	0.8	7.67		33		11			196	15
	JND	26/10/2016		0.2	0.9	7.46		18		14	4.7		254	15
	JND	26/04/2017		0.04	0.9	7.55		26		12			192	13
	JRCREEK 1	23/10/2012				6.7		59			5	5	330	7.5
	JRCREEK 1	11/12/2013		0.025	2.4			52			2.5	2.5	210	27
	JRCREEK 1	10/04/2014		0.22	2.5	6.57		14		15	5		193	26
	JRCREEK 1	2/11/2015		0.02	2.2	6.69		29		12			205	29
	JRCREEK 1	26/10/2016		0.05	3	7.11		24		6	2		230	32
	JRCREEK 1	26/04/2017		0.005	2	7.08		11		0.5			104	24
	JRCREEK 2	23/10/2012				7		26			2.5	2.5	160	2.5
	JRCREEK 2	12/04/2013				7.3		49			2.5	2.5	240	11
	JRCREEK 2	11/12/2013		0.11	1.1			11			2.5	2.5	130	5.5
	JRCREEK 2	10/07/2014			0.78		0.025	15			2.5	2.5	99	5.8
	JRCREEK 2	3/11/2014		0.01	2.2	8.81		17		10	3.3		206	10
	JRCREEK 2	10/04/2015		0.13	1.2	7.26		20		9	3		146	12
	JRCREEK 2	2/11/2015		0.04	0.6	7.45		21		9			164	9
	JRCREEK 2	6/04/2016		0.05	1	8.21		23		6			148	12
	JRCREEK 2	26/10/2016		0.06	1	7.38		10		5	1.7		110	11
	JRCREEK 2	26/04/2017		0.04	0.8	7.67		16		3			100	10
	JRSWD	23/10/2012				7.8		60			15	15	420	2.5
	JRSWD	12/04/2013				8.2		73			26	26	590	38
	JRSWD	12/12/2013		0.81	3.3			66			14	14	400	18
	JRSWD	10/07/2014			2.1		0.15	57			21	21	380	20
	JRSWD	3/11/2014		0.61	2.7	8.01		41		40	13.3		530	17
	JRSWD	10/04/2015		1.64	7.6	7.3		37		27	9		865	19
	JRSWD	2/11/2015		0.72	3.2	7.64		51		35			654	25
	JRSWD	5/04/2016		0.06	1.8	7.6		66		23			474	22
	JRSWD	26/10/2016		0.72	2.3	7.65		48		32	10.7		604	23
	JRSWD	26/04/2017		0.26	2.5	7.79		61		27			434	22

Location Type	Location Code	Sampled Date	Hardness as CaCO3 mg/L	Turbidity NTU	Sulfate as SO4 - Turbidimetric (Filtered mg/L	Volatile Fatty Acids (as Acetic Acid) mg/L	Nitrogen (Organic) mg/L	Volatile Fatty Acids mg/L
Surface Water	JND	30/01/2006						
	JND	1/08/2006						
	JND	30/01/2007						
	JND	1/08/2007						
	JND	29/07/2008						
	JND	7/04/2009						
	JND	5/10/2009						
	JND	23/03/2010						
	JND	5/08/2010						
	JND	8/03/2011						
	JND	8/03/2011						
	JND	8/03/2011						
	JND	27/10/2011						
	JND	10/04/2012						
	JND	10/04/2012						
	JND	10/04/2012						
	JND	23/10/2012						
	JND	9/04/2013						
	JND	11/12/2013		96				
	JND	10/07/2014		65.9			1.2	
	JND	3/11/2014						16
	JND	10/04/2015						12
	JND	2/11/2015		76.9				9
	JND	6/04/2016		19.7				7
	JND	26/10/2016		86.9	14	10		10
	JND	26/04/2017		43.9				10
	JRCREEK 1	23/10/2012						
	JRCREEK 1	11/12/2013		69				
	JRCREEK 1	10/04/2014						12
	JRCREEK 1	2/11/2015		16.9				9
	JRCREEK 1	26/10/2016		35.7	6	13		13
	JRCREEK 1	26/04/2017		18.7				10
	JRCREEK 2	23/10/2012						
	JRCREEK 2	12/04/2013						
	JRCREEK 2	11/12/2013		23				
	JRCREEK 2	10/07/2014		17.5			0.6	
	JRCREEK 2	3/11/2014						16
	JRCREEK 2	10/04/2015						12
	JRCREEK 2	2/11/2015		7.6				9
	JRCREEK 2	6/04/2016		21.1				12
	JRCREEK 2	26/10/2016		8.7	5	10		10
	JRCREEK 2	26/04/2017		32.2				10
	JRSWD	23/10/2012						
	JRSWD	12/04/2013						
	JRSWD	12/12/2013		42				
	JRSWD	10/07/2014		230			1.9	
	JRSWD	3/11/2014						24
	JRSWD	10/04/2015						14
	JRSWD	2/11/2015		153				14
	JRSWD	5/04/2016		97.7				7
	JRSWD	26/10/2016		135	32	10		10
	JRSWD	26/04/2017		62.8				10

			BTEX							TRH								
Location Type	Location Code	Sampled Date	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylene (m & p) µg/L	Xylene (o) µg/L	Xylene Total µg/L	Total BTEX µg/L	C6 C9 µg/L	C10 C14 µg/L	C15 C28 µg/L	C29C36 µg/L	+C10 C36 (Sum of total) µg/L	C6C10 µg/L	C10C16 µg/L	C16C34 µg/L	C34C40 µg/L
Groundwater	119506	8/01/1997																
		22/01/1998																
		26/08/1998																
		26/02/1999																
		13/07/1999																
		18/01/2000																
		29/08/2000																
		15/02/2001																
		24/07/2001																
		9/01/2002																
		24/07/2002																
		26/02/2003																
		22/08/2003																
		17/02/2004																
		28/07/2004																
		15/02/2005																
		5/07/2005																
		1/02/2006																
		1/08/2006																
		31/01/2007																
		30/07/2007																
		30/07/2008																
		6/04/2009																
		8/10/2009																
		22/03/2010																
		4/08/2010																
		8/03/2011																
		27/10/2011																
		10/04/2012																
		24/10/2012																
		8/04/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		18/12/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		18/12/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		18/12/2013	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		9/07/2014	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		30/10/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	100	200	300	<20	<100	310	<100
		9/04/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		1/11/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		6/04/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		27/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		27/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
Groundwater	119507	8/1/1997																
		22/01/1998																
		26/08/1998																
		26/02/1999																
		13/07/1999																
		18/01/2000																
		29/08/2000																
		15/02/2001																
		24/07/2001																
		9/01/2002																
		24/07/2002																
		26/02/2003																
		21/08/2003																
		17/02/2004																
		28/07/2004																
		15/06/2005																
		6/07/2005																
		1/08/2006																
		1/08/2007																
		31/07/2008																
		8/04/2009																
		7/10/2009																
		5/08/2010																
		27/10/2011																
		12/04/2012																
		23/10/2012																
		9/04/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		12/04/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		18/12/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		10/07/2014	<1	2	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		30/10/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		10/04/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		1/11/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		6/04/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		27/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		27/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100

			CRC Care TPH Fractions			PAH	Metals													
Location Type	Location Code	Sampled Date	C10 C40 (Sum of total) µg/L	F1: C6C10 less BTEX µg/L	F2: >C10C16 less NAPHTHALENE µg/L	Naphthalene µg/L	Cadmium mg/L	Calcium (Filtered) mg/L	Chromium (III+VI) mg/L	Copper mg/L	Iron mg/L	Iron (Filtered) mg/L	Lead mg/L	Magnesium (Filtered) mg/L	Manganese (Filtered) mg/L	Nickel mg/L	Phosphorus mg/L	Potassium (Filtered) mg/L	Zinc mg/L
Groundwater	119506	8/01/1997						2.3			2.9			15				7	
		22/01/1998						0.9			21			21				69	
		26/08/1998						1.4			<0.1			19				6.6	
		26/02/1999						1.1			2.4			22				6.4	
		13/07/1999						1.4			<0.03			21				11	
		18/01/2000									0.4								
		29/08/2000					<0.0005		0.005	0.019	0.8		0.036			<0.002			0.22
		15/02/2001					<0.005		<0.005	<0.005	3.2		<0.005			<0.005			0.32
		24/07/2001					<0.005		<0.005	<0.005	<0.1		<0.005			<0.005			0.52
		9/01/2002					<0.001		<0.001	<0.001	<0.01		<0.001			0.002			0.484
		24/07/2002								0.002			0.003			0.003			0.202
		26/02/2003						2			0.81			40	0.03		0.29	11	
		22/08/2003						1.7			1.9			38	0.016			7.9	
		17/02/2004						2						37	0.022		0.33	7.6	
		28/07/2004						2.2			3			38	0.026			7.4	
		15/02/2005						2.6			<0.05			40	0.007			9.4	
		5/07/2005						4.3			0.08			43	0.01			10	
		1/02/2006						2.3			<0.05			39	0.008			7.3	
		1/08/2006						2.5			<0.05			45	<0.005			8.9	
		31/01/2007						3.4			<0.05			52	0.012			12	
		30/07/2007						2.5			<0.05			42	<0.005			12	
		30/07/2008						<5			1.8			51	0.007			13	
		6/04/2009						<5			<0.05			51	0.013			12	
		8/10/2009						2.8			17			47	0.072			22	
		22/03/2010						2.7			12			39	0.006			8.8	
		4/08/2010						2.1				<0.05		39	<0.005			8	
		8/03/2011						2.1				4.9		40	<0.005			8	
		27/10/2011						2.5				15		42	<0.005			7.7	
		10/04/2012						2.2				0.49		54	0.009			6.5	
		24/10/2012						2.1				<0.05		37	<0.005			6.7	
		8/04/2013		<20	<50	<20		1.9				<0.05		38	<0.005			6.7	
		18/12/2013		<20	<50	<20		1.9				<0.05		4.1	<0.005		<0.5	6.2	
		18/12/2013		<20	<50	<20		2.1				<0.05		36	<0.005		<0.5	5.3	
		18/12/2013	<100	<20	<100	<5		3				<0.05		39	0.004		<0.01	8	
		9/07/2014		<20	<50	<20		2.2				<0.05		38	<0.005			7.1	
		30/10/2014	310	<20	<100	<5		2				<0.05		37	0.019		0.24	8	
		9/04/2015	<100	<20	<100	<5		2				<0.05		36	0.004		<0.01	8	
		1/11/2015	<100	<20	<100	<5		2				<0.05		37	0.001		0.01	8	
		6/04/2016	<100	<20	<100	<5		2				<0.05		38	<0.001		<0.01	6	
		27/10/2016	<100	<20	<100	<5		1				<0.05		32	<0.001		0.01	7	
		27/04/2017	<100	<20	<100	<5		2				<0.05		40	<0.001		<0.01	9	
Groundwater	119507	8/1/1997						2.3			12			50				12	
		22/01/1998						2.2			16			62				25	
		26/08/1998						1.8			8.9			57				15	
		26/02/1999						1.4			11			58				11	
		13/07/1999						1.9			2			52				19	
		18/01/2000									10								
		29/08/2000					<0.0005		0.007	0.012	6.4		0.036			<0.002			0.25
		15/02/2001					<0.005		0.014	<0.0005	3.3		<0.0005			<0.0005			0.59
		24/07/2001					<0.005		0.007	<0.005	0.9		<0.005			<0.005			0.083
		9/01/2002					<0.001		<0.001	<0.001	0.14		<0.001			0.002			0.416
		24/07/2002								<0.001			<0.001			0.004			0.096
		26/02/2003						2			2.99			44	0.07		0.32	12	
		21/08/2003						1.3			12			44	0.094			8.9	
		17/02/2004						1.8						41	0.081		0.94	9.4	
		28/07/2004						2			12			42	0.063			9.4	
		15/06/2005						1.5			8			44	0.04			9.6	
		6/07/2005						2.1			9.9			44	0.047			9.7	
		1/08/2006						1.4			2.7			45	0.012			9	
		1/08/2007						3			<0.05			38	0.029			14	
		31/07/2008						<5			0.83			47	0.036			12	
		8/04/2009						<5			2.7			61	0.043			12	
		7/10/2009						1.4			6.4			41	0.026			9	
		5/08/2010						1.9				2.6		57	0.035			11	
		27/10/2011						1.4				17		40	0.024			9.2	
		12/04/2012						1.7				1.5		45	0.034			9.8	
		23/10/2012						1.4				0.86		39	0.011			8.7	
		9/04/2013		<20	<50	<20		1.1				0.9		39	0.007			8.7	
		12/04/2013		<20	<50	<20		1.1				0.95		40	0.007			8.8	
		18/12/2013		<20	<50	<20		1.2				4.2		36	0.01		<0.5	9	
		10/07/2014		<20	<50	<20		3.9				0.98		41	0.011			9.4	
		30/10/2014	<100	<20	<100	<5		1				1.31		39	0.01		0.23	10	
		10/04/2015	<100	<20	<100	<5		1				1.04		39	0.01		0.09	10	
		1/11/2015	<100	<20	<100	<5		2				0.75		42	0.012		0.51	10	
		6/04/2016	<100	<20	<100	<5		1				0.35		44	0.007		<0.01	10	
		27/10/2016	<100	<20	<100	<5		<1				0.33		38	0.006		0.02	9	
		27/04/2017	<100	<20	<100	<5		1				0.1		48	0.003		<0.01	12	

			BTEX							TRH								
Location Type	Location Code	Sampled Date	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylene (m & p) µg/L	Xylene (o) µg/L	Xylene Total µg/L	Total BTEX µg/L	C6 C9 µg/L	C10 C14 µg/L	C15 C28 µg/L	C29C36 µg/L	+C10 C36 (Sum of total) µg/L	C6C10 µg/L	C10C16 µg/L	C16C34 µg/L	C34C40 µg/L
Groundwater	141402	29/08/2000																
		15/02/2001																
		24/07/2001																
		9/01/2002																
		24/07/2002																
		26/02/2003																
		21/08/2003																
		17/02/2004																
		27/07/2004																
		15/02/2005																
		5/07/2005																
		31/01/2006																
		1/08/2006																
		31/01/2007																
		1/08/2007																
		29/07/2008																
		6/04/2009																
		6/10/2009																
		23/03/2010																
		5/08/2010																
		7/03/2011																
		27/10/2011																
		27/10/2011																
		27/10/2011																
		10/04/2012																
		24/10/2012																
		11/04/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		12/12/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		12/12/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		12/12/2013	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		9/07/2014	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		30/10/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		30/10/2014	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		30/10/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		9/04/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		1/11/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		5/04/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		27/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		27/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
	141403	29/08/2000																
		15/02/2001																
		24/07/2001																
		9/01/2002																
		24/07/2002																
		26/02/2003																
		21/08/2003																
		17/02/2004																
		28/07/2004																
		15/02/2005																
		6/07/2005																
		1/08/2006																
		1/08/2007																
		31/07/2008																
		7/04/2009																
		7/10/2009																
		5/08/2010																
		27/10/2011																
		12/04/2012																
		23/10/2012																
		23/10/2012																
		23/10/2012																
		12/04/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		18/12/2013	<1	3	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		10/07/2014	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		30/10/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		10/04/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		1/11/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		6/04/2016	<1	4	<2	<2	<2	<2	4	<20	<50	<100	<50	<50	<20	<100	<100	<100
		27/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		27/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100

			CRC Care TPH Fractions			PAH	Metals												
Location Type	Location Code	Sampled Date	C10 C40 (Sum of total) µg/L	F1: C6C10 less BTEX µg/L	F2: >C10C16 less NAPHTHALENE µg/L	Naphthalene µg/L	Cadmium mg/L	Calcium (Filtered) mg/L	Chromium (III+VI) mg/L	Copper mg/L	Iron mg/L	Iron (Filtered) mg/L	Lead mg/L	Magnesium (Filtered) mg/L	Manganese (Filtered) mg/L	Nickel mg/L	Phosphorus mg/L	Potassium (Filtered) mg/L	Zinc mg/L
Groundwater	141402	29/08/2000					<0.0005		0.018	**0.47**	23		0.14			<0.002			**4.9**
		15/02/2001					<0.005		0.009	0.015	<0.1		<0.005			<0.005			0.92
		24/07/2001					<0.005		<0.005	<0.005	<0.1		0.006			<0.005			0.29
		9/01/2002					<0.001		<0.001	0.006	<0.01		<0.001			0.002			0.263
		24/07/2002								0.003			<0.001			0.002			0.082
		26/02/2003						3			<0.01			31	0.01		0.68	8	
		21/08/2003						2			5.3			33	0.034			6.2	
		17/02/2004						2.3						32	0.003		0.72	6.5	
		27/07/2004						2.6			3.3			31	0.044			6.4	
		15/02/2005						2.6			<0.05			34	0.005			6.7	
		5/07/2005						2.5			<0.05			36	0.005			15	
		31/01/2006						2.4			<0.05			33	0.002			6.7	
		1/08/2006						2.6			<0.05			32	<0.005			6.7	
		31/01/2007						3.6			<0.05			38	0.006			9.9	
		1/08/2007						3			<0.05			27	<0.005			12	
		29/07/2008						<5			<0.05			27	<0.005			13	
		6/04/2009						<5			<0.05			34	<0.005			8.4	
		6/10/2009						1.7			5.5			29	0.027			7	
		23/03/2010						2.5			7.1			26	0.007			5.9	
		5/08/2010						2.4				<0.05		30	<0.005			7.8	
		7/03/2011						2.2				2.7		30	0.055			7.4	
		27/10/2011						3.2				18		30	0.007			6.5	
		27/10/2011						3				<0.05		34	0.007			7	
		27/10/2011						3.2				17		30	0.007			6.5	
		10/04/2012						2.3				<0.05		32	<0.005			6.6	
		24/10/2012						1.7				<0.05		27	<0.005			6.1	
		11/04/2013		<20	<50	<20		1.5				<0.05		28	<0.005			5.7	
		12/12/2013		<20	<50	<20		16				<0.05		26	<0.005		<0.5	59	
		12/12/2013		<20	<50	<20		16				<0.05		26	<0.005		1	59	
		12/12/2013	<100	<20	<100	<5		<1				<0.05		19	0.004		0.02	4	
		9/07/2014		<20	<50	<20		1.7				<0.05		27	<0.005			6.4	
		30/10/2014	<100	<20	<100	<5		1				<0.05		28	0.003		0.27	7	
		30/10/2014		<20	<50	<20		1.3				<0.05		28	<0.005		<0.5	6.4	
		30/10/2014	<100	<20	<100	<5		1				<0.05		28	0.003		0.25	7	
		9/04/2015	<100	<20	<100	<5		2				<0.05		31	0.003		<0.01	7	
		1/11/2015	<100	<20	<100	<5		1				<0.05		30	0.003		0.01	7	
		5/04/2016	<100	<20	<100	<5		2				<0.05		33	0.001		<0.01	7	
		27/10/2016	<100	<20	<100	<5		1				<0.05		30	<0.001		0.04	6	
		27/04/2017	<100	<20	<100	<5		2				<0.05		34	<0.001		<0.01	8	
	141403	29/08/2000					<0.0005		0.044	0.049	38		0.1			0.05			2.7
		15/02/2001					<0.005		0.01	<0.005	3.1		<0.005			0.005			0.2
		24/07/2001					<0.005		0.009	<0.005	2.8		<0.005			0.012			0.17
		9/01/2002					<0.001		<0.001	<0.001	0.01		<0.001			0.014			0.619
		24/07/2002								0.001			<0.001			0.008			0.263
		26/02/2003						2			0.66			59	0.03		0.66	16	
		21/08/2003						1.1			26			57	0.14			12	
		17/02/2004						1.6						65	0.018		1.2	13	
		28/07/2004						7.3			23			62	0.2			13	
		15/02/2005						2			0.22			57	0.05			12	
		6/07/2005						2			0.05			55	0.017			15	
		1/08/2006						1.5			0.46			54	0.025			11	
		1/08/2007						2.9			1.6			48	0.062			17	
		31/07/2008						5.7			<0.05			74	0.021			25	
		7/04/2009						<5			<0.05			58	0.011			12	
		7/10/2009						1.8			17			53	0.08			13	
		5/08/2010						1.6				<0.05		58	<0.005			14	
		27/10/2011						1.4				120		56	0.01			12	
		12/04/2012						2				0.22		49	0.018			12	
		23/10/2012						1.5				0.82		46	<0.005			11	
		23/10/2012						1				0.89		56	0.005			15	
		23/10/2012						1.2				0.91		46	0.005			11	
		12/04/2013		<20	<50	<20		1.2				0.81		49	<0.005			11	
		18/12/2013		<20	<50	<20		1.2				0.62		48	<0.005		<0.5	9.6	
		10/07/2014		<20	<50	<20		1.2				0.21		51	<0.005			11	
		30/10/2014	<100	<20	<100	<5		<1				0.3		52	0.006		0.36	13	
		10/04/2015	<100	<20	<100	<5		<1				<0.05		53	0.005		0.02	13	
		1/11/2015	<100	<20	<100	<5		<1				<0.05		55	0.003		0.02	13	
		6/04/2016	<100	<20	<100	<5		1				0.82		54	0.004		0.34	12	
		27/10/2016	<100	<20	<100	<5		2				<0.05		43	0.004		0.1	12	
		27/04/2017	<100	<20	<100	<5		2				0.1		50	0.002		0.07	13	

			BTEX							TRH									
Location Type	Location Code	Sampled Date	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylene (m & p) µg/L	Xylene (o) µg/L	Xylene Total µg/L	Total BTEX µg/L	C6 C9 µg/L	C10 C14 µg/L	C15 C28 µg/L	C29C36 µg/L	+C10 C36 (Sum of total) µg/L	C6C10 µg/L	C10C16 µg/L	C16C34 µg/L	C34C40 µg/L	
Groundwater	9022881/1	30/01/2006																	
		1/08/2006																	
		30/01/2007																	
		1/08/2007																	
		29/07/2008																	
		6/04/2009																	
		5/10/2009																	
		23/03/2010																	
		6/08/2010																	
		8/03/2011																	
		27/10/2011																	
		10/04/2012																	
		24/10/2012																	
		11/04/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
		12/12/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
		9/07/2014	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
		9/07/2014	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
		9/07/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		27/10/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		9/04/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		9/04/2015	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
		9/04/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		31/10/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		31/10/2015	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
		31/10/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		5/04/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		27/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		27/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		27/10/2016	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
		26/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		26/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		26/04/2017	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
Groundwater	9022881/2	30/01/2006																	
		1/08/2006																	
		30/01/2007																	
		1/08/2007																	
		29/07/2008																	
		6/04/2009																	
		6/10/2009																	
		23/03/2010																	
		5/08/2010																	
		8/03/2011																	
		27/10/2011																	
		10/04/2012																	
		24/10/2012																	
		11/04/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
		12/12/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
		9/07/2014	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
		3/11/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		9/04/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		31/10/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		5/04/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		5/04/2016	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100	
		5/04/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		27/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100	
		27/04/2017	<1	6	<2	<2	<2	<2	6	<20	<50	<100	<50	<50	<20	<100	<100	<100	

			CRC Care TPH Fractions			PAH	Metals													
Location Type	Location Code	Sampled Date	C10 C40 (Sum of total) µg/L	F1: C6C10 less BTEX µg/L	F2: >C10C16 less NAPHTHALENE µg/L	Naphthalene µg/L	Cadmium mg/L	Calcium (Filtered) mg/L	Chromium (III+VI) mg/L	Copper mg/L	Iron mg/L	Iron (Filtered) mg/L	Lead mg/L	Magnesium (Filtered) mg/L	Manganese (Filtered) mg/L	Nickel mg/L	Phosphorus mg/L	Potassium (Filtered) mg/L	Zinc mg/L
Groundwater	9022881/1	30/01/2006						1.8			<0.05			13	0.079			3.8	
		1/08/2006						2.5			<0.05			18	0.073			4.1	
		30/01/2007						3.1			<0.05			20	0.05			5.4	
		1/08/2007						2.6			<0.05			17	0.024			6.9	
		29/07/2008						<5			<0.05			13	0.02			9.3	
		6/04/2009						<5			0.09			20	0.019			7.7	
		5/10/2009						1.9			12			14	0.014			18	
		23/03/2010						2.7			2.4			16	0.007			4	
		6/08/2010						2.1				<0.1		16	<0.01			3.7	
		8/03/2011						2.1				8.7		14	0.019			3.3	
		27/10/2011						2				53		8.7	0.008			2.5	
		10/04/2012						1.2				0.05		8.8	0.03			2.5	
		24/10/2012						1.2				0.09		5.2	0.01			1.7	
		11/04/2013		<20	<50	<20		1.9				0.23		13	0.017			2.9	
		12/12/2013		<20	<50	<20		33				<0.05		17	<0.005		0.7	27	
		9/07/2014		<20	<50	<20		2.1				<0.05		11	<0.005			2.7	
		9/07/2014		<20	<50	<20		1.9				<0.05		11	<0.005			2.6	
		9/07/2014	<100	<20	<100	<5		1				<0.05		10	0.002		0.03	2	
		27/10/2014	<100	<20	<100	<5		2				<0.05		10	0.002		0.09	3	
		9/04/2015	<100	<20	<100	<5		1				<0.05		11	0.005		0.01	3	
		9/04/2015		<20	<50	<20		1.9				<0.05		11	<0.005		<0.5	2.5	
		9/04/2015	<100	<20	<100	<5		2				<0.05		12	0.004		<0.01	3	
		31/10/2015	<100	<20	<100	<5		3				<0.05		16	0.001		0.02	3	
		31/10/2015		<20	<50	<10		4				<0.05		16	<0.005			2.5	
		31/10/2015	<100	<20	<100	<5		3				<0.05		16	<0.001		0.01	3	
		5/04/2016	<100	<20	<100	<5		2				0.07		9	0.006		<0.01	2	
		27/10/2016	<100	<20	<100	<5		1				<0.05		5	<0.001		<0.01	1	
		27/10/2016	<100	<20	<100	<5		1				<0.05		5	<0.001		0.02	1	
		27/10/2016		<20	<50	<10		2.5				<0.05		9.1	<0.005			1.9	
		26/04/2017	<100	<20	<100	<5		6				<0.05		15	<0.001		0.01	3	
		26/04/2017	<100	<20	<100	<5		5				<0.05		14	<0.001		<0.01	3	
		26/04/2017		<20	<50	<10		3.9				<0.05		14	<0.005			2.3	
Groundwater	9022881/2	30/01/2006						11			<0.05			17	0.13			3.2	
		1/08/2006						3.5			<0.05			16	0.037			3.1	
		30/01/2007						2.5			<0.05			15	0.021			3	
		1/08/2007						1.8			0.07			11	0.019			4.1	
		29/07/2008						<5			<0.05			13	<0.005			<5	
		6/04/2009						<5			<0.05			19	0.011			<5	
		6/10/2009						2			5			18	0.046			3.8	
		23/03/2010						2.3			<0.05			14	<0.005			2.2	
		5/08/2010						1.9				<0.05		14	<0.005			2.8	
		8/03/2011						2.3				14		13	<0.005			2.3	
		27/10/2011						3.5				40		16	0.006			2.4	
		10/04/2012						3.2				0.26		16	0.026			2.5	
		24/10/2012						3.6				<0.05		16	<0.005			2.2	
		11/04/2013		<20	<50	<20		3.6				<0.05		17	<0.005			2.1	
		12/12/2013		<20	<50	<20		36				<0.05		15	<0.005		<0.5	21	
		9/07/2014		<20	<50	<20		3.8				<0.05		16	<0.005			2.4	
		3/11/2014	<100	<20	<100	<5		3				1.09		16	0.018		0.18	2	
		9/04/2015	<100	<20	<100	<5		3				<0.05		14	0.002		<0.01	2	
		31/10/2015	<100	<20	<100	<5		4				<0.05		18	0.001		0.02	3	
		5/04/2016	<100	<20	<100	<5		2				<0.05		9	0.006		<0.01	2	
		5/04/2016		<20	<50	<10		2.6				<0.05		10	0.007			2	
		5/04/2016	<100	<20	<100	<5		4				0.09		19	0.001		<0.01	3	
		27/10/2016	<100	<20	<100	<5		4				<0.05		16	<0.001		0.01	2	
		27/04/2017	<100	<20	<100	<5		6				0.09		21	<0.001		<0.01	3	

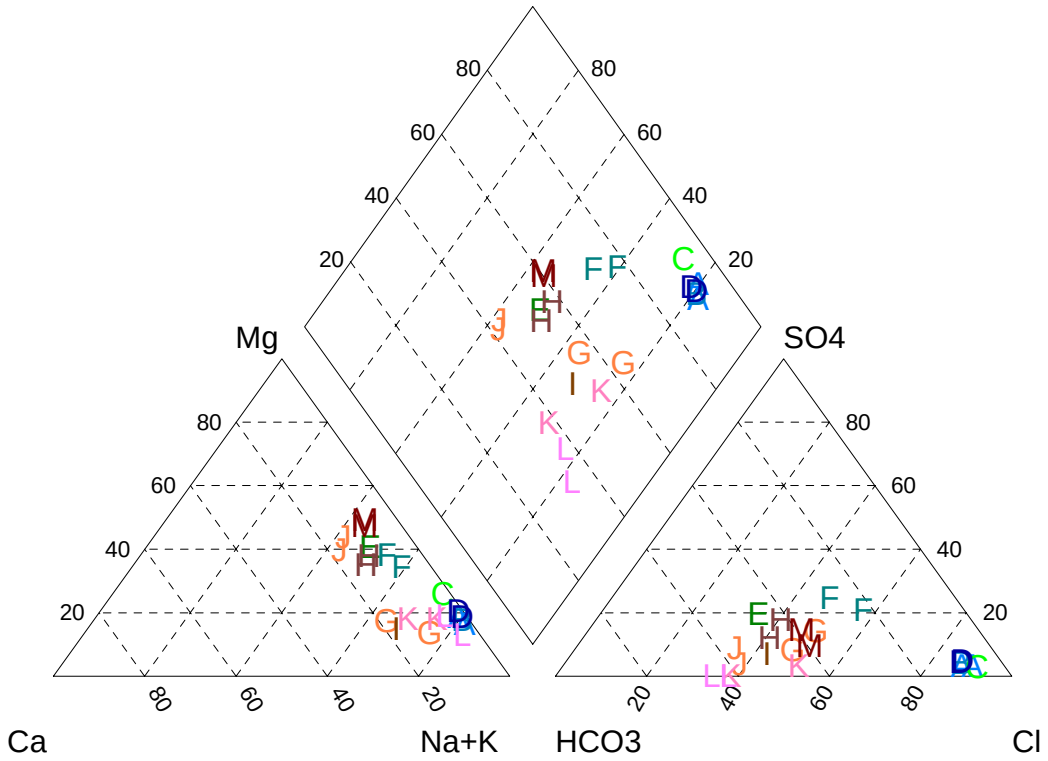
			BTEX							TRH								
Location Type	Location Code	Sampled Date	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylene (m & p) µg/L	Xylene (o) µg/L	Xylene Total µg/L	Total BTEX µg/L	C6 C9 µg/L	C10 C14 µg/L	C15 C28 µg/L	C29C36 µg/L	+C10 C36 (Sum of total) µg/L	C6C10 µg/L	C10C16 µg/L	C16C34 µg/L	C34C40 µg/L
Leachate	JRLD	27/07/2004																
		15/02/2005																
		6/07/2005																
		30/01/2006																
		1/08/2006																
		31/01/2007																
		1/08/2007																
		29/07/2008																
		5/10/2009																
		23/03/2010																
		17/08/2010																
		8/03/2011																
		27/10/2011																
		3/11/2011																
		10/04/2012																
		23/10/2012																
		12/04/2013	<1	<1	<1	<2	<1	<3		<20	120	300	<100	400	<20	170	300	<100
		12/12/2013	<1	<1	<1	<2	<1	<3		<20	70	200	<100	300	<20	100	300	<100
		9/07/2014	<1	<1	<1	<2	<1	<3		<20	120	200	<100	300	<20	160	200	<100
		3/11/2014	<1	<2	<2	<2	<2	<2	<1	<20	100	360	<50	460	<20	130	390	<100
		10/04/2015	<1	<2	<2	<2	<2	<2	<1	<20	160	680	80	920	<20	260	650	<100
		2/11/2015	<1	<2	<2	<2	<2	<2	<1	<20	120	400	80	600	<20	200	400	<100
		5/04/2016	<1	<2	<2	<2	<2	<2	<1	<20	80	430	60	570	<20	170	410	<100
		26/10/2016	<1	54	<2	<2	<2	<2	54	80	300	700	80	1080	80	490	560	<100
		26/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	330	<50	330	<20	110	270	<100
	JRLP	21/08/2003																
		17/02/2004																
		27/07/2004																
		15/02/2005																
		6/07/2005																
		30/01/2006																
		1/08/2006																
		30/01/2007																
		1/08/2007																
		31/07/2008																
		7/04/2009																
		7/10/2009																
		23/03/2010																
		17/08/2010																
		8/03/2011																
		28/10/2011																
		10/04/2012																
		23/10/2012																
		12/04/2013	<1	<1	<1	<2	<1	<3		<20	320	1200	200	1700	<20	500	1100	<100
		12/12/2013	<4	<4	<4	<8	<4	<12		<80	350	1300	200	1900	<80	530	1300	<100
		10/07/2014	<1	<1	<1	<2	<1	<3		<20	140	500	<100	600	<20	210	400	<100
		2/11/2015	<1	<2	<2	10	<2	10	10	110	1690	3480	150	5320	60	2170	3010	<100
		5/04/2016	<1	<2	<2	12	3	15	15	70	1320	3080	200	4600	60	1650	2760	<100
		26/10/2016	<1	<2	<2	10	<2	10	10	80	1350	4000	390	5740	40	1830	3700	<100
		27/04/2017	3	2	<2	20	7	27	32	160	1740	3750	310	5800	110	2160	3300	110
Surface Water	Fire Dam	26/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		26/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
	JND	18/01/2000																
		29/08/2000																
		15/02/2001																
		24/07/2001																
		9/01/2002																
		24/07/2002																
		26/02/2003																
		21/08/2003																
		17/02/2004																
		28/07/2004																
		15/02/2005																
		6/07/2005																
		30/01/2006																
		1/08/2006																
		30/01/2007																
		1/08/2007																
		29/07/2008																
		7/04/2009																
		5/10/2009																
		23/03/2010																
		5/08/2010																
		8/03/2011																
		8/03/2011																
		8/03/2011																
		27/10/2011																
		10/04/2012																
		10/04/2012																
		10/04/2012																
		23/10/2012																
		9/04/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		11/12/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		10/07/2014	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		3/11/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		10/04/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		2/11/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		6/04/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		26/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		26/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100

Location Type	Location Code	Sampled Date	CRC Care TPH Fractions			PAH	Metals												
			C10 C40 (Sum of total) µg/L	F1: C6C10 less BTEX µg/L	F2: >C10C16 less NAPHTHALENE µg/L	Naphthalene µg/L	Cadmium mg/L	Calcium (Filtered) mg/L	Chromium (III+VI) mg/L	Copper mg/L	Iron mg/L	Iron (Filtered) mg/L	Lead mg/L	Magnesium (Filtered) mg/L	Manganese (Filtered) mg/L	Nickel mg/L	Phosphorus mg/L	Potassium (Filtered) mg/L	Zinc mg/L
Leachate	JRLD	27/07/2004						18			3.4			15	2.2			12	
		15/02/2005						14			0.07			16	0.03			14	
		6/07/2005						13			0.14			16	0.005			15	
		30/01/2006						17			0.15			22	0.28			17	
		1/08/2006						17			0.1			24	1.5			12	
		31/01/2007						27			0.28			40	0.26			25	
		1/08/2007						59			9.3			35	3.3			42	
		29/07/2008						26			0.52			51	0.28			36	
		5/10/2009						17			0.59			30	0.024			20	
		23/03/2010						39			2.9			40	2.5			32	
		17/08/2010						110				4.6		73	2.3			55	
		8/03/2011						48				0.89		75	0.008			75	
		27/10/2011						60				0.75		49	0.12			56	
		3/11/2011																	
		10/04/2012						37				0.22		56	0.14			64	
		23/10/2012						38				0.18		61	0.12			77	
		12/04/2013		<20	170	<20		30				0.34		130	0.088			160	
		12/12/2013		<20	100	<20		34				0.41		57	0.18		1.5	73	
		9/07/2014		<20	160	<20		31				<0.05		49	0.18			83	
		3/11/2014	520	<20	130	<5		35				0.07		46	0.176		0.33	87	
		10/04/2015	910	<20	260	<5		27				<0.05		79	0.109		0.86	148	
		2/11/2015	600	<20	200	<5		37				0.24		85	0.265		0.74	151	
		5/04/2016	580	<20	170	<5		34				0.07		80	0.162		0.29	136	
		26/10/2016	1050	30	490	<5		80				0.57		70	1.16		0.48	122	
		26/04/2017	380	<20	110	<5		45				0.39		81	0.192		0.26	154	
	JRLP	21/08/2003						82			0.3			16	<0.001			3.8	
		17/02/2004						150						120	7.6		0.85	69	
		27/07/2004						170			120			160	1.1			49	
		15/02/2005						120			56			150	0.18			57	
		6/07/2005						150			1.7			200	0.52			110	
		30/01/2006						28			20			37	1.2			20	
		1/08/2006						45			58			79	8.4			31	
		30/01/2007						49			36			79	0.036			44	
		1/08/2007						410			28			480	2.1			500	
		31/07/2008						150			4.2			460	0.24			290	
		7/04/2009						76			6.8			410	0.013			290	
		7/10/2009						42			12			220	0.019			130	
		23/03/2010						100			2.7			320	0.41			230	
		17/08/2010						56				120		330	0.15			210	
		8/03/2011						57				8		290	0.056			210	
		28/10/2011						70				6.1		270	0.057			240	
		10/04/2012						50				1.9		250	0.072			240	
		23/10/2012						140				0.65		250	0.2			240	
		12/04/2013		<20	500	<20		36				0.33		180	0.027			190	
		12/12/2013		<80	530	<80		27				0.78		190	0.027		11	220	
		10/07/2014		<20	210	<20		73				1.1		280	0.096			350	
		2/11/2015	5180	50	2170	<5		68				1.98		231	0.13		1.63	367	
		5/04/2016	4410	40	1650	<5		66				2.67		267	0.13		0.52	380	
		26/10/2016	5530	30	1830	<5		47				2.72		147	0.146		3.43	354	
		27/04/2017	5570	80	2160	<5		86				4.73		290	0.207		0.84	420	
Surface Water	Fire Dam	26/10/2016	<100	<20	<100	<5		11				0.32		9	0.067		1.92	50	
		26/04/2017	<100	<20	<100	<5		15				0.18		9	0.128		0.31	33	
	JND	18/01/2000					<0.0005	260	0.003	0.004	2.9		0.008	43		0.009		8	0.04
		29/08/2000					**0.0012**	5.2	0.002	0.003	1.9		0.003	4.3		0.003		3.9	0.14
		15/02/2001					<0.005		<0.005	<0.005	0.3		<0.005			<0.005			<0.005
		24/07/2001					<0.005		<0.005	<0.005	2.5		<0.005			<0.005			0.011
		9/01/2002					<0.001		0.007	0.004	2.83		0.002			0.005			0.01
		24/07/2002								0.001			<0.001			0.001			0.011
		26/02/2003						92			0.09			24	0.48		0.12	7	
		21/08/2003						73			0.3			26	0.061			5.3	
		17/02/2004						50						20	0.038		0.14	7	
		28/07/2004						14			1.7			6.8	0.018			6.6	
		15/02/2005						13			0.3			7.6	0.007			8.8	
		6/07/2005						16			0.1			9.4	0.001			7.4	
		30/01/2006						12			0.17			6.7	0.003			6.1	
		1/08/2006						12			0.15			7.9	0.024			4.5	
		30/01/2007						13			0.19			9.5	<0.005			4.2	
		1/08/2007						31			1.2			11	0.057			11	
		29/07/2008						38			0.29			12	<0.005			9.3	
		7/04/2009						25			0.09			12	<0.005			8.4	
		5/10/2009						20			0.019			11	0.0017			6.4	
		23/03/2010						22			0.28			11	0.011			8.1	
		5/08/2010						19				0.14		9.8	0.007			7.4	
		8/03/2011						<0.5				<0.05		<0.5	<0.005			<0.5	
		8/03/2011						17				0.14		8	0.002			9	
		8/03/2011						16				0.29		8.3	<0.005			7.9	
		27/10/2011						8				0.4		4.3	<0.005			5.3	
		10/04/2012						7.3				3.3		4.2	0.021			5.7	
		10/04/2012						7				2.31		4	0.023			10	
		10/04/2012						6.8				2.8		4.2	0.019			6	
		23/10/2012						6				0.7		4.5	0.007			7.6	
		9/04/2013		<20	<50	<20		8				0.24		7.2	0.005			13	
		11/12/2013		<20	<50	<20		8				1		7.7	0.054		<0.5	12	
		10/07/2014		<20	<50	<20		11				0.23		11	<0.005			13	
		3/11/2014	<100	<20	<100	<5		9				0.21		10	0.004		0.14	17	
		10/04/2015	<100	<20	<100	<5		6				0.11		7	0.006		0.03	13	
		2/11/2015	<100	<20	<100	<5		6				0.37		6	0.016		0.11	10	
		6/04/2016	<100	<20	<100	<5		8				0.08		8	0.023		<0.01	10	
		26/10/2016	<100	<20	<100	<5		4				0.16		4	0.002		0.05	8	
		26/04/2017	<100	<20	<100	<5		8				0.6		7	0.019		<0.01	11	

Location Type	Location Code	Sampled Date	BTEX							TRH								
			Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylene (m & p) µg/L	Xylene (o) µg/L	Xylene Total µg/L	Total BTEX µg/L	C6 C9 µg/L	C10 C14 µg/L	C15 C28 µg/L	C29C36 µg/L	+C10 C36 (Sum of total) µg/L	C6C10 µg/L	C10C16 µg/L	C16C34 µg/L	C34C40 µg/L
	JRCREEK 1	23/10/2012																
		11/12/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		10/04/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	110	<100
		2/11/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		26/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		26/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	190	<50	190	<20	<100	180	<100
	JRCREEK 2	23/10/2012																
		12/04/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		11/12/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		10/07/2014	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		3/11/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		10/04/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		2/11/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		6/04/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		26/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		26/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
	JRSWD	23/10/2012																
		12/04/2013	<1	<1	<1	<2	<1	<3		<20	60	600	600	1300	<20	70	1000	300
		12/12/2013	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	200	<100
		10/07/2014	<1	<1	<1	<2	<1	<3		<20	<50	<100	<100	<100	<20	<50	<100	<100
		3/11/2014	<1	<2	<2	<2	<2	<2	<1	<20	<50	130	260	390	<20	<100	410	<100
		10/04/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	160	100	260	<20	<100	240	<100
		2/11/2015	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		5/04/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		26/10/2016	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100
		26/04/2017	<1	<2	<2	<2	<2	<2	<1	<20	<50	<100	<50	<50	<20	<100	<100	<100

Location Type	Location Code	Sampled Date	CRC Care TPH Fractions			PAH	Metals												
			C10 C40 (Sum of total) µg/L	F1: C6C10 less BTEX µg/L	F2: >C10C16 less NAPHTHALENE µg/L	Naphthalene µg/L	Cadmium mg/L	Calcium (Filtered) mg/L	Chromium (III+VI) mg/L	Copper mg/L	Iron mg/L	Iron (Filtered) mg/L	Lead mg/L	Magnesium (Filtered) mg/L	Manganese (Filtered) mg/L	Nickel mg/L	Phosphorus mg/L	Potassium (Filtered) mg/L	Zinc mg/L
	JRCREEK 1	23/10/2012						11				1		11	0.12			12	
		11/12/2013		<20	<50	<20		3.3				2.1		4	0.094		<0.5	1.1	
		10/04/2014	110	<20	<100	<5		2				0.24		3	0.051		0.22	12	
		2/11/2015	<100	<20	<100	<5		5				2.2		6	0.071		0.15	4	
		26/10/2016	<100	<20	<100	<5		5				0.76		5	0.06		0.19	3	
		26/04/2017	180	<20	<100	<5		4				2.64		4	0.073		0.34	13	
	JRCREEK 2	23/10/2012						5.1				1.1		6.3	0.019			8.4	
		12/04/2013		<20	<50	<20		8.5				0.88		13	0.02			16	
		11/12/2013		<20	<50	<20		3.4				0.85		4	0.03		<0.5	5.7	
		10/07/2014		<20	<50	<20		4.6				0.08		5.5	<0.005			7.5	
		3/11/2014	<100	<20	<100	<5		4				0.13		5	0.002		0.09	6	
		10/04/2015	<100	<20	<100	<5		4				0.09		6	0.011		0.09	7	
		2/11/2015	<100	<20	<100	<5		4				0.15		6	0.005		0.04	6	
		6/04/2016	<100	<20	<100	<5		5				0.08		7	0.003		0.02	5	
		26/10/2016	<100	<20	<100	<5		2				0.39		3	0.029		0.06	6	
		26/04/2017	<100	<20	<100	<5		5				0.24		6	0.016		<0.01	9	
	JRSWD	23/10/2012						28				0.56		10	0.92			36	
		12/04/2013		<20	70	<20		31				0.15		14	0.042			51	
		12/12/2013		<20	<50	<20		23				1.4		11	0.17		<0.5	33	
		10/07/2014		<20	<50	<20		32				<0.05		14	0.1			34	
		3/11/2014	410	<20	<100	<5		24				<0.05		9	0.039		0.28	27	
		10/04/2015	240	<20	<100	<5		8				0.23		6	0.005		1.18	25	
		2/11/2015	<100	<20	<100	<5		15				1.14		10	0.19		0.49	38	
		5/04/2016	<100	<20	<100	<5		17				0.06		11	0.18		0.12	30	
		26/10/2016	<100	<20	<100	<5		12				0.12		8	0.038		0.44	33	
		26/04/2017	<100	<20	<100	<5		20				0.08		12	0.099		0.15	41	

Piper Plot

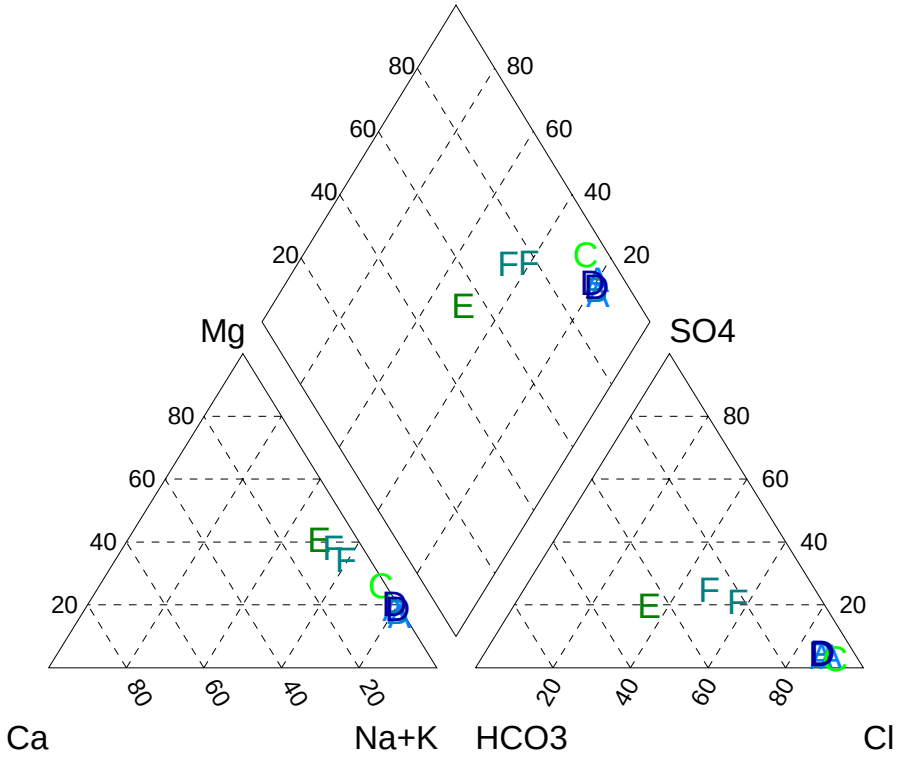


Legend

A	119506
B	119507
C	141402
D	141403
E	9022881/1
F	9022881/2
G	Fire Dam
H	JND
I	JRCREEK 1
J	JRCREEK 2
K	JRLD
L	JRLP
M	JRSWD

Golder Associates	Drawn: CLR	Date: 18/8/2018	**Piper Plot**
	Checked:	Date:	Leachate, Groundwater and Surface Water
	Revision:	Date:	
	Scale: As Shown	**A4**	Project No: 1789713

Piper Plot

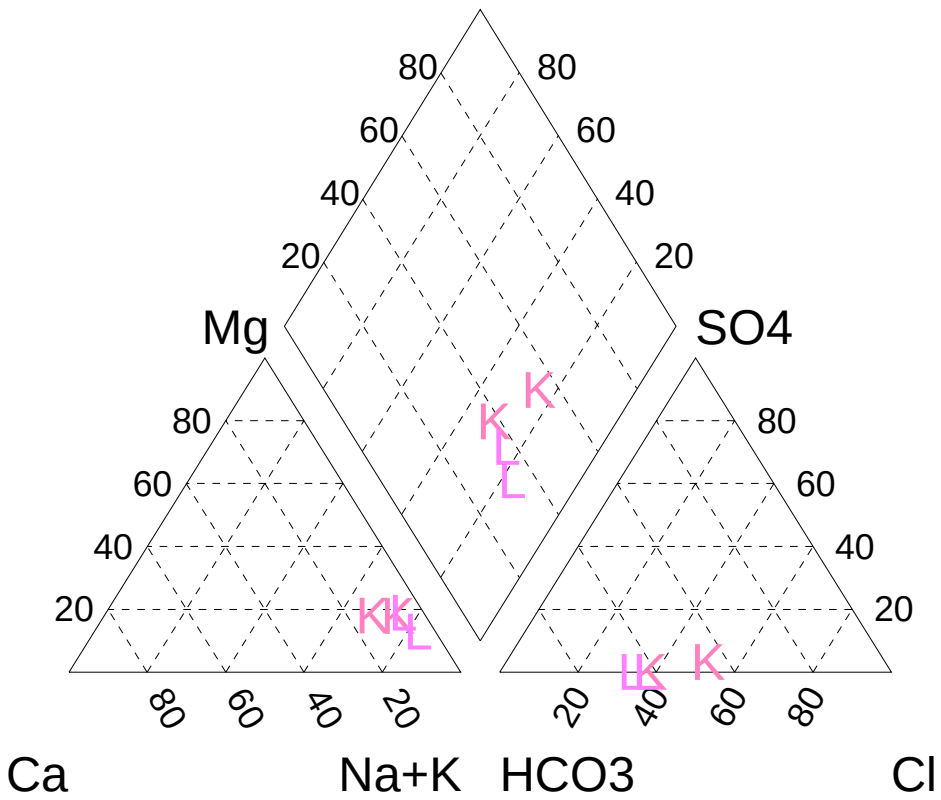


Legend

A	119506
B	119507
C	141402
D	141403
E	9022881/1
F	9022881/2

Golder Associates	Drawn: CLR	Date: 18/8/2018	**Piper Plot**
	Checked:	Date:	
	Revision:	Date:	Groundwater
	Scale: As Shown	**A4**	Project No: 1789713

Piper Plot



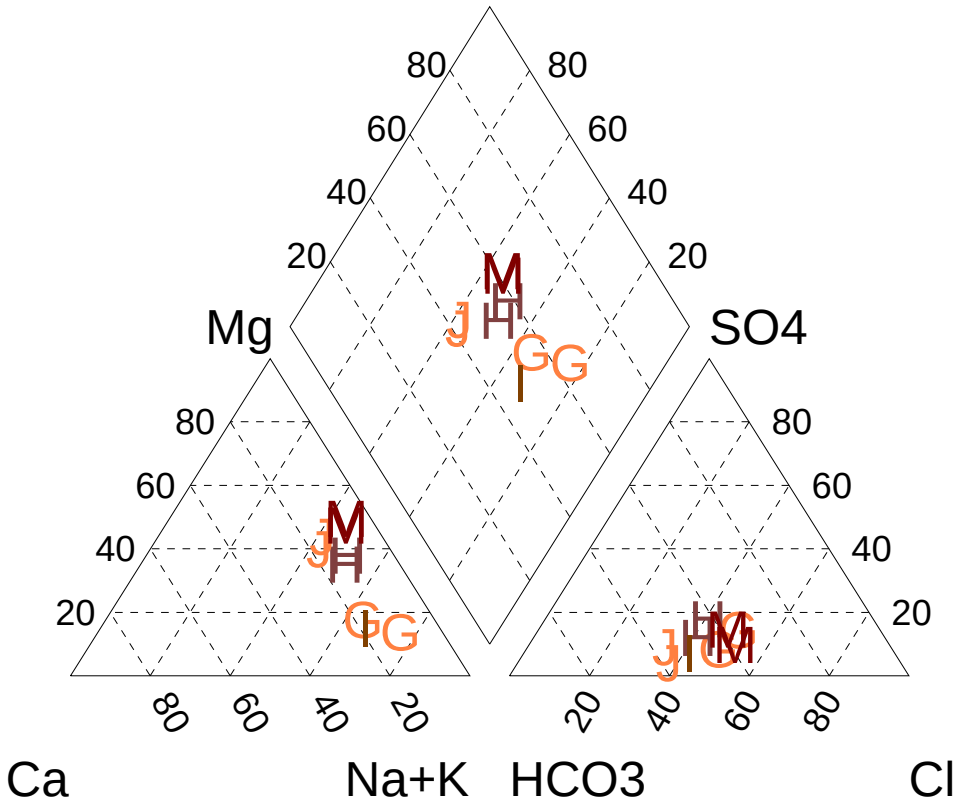
Legend

K JRLD

L JRLP

Golder Associates	Drawn: CLR	Date: 18/8/2018	Piper Plot	
	Checked:	Date:		
	Revision:	Date:	Leachate	
	Scale: As Shown	A4	Project No: 1789713	

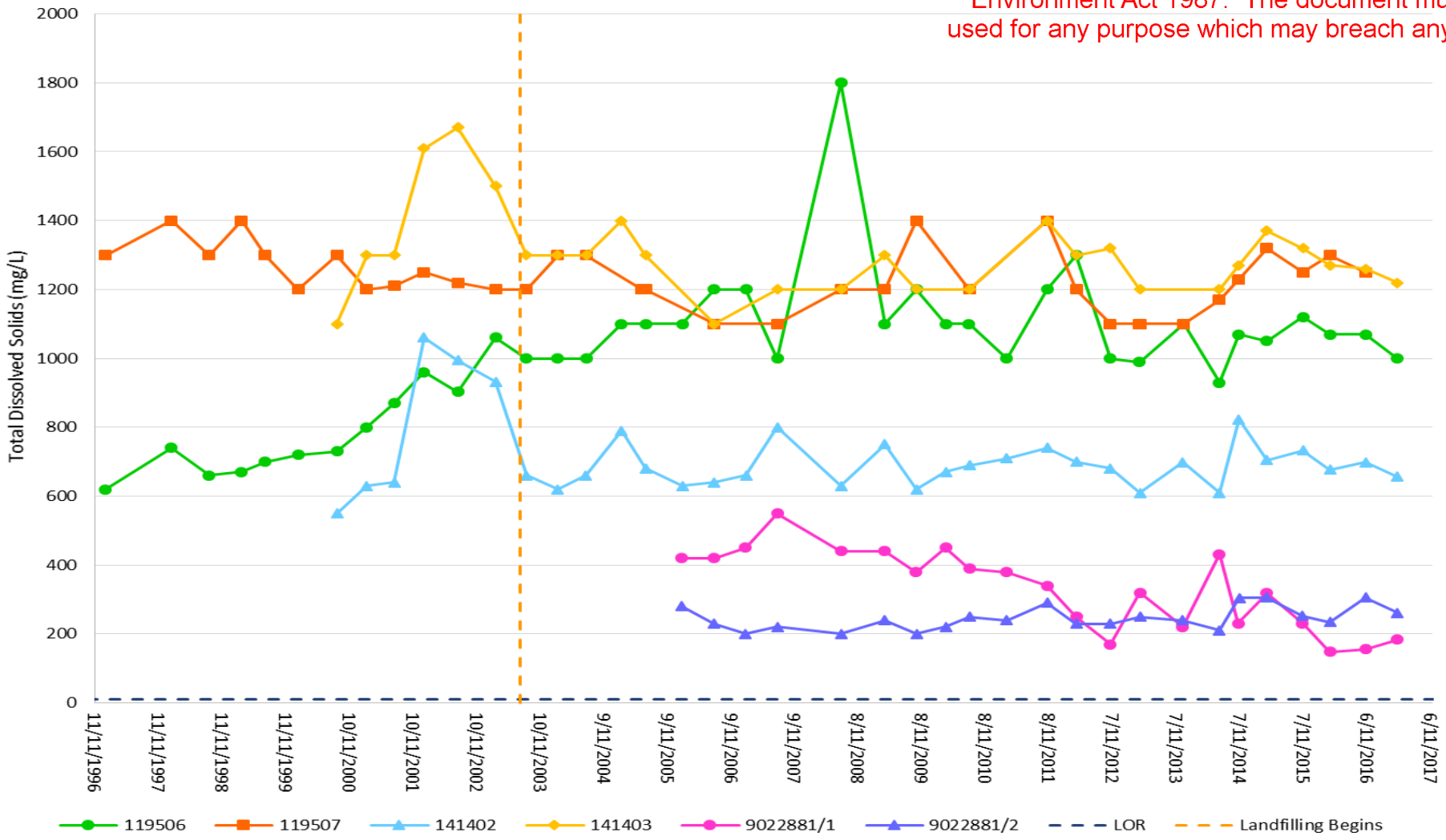
Piper Plot



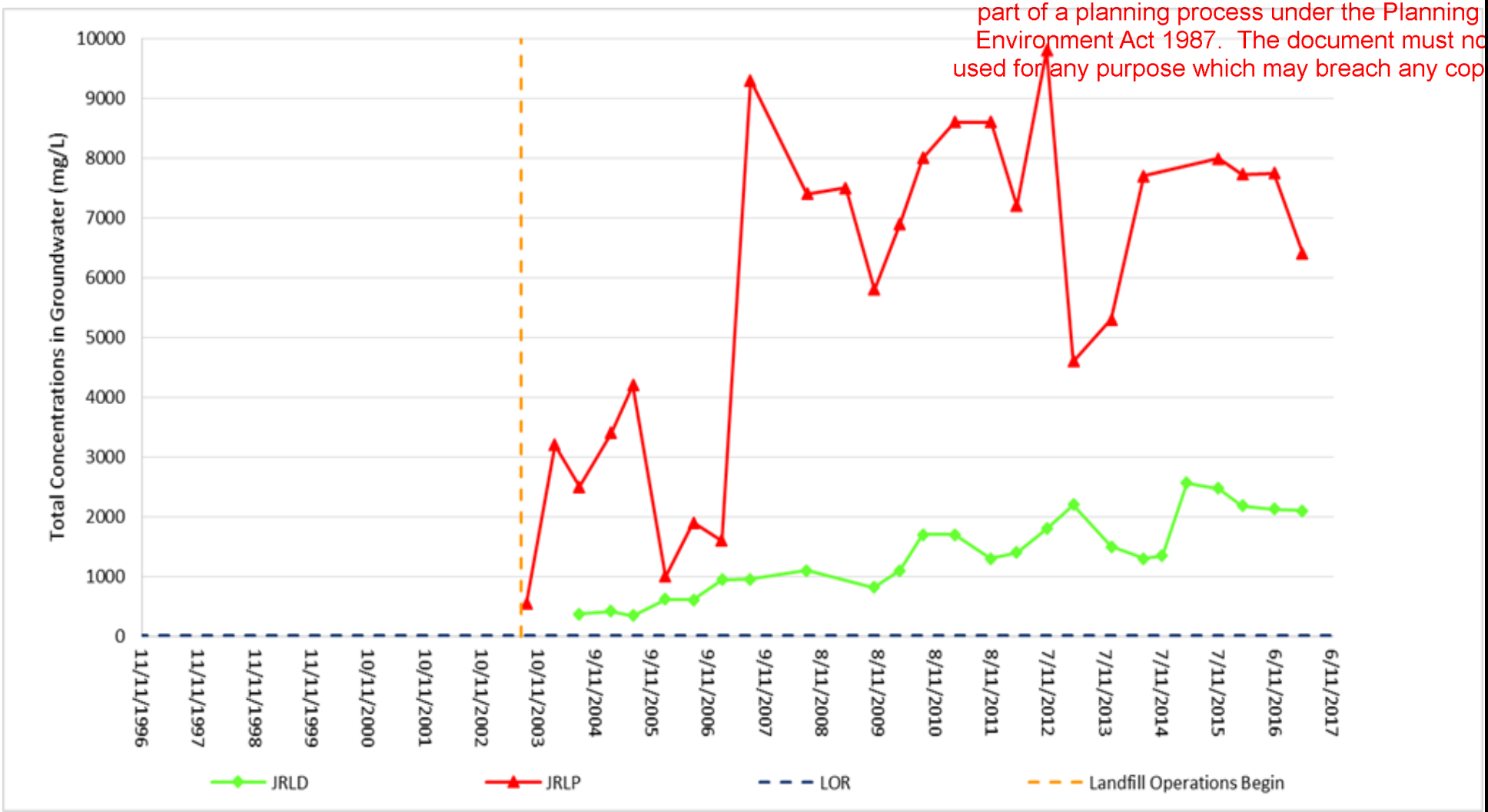
Legend

- G Fire Dam
- H JND
- I JRCREEK 1
- J JRCREEK 2
- M JRSWD

Golder Associates	Drawn: CLR	Date: 18/8/2018	**Piper Plot** Surface Water	
	Checked:	Date:		
	Revision:	Date:		
	Scale: As Shown	**A4**	Project No: 1789713	



GOLDER	Drawn: EJK	Date:30/6/2018	TDS - Groundwater	
	Checked: CLR	Date: 25/7/2018		
	Revision:	Date:		
	Scale: As Shown	A4	Project No: 1789713-002	Appendix C



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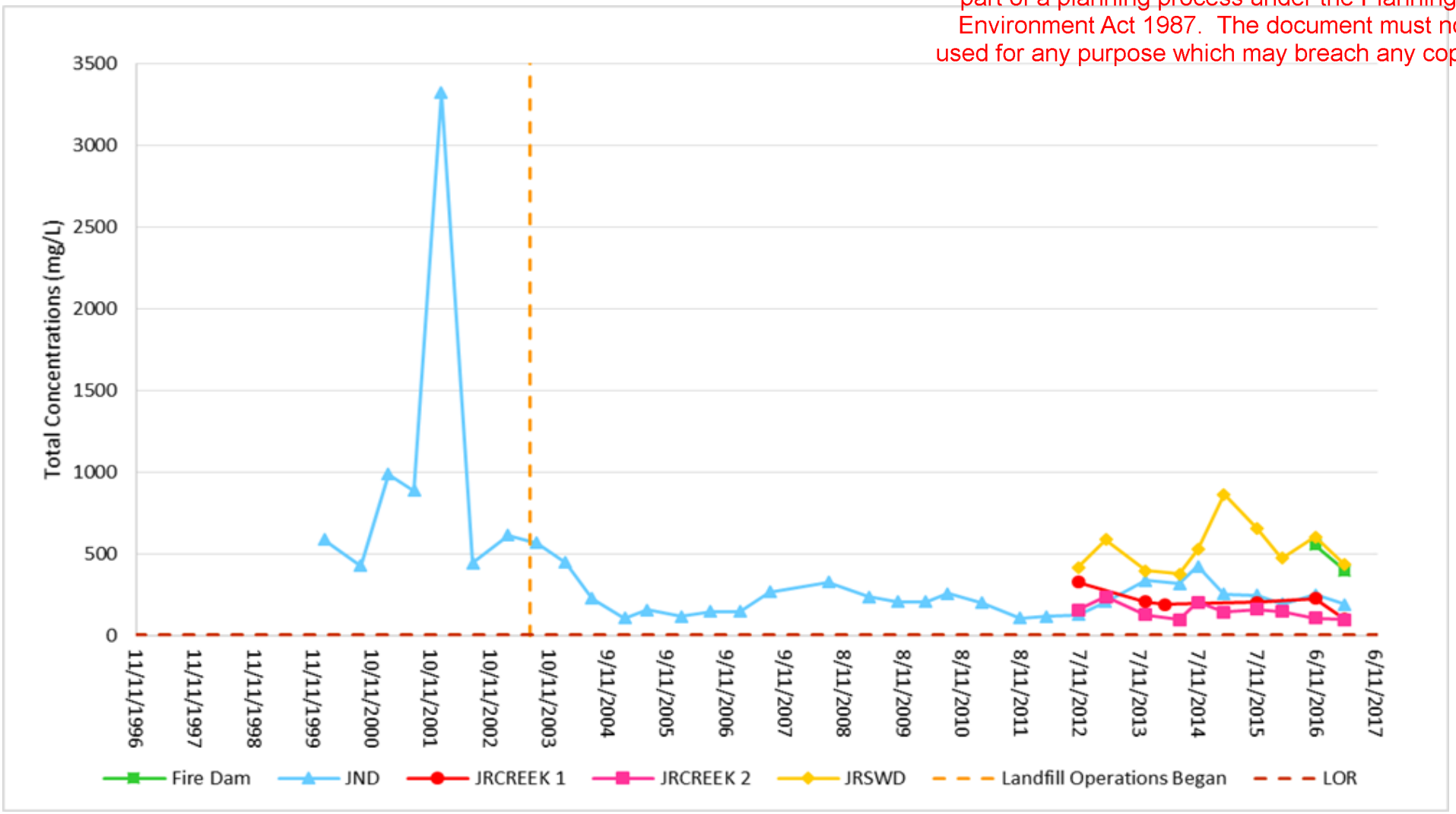
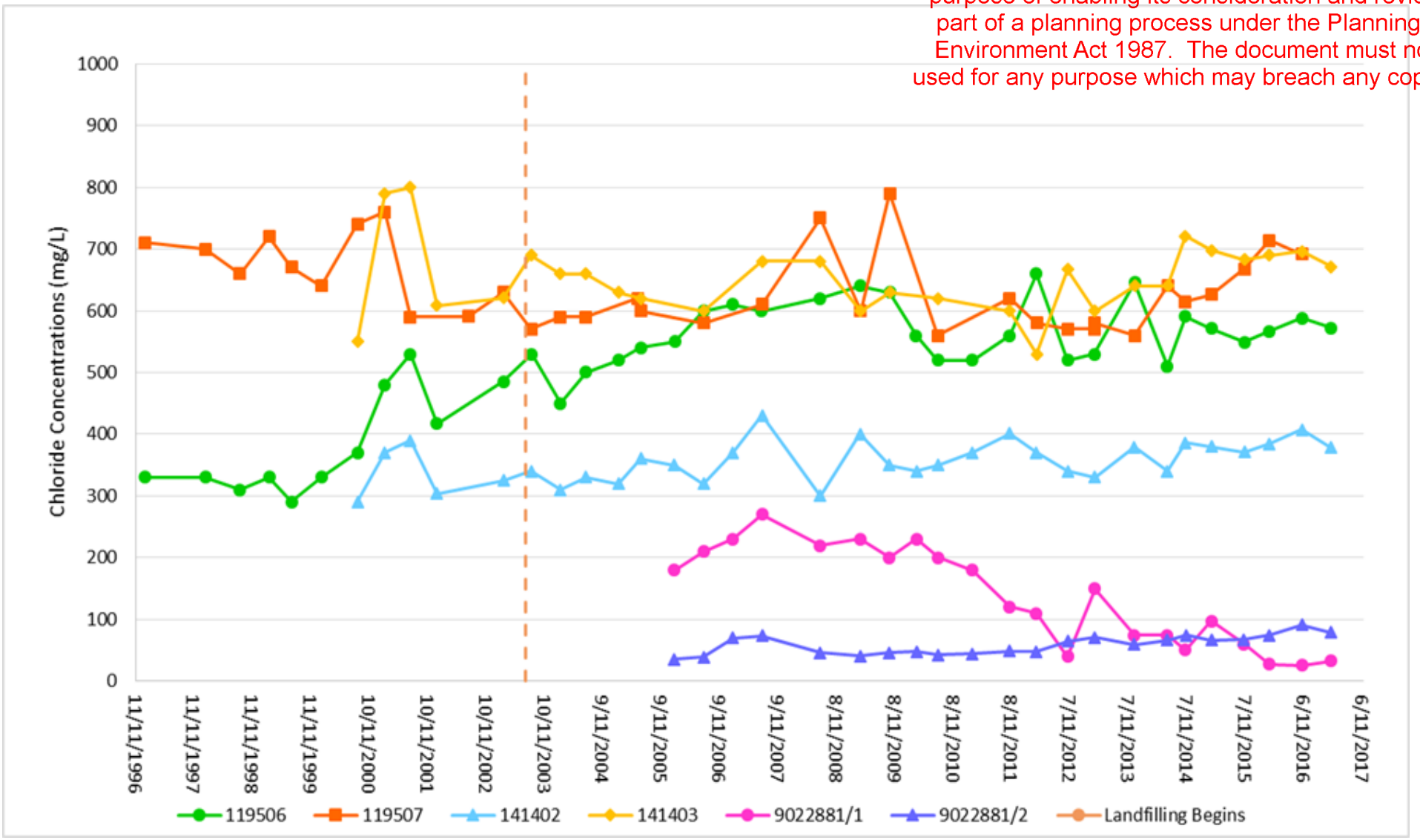
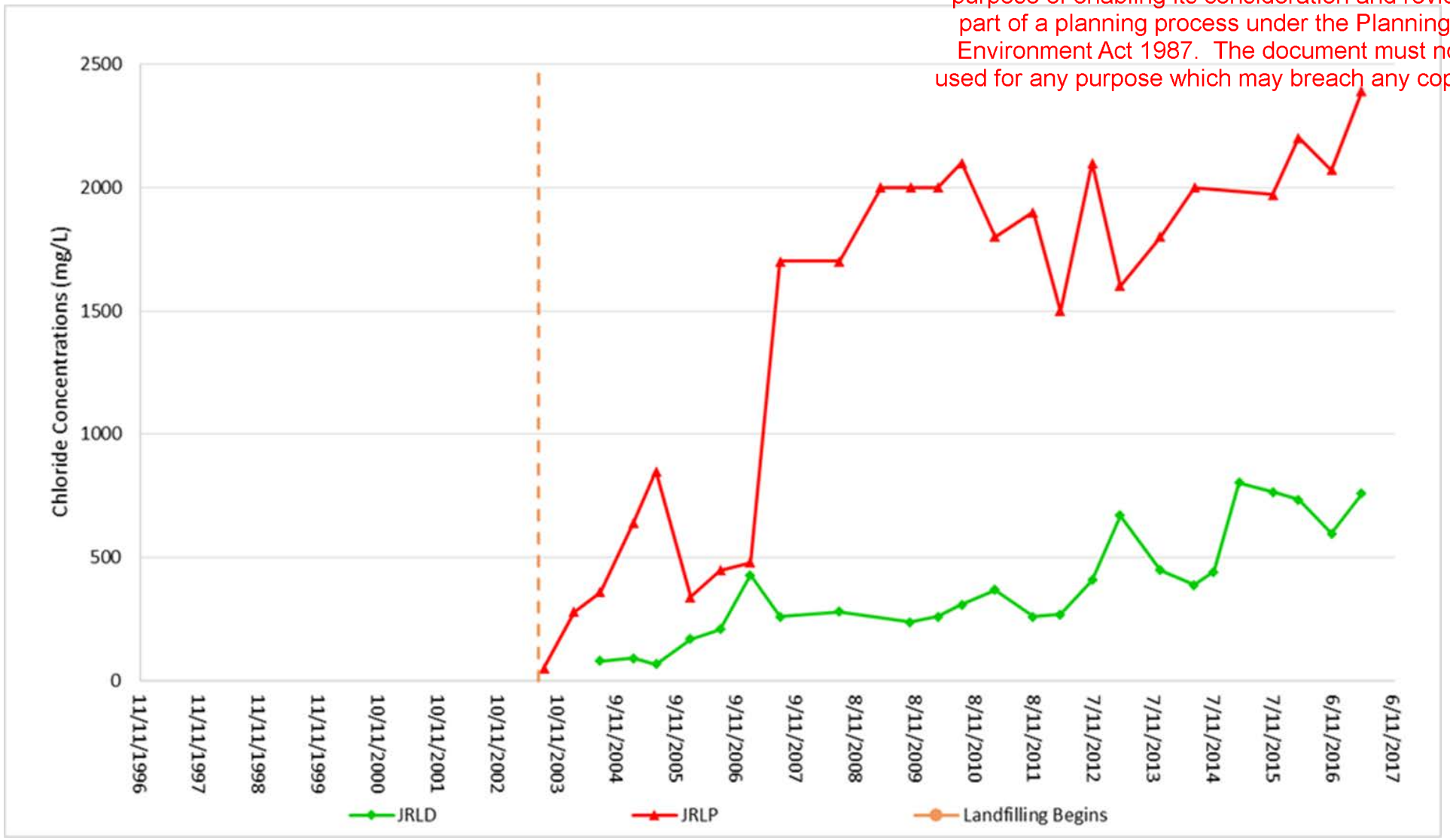
	Checked: CLR	Date: 25/7/2018			
	Revision:	Date:			
	Scale: As Shown	A4	Project No: 1789713-002	Appendix C	



GOLDER	Drawn: EJK	Date:30/6/2018		TDS - Surface Water	
	Checked: CLR	Date: 25/7/2018			
	Revision:	Date:			
	Scale:	As Shown	A4	Project No: 1789713-002	Appendix C



GOLDER	Drawn: EJK	Date:30/6/2018	**Chloride - Groundwater**	
	Checked: CLR	Date: 25/7/2018		
	Revision:	Date:		
	Scale: As Shown	**A4**	Project No: 1789713-002	**Appendix C**



GOLDER	Drawn: EJK	Date:30/6/2018		**Chloride - Leachate**	
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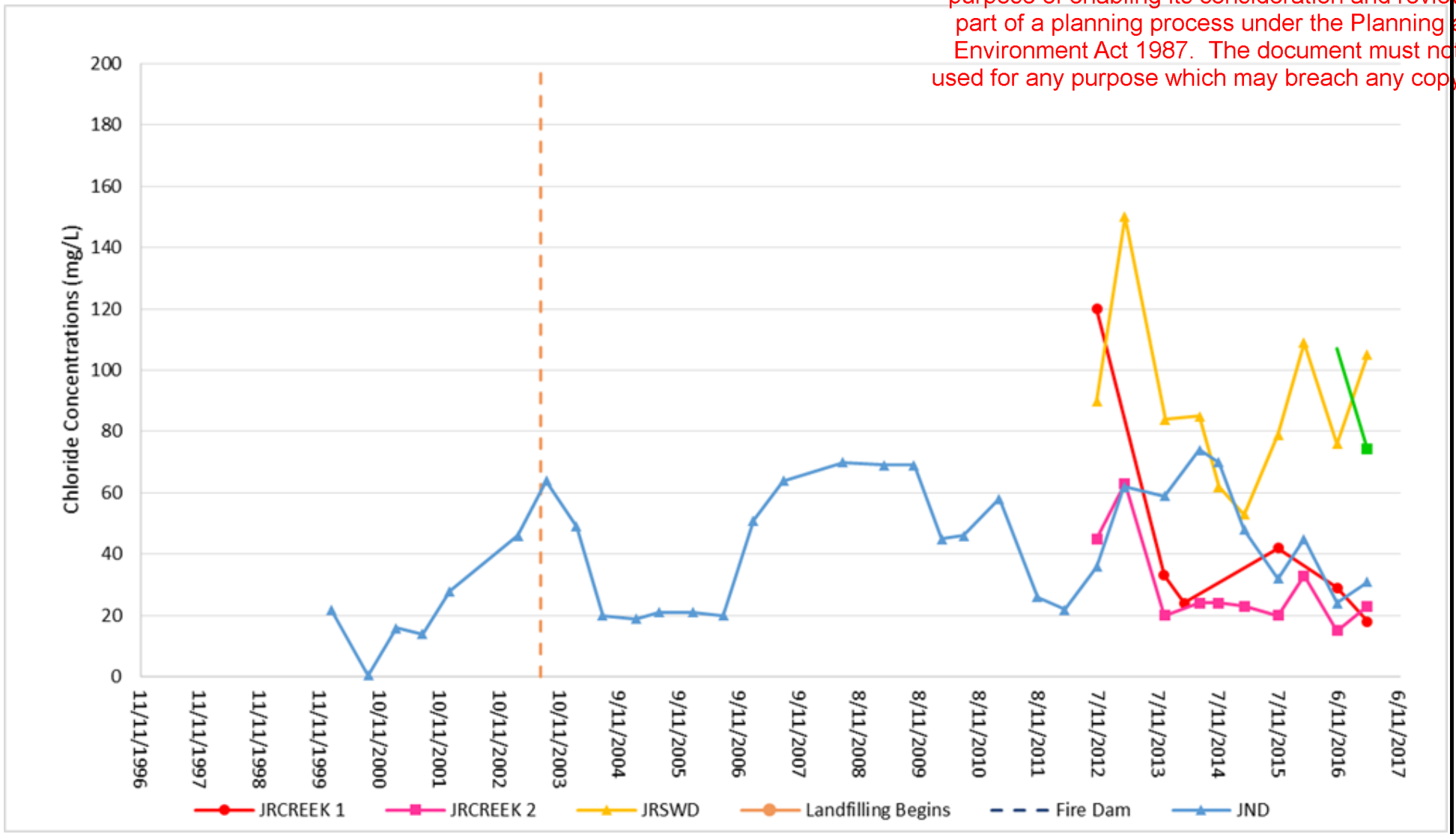
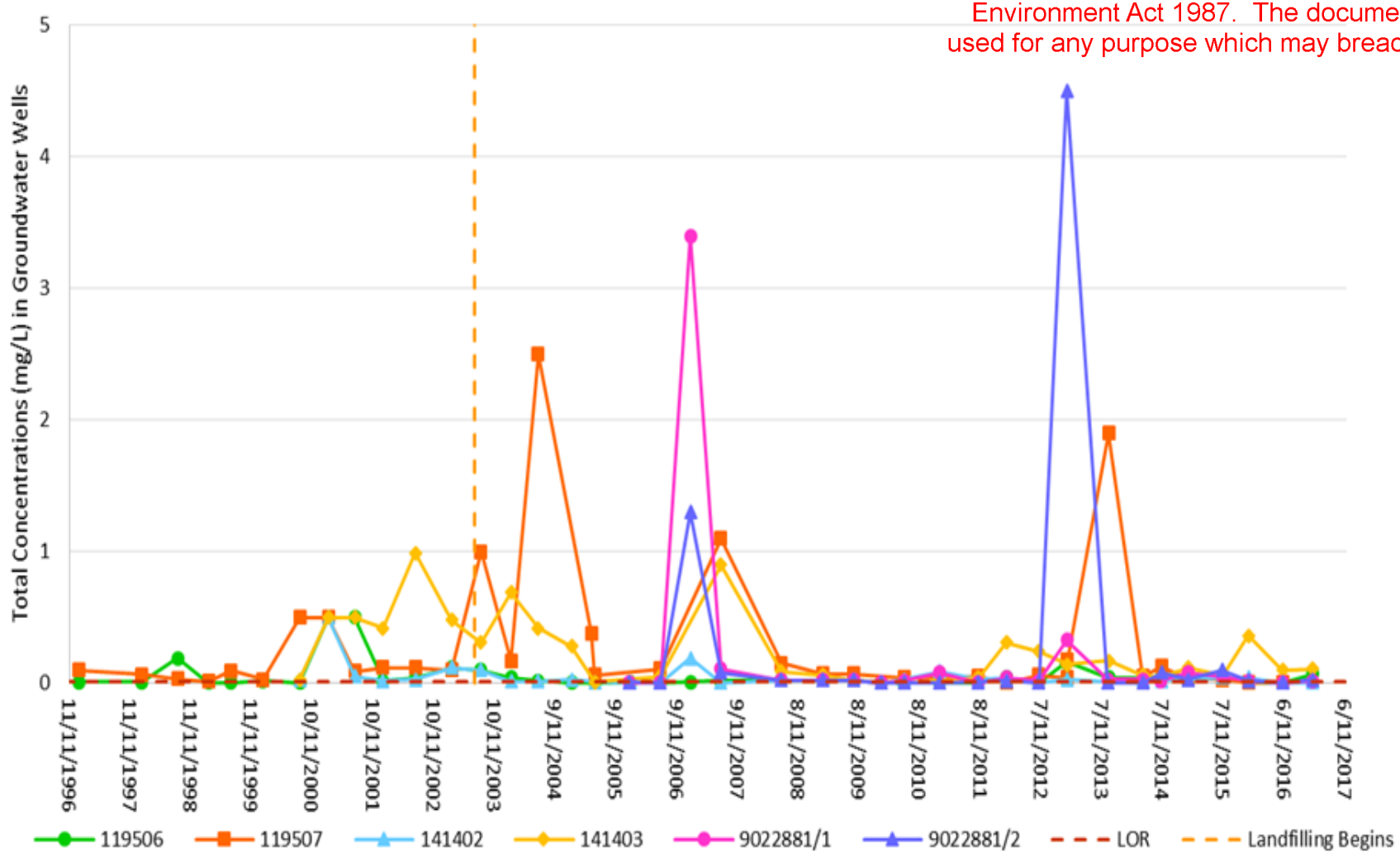
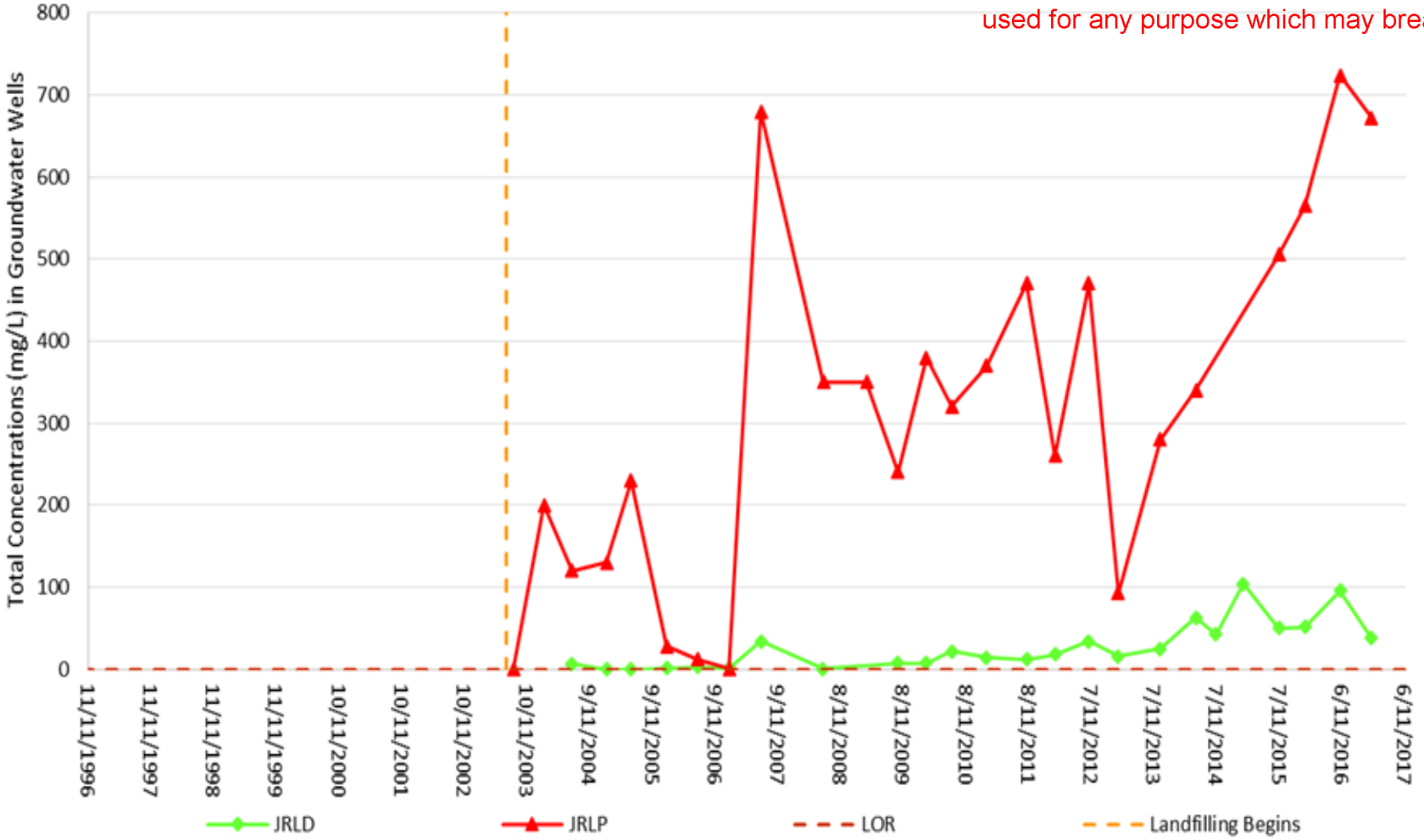
	Revision:	Date:			
	Scale:	As Shown	**A4**	Project No: 1789713-002	**Appendix C**



GOLDER	Drawn: EJK	Date:30/6/2018		**Chloride - Surface Water**	
	Checked: CLR	Date: 25/7/2018			
	Revision:	Date:			
	Scale:	As Shown	**A4**	Project No: 1789713-002	**Appendix C**



GOLDER	Drawn: EJK	Date:30/6/2018	**Ammonia as N - Groundwater**	
	Checked: CLR	Date: 25/7/2018		
	Revision:	Date:		
	Scale: As Shown	**A4**	Project No: 1789713-002	**Appendix C**



GOLDER	Drawn: EJK	Date:30/6/2018		**Ammonia as N - Leachate**	
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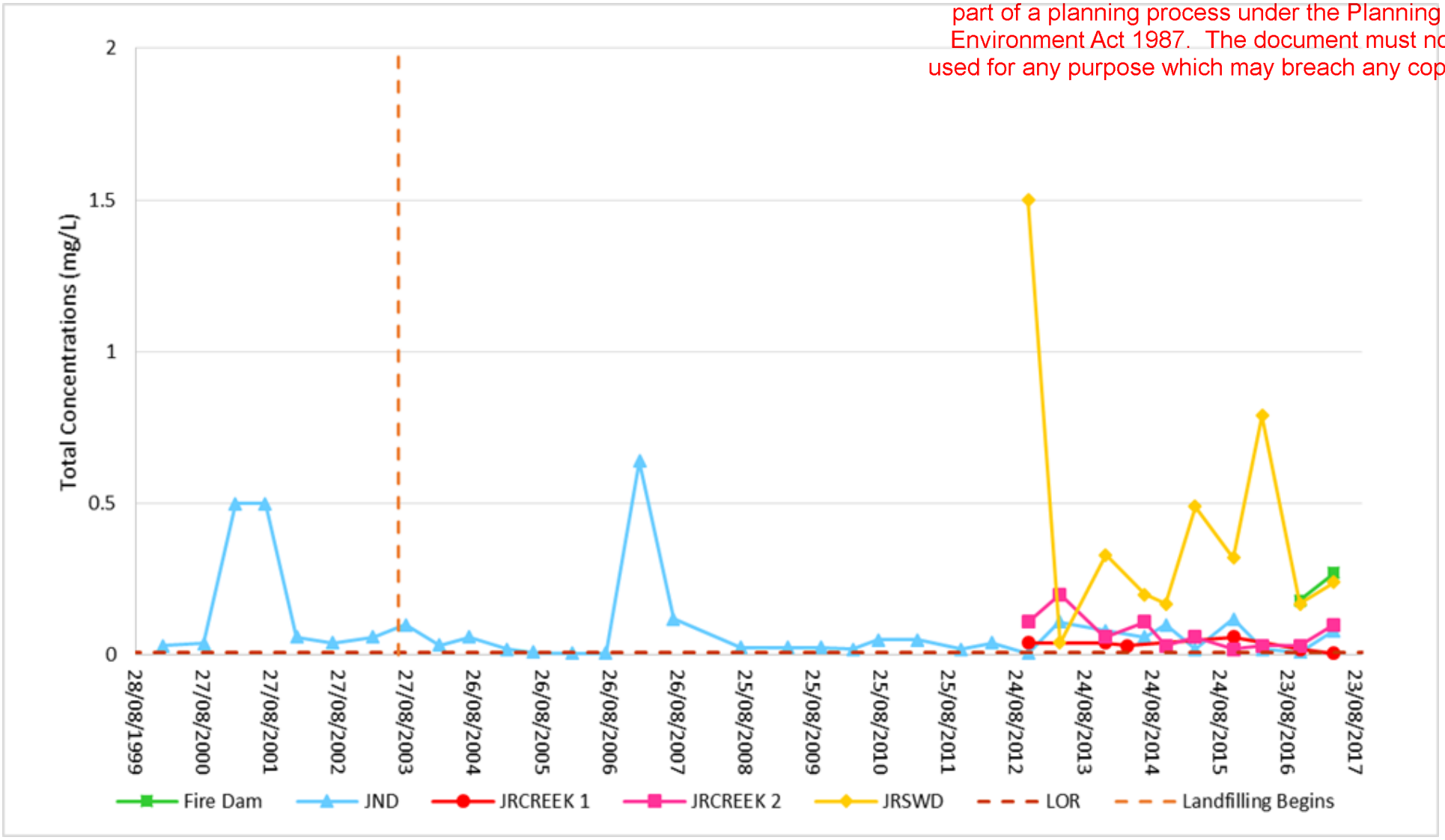
	Revision:	Date:			
	Scale: As Shown	**A4**	Project No: 1789713-002	**Appendix C**	

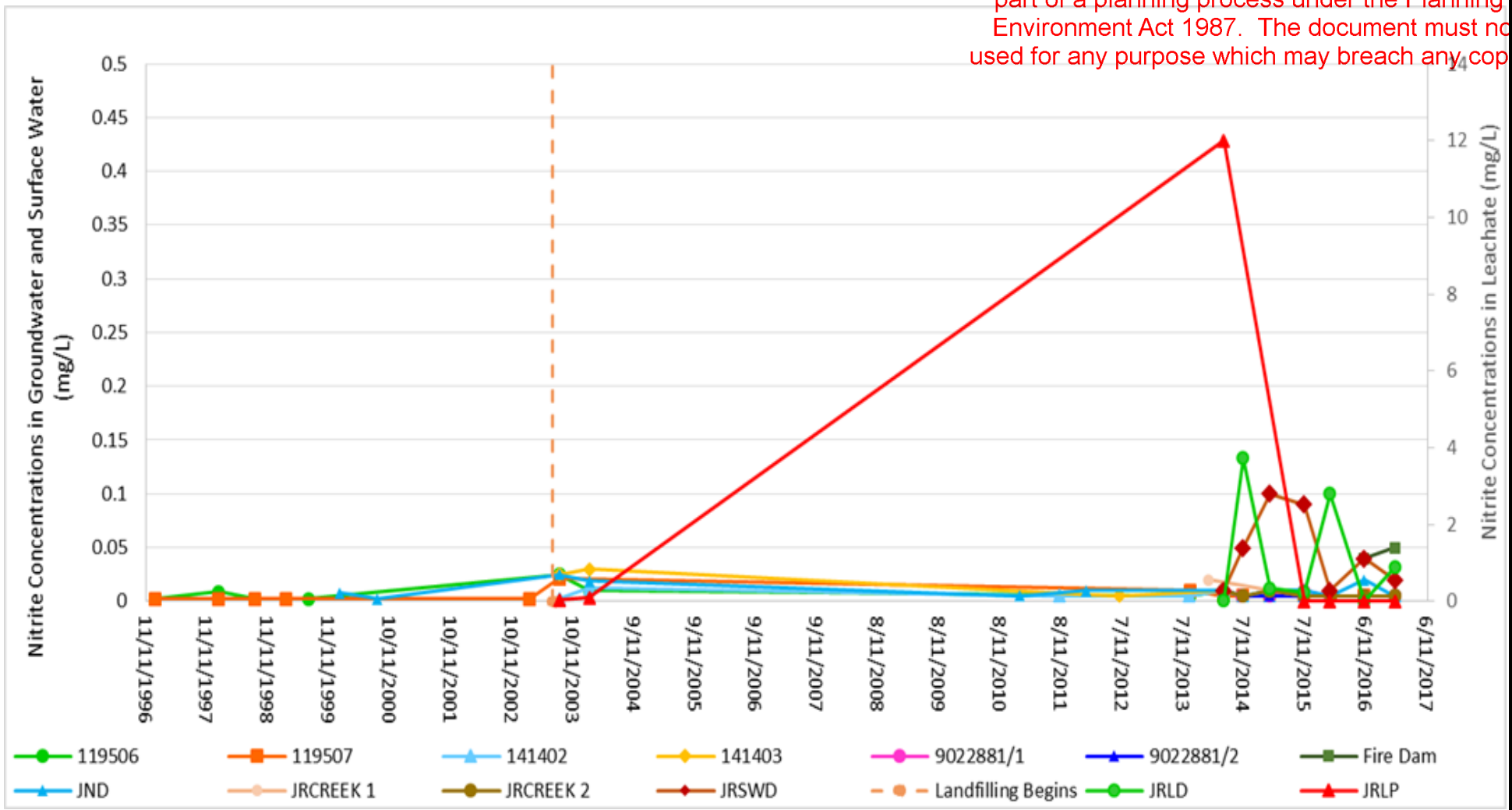


GOLDER

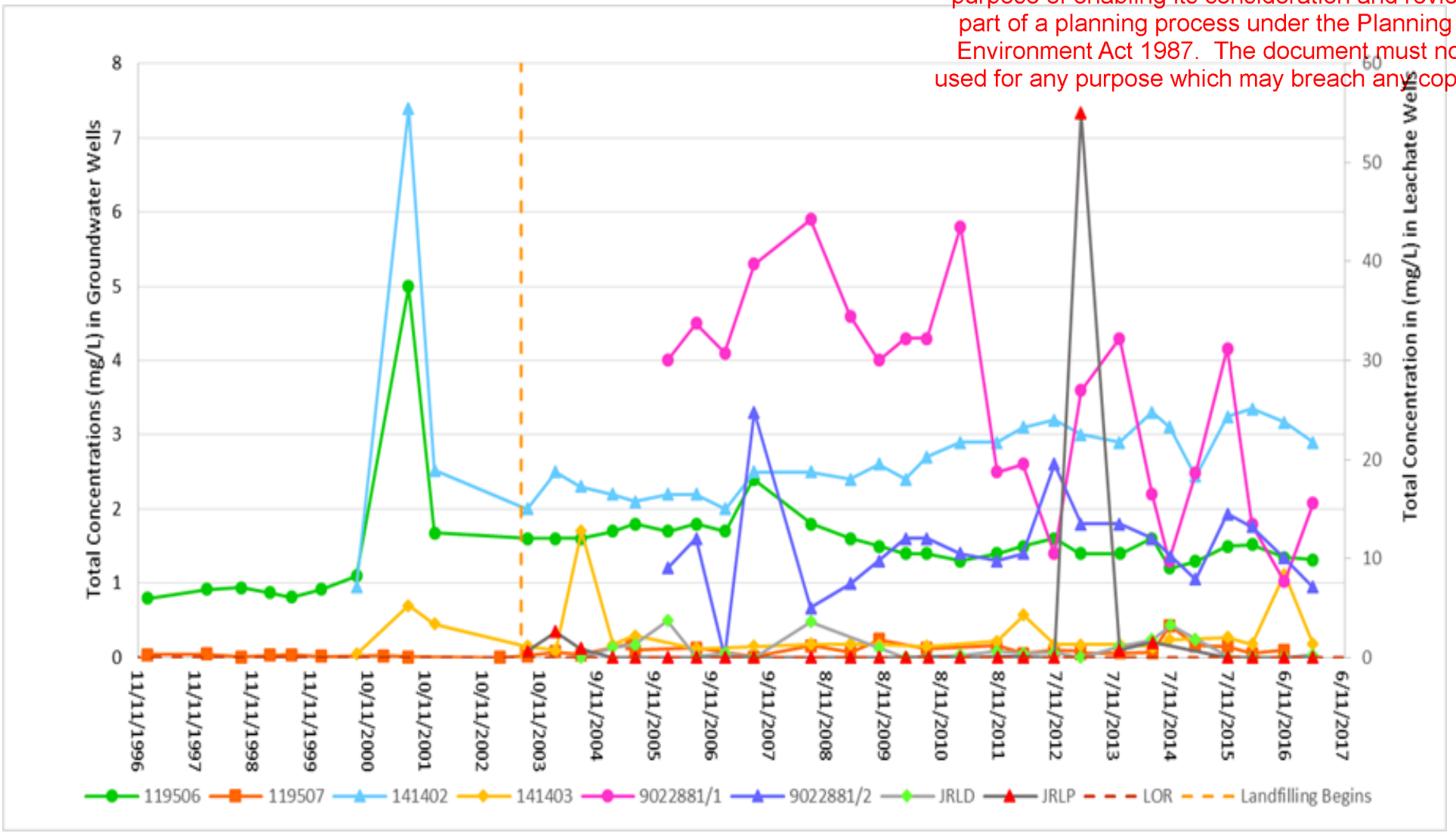
Drawn: EJK	Date:30/6/2018			
Checked: CLR	Date: 25/7/2018			
Revision:	Date:			
Scale: As Shown	A4	Project No: 1789713-002		

Ammonia as N - Surface Water

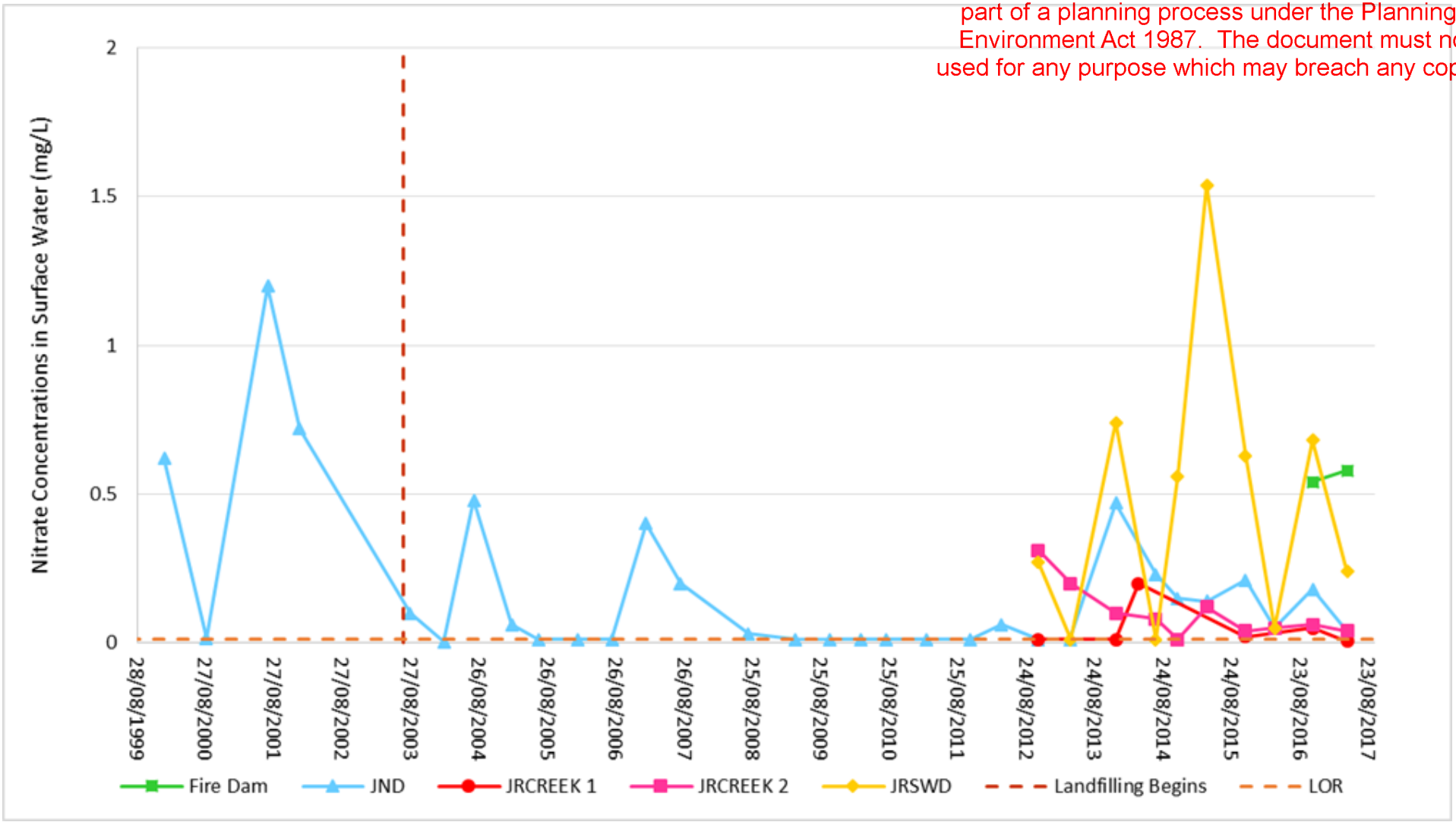
Appendix C



GOLDER	Drawn: EJK	Date:30/6/2018		Nitrite in Groundwater, Leachate and Surface Water	
	Checked: CLR	Date: 25/7/2018			
	Revision:	Date:			
	Scale:	As Shown	A4	Project No: 1789713-002	Appendix C



GOLDER	Drawn: EJK	Date:30/6/2018		Nitrate - Groundwater and Leachate	
	Checked: CLR	Date: 25/7/2018			
	Revision:	Date:			
	Scale: As Shown	A4	Project No: 1789713-002	Appendix C	



GOLDER	Drawn: EJK	Date:30/6/2018		**Nitrate - Surface Water**	
	Checked: CLR	Date: 25/7/2018			
	Revision:	Date:			
	Scale: As Shown	**A4**	Project No: 1789713-002		**Appendix C**

APPENDIX D

Limitations

Golder Associates

IMPORTANT INFORMATION RELATING TO THIS REPORT

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

This Report is provided for use solely by Golder's Client and persons acting on the Client's behalf, such as its professional advisers. Golder is responsible only to its Client for this Report. Golder has no responsibility to any other person who relies or makes decisions based upon this Report or who makes any other use of this Report. Golder accepts no responsibility for any loss or damage suffered by any person other than its Client as a result of any reliance upon any part of this Report, decisions made based upon this Report or any other use of it.

This Report has been prepared in the context of the circumstances and purposes referred to in, or derived from, the Contract and Golder accepts no responsibility for use of the Report, in whole or in part, in any other context or circumstance or for any other purpose.

The scope of Golder's Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification.

GOLDER

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Attachment 3

Bairnsdale Landfill

Auditor Review Register of Hydrogeological Assessment

East Gippsland Shire Council

Auditor Review and comments regarding Golder Hydrogeological Assessment for Bairnsdale Landfill

Table 1 Draft report

Item	Report Reference	Auditor's Comments (draft of 30th July 2018)	Assessor's Feedback (draft of 30th July 2018)	Auditor's Comments (draft of 21st August 2018)
General				
1	Figures 13 to24	Figures 16, 17 & 18 incorrectly label "*Landfilling begins*"	Noted, amended.	Accepted Change made.
2		Any existing groundwater contamination may be due to historical activity before there was effective leachate control in Cells 1/1A.	Noted.	Noted.
Specific				
3	S1.1,p1, para2	Add to license reference - Premises 72826 and as amended on 20th February 2017.	Noted, amended.	Accepted Change made.
4	S1.2,p1, para1	"*L1*" should be "LI".	Noted, amended.	Accepted Change made.
5	S1.2,p1, para1	Isn't the objective simply to prepare a HA in accordance with licence condition LI _L4.3?	Noted, amended.	Accepted Change made.
6	S1.3,p1, bullet5	Replace "*summarising*" with "*presenting*". [If CHM is summarised where is the detailed version?]	Noted, amended.	Accepted Change made.
7	S2.1,p4, para 1	"*To the south of the landfilled area is a soil stockpile and Sedimentation Pond, as well as another small pond or dam*". Explicitly state this is south of the site (premises). "*The northwestern part slopes to the northeast and the southwestern part slopes to the east*". Suggest remove as unclear & addressed in topography.	Noted, amended.	Accepted Change made.
8	S2.2.2, p5, last para	Clarify **site** levels. South-east corner is adjacent Skeene Creek south of site. State level at south-east corner of site (south-east of Cell 2) is 28.2 m AHD.	Noted, amended including the additional of a figure showing site survey data.	Accepted Change made.

Item	Report Reference	Auditor's Comments (draft of 30th July 2018)	Assessor's Feedback (draft of 30th July 2018)	Auditor's Comments (draft of 21st August 2018)
9	S2.2.4, p7,	Spoil heap is south of licenced area. Should this be Cells 2 and 3? Understood that the pond overflows to Skeene Creek.	Clarified. The runoff from the stockpiles is included to highlight both that the stockpiles don't contribute to runoff in the licensed area and that the Sedimentation Pond is a potential source of runoff to the Brownlow Quarry and Skeene Creek. Finally although not in the licensed premises the site is defined to include the stockpile and Sedimentation Pond in the Annual Monitoring Report (Cardno, 2017)	Mostly accepted Changes made. Outstanding Report states south of Cells 1 and 2. Shouldn't this be Cells 2 and 3? **Outstanding matters addressed in final report.**
10	S2.5, p11, Environmental Audit, bullet2 under interpretation of monitoring results - groundwater	Suggest change "a risk" to a "significant risk"	This section is summarising the Audit findings where it is described as a low to medium risk (Table E-1). The text included in the HA is shown below and reflects the Audit findings. ■ The risk of seepage of contaminated stormwater through landfill floor and other areas and impacting groundwater beneficial uses is considered low to medium	Not accepted Change has not been made. Outstanding Table E-1 states "The Auditor concluded that although nitrate concentration al this monitoring site is likely to have been influenced by landfill seepage it does not pose a significant risk to beneficial uses as the concentration is below relevant water quality objectives and is not increasing". This relates to groundwater – see Outcome of the audit interpretation of groundwater monitoring results. **Outstanding matters addressed in final report.**

Item	Report Reference	Auditor's Comments (draft of 30th July 2018)	Assessor's Feedback (draft of 30th July 2018)	Auditor's Comments (draft of 21st August 2018)
11	S4.1.3,p19, Quaternary Aquifer	Recognising the description of the Quaternary sediments from the bore logs, this K range appears too high for the site. Can you confirm whether this material would have been removed as overburden during the quarrying activity?	This layer may have been removed in some areas of the site during quarrying however it is our understanding that quarrying mainly impacted the area around Cell 1. An additional statement has been added commenting on site conditions as opposed to literature values.	Accepted. Table 4 acknowledges hydraulic conductivity values considered to be high.
12	S4.2, p20, Figure 7.	Include Leachate Sumps 2 and 3.	Noted, amended.	Accepted Change made.
13	S4.2.1,p21, bullet2	Groundwater levels at most bores appear to have fallen since November 2015.	Looking only from 2015 there is a slight decrease in most of the wells, however looking at the longer time data the overall trend remains upwards or flattening. A sentence has been added to the bullet point to acknowledge the trend in data since 2015.	Accepted Change made.
14	S4.2.1,p21, bullet3	Reason for greater rate of rise could be irrigation and leachate seepage from landfill as well as fire dam and stormwater pond.	Noted, amended.	Accepted Change made.
15	4.2.1, p23, para1	Clarify horizontal flow only. Provide an opinion, on K's based upon bore logs, noting K of $1e^{-3}$ m/s is a generally categorized as a gravel.	Noted, amended.	Further clarification required. Outstanding Horizontal velocity estimate of up to 13.8 m/day based upon K of $1e^{-3}$ m/s. This does appear to be realistic based upon bore logs. **Outstanding matters addressed in final report.**

Item	Report Reference	Auditor's Comments (draft of 30th July 2018)	Assessor's Feedback (draft of 30th July 2018)	Auditor's Comments (draft of 21st August 2018)
16	4.4.1, p24, last para.	*"In lieu of data from the sumps in Cells 2 and 3, and given the success of this system in maintaining the leachate head below 0.3 m above the liner in Cell 1 it is assumed for the purpose of this HA that the leachate in Cells 2 and 3 is also being maintained below 0.3 m above the liner"*. For the purposes of the HA should be considered as an uncertainty.	Noted, amended.	Accepted Change made.
17	4.5.1, p27, Figure 12	Plot Fire Dam and Stormwater Pond on Piper diagram.	All of the surface water features have been added to the Piper plot. In addition plots showing only groundwater, leachate or surface water have been added to Appendix C. The discussion on water types has been amended to include the additional locations.	Accepted Change made.
18	4.5.2, p28, Groundwater, bullet 4, sub-bullet 1	902288 1/2 last value appears equivalent to first value.	Noted, amended.	Accepted. No change made. After revised review acknowledge that change not required.
19	4.5.2, p29, Leachate, bullet1	Should it be a full-stop after '*leachate concentrations*' and before '*after*'? After 2006 concentrations appear to fluctuate around a mean.	No full stop is intended in this sentence.	Accepted No change made. Agree that change not required.
20	4.5.3, p33, surface water, bullet1	Is not possible to determine seasonal pattern as monitoring events are twice/year?	It is considered possible but not conclusive to pick up seasonality. The sentence has been amended to reflect this.	Accepted Change made.

Item	Report Reference	Auditor's Comments (draft of 30th July 2018)	Assessor's Feedback (draft of 30th July 2018)	Auditor's Comments (draft of 21st August 2018)
21	4.5.3, p34, Ammonia surface water, bullet1	Any comment on the observation that most elevated levels are one-off spikes. Any relationship with Bore 141402 ammonia and nitrate. Appears as a single ammonia peak and a gradual increase in nitrate.	The elevated ammonia spikes at JND tend to involve at least two consecutive monitoring events suggesting that they are real. The nitrate peak appears in 119506, 141402 and to a lesser degree in 141403 in 2001 suggesting that there was more widespread cause for the nitrate spike at this time, the source of which is unknown. The increasing nitrate concentrations groundwater well 141402 does not appear to correlate to ammonia (as N) concentrations. See graph under comments table.	Accepted No need to comment on relationship between bore 141402 ammonia and nitrate as ammonia concentrations very low.

Item	Report Reference	Auditor's Comments (draft of 30th July 2018)	Assessor's Feedback (draft of 30th July 2018)	Auditor's Comments (draft of 21st August 2018)
22	4.5.9, p41	Consider plotting Total P and turbidity for leachate and surface water features and commenting on the results.	There is data available for total phosphate for the period 1999 to 2002, and one data point each in 2010, 2011 and 2014. There is data available for turbidity for from December 2013 to 2017. The data for the two determinants don't overlap sufficiently to allow a comparison of the data. Individually there is insufficient data for phosphate to allow trends to be identified. A section has been added presenting and discussing the turbidity results under Water Chemistry.	Accepted
23	4.5.9, p41	Summary box for groundwater. Possibility that nitrate at 141402 is landfill related. Provide further justification as to why chloride concentration at 902288/1 and 902288/2 suggests possible contamination from fire dam as stormwater dam. Both bores have 20% meq sulphate. It would be helpful to plot sulphate trends and L/N ratios.	Further justification has been given with reference to the Piper plot.	Accepted Change made. Accepted Chloride concentrations are similar. I also note Piper plot shows these bores plotting with JND (near JRCreek 1), JRSWD (Stormwater Pond) and JRCreek 2 (Upgradient) Accepted No change. Plot not essential.
24	4.5.9, p41	Summary box for surface water? Are there any trends in total P and turbidity?	Surface water has been included in the summary box.	Further clarification required. <u>Outstanding</u> Add discussion on turbidity in the box. **Outstanding matters addressed in final report.**

Item	Report Reference	Auditor's Comments (draft of 30th July 2018)	Assessor's Feedback (draft of 30th July 2018)	Auditor's Comments (draft of 21st August 2018)
25	4.7, p46	State the location of the nearest consumptive use bore hydraulically downgradient of landfill and its use.	Clarified below Figure 25.	Accepted Change made.
26	5.0, p47, para 1	Clarify assessment limited to landfill leachate induced sources.	Noted, amended.	Accepted Change made.
27	5.0, p47, sources	Other source – leachate irrigation?	Noted, amended.	Accepted Change made.
28	5.0, p47, receptors	Simpler to reference Table 8 for consistency. Table 8 refers to desirable water, not acceptable. Have both on site receptors & off-site receptors. For groundwater there are existing and potential uses.	Noted, amended.	Accepted Change made.
29	5.0, p47, pathways	<u>Additional</u> Irrigated leachate via surface runoff to surface water storage Irrigated leachate infiltration to groundwater Perched leachate in uncapped above ground landfills to surface: • to surface water storage • to vegetation • to groundwater via irrigation	Noted, amended.	Accepted Change made.
30	5.0, p47, assessment of impacts	Before doing this assessment, should go through all receptors to assess whether they are realisable, then only assess those that are realisable.	Noted, amended.	Accepted S5 includes a determination of whether any applicable beneficial uses are precluded based upon whether the use is realisable and if impact by groundwater or surface water contamination.

<table>
<tr><th>Item</th><th>Report Reference</th><th>Auditor's Comments (draft of 30th July 2018)</th><th>Assessor's Feedback (draft of 30th July 2018)</th><th>Auditor's Comments (draft of 21st August 2018)</th></tr>
<tr><td>31</td><td>5.0, p48, Table 12</td><td>Can this table be presented as a risk register as per EPA Publication 1321.2 using a risk assessment matrix for realizable beneficial uses on and off site and on the basis existing performance criteria for leachate control in sumps. That is:
"The maximum leachate head on the liner (as measured at the lowest point of the liner surface) for a landfill situated above the watertable is 0.3 metres. The leachate head in the sump may exceed 0.3 metres as the sump is generally recessed below the level of the liner; some liquid is usually necessary to protect the pump in the sump" as per the BPEM.
It will require source, pathway, receptor, existing controls, likelihood, consequence and risk columns.</td><td>Following implementing item 30 this step is no longer considered necessary.</td><td>Further clarification required.
<u>Outstanding</u>
A risk matrix has not been prepared.
While accept that existing and potential beneficial users have not been impacted what is the risk of future impacts.
While current impact identified, future risk should be assessed based upon current leachate levels. This identifies need for additional controls.
Outstanding matters addressed in final report.</td></tr>
<tr><td>32</td><td>6.0, p49</td><td>Confirm LFG system installed with date and title of cap construction audit. Typo in gas.</td><td>Apologies, you are correct to point out that the design is EPA and Auditor approved but not yet installed. Amended.</td><td>Accepted
Change made. Gas system proposed.</td></tr>
<tr><td>33</td><td>7.0, p50, para 2</td><td>Typo in sumps.</td><td>Noted, amended.</td><td>Accepted
Change made.</td></tr>
<tr><td>34</td><td>7.0, p50, Table 13</td><td>
<table>
<tr><th rowspan="2">Cell</th><th rowspan="2">Sump</th><th colspan="3">Maximum leachate management level (m AHD)</th></tr>
<tr><th>(m AHD)</th><th>(m bTOC)</th><th>Level above lowest point of the liner surface (excluding leachate aggregate layer) outside of sump</th></tr>
<tr><td>Cell 1/1A</td><td>Leachate sump 1 (JRLP)</td><td>22.75</td><td>12.16</td><td>-</td></tr>
<tr><td>Cell 2</td><td>Leachate sump 2</td><td>TBD</td><td>TBD</td><td>0.3 m</td></tr>
<tr><td>Cell 3</td><td>Leachate sump 3</td><td>TBD</td><td>TBD</td><td>0.3 m</td></tr>
</table>
</td><td>Noted, amended.</td><td>Accepted
Change made.</td></tr>
</table>

Item	Report Reference	Auditor's Comments (draft of 30th July 2018)	Assessor's Feedback (draft of 30th July 2018)	Auditor's Comments (draft of 21st August 2018)
35	7.0, p50, below Table 13	*The* level (m AHD) is the compliance level as the depth below ToC may change over time due to capping works or settlement). Leachate levels are likely to reduce following complete capping of the site. Should the leachate level exceed the maximum leachate management level for more than two consecutive measurements or if increasing trends in landfill contaminants are recorded in groundwater at the site either: • a leachate extraction system should be installed to achieve compliance, and/or • the risk of harm be reassessed allowing for the inclusion of information from the new monitoring bores and the stage of closure/capping, and subject to the outcomes the maximum leachate management target leachate level(s) or the number of compliance points be amended and the necessary action be taken to ensure compliance. should be adopted.	Noted, amended.	Accepted Change made.
36	8.0, p51	Review in light of above comments,		Accepted Change made. Gas system proposed.

Item	Report Reference	Auditor's Comments (draft of 30th July 2018)	Assessor's Feedback (draft of 30th July 2018)	Auditor's Comments (draft of 21st August 2018)
37	S1.1, pg. 1	Also note Reporting requirement 3.1 of Pollution Abatement Notice (PAN) 90009081 (Attachment 1) dated 15th August 2018 states: By 17 September 2018 you must provide to EPA a hydrogeological assessment for the premises that: a) is in accordance with Hydrogeological Assessment (Groundwater Quality) Guidelines (EPA Publication 668, released September 2006); b) specifies the maximum leachate management level for all unlined and partially lined cells which protects beneficial uses of groundwater and allows for the effective management of landfill gas; and c) is verified by a person who has been appointed as an environmental auditor under the Environment Protection Act 1970. The reporting requirement is identical to Condition LI_L4.3 of Licence 74237 Premises 72826, amended on 20th February 2017, except that the reporting date that has been superseded by the (PAN) 90009081 date of 17th September2018 and 'for the premises' has been replaced by 'for all unlined and partially lined cells'. Cells 1 and 1A are partially lined. Cells 2 and 3A-1 are fully lined. This HA also specifies the maximum leachate management levels for Cells 2 and 3A-1 in accordance with the licence.		**Outstanding matters addressed in final report.**

Item	Report Reference	Auditor's Comments (draft of 30th July 2018)	Assessor's Feedback (draft of 30th July 2018)	Auditor's Comments (draft of 21st August 2018)
38	S7	Amend text below table 12 (previously table 13) to state: Cells 2 and 3 are understood to be fully lined cells. In Accordance with the EPA (2015) *Landfill BPEM* the maximum leachate levels are 300 mm above the lowest point of the liner surface. Amend paragraph commencing "Should the leachate level exceed …."to Should the leachate level(s) exceed the maximum leachate management level for more than two consecutive measurements in any cell or if increasing trends in landfill contaminants are recorded in groundwater at the site reassess the risk of harm and if considered to be unacceptable due to leachate impacts, review and revise within waste leachate monitoring points and maximum leachate management target leachate level(s).		**Outstanding matters addressed in final report.**
39	After S7.	Recommendations Implement relevant Nolan Consulting (2017) *"Section 53V Audit - Audit of Landfill Operation 200 Johnstons Road, Bairnsdale Service Order No. 8005330"*.		**Outstanding matters addressed in final report.**

Table 2 Auditor's Review and Comments - EPA Publication 668: Hydrogeological Assessment (Groundwater Quality) Guidelines

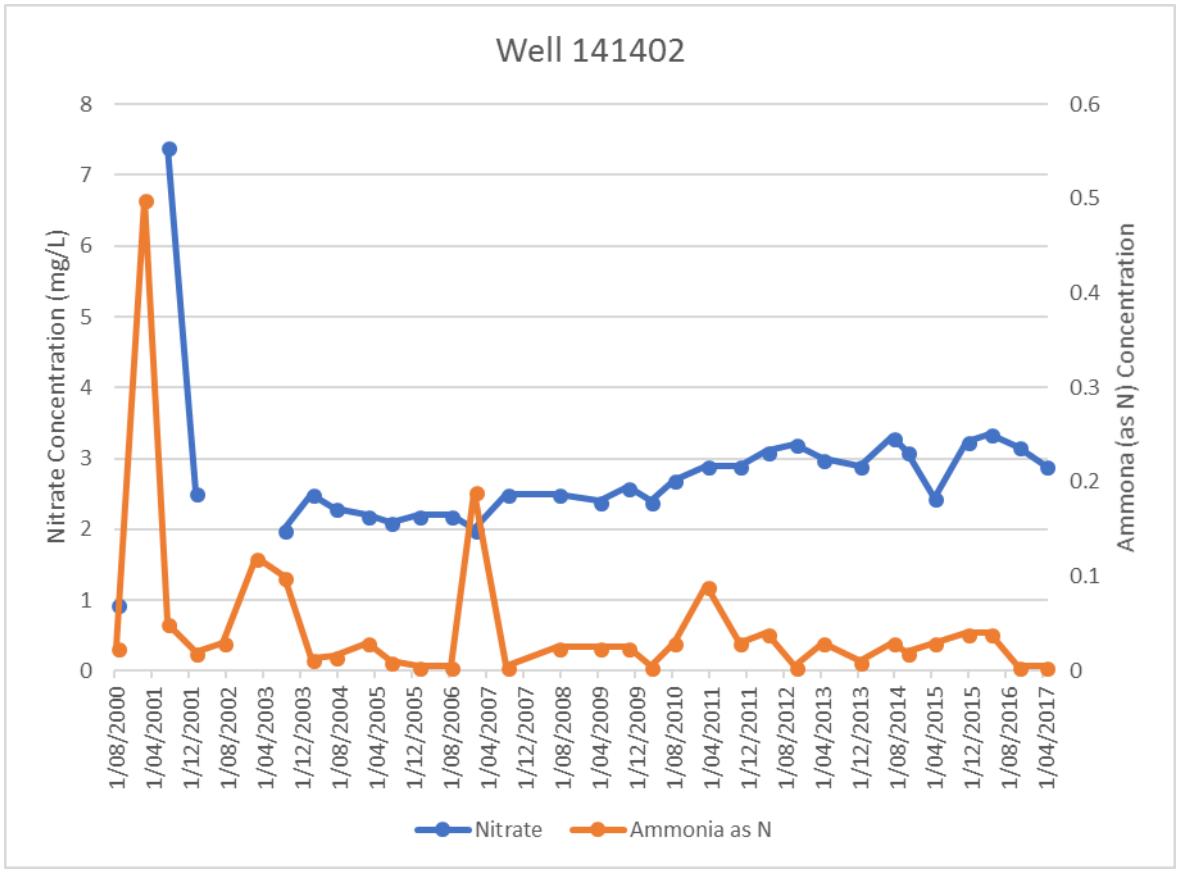
Item	EPA Guidelines	Auditor's Comments	Assessor's Feedback
1.	The HA should include assessment of the:		
	• Hydrogeology of the site and surrounding region	Included.	✓
	• Aquifer properties and groundwater flow directions, paths and rates	Provide velocity estimates, and estimate time for leachate to seepage to saturated groundwater	Given the available data it is not considered feasible to make a meaningful calculation of unsaturated velocity. The extra travel time needed to travel through the subsurface is acknowledged in the text.
	• Potential for activities to cause groundwater contamination	Included.	✓
	• Distribution and concentration of existing contamination	Included	✓
	• Expected transport and fate of groundwater contaminants	Included. Further clarification required. See Table 1.	✓
	• Risk to human health and/or ecological receptors in the environment	Partially, revised risk register recommended.	✓
2.	Clear objectives must be determined. A HA's scope should be site-specific and risk-based.	Included.	✓
3.	A desktop study should be completed to inform field collection of data.	Historical groundwater and leachate details included.	✓
4.	The following field data collection steps should be taken:	Relied on existing information	✓

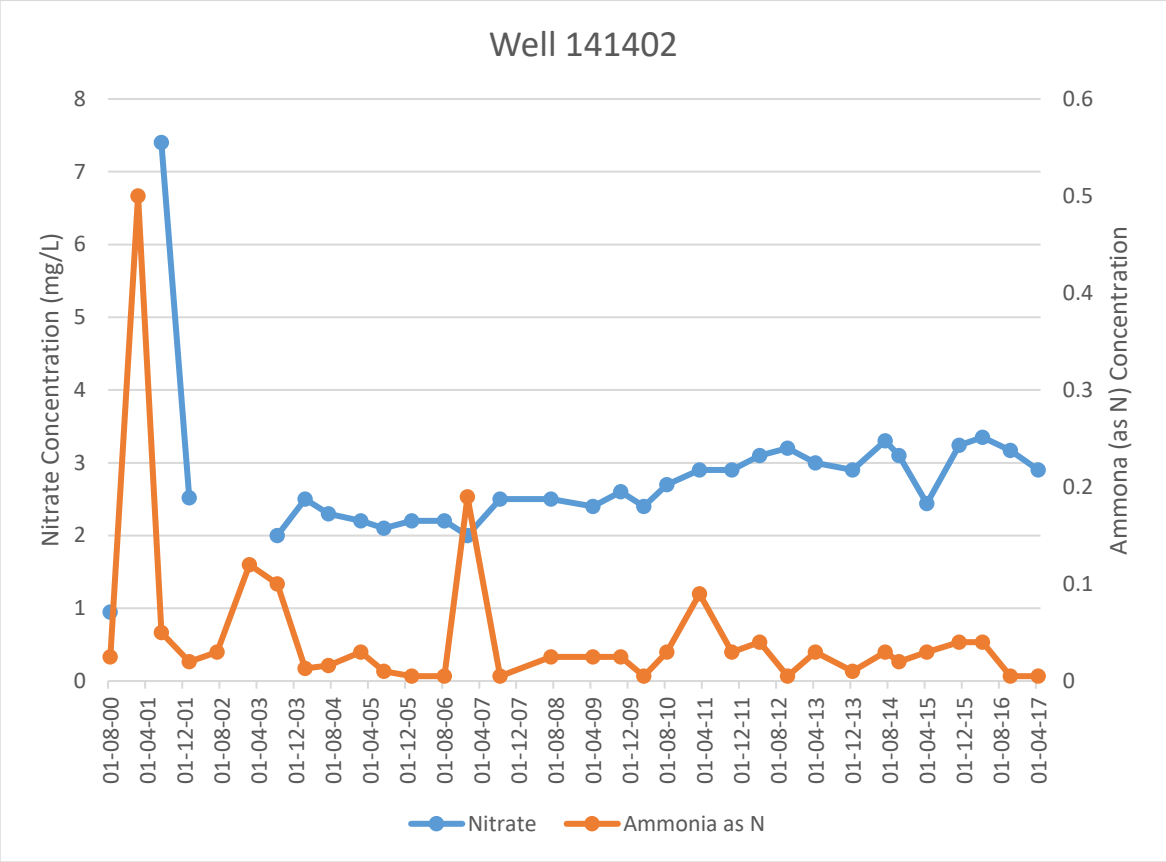
Item	EPA Guidelines	Auditor's Comments	Assessor's Feedback
	• Characterise the site geology (which units are present and act as aquifers or aquitards). It may be necessary to determine the hydraulic properties of the aquifers, and sometimes the aquitards	Included.	✓
	• Measure groundwater levels to estimate the rates and directions of lateral and vertical groundwater movement	Vertical groundwater movement is not discussed. Upper and lower rates not estimated.	✓
	• Map the lateral and vertical extent of groundwater chemistry and contaminants	Presented in the report.	✓
	• Assess plume movement (including plume stability, growth or decay).	Discuss ammonia to nitrate nitrification process and comment upon status with 141402 with elevated NO_3	No groundwater plume has been identified at the site,
	• Identify areas of contaminant migration and places where contaminant may be stored	As above.	No groundwater plume has been identified at the site,
5.	Groundwater bore network used for HA preparation:		
	• Is an up-gradient background bore present and operational at the site and identified in the HA to allow for the determination of 'background' groundwater quality?	Yes	✓
	• Are down-gradient or lateral bores (typically 2-3 bores), suitable to assess potential off-site migration of contamination, present. Are these identified in the HA?	Audit recommends new bore recommended at south-east corner of Cell 2. Does HA consider existing network adequate.	Concur, recommendation added.
	• Do groundwater bores target the different lithologies known/expected to be present at the site?	HA to comment. Are there shallow and deep saturated units within the HHF separated by an aquitard?	None identified.

Item	EPA Guidelines	Auditor's Comments	Assessor's Feedback
6.	Where flow and solute transport modelling is undertaken to support the HA, there needs to be sufficient supporting material to provide adequate 'weight of evidence' to support interpretations and conclusions. Model results should be reported with clear uncertainty analysis and error bans, and details of the sensitivity of the model to changes in key variables.	Groundwater modelling was not considered necessary for the HA and was therefore not undertaken.	✓
7.	A groundwater impact (qualitative risk) assessment, using the 'source-pathway-receptor' approach, should include the following components and multiple lines of evidence:	Partially, revised risk register recommended.	✓
	• Assessing the source of the contaminant and nature of the chemicals of concern	Partially, additional sources to be considered.	✓
	• Identifying existing and potential uses relative to those protected by State environment protection policy (Groundwaters of Victoria) ('SEPP (GoV)') and the receptors that may be affected	Included.	✓
	• Estimating likely groundwater flow paths and rates, and potential exposure of the receptors to the contaminants	Partially, revised risk register recommended.	✓
	• Assessing the likely impact on water quality and beneficial uses of the groundwater by reference to water quality criteria	Undertaken.	✓

Item	EPA Guidelines	Auditor's Comments	Assessor's Feedback
	• Evaluating the volatilisation pathway for organic contaminants	BTEXs discussed	✓
	• Obtaining evidence of natural attenuation of contaminants and plume stability	Require a comment.	No plume has been identified.
8.	Groundwater level measurement, sampling and QA/QC should follow the guidance provided in EPA Publications 669 (Groundwater sampling guidelines) and IWRG701 (Sampling and Analysis of Waters, Wastewaters, Soils and Wastes).	QA/QC comment provided.	✓
9.	Water level measurements should be reported relative to ground level and to a common datum, preferably Australian Height Datum (AHD).	Included.	✓
10.	Water levels in all bores at a site should be measured on the same day and before purging or sampling.	Please confirm for April 2017 monitoring event. .	✓
11.	The HA report should seek to answer:		
	• How do the levels of contamination compare to criteria in ANZECC 2000?	Included.	✓
	• Are LNAPL or DNAPL contaminants present? If present, how do petroleum hydrocarbon levels compare to Dutch Investigation Criteria?	Not specifically included.	The absence of NAPL was noted in Section 4.5.8.
	• Which aquifers and aquitards are affected by contamination?	Included.	✓

Item	EPA Guidelines	Auditor's Comments	Assessor's Feedback
	• Do contaminants exhibit evidence of natural attenuation in the aquifer and, if so, over what time frames?	Not specifically included.	No appropriate given the lack of plume.
12.	Potential HA outcomes to be included in the HA report:	Auditor comments on proposed leachate management are identified in Table 1.	✓





Appendix E

EGSC- Business Case for the in-house processing of organic waste

Business Case for the in-house processing of organic waste

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1. Project Overview

This project plan outlines the process for establishment of an aerobic composting facility adjacent to the Bairnsdale Regional landfill. The facility is intended to process 25,000t per year of Garden Organics (GO) and mixed Food Organics and Garden Organics (FOGO). The construction of this facility will facilitate a smooth transition to a kerbside FOGO collection and ensure all environment protection obligations are met for the management of Organic Waste in East Gippsland.

2. Background

GO received at East Gippsland Shire Councils transfer stations is currently shredded by a contractor between 4 and 7 times per year. This shredded waste has previously been used in the rehabilitation of landfill cells however, following the 2022 closure of the Cann River landfill no further rehabilitation woks (excluding maintenance and Bairnsdale cells) will be required. As such a new processing method is required. Furthermore, East Gippsland Shire Council in line with the Recycling Victoria Policy is required to introduce a FOGO collection by 2030 which further creates demand for a local organic waste processing facility.

2.1. Organic Waste in East Gippsland

Garden Organics (GO) are accepted at 11 of the East Gippsland Shire Councils Transfer stations. Volumes received vary significantly from site to site with Bairnsdale being the largest receiver at 12,000t per year. In total, the waste facilities receive a combined 26,000T per year (inclusive of kerbside collection). It is however worth noting that receival volumes are measured in m^3 so an average bulk density conversion has been applied to achieve tonnage data which better aligns with EPA guidelines.

In addition to the GO received at transfer Stations, East Gippsland Shire Council will introduce a kerbside FOGO collection in 2025. Based on the 2021 Waste Audit conducted by A.Prince Consultants, an estimated 4500t of Food Organics (FO) will be received annually through the kerbside FOGO collection. The Mallacoota community is currently serviced by a fortnightly kerbside FOGO collection which is processed locally at a council owned anaerobic composting facility.

2.2. Available/Assessed Processing Options

As outlined above, East Gippsland Shire Council has previously had scope to utilize shredded GO in the rehabilitation of landfill cells, however, with the Bairnsdale landfill soon to be the sole facility servicing East Gippsland the supply of shredded GO will far exceed demand.

2.2.1 Gippsland Regional Organics

The closest commercial composting facility to the East Gippsland Shire is Gippsland Regional Organics (GRO) located in Dutson Downs which is 96km from the Bairnsdale Landfill. The cost of outsourced processing through a facility such as GRO is likely significant and cannot be offset through the sale of composted organics. In addition to this there is significant

environmental implications related to the transport of organic waste to a commercial facility. Table 1 below provides some indicative costs for outsourced FOGO processing based on discussions with GRO in January 2021.

Item	Indicative Cost Per Tonne
Initial processing (shredding and decontamination)	
Gate fee to GRO	
Transport to GRO	
TOTAL	

Table 1: Indicative outsourced processing costs (NOTE: these costs are based on informal discussions with GRO and are not indicative of all commercial facilities or a formal quote)

2.2.2 Other Gippsland Organics Processors

Several other organic waste recyclers operate in the Latrobe valley. These facilities do not require feedstock to be shredded or decontaminated (contamination limits apply) prior to delivery. Indicative pricing from these facilities indicate gate fees in excess of $100/t which does not account for transport. The use of one of these facilities is projected to cost council in excess of $2million per annum without any scope to recover cost through product sale.

2.2.3 Sale of Raw Mulch

The sale of raw mulched GO is another disposal method which has been considered but deemed too high risk due to the potential for spreading of pathogens and weeds which would otherwise be destroyed through the composting process. Additionally, this method does not provide for the processing of FO.

2.2.4 Alternate and Emerging Technologies

Various other organic waste processing technologies are in use around the world including Pyrolysis, Insect Bioconversion, vermiculture/vermicomposting, dehydration and both thermal and biological waste to energy. Unfortunately, none of these technologies are currently well established in the Australian market and the cost of establishment would be prohibitive to council.

Given the potentially significant cost of outsourcing the processing of councils FOGO waste, officers have conducted comprehensive investigations into the establishment of an in-house aerobic composting facility. It is this project which is assessed herein.

2.3. Project Drivers

The current acceptance of GO at council's waste facilities is provided as a service to the East Gippsland Community. This service enables safe and environmentally friendly disposal of GO from residents' properties. Similarly, the kerbside collection of GO provides a convenient service to around 20,000 properties across East Gippsland. The Victorian State Governments *Recycling Victoria: A New Economy* Policy mandates the introduction by councils of a FOGO disposal service for all Victorians by 2030. East Gippsland Shire Councils current Kerbside collection contract expires in 2025, as such a kerbside FOGO collection will likely be rolled out as part of the next collection contract.

The disposal of both FO and GO is heavily regulated with GO being prohibited from landfill and FO being highly undesirable due to the significant emissions caused by its breakdown under

anaerobic conditions. As a combustible material, stockpiles of GO must be managed effectively to ensure compliance with the *Environment Protection Act 2017.*

3. Proposed Site

The site proposed for this project is within the Footprint of the Council owned property at 200 Johnston's Road Forge Creek (Site of the Bairnsdale Regional Landfill). The property consists of 211Ha of land zoned FZ1, approximately 70Ha of this land is licensed for use as landfill which is projected to fulfill councils' requirements until around 2050. The proposed composting facility will occupy a footprint of 3.3Ha on the Northern Boundary of the property, this location maximizes separation distances to sensitive receptors (See section 4.2). The preliminary site plan (See site plan) provides on an overview of the proposed site layout and location within the property.

4. Key Considerations

A detailed feasibility study has been completed following a comprehensive composting trial conducted on site at the Bairnsdale Regional Landfill. This study assesses and confirms the ability of East Gippsland Shire Councils waste team to produce a high-quality compost product from the GO feedstock available.

4.1. Feedstock Volumes

The volumes of GO currently received at East Gippsland Shire Councils waste facilities are significantly higher than like councils. For example, city of Mildura receives an average of 12,000T of GO per year despite covering a larger area than East Gippsland and being home to 5000 more residents. The key difference between East Gippsland Shire Council and others is that all other Victorian councils charge residents to dispose of GO at transfer stations. Data provided by both City of Mildura and Latrobe City Council indicate a 40% reduction in GO volumes when a fee was introduced for disposal. It would be prudent for East Gippsland Shire Council to introduce a fee for the disposal of GO at transfer stations in an effort to reduce volumes managed and enable a cost neutral operation for the processing of GO.

Further feedstock management should also be investigated to manage stockpiles at remote sites. The introduction of seasonal only drop off points at most transfer Stations would significantly reduce the requirement for organics shredding. Doing so would significantly reduce shredding costs while still providing convenient options for East Gippsland residents to dispose of their GO.

4.2. EPA Compliance

Victorian Environment Protection Authority (EPA) works approval will be required for the operation of a composting facility of this proposed scale. EPA Publication 1588.1 'Designing, Construction and Operating Composting Facilities' (the EPA guideline) provides a guideline for aerobic thermophilic composting facilities in Victoria. The works approval will require compliance considerations for a range of risks in line with the General Environmental Duty (GED) including

odour emissions, ground water contamination and physical waste pollution. Feedstock composition will determine the severity of risks posed by the composting facility. The EPA guideline provides a categorization of feedstock risk which is shown below in Figure 1.

Category	Risk level	Waste types	Definitions and examples
1	Lowest	Garden and landscaping organics	Grass, leaves, plants, branches, tree trunks and tree stumps
		Untreated timber	Sawdust, shavings, timber offcuts, crates, pallets, wood packaging
		Natural organic fibrous organics	Peat, seed hulls/husks, straw, bagasse and other natural organic fibrous organics
2	Medium	Municipal source separated kerbside garden waste	Grass, leaves, plants, branches, tree trunks and tree stumps
		Biosolids and aged manure	Biosolids that meet treatment grades T1 to T3[5]. Aged manure that has a dry matter greater than 35%
3	Medium to high	Dewatered sewage sludge and fresh manures	Dewatered sewage sludge (does not meet the T1 to T3 standards), animal manure and mixtures of animal manure and animal bedding organics
		Other natural or processed vegetable organics	Vegetables, fruits and seeds and processing wastes, winery, brewery and distillery wastes, food organics excluding organics in category 4
		Mixed source separated kerbside (Garden waste/food waste – FOGO)	Grass, leaves, plants, branches, tree trunks and stumps, vegetables, fruit and meat
		Grease interceptor trap wastes	Grease trap waste with less than 10% solids
4	Highest	Liquid organic wastes (excluding grease interceptor trap waste with less than 10% solids)	Liquid food waste and liquid food processing wastes (including sludges), liquid animal wastes (blood) and paunch (sludge), grease trap with greater than 10% solids
		Meat, fish and fatty foods	Animal mortalities, parts of carcasses, bone, fish and fatty processing or food

Figure 1: Feedstock Risk Categories

Based on the risk categorization in Figure 1, the feedstock processed by East Gippsland Shire Council would fall into category 3 ‘medium to high’. As such, process controls will be required to mitigate risks in line with the GED.

4.2.1. Odour

The composting of organic waste can create significant offensive odour emission depending on the feedstock and process being used. Various controls will be implemented to mitigate this risk.

1- Enclosed receival- All feedstock received on site will be initially deposited in an enclosed receivals area to reduce odour emissions from the receival process.
2- Enclosed aerobic composting- the initial pasteurization stage of the composting process will take place in an enclosed aerobic composting system (see figure 2). This type of system significantly reduces odour emission from the organic waste during the first stage of composting.

Figure 2: Example of an enclosed aerated composting system

3- Significant Buffers- Site selection has been performed with consideration to the guidelines recommended separation distances (see figure 3). Sensitive receptors within range of the proposed sites consist of a small number of residential properties (farm houses) which are clearly identified in the site plans above.

Types of feedstock	Technology being used	Size of the plant	Recommended separation distance (metres)
Green waste Vegetable organics Grease inceptor trap waste	Open air receival Enclosed aerobic composting with secondary odour capture and treatment equipment Open air maturation	1,200 tonnes per annum	>300
		14,000 tonnes per annum	>500
		36,000 tonnes per annum	>800
		55,000 tonnes per annum	>1,000
		75,000 tonnes per annum	>1,200
		90,000 tonnes per annum	>1,400

Figure 3: Recommended separation distance to sensitive receptors

Based on the separation distances recommended by the guideline, the proposed site would be appropriately located to process somewhere between 14,000 and 36,000t of organic waste per annum. It is worth noting that the prevailing winds on the proposed site(see figure 4) would primarily blow odour to the South East in which case the closest sensitive receptor is over 1150m from the site.

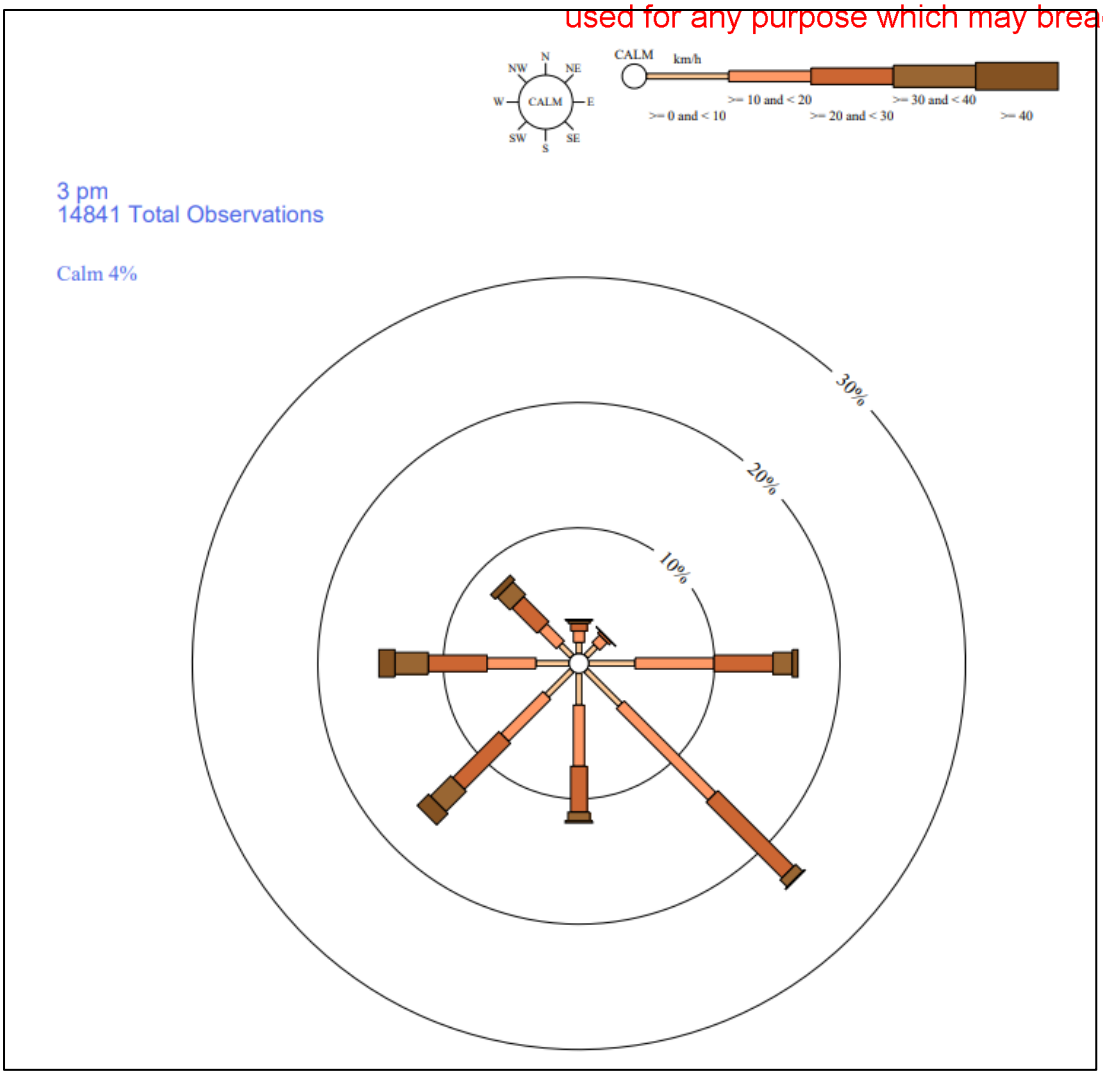


Figure 4: Rose of wind direction versus wind speed in km/h (01 Jul 1942 to 10 Aug 2021) at the Bairnsdale Airport (Source: Bureau of Meteorology)

4- Vegetative Wind Break- The proposed site would include a vegetated windbreak of approximately 2ha between the organic waste processing area and the sensitive receptor 700m(approx.) to the sites West.

4.2.2. Surface water, groundwater, and land contamination

To mitigate any risk to ground water quality posed by the composting process, all water on site will be captured and diverted to a holding pond for treatment or reuse. This capture will occur passively with the entire site consisting of a nonpermeable surface (hydraulic conductivity less than 1 x 10^{-9} m/s) and comprehensive drainage system. Due to the water intensity of the composting process much of this runoff can be circulated back into the process to maintain optimum compost moisture content. Any excess runoff will be treated through evaporation or transport to a suitable treatment facility where required.

4.2.3. Litter

FOGO collected through residential kerbside collections is often highly contaminated with inorganic waste material. While the organic waste will undergo an initial decontamination process it is likely that some residual waste will remain. The majority of this remaining waste will be removed through screening at the end of the composting process however it is important that it is managed during the composting process and prevented from leaving the facility boundary. A 2m(minimum height) chain link fence extending around the entire site boundary will act as a screen to prevent any waste from leaving the site.

4.2.4. Noise

Noise nuisance from composting operations may arise from the use of both mobile and fixed machinery within the premises and from movements of transport vehicles servicing the premises. To mitigate this risk noise emission will be considered when selecting plant and a preference will be given to electric equipment. Tree breaks will also be utilised to create a natural sound barrier between the site and sensitive receptors.

4.2.5. Dust and bioaerosols

Dust and bioaerosols can be created during the agitation of organic material while processing. This may occur while grinding, sorting, moving, or turning organic material. To mitigate risks associated with dust or bioaerosols the material will be kept moist to increase weight and cohesion.

4.2.6. Animal and Human Health

Vermin, birds, water and wind can act as vectors to transport waste, weeds and/or pathogens offsite. This can be a potential risk to the environment, and human health. Compost facilities can also act as habitats for populations of pests to proliferate. To mitigate these risks operational procedures will be in place to ensure plant and equipment is cleaned between the handling of pasteurized and non-pasteurised material. Strict testing procedures will also be in place to ensure pasteurisation is achieved.

4.2.7. Greenhouse Gas Emissions

Emissions will be generated through the composting of organic material and will be kept to a minimum by ensuring sufficient aeration throughout the process. Plant and machinery may also create emissions however electric plant will be sought where possible and will generate no emissions as East Gippsland Shire Council purchases 100% renewable energy.

4.2.8. Fire

Fire at composting facilities can arise from a number of sources, including spontaneous combustion. To mitigate this risk, moisture in composting organic material will be kept at optimum levels and a fire prevention and management procedure will be put in place.

5. Proposed Facility

5.1. Composting Process

Composting is the controlled process of organic waste decomposition primarily performed by micro-organisms. Technologies available for controlling this process are various and range significantly in scale. The technology proposed for this process involves the use of a forced air

floor system (see 5.2.3) for the initial pasteurisation of organic waste. This initial pasteurisation will take place over a period of 21 days.

Following the initial 21-day processing period in the forced air-floor system the organic waste will be formed into open windrows on the sites hardstand area and begin the maturation process. This maturation period which will last for at least 12 weeks and is characterized by declining temperatures and stabilization of microbial activity. During this time the windrows will be periodically 'turned' to maintain aeration and moisture will be added as required. To undertake this step a variety of specific plant will be required

5.1.1. Process Flow

Figure 5 below provides a detailed process flow of material from entering the facility through to leaving as a mature compost product.

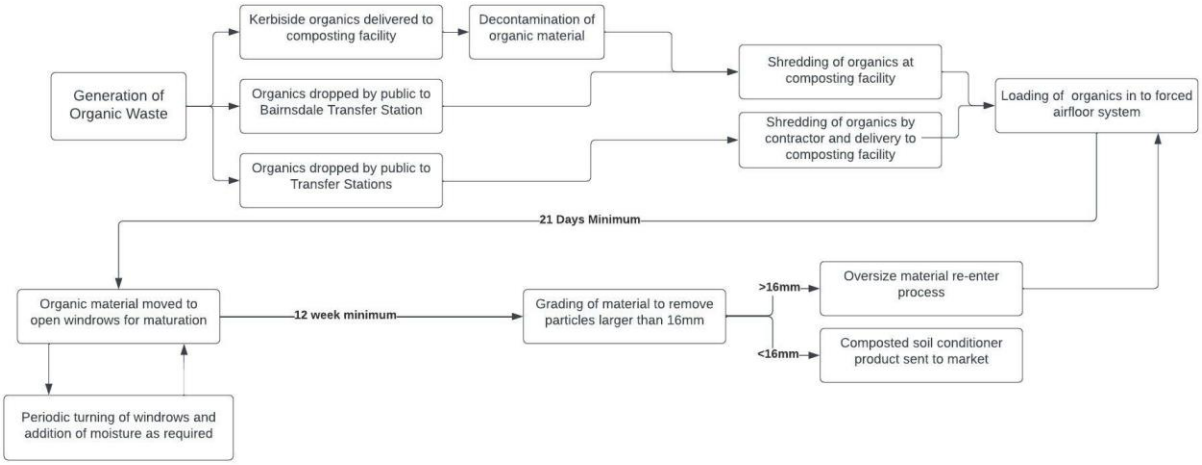


Figure 5: material flow from generation to product sale

5.1.2. Process Labour Requirements

The processing of organic waste requires a range of tasks to be performed. Table 2 below provides a summary of tasks required and an estimate of weekly hours required to perform the tasks.

Task	Estimated weekly hours
Decontamination of organic material	15
Grinding or organic material	15
Movement of organic material around site	5
Loading of forced air-floor systems	10
Monitoring of forced air-floor systems	5
Forming of open windrows	12
Maintenance of open windrows (turning and monitoring)	15
Grading of finished product	5
General administration	10
Total Labour hours	**92 (2.5fte)**

Table 2: Proposed Labour requirements

5.2. Composting Technology Requirements

The proposed composting facility will utilize a combination of forced air-floor covered composting systems with an open-air maturation. This process has been selected for its alignment to the EPA guideline as appropriate for the sites available buffer distances. A range of plant will be required for the handling and processing of organic waste. Table 3 below provides a list of plant required for the operation of this facility.

Plant	Purpose
Slow Speed Grinder	A slow speed grinder is required for the shredding of organic waste prior to beginning the composting process. See section 5.2.1.
Front-end loader	A front-end leader is required to move organic waste around the composting site including loading forced air-floor bunkers and forming of open windrows. See section 5.2.2.
Forced air-floor system	This plant is required for the aeration of organic waste during initial pasteurisation process. See section 5.2.3.
Tractor	A tractor is required to tow the 'windrow turner' which aerates windrows during the open windrow process. See section 5.2.4.
Windrow turner	The windrow turner is towed behind the tractor and works to aerate and shape windrows into uniform shape and size. See section 5.2.4.
Trommel	A trommel will be required for the size grading of finished compost. As a minimum a 16mm screen will be required. See section 5.2.5.

Table 3: List of required plant and its purpose on site

5.2.1. Slow Speed Grinder

The nature of organic waste accepted on site consisting of waste from small organic particles through to large tree stumps creates a requirement for the grinding of waste prior to composting. Council currently engages a contractor for the periodic grinding of organic waste however this facility would require daily grinding to continuously feed the composting process and avoid stockpiling of waste. As such a suitable slow speed grinder will be required. Figure 6 provides an example of the type of slow speed grinder which would be required.

Figure 6: Example of Slow Speed Grinder (Source: Terex)

5.2.2. Front-end loader

A front-end loader will be required on site for the general handling and movement of organic material around the site. This plant will be vital for the loading of the shredder, loading of forced air-floor bunkers, and setting of windrows.

5.2.3. Forced Air Floor

The forced air floor technology which is proposed for use consists of covered ‘bunkers’ in which the organic waste is placed. These ‘bunkers’ consist of a permeable concrete floor underneath which is a forced aeration system. This forced aeration maintains optimal conditions for the aerobic microorganisms active within the composting organic waste. Figure 7 below provides a basic cross section of a forced air floor composting system. This system will include an automated compost temperature and oxygen content reporting and tracking system to ensure effective pasteurisation. The organic waste would spend an average of 21 days in the forced air-floor system.

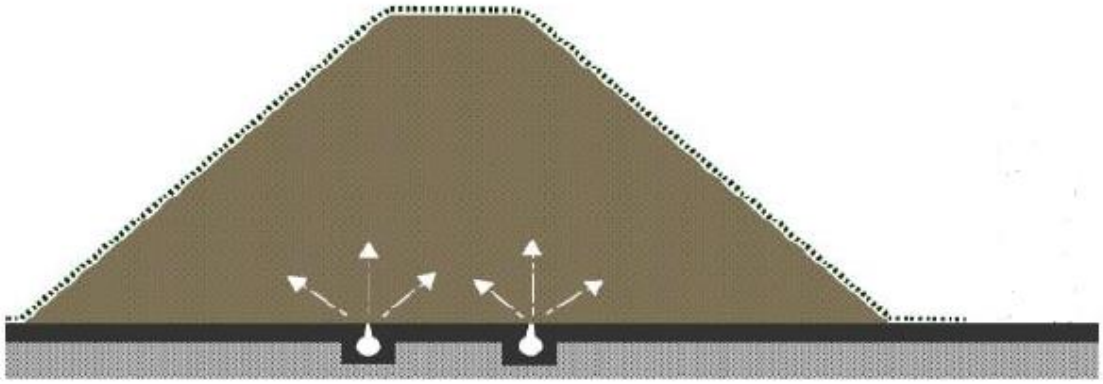


Figure 7: Cross section of forced air-floor composting system (Source: MOR composting systems)

5.2.4. Tractor

A Tractor is required on site to tow the windrow turner. There are many options for tractors suitable for this purpose.

5.2.5. Windrow Turning

The turning of open windrows requires a specialized windrow turner. Available technology in this space ranges significantly in scale and cost. An assessment of plant used at similar sized facilities indicates that a suitable turner would be one similar to that shown in Figure 8. The windrow turning unit requires a tractor to tow and provide power to the unit. The windrow turning unit will also include an inbuilt water tank and spray manifold to apply water to the windrows as required.

Figure 8: Example of suitable windrow turner (Source: True Blue Composters)

5.2.6. Trommel

The variable nature of organic waste feedstock means that the finished compost contains a variety of material sizes. In line with Australian Standard 4544: Composts, soils conditioners and mulches, a mature composted soil conditioner is to contain particles no larger than 16mm. As such the Trommel will require a 16mm screen to separate all material larger than 16mm. Figure 8 below provides an example of a suitable trommel for the facility.

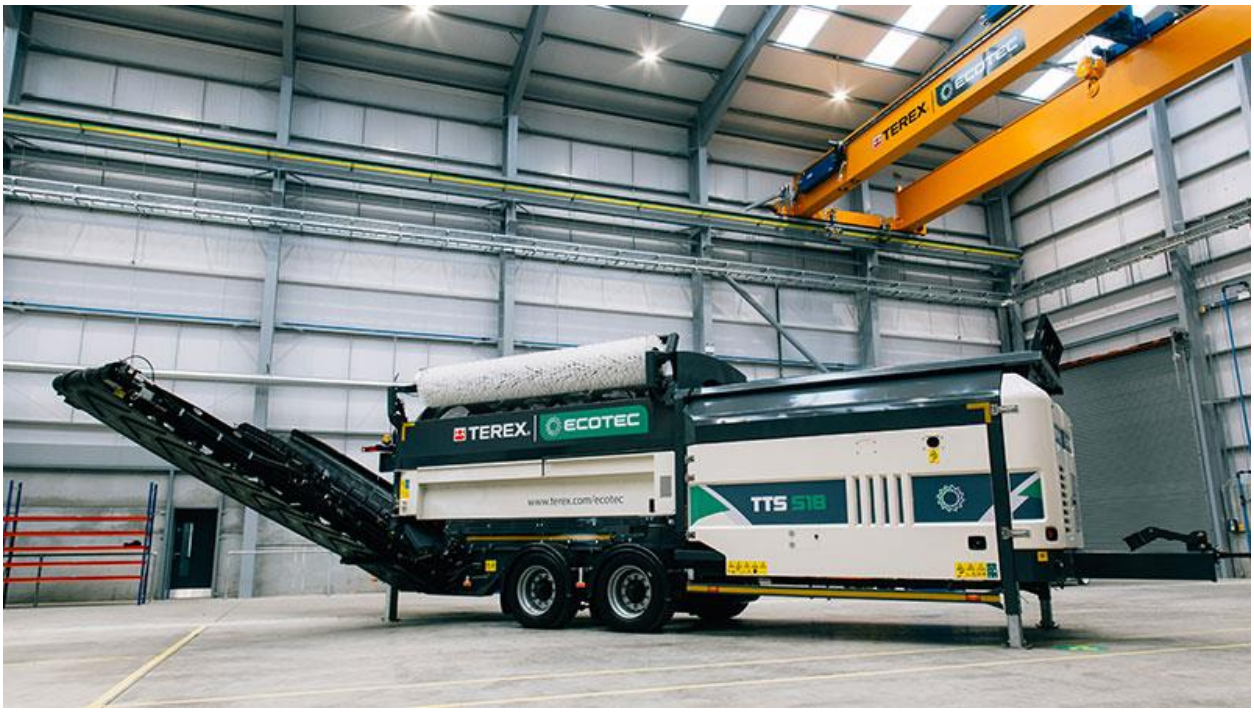


Figure 9: Example of suitable Trommel (Source: Terex)

6. Proposed Construction Plan

6.1. Works approval application

Construction of this facility will require an EPA works approval. The proposed application is for 20,000T per annum in vessel FOGO composting with enclosed receival and Open-air maturation plus 5000T per year of GO only in Open Windrow. The additional 5000T of GO processing is to provide a contingency volume for periods of high feedstock receival. This contingency processing would take place in a designated area in the South Eastern corner of the site to maximise buffer distances to sensitive receptors. The volume requested for this works approval is contingent on the introduction of a disposal fee to drive reduced feedstock receival volumes.

EPA allows for projects with acceptable levels of risk to human health and the environment to be carried out under a ‘project pilot licence’. It may be worth beginning the approvals process with this type of licence to determine the odour implications of open windrow composting GO feedstock. The ability to send GO feedstock directly to open windrow could save over $xx in capital costs.

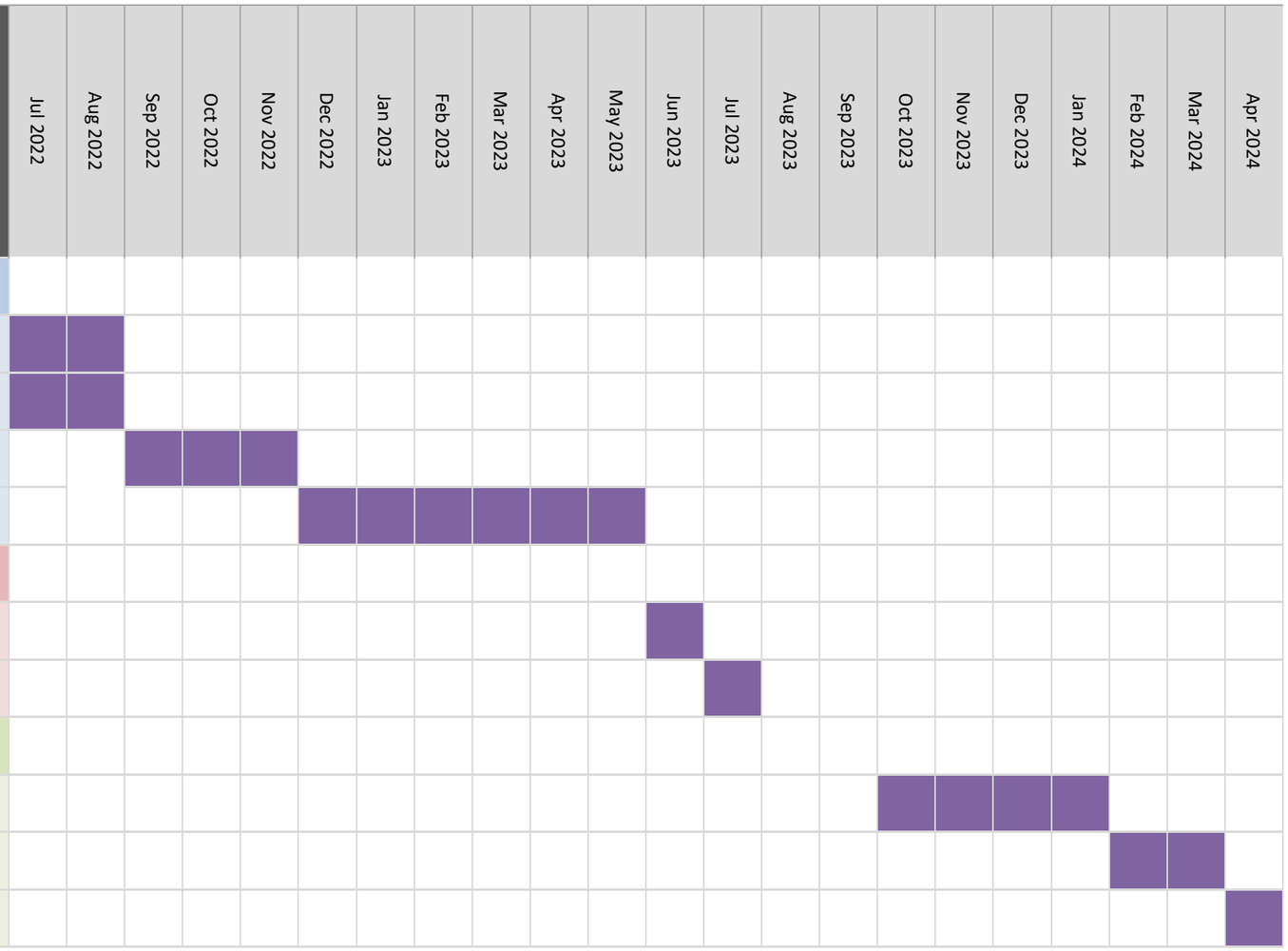
6.2. Construction Plan

Tendering for site construction will begin soon after all approvals are received. Tenders will be required for site construction including roads, hardstand, drainage, site buildings and contact water dam. Further tenders will be required for the supply of all site plant.

6.3. Project Timeline

The below timeline provides an overview of the projected timeline for project implementation. Note that this project is planned for completion by 31/12/2023 however a 4-month buffer has been allowed for any delays which may be incurred.

TASK	START	END
Planning and Approvals		
Council Endorsement	01/07/2022	04/07/2022
Finalisation of Site Plans	01/07/2022	31/08/2022
Planning Approval	01/09/2022	30/11/2022
EPA Works Approval	01/12/2022	31/05/2023
Procurement		
Tender for Site Construction	01/06/2023	30/06/2023
Tender for Site Plant	01/07/2023	31/07/2023
Construction and Commissioning		
Site Construction	01/10/2023	30/01/2024
Site Commissioning	01/02/2024	30/03/2024
Site in full operation	01/04/2024	30/04/2024



7. Capital Budget

This project will require significant capital investment which is detailed below in Table 4. The pricing presented below provides an upper and lower cost limit.

Item	Category	Indicative cost low	Indicative cost high

Table 4: Capital expenditure budget estimate

8. Operational Budget

Table 5 below provides indicative budget requirements for the operation of this proposed facility. Note that the costs in yellow are estimates only and require validation. The amortization of capital costs does not account for depreciation.

Item	Annual Cost Low	Annual Cost High
Staff Costs @ 2.5fte		
Plant Operating Costs (Fuel, servicing etc.)		
Utilities		
Site Maintenance		
Capital cost amortised over 10 years		
Total Annual Cost		
Total Cost per Tonne (25,000t)		

Table 5: Indicative site operational costs

9. Project Finance

This project will require significant upfront capital expenditure. A range of potential funding opportunities exist to support this project such as Sustainability Victoria's Councils fund under which officers have already applied for $xx. As the approvals and construction for this process will extend over at least 2 years officers recommend utilising the Bushfire Waste Income Reserves to progress this project.

10. Project Income

In creating a nutrient rich organic compost, council will have several options for the products distribution, some of which will generate income to offset operational costs. Three possible scenarios are presented below.

Scenario 1. Cost recovery through disposal costs

With the high estimate of organic waste processing per tonne being $xx, operating costs could easily be recovered through the setting of a charge for the disposal of organic waste. As discussed above, officers believe that a fee for the disposal of garden waste is essential to enable the success of this project by reducing feedstock volumes.
Applying a cost of $xx per tonne for garden waste would mean a per cubic metre cost of approximately $xx. This charge would be consistent with neighbouring councils such as Wellington who charge $xx per m^3 and Bass Coast who charge $xx per m^3.

Cost recovery via this structure would allow for compost to be distributed to the community free of charge. This would likely involve holding several collection days throughout the year where community members can attend the site to collect loads of compost. This would however require dedicated staff and plant and would disproportionately benefit the residents of Bairnsdale and surrounds.

Scenario 2. Sale of compost

As a valuable agricultural input, the composted organic waste could be sold to offset processing costs. Based on the estimated output of 10,000t (low estimate) of compost per annum the compost would need to be sold for around $xx/t to cover processing costs. As compost is available for between $xx/t and $xx/t (online search), a cost of $xx/t would be non-competitive and likely result in a lack of sales.

Scenario 3. Hybrid model

Scenario 3 presents a hybridised model of the 2 solutions above. Under this model, a charge would be introduced for the disposal of organic waste at councils' facilities while a nominal fee is also introduced on the sale of the finished product to cover the cost of loading customer trailers/trucks. In introducing a fee cost for the purchase of compost, the disproportionate benefit to the residents of Bairnsdale and surrounds would be mitigated.

11. Future Expansion

Assuming an initial license capacity of 25,000T per annum there may be a future need for increased processing capacity. Increased capacity would require an amended works approval which would likely be limited by the Buffer distances to the nearest sensitive receptors. As such

it would be prudent to investigate the purchase of neighbouring properties to ensure Buffers are available for future expansion of both the composting facility and adjoining landfill.

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