

INFORMATION REGARDING ENVIRONMENTAL AUDIT REPORTS

August 2007

VICTORIA'S AUDIT SYSTEM

An environmental audit system has operated in Victoria since 1989. The *Environment Protection Act 1970* (the Act) provides for the appointment by the Environment Protection Authority (EPA Victoria) of environmental auditors and the conduct of independent, high quality and rigorous environmental audits.

An environmental audit is an assessment of the condition of the environment, or the nature and extent of harm (or risk of harm) posed by an industrial process or activity, waste, substance or noise. Environmental audit reports are prepared by EPA-appointed environmental auditors who are highly qualified and skilled individuals.

Under the Act, the function of an environmental auditor is to conduct environmental audits and prepare environmental audit reports. Where an environmental audit is conducted to determine the condition of a site or its suitability for certain uses, an environmental auditor may issue either a certificate or statement of environmental audit.

A certificate indicates that the auditor is of the opinion that the site is suitable for any beneficial use defined in the Act, whilst a statement indicates that there is some restriction on the use of the site.

Any individual or organisation may engage appointed environmental auditors, who generally operate within the environmental consulting sector, to undertake environmental audits. The EPA administers the environmental audit system and ensures its ongoing integrity by assessing auditor applications and ensuring audits are independent and conducted with regard to guidelines issued by EPA.

AUDIT FILES STRUCTURE

Environmental audit reports are stored digitally by EPA in three parts: the audit report (part A), report appendices (part B) and, where applicable, the certificate or statement of environmental audit and an executive summary (part C). A report may be in colour and black-and-white formats. Generally, only black-and-white documents are text searchable.

Report executive summaries, findings and recommendations should be read and relied upon only in the context of the document as a whole, including any appendices and, where applicable, any certificate or statement of environmental audit.

AUDIT REPORT CURRENCY

Audit reports are based on the conditions encountered and information reviewed at the time of preparation and do not represent any changes that may have occurred since the date of completion. As it is not possible for an audit to present all data that could be of interest to all readers, consideration should be made to any appendices or referenced documentation for further information.

When information regarding the condition of a site changes from that at the time an audit report is issued, or where an administrative or computation error is identified, environmental audit reports, certificates and statements may be withdrawn or amended by an environmental auditor. Users are advised to check EPA's website to ensure the currency of the audit document.

PDF SEARCHABILITY AND PRINTING

EPA Victoria can only certify the accuracy and correctness of the audit report and appendices as presented in the hardcopy format. EPA is not responsible for any issues that arise due to problems with PDF files or printing.

Except where PDF normal format is specified, PDF files are scanned and optical character recognised by machine only. Accordingly, while the images are consistent with the scanned original, the searchable hidden text may contain uncorrected recognition errors that can reduce search reliability. Therefore, keyword searches undertaken within the document may not retrieve all references to the queried text.

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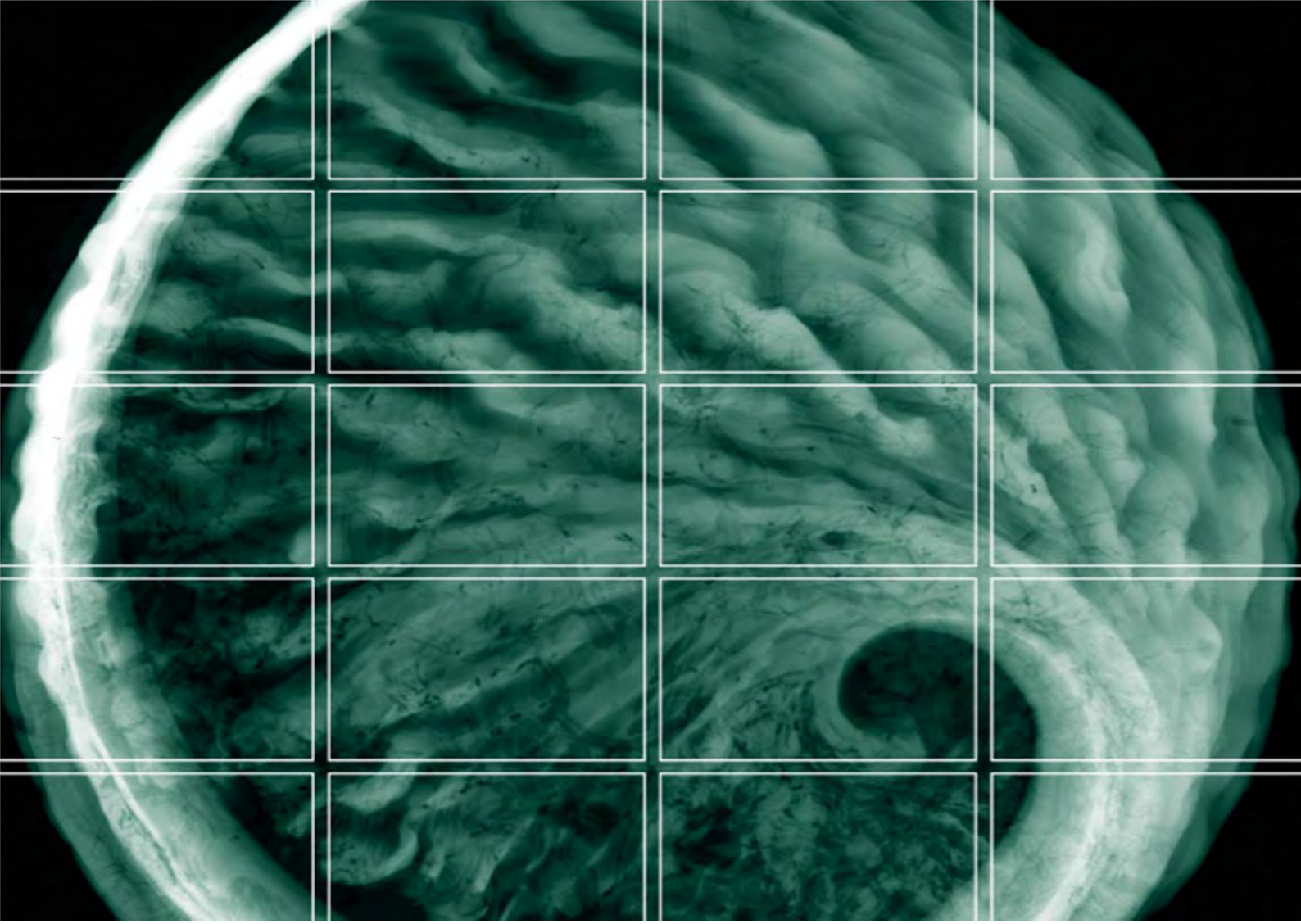
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FURTHER INFORMATION

For more information on Victoria's environmental audit system, visit EPA's website or contact EPA's Environmental Audit Unit.

Web: www.epa.vic.gov.au/envaudit

Email: environmental.audit@epa.vic.gov.au



City of Greater Bendigo

Section 53V Audit of Risk of Harm - Landfill Buffer Eaglehawk Landfill 191 – 193 Upper California Gully Road, Eaglehawk Victoria

Service Order: 8005693

CARMS Reference: 60409-9
Service Order Number: 8005693

16 December 2019

Project No.: 0448421

The business of sustainability

ERM

APPENDIX A FIGURES

Figure 1: Site Locality Plan

Figure 2a Site Features Plan – current Operations

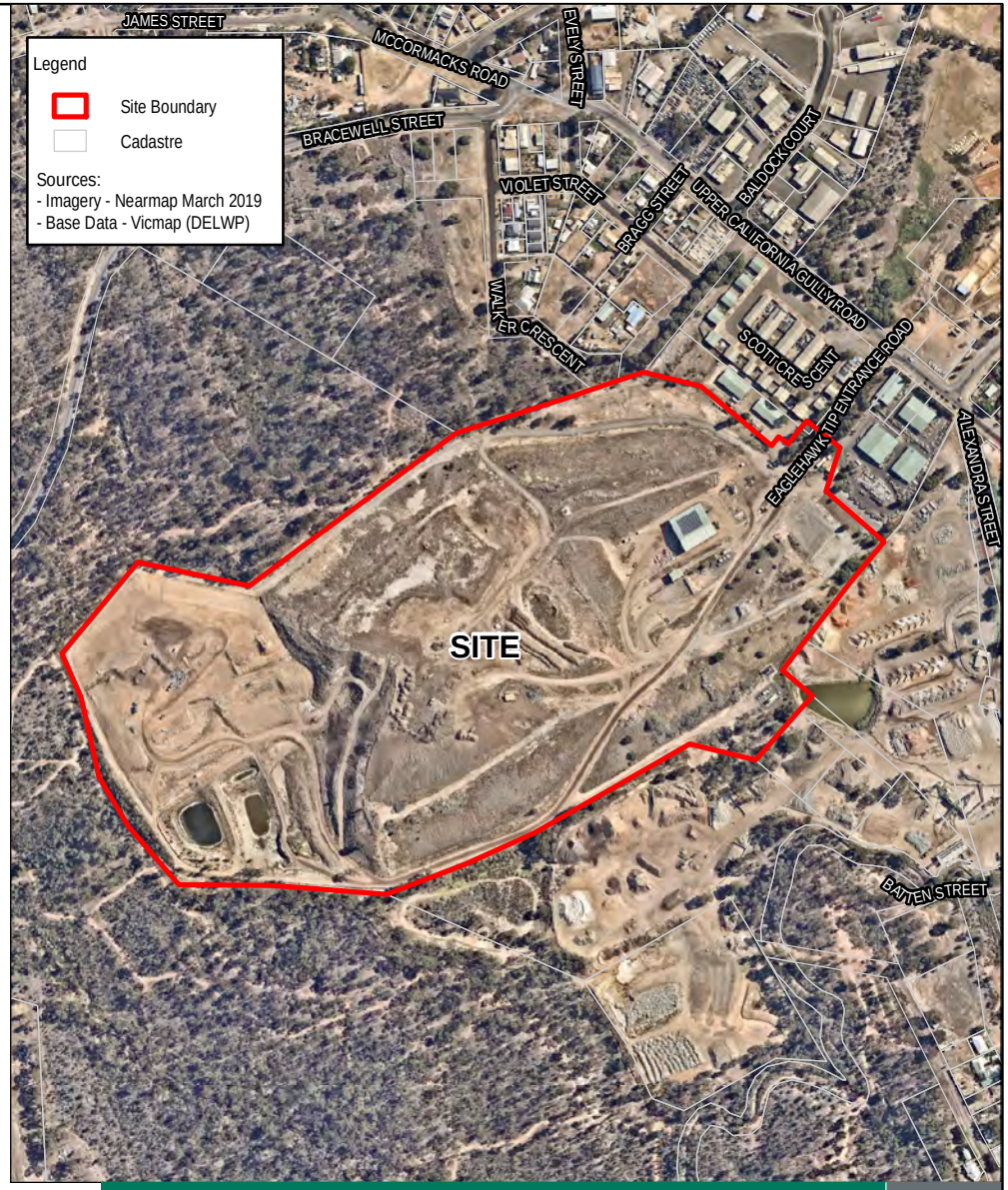
Figure 2b Site Features Plan – Proposed Operations

Figure 3 Planning Scheme Zoning and Overlay Map

Figure 4a Separation Distances – Current Operations

Figure 4b Separation Distances – Proposed Operations





Site Location

F1

Drawing No:	0448421m_LBR_G001_R0.mxd		Eaglehawk Landfill Buffer Audit 191- 193 Upper California Gully Rd, Eaglehawk VIC
Date:	16/08/2019	Drawing Size: A4	
Drawn By:	CB	Reviewed By: NB	Client: City of Greater Bendigo

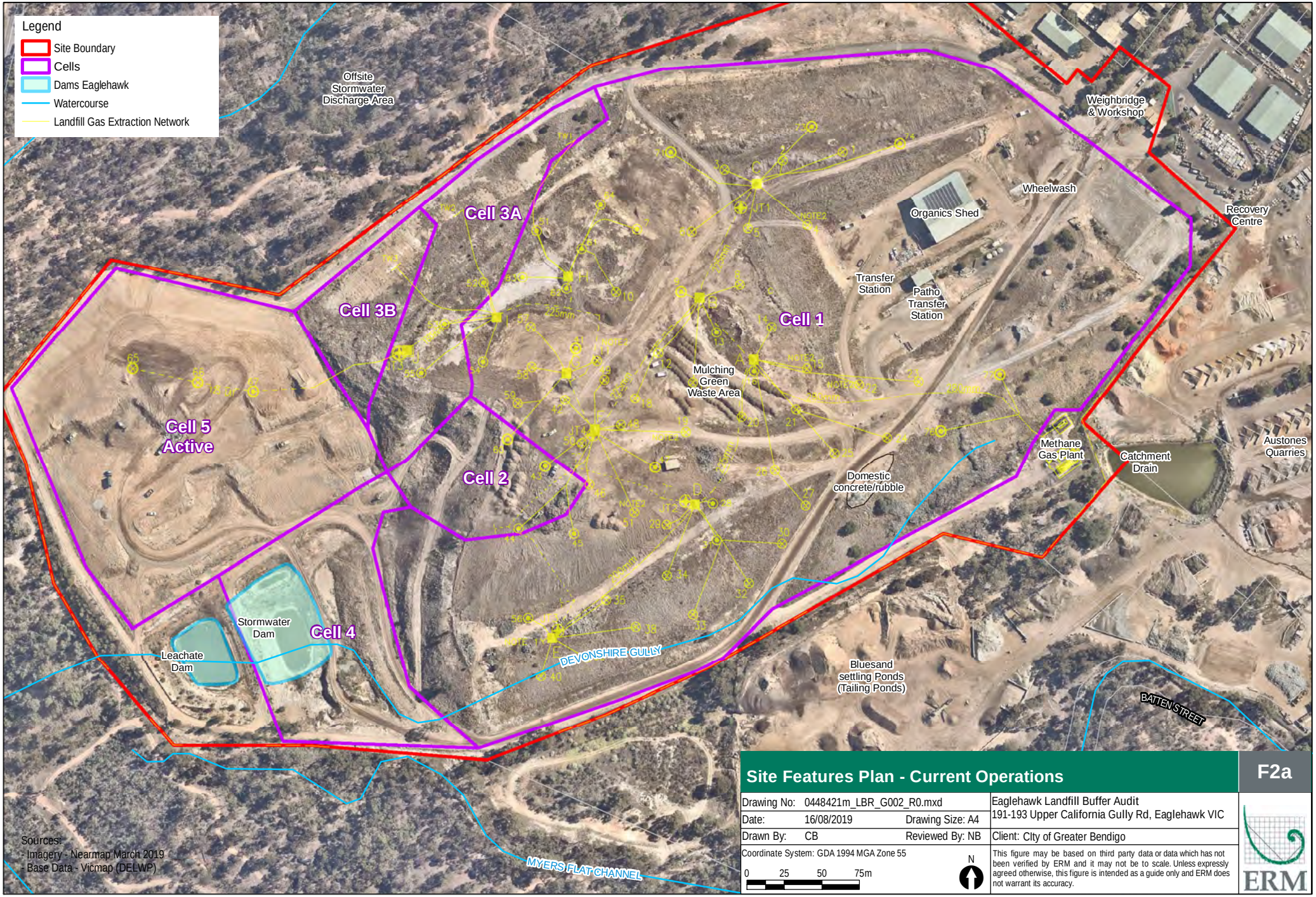
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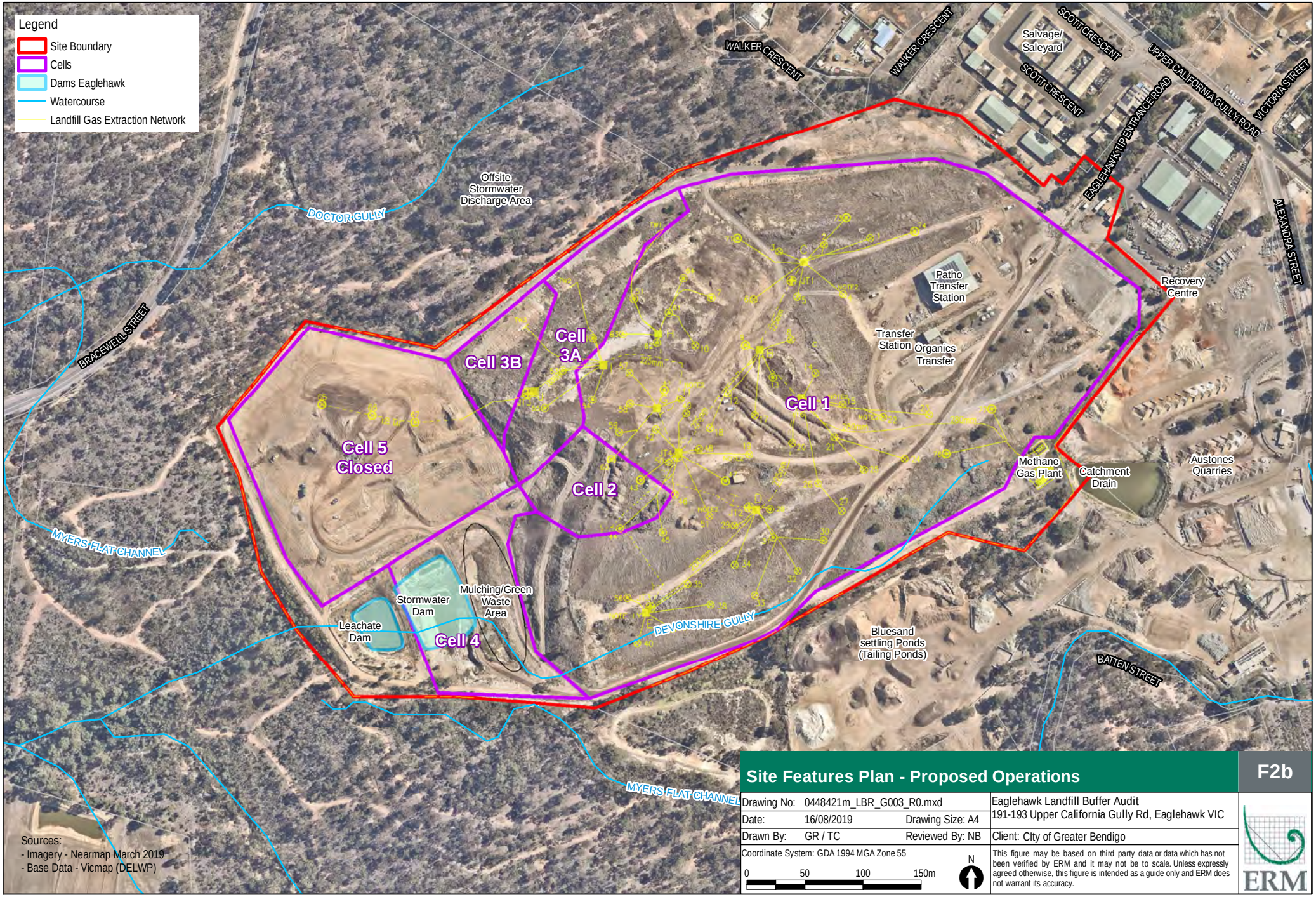
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ERM


Legend
Site Boundary
Cells
Dams Eaglehawk
Watercourse
Landfill Gas Extraction Network
Offsite Stormwater Discharge Area
Cell 3A
Cell 3B
Cell 1
Cell 2
Cell 4
Cell 5 Active
Weighbridge & Workshop
Wheelwash
Organics Shed
Recovery Centre
Transfer Station
Patho Transfer Station
Mulching Green Waste Area
Methane Gas Plant
Catchment Drain
Austones Quarries
Domestic concrete/rubble
Stormwater Dam
Leachate Dam
DEVONSHIRE GULLY
Bluesand settling Ponds (Tailing Ponds)
BATTEN STREET
MYERS FLAT CHANNEL
Sources:
- Imagery - Nearmap March 2019
- Base Data - Vicmap (DELWP)
Site Features Plan - Current Operations
F2a
Drawing No: 0448421m_LBR_G002_R0.mxd
Date: 16/08/2019
Drawing Size: A4
Drawn By: CB
Reviewed By: NB
Coordinate System: GDA 1994 MGA Zone 55
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Eaglehawk Landfill Buffer Audit
191-193 Upper California Gully Rd, Eaglehawk VIC
Client: Clty of Greater Bendigo
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Site Features Plan - Proposed Operations

F2b

Drawing No:	0448421m_LBR_G003_R0.mxd		Eaglehawk Landfill Buffer Audit 191-193 Upper California Gully Rd, Eaglehawk VIC
Date:	16/08/2019	Drawing Size: A4	Client: Clty of Greater Bendigo
Drawn By:	GR / TC	Reviewed By: NB	

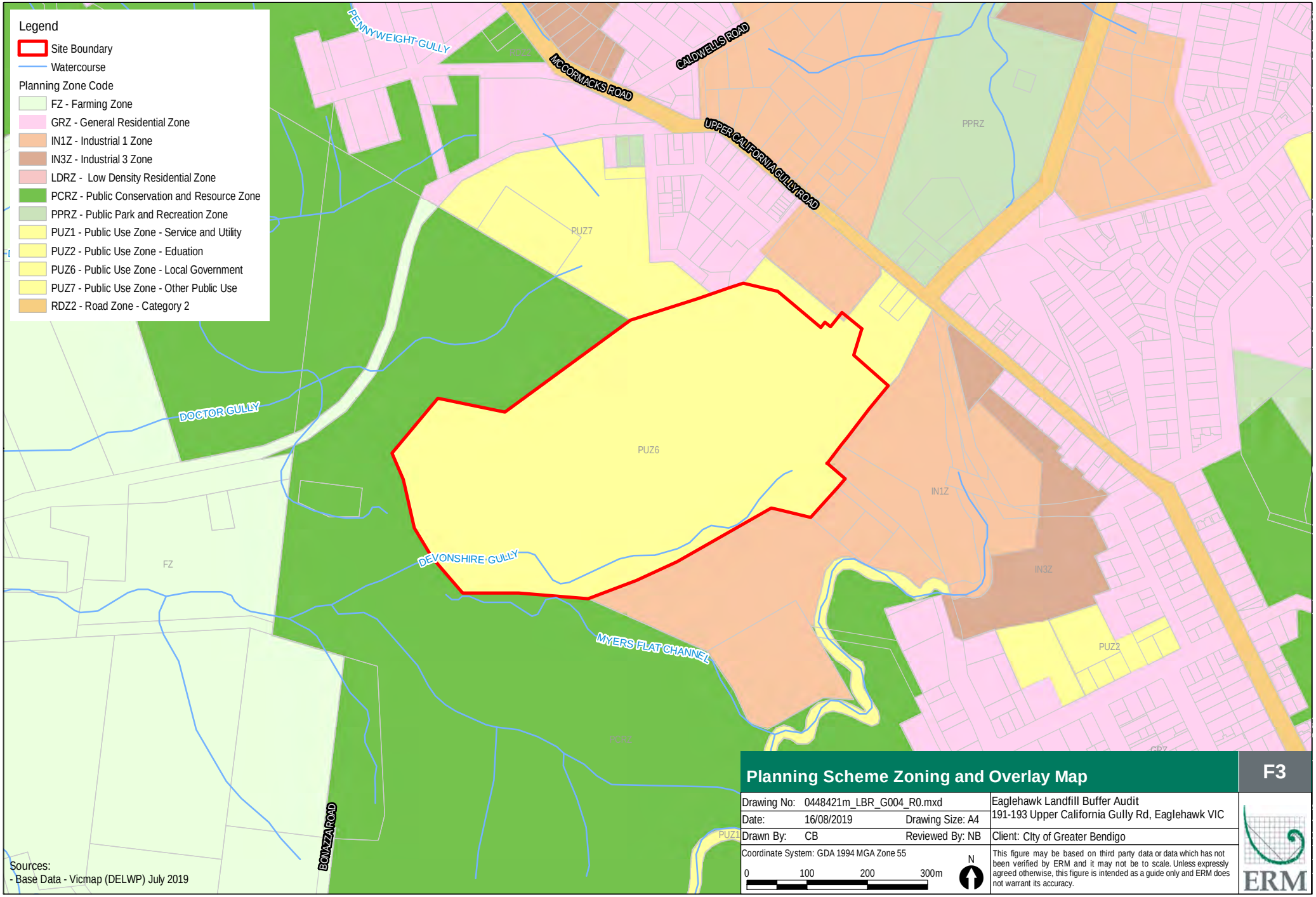
Coordinate System: GDA 1994 MGA Zone 55

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Sources:
- Base Data - Vicmap (DELWP) July 2019

Planning Scheme Zoning and Overlay Map

F3

Drawing No:	0448421m_LBR_G004_R0.mxd		Eaglehawk Landfill Buffer Audit 191-193 Upper California Gully Rd, Eaglehawk VIC
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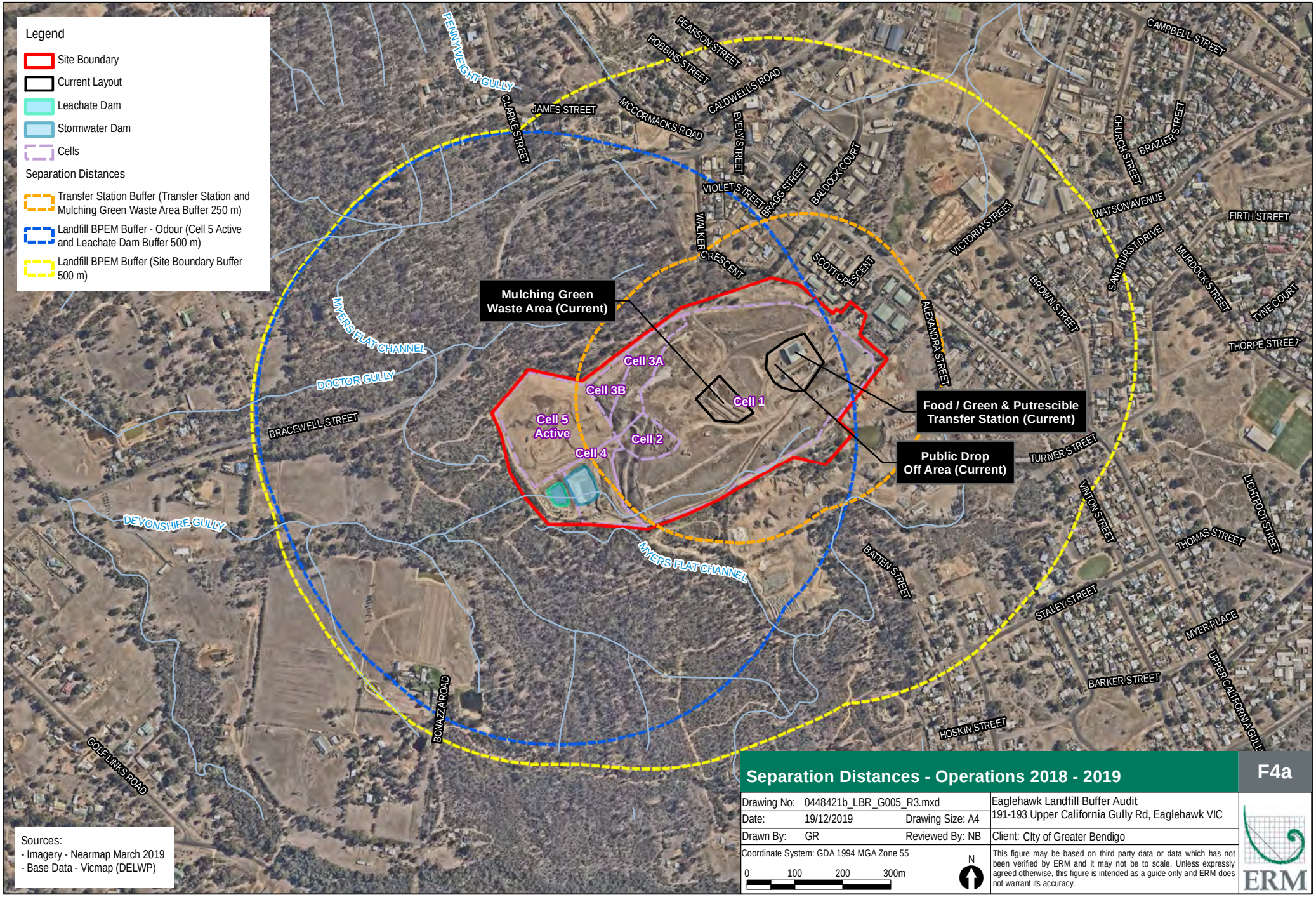
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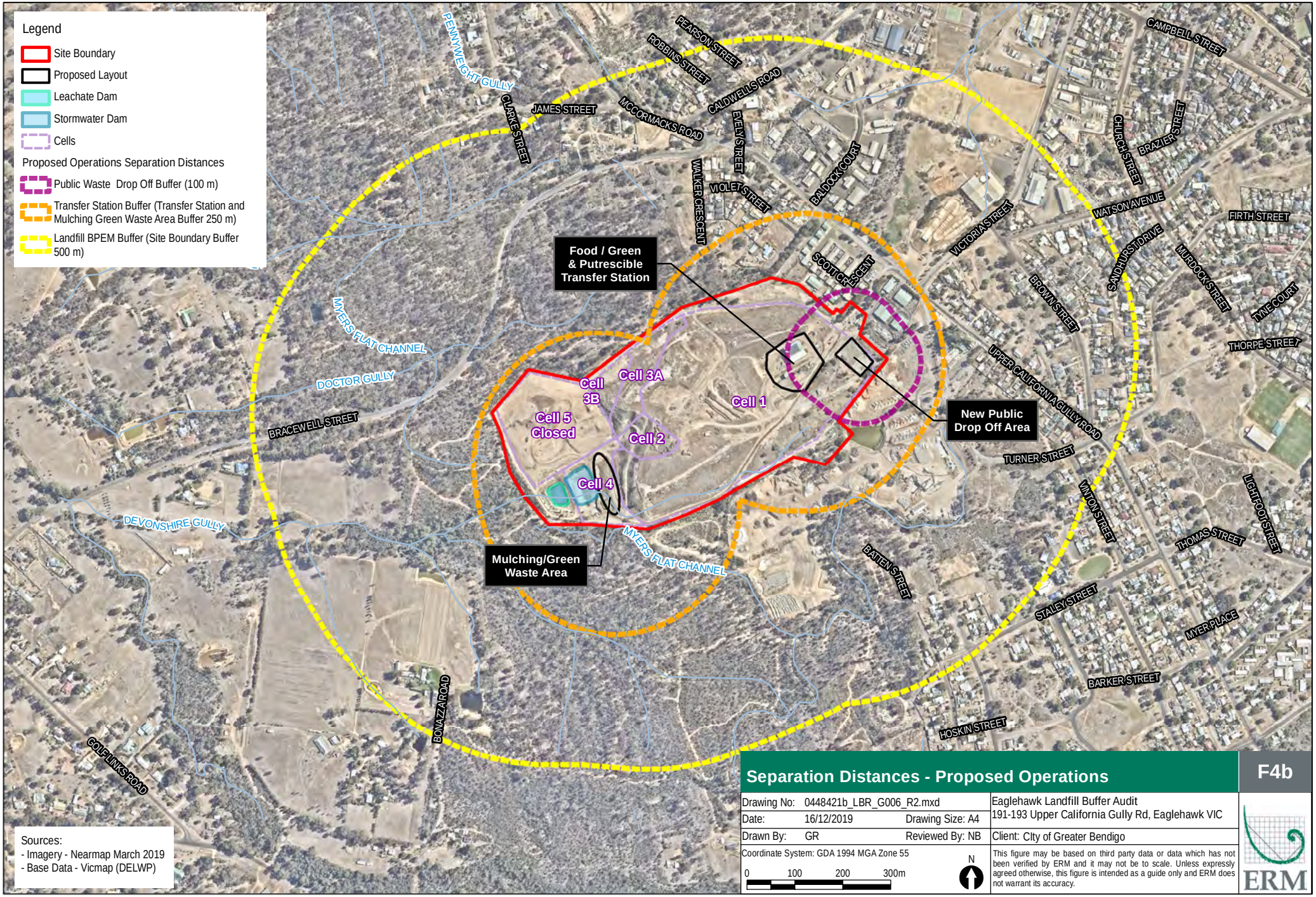
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Legend
Site Boundary
Current Layout
Leachate Dam
Stormwater Dam
Cells
Separation Distances
Transfer Station Buffer (Transfer Station and Mulching Green Waste Area Buffer 250 m)
Landfill BPEM Buffer - Odour (Cell 5 Active and Leachate Dam Buffer 500 m)
Landfill BPEM Buffer (Site Boundary Buffer 500 m)
Mulching Green Waste Area (Current)
Food / Green & Putrescible Transfer Station (Current)
Public Drop Off Area (Current)
Cell 1
Cell 2
Cell 3A
Cell 3B
Cell 4
Cell 5 Active
PENNYWEIGHT GULLY
CLARKE STREET
JAMES STREET
PEARSON STREET
ROBBINS STREET
McCORMACKS ROAD
CALDWELLS ROAD
EVELYN STREET
VIOLET STREET
BRAGG STREET
BALDOCK COURT
WALKER CRESCENT
SCOTT CRESCENT
VICTORIA STREET
ALEXANDRA STREET
BROWN STREET
CAMPBELL STREET
CHURCH STREET
BRAZIER STREET
WATSON AVENUE
FIRTH STREET
SANDHURST DRIVE
MURDOCK STREET
TYNE COURT
THORPE STREET
TURNER STREET
VINTON STREET
LIGHTFOOT STREET
THOMAS STREET
MYER PLACE
BARKER STREET
UPPER CALIFORNIA GULLY
HOSKIN STREET
STALEY STREET
BATTEN STREET
MYERS FLAT CHANNEL
DOCTOR GULLY
BRACEWELL STREET
DEVONSHIRE GULLY
BONAZZA ROAD
GOLF LINKS ROAD
Sources:
- Imagery - Nearmap March 2019
- Base Data - Vicmap (DELWP)
Separation Distances - Operations 2018 - 2019
F4a
Drawing No: 0448421b_LBR_G005_R3.mxd
Date: 19/12/2019
Drawing Size: A4
Drawn By: GR
Reviewed By: NB
Coordinate System: GDA 1994 MGA Zone 55
0 100 200 300m
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Eaglehawk Landfill Buffer Audit
191-193 Upper California Gully Rd, Eaglehawk VIC
Client: Clty of Greater Bendigo
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ERM


Legend
Site Boundary
Proposed Layout
Leachate Dam
Stormwater Dam
Cells
Proposed Operations Separation Distances
Public Waste Drop Off Buffer (100 m)
Transfer Station Buffer (Transfer Station and Mulching Green Waste Area Buffer 250 m)
Landfill BPEM Buffer (Site Boundary Buffer 500 m)
Food / Green & Putrescible Transfer Station
New Public Drop Off Area
Mulching/Green Waste Area
Cell 1
Cell 2
Cell 3A
Cell 3B
Cell 4
Cell 5 Closed
PENNYWEIGHT GULLY
CLARKE STREET
JAMES STREET
PEARSON STREET
ROBBINS STREET
CALDWELLS ROAD
McCORMACKS ROAD
EVELYN STREET
WALKER CRESCENT
VIOLET STREET
BALDOCK COURT
CAMPBELL STREET
CHURCH STREET
BRAZIER STREET
WATSON AVENUE
FIRTH STREET
VICTORIA STREET
SCOTT CRESCENT
SANDHURST DRIVE
MURDOCK STREET
TYNE COURT
BROWN STREET
THORPE STREET
UPPER CALIFORNIA GULLY ROAD
MYERS FLAT CHANNEL
DOCTOR GULLY
BRACEWELL STREET
TURNER STREET
VINTON STREET
LIGHTFOOT STREET
THOMAS STREET
DEVONSHIRE GULLY
BATTEN STREET
STALEY STREET
MYER PLACE
BARKER STREET
BONAZZA ROAD
GOLF LINKS ROAD
HOSKIN STREET
Sources:
- Imagery - Nearmap March 2019
- Base Data - Vicmap (DELWP)
Separation Distances - Proposed Operations
F4b
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Date: 16/12/2019
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Drawn By: GR
Reviewed By: NB
Coordinate System: GDA 1994 MGA Zone 55
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Eaglehawk Landfill Buffer Audit
191-193 Upper California Gully Rd, Eaglehawk VIC
Client: Clty of Greater Bendigo
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APPENDIX B EPA DOCUMENTATION

ENVIRONMENT PROTECTION ACT 1970
SECTION 20

LICENCE

GREATER BENDIGO CITY COUNCIL

Holder of

Licence:	**46490**
Issued:	09/05/1975
Last Amended:	22/11/2017
ABN:	74 149 638 164
Registered Address:	189-229 LYTTLETON TCE BENDIGO VIC 3550
Premises Address:	191-193 UPPER CALIFORNIA GULLY RD EAGLEHAWK VIC 3556
Scheduled Categories:	A01 Prescribed Industrial Waste Management
	A05 Landfills
Description:	The licence holder operates a landfill. This licence allows for solid inert waste, shredded tyres, putrescible waste and prescribed industrial waste to be deposited to land.

STEPHEN ADAMTHWAITE
Team Leader
Development Assessments
Delegate of the Environment Protection Authority

Issued under the *Environment Protection Act 1970*, Section 20

PREAMBLE

Licences

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

Why we issue licences: EPA is responsible for preventing or controlling pollution (including noise) and improving the quality of the environment. This responsibility includes regulating activities that may present a danger to the environment. One of the tools available to EPA is the licensing of certain scheduled premises that may present a risk to the environment.

Section 20 of the Act requires the occupier of a "scheduled premises" to obtain an EPA licence to discharge, handle, treat or dispose of waste to the environment. These premises are defined in the *Environment Protection (Scheduled Premises and Exemptions) Regulations 2017* ("the Regulations").

When we issue licences: EPA will issue a licence when satisfied that an applicant has put in place measures to protect the environment. Licences allow activities to occur and set performance outcomes based on a site's environmental risk. EPA can amend, suspend or revoke a licence in response to changes in standards, site activities or licence holder performance. Licence holders must submit an annual performance statement and pay an annual fee to EPA. All licences and performance statements are publicly available.

Licence information and obligations

Interpretation: For the purposes of this licence "You" means the licence holder identified on the first page of this licence at the "premises" identified on the first page and represented in Schedule 1.
Unless the contrary intention appears, words or terms used in the conditions of your licence have the same meaning as in the Act, including any regulations or policies made pursuant to the Act."

Compliance:
You must comply at all times with the Act and all policies and regulations administered by EPA. Strict penalties apply for non-compliance with any part of your licence or making a false claim on your annual performance statement.

Your licence is subject to conditions. These conditions give rise to a number of duties and obligations on you as the licence holder. Some of these are general in nature, while others require you to do (or not to do) specific things. The duties and obligations imposed by these conditions do not derogate from each other in any way, nor do they affect any other duties or obligations which you are required by law to comply with. You must fulfil all of the duties and perform all of the obligations set out in this licence or otherwise required by law. Certain conditions on your licence may require you to seek a further approval from EPA. Such approvals can be sought via written application to approvals.applications@epa.vic.gov.au. Approvals are only given in writing from the lead assessing officer.

Landfill levy: Landfills must, in accordance with the method and frequency specified in section 50SB of the Act, calculate the amount of landfill levy payable, prepare a landfill levy statement, and submit to EPA both the statement and fee payable.

Review of decisions: If you object to any of the licence conditions, you may have the decision reviewed by applying in writing to the Registrar, Planning and Environment Division, Victorian Civil and Administrative Tribunal ("VCAT"), 7th Floor, 55 King Street, Melbourne within 21 days of the date of issue. An application fee may be applicable when lodging an appeal with VCAT. Contact VCAT on (03) 9628 9777 for further details on fees associated with an appeal. A copy of the appeal should also be forwarded to the Manager, Development Assessments Unit, Environment Protection Authority, GPO Box 4395, Melbourne, 3001, within 7 days of lodgement of the appeal.

Interested (third) parties may also appeal against the licence within 21 days of the date of issue. The Tribunal will notify you if such appeals are received. If an appeal is lodged, this licence will not come into effect.

Licence structure

Structure: Your licence has multiple parts:

- Environmental performance conditions - setting out the performance outcomes you must meet;
- Schedule 1A - locality plan of your premises;
- Schedule 1B - plan of premises (provided by you).

Some types of licences also contain Schedule 1C - final landfill contour plans and/or Schedule 2 - tables specifying wastes that may be accepted at the premises and the associated treatment applied to them.

CONDITIONS

General Conditions

LI_G1	You must ensure that waste is not discharged, emitted or deposited beyond the boundaries of the premises except in accordance with this licence or under the Act.
LI_G2	You must immediately notify EPA of non-compliance with any condition of this licence by calling 1300 EPA VIC (1300 372 842), sending an email to contact@epa.vic.gov.au, or using the EPA Interaction Portal.
LI_G3	By 30 September each year you must submit an annual performance statement to EPA for the previous financial year in accordance with the Annual Performance Statement Guidelines (EPA Publication 1320.3, released June 2011).
LI_G4	Documents and monitoring records used for preparation of the annual performance statement must be retained at the premises for five years from the date of each statement, and be able to be immediately produced upon request by an officer of the Authority.
LI_G6	You must provide EPA with a financial assurance determined by the EPA, and maintain such assurance (including any part of such assurance) so that it can be claimed on, utilised or realised as and when required.

Amenity Conditions

LI_A1	You must ensure that odours offensive to the senses of human beings are not discharged, emitted or released beyond the boundaries of the premises.
LI_A2	You must ensure that there are no emissions of noise and/or vibrations from the premises which are detrimental to either of the following: a) the environment in the area around the premises; and b) the wellbeing of persons and/or their property in the area around the premises.
LI_A2.1	You must implement noise and vibration abatement controls that accord with the requirements of Section 6.9 of the Best Practice Environmental Management, Siting, Design, Operation and Rehabilitation of Landfills (EPA Publication 788), including but not limited to: a) setting the site out to minimise noise impacts; b) providing an acoustic screen to homes; and c) managing site activities during operating hours.
LI_A3	You must ensure that nuisance dust and/or nuisance airborne particles are not discharged or emitted beyond the boundaries of the premises, except as permitted by this licence.
LI_A3.1	You must implement dust management controls that accord with the requirements of Section 6.7.4 of the Best Practice Environmental Management, Siting, Design, Operation and Rehabilitation of Landfills (EPA Publication 788) including, but not limited to: a) vegetating exposed areas and forming internal roads; b) ensuring waste is covered appropriately and on time; and c) using water or other dust suppressants.

Waste Acceptance Conditions

LI_WA1	You must ensure all of the following: a) only waste of a type shown in Schedule 2 of this licence is accepted at the premises; and b) if it is identified that any waste has been received at the premises that is of a type not shown in Schedule 2 in contravention of paragraph a) above, such waste must be placed in a designated and sign-posted temporary storage area and sent for disposal to a site licensed by EPA to receive such waste within 21 days of the date it was received.
LI_WA1.2.1	You may only accept arsenic-contaminated soil that: a) is sourced from the City of Greater Bendigo Municipality; b) has a total arsenic concentration of less than 5000 mg/kg; and c) has a leachable fraction of arsenic less than 0.7 mg/L.
LI_WA2	Wastes accepted at the premises may only be treated or disposed of in accordance with Schedule 2.

Waste Management Conditions

LI_WM3	You must ensure that litter originating from the premises is not present beyond the boundaries of the premises.
LI_WM3.1	You must implement litter controls that accord with the requirements of Section 7.8 of the Best Practice Environmental Management, Siting, Design, Operation and Rehabilitation of Landfills (EPA Publication 788.3, released August 2015), including, but not limited to: a) minimising the size of the tipping area; b) controlling litter at the active tipping area; c) establishing a program of frequent cleaning of litter from fences and the surrounding area; and d) establishing contingency plans to deal with extreme events that cause gross litter problems.
LI_WM4	You must ensure that waste does not burn at the premises.

Landfill Conditions

LI_L1	You must develop and put into place a monitoring program that accords with Section A of the Landfill Licensing Guidelines, (EPA Publication 1323.3, released September 2016). The program must evaluate the risks to the environment associated with the operation of the landfill and the steps which can be taken to manage such risks and enable both you and EPA to determine changes in the condition of the environment or impacts to environmental quality as a result of activities at the premises. The monitoring program must be verified by a person who has been appointed as an environmental auditor under the Environment Protection Act 1970 and it must do all of the following: a) contain an assessment of the risks to the environment arising from the waste that has been deposited at the premises and of the current landfill operation prepared in accordance with the Landfill Licensing Guidelines, (EPA Publication 1323.3, released September 2016) or another method approved by EPA in writing; b) describe the environmental monitoring of landfill gas, leachate, groundwater, land, air, odour, noise, dust and surface water which will be undertaken to respond to the risks identified in the risk assessment in paragraph a) above; c) contain trigger levels and contingency actions to prevent further pollution when exceeded; d) specify the frequency for completing environmental audits of the landfill operation; and e) be appropriate and adapted to the characteristics of the landfill, including the landfill design, the volume of waste received, the age and planned future lifespan of the landfill and the surrounding environment.
LI_L2	You must engage a person who has been appointed as an environmental auditor under the Environment Protection Act 1970 to conduct and submit to EPA environmental audits of the risk of harm actually or potentially arising from landfill operation under Section 53V of the Act at the frequency specified in the monitoring program.
LI_L3	You must ensure that surface water is segregated from active landfill cells.
LI_L4	Waters contaminated by leachate must not be discharged beyond the boundaries of the premises.
LI_L4.3	By 30 June 2017 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.
LI_L5	You must take all practicable measures to prevent emissions of landfill gas from exceeding the action levels specified in Table 6.4 of Best Practice Environmental Management, Siting, Design, Operation and Rehabilitation of Landfills (EPA Publication 788.3, released August 2015).
LI_L6	All waste in the cell(s) listed in Schedule 2 apart from at the active tipping face must be covered at all times.
LI_L7	By the end of each day's operations waste must be covered in one of these ways: a) with a layer of soil at least 0.15 metres thick if the waste is only solid inert waste; b) with a layer of soil at least 0.30 metres thick for all other wastes; or c) using alternative cover approved by EPA in writing.

LI_L7.1	You must cover waste asbestos immediately upon deposition in one of these ways: a) with a layer of waste (not including waste asbestos) at least 1 metre thick or a layer of soil at least 0.3 metres thick; or b) using alternative cover approved by EPA in writing.
LI_L8	You must: a) limit the area of the tipping face of each cell to 900m2; b) only operate one tipping face at any time unless a second tipping face is required for short term operational reasons; and c) ensure the active tipping face is mechanically stable as per Section 7.6 of the Best Practice Environmental Management, Siting, Design, Operation and Rehabilitation of Landfills (EPA Publication 788.3, released August 2015).
LI_L9	You must ensure all of the following: a) Waste that is accepted for disposal at the premises is only placed into cell(s) listed in Schedule 2; and b) Waste for disposal is not placed outside of the perimeter of any cell(s) listed in Schedule 2.
LI_L10	You must ensure that waste that has been previously deposited is not recovered and reprocessed except in accordance with written approval from EPA.
LI_L11	You must ensure that waste is not stockpiled at the premises prior to deposit in a cell except in accordance with written approval from EPA.
LI_L12	You must ensure that an independent annual survey is conducted by a licensed surveyor, or other method approved by EPA in writing, by the end of June each year for each landfill cell at the premises and submitted to EPA with your annual performance statement. The survey must: a) confirm the volume and mass of air space consumed since the last survey; and b) verify that the top of the waste deposited in cells is in compliance with the EPA approved pre-settlement contour plan.
LI_L13	You must manage each landfill cell so that the surface contour prior to settlement conforms to the surface profile grades in Section 8.1.5 of the Best Practice Environmental Management, Siting, Design, Operation and Rehabilitation of Landfills (EPA Publication 788.3, released August 2015) or otherwise as approved by EPA in writing and so that the top of waste prior to settlement is not higher at any point than the pre-settlement top of waste approved contour plan shown in Schedule 1C.
LI_L14	A weighbridge must be used at the landfill to measure and record a) the weight of waste received at the premises; and b) the weight of waste that is removed from the premises.
LI_L15	You must take measures to prevent hotspots in the waste mass at the landfill site.
LI_L16	You must report hotspots within the waste mass to EPA within 24 hours of detection.
LI_L17	You must manage hotspots within the waste mass in accordance with the Landfill Licensing Guidelines (EPA Publication 1323.3, released September 2016).

LI_L18 You must:

a) notify EPA of your intention to commence construction of a new landfill cell at the premises by written notice in accordance with Appendix 7 of the Landfill Licensing Guidelines (EPA Publication 1323.3, released September 2016); and
b) not start constructing a new cell without written EPA approval.

LI_L19 Prior to commencing construction of a new landfill cell you must submit the following material to EPA so that it may consider whether or not to grant approval for the construction of the new cell:

a) detailed designs of the landfill cell meaning plans, technical specifications and a construction quality assurance plan which comply with Section 6 and Appendices D, E and F of the Best Practice Environmental Management, Siting, Design, Operation and Rehabilitation of Landfills (EPA Publication 788.3, released August 2015);
b) an assessment report of the of the detailed designs prepared by a person who has been appointed as an environmental auditor under the Environment Protection Act 1970 in accordance with Appendix 14 of the Landfill Licensing Guidelines (EPA Publication 1323.3, released September 2016); and
c) a completed and signed auditor declaration in the format shown in Appendix 15 of the Landfill Licensing Guidelines (EPA Publication 1323.3, released September 2016).

LI_L20 Upon approval by EPA to construct each new landfill cell, you must engage a person who has been appointed as an environmental auditor under the Environment Protection Act 1970 to conduct an environmental audit and submit an environmental audit report to EPA. The environmental audit report must:

a) verify that the construction of the new landfill cell is in accordance with EPA approved designs;
b) assess any potential risks associated with the construction or use of the new landfill cell; and
c) be prepared in accordance with Section 53V of the Environment Protection Act 1970.

LI_L21 You must not commence filling of any new landfill cell with waste without the written approval of EPA.

LI_L22 You must implement a rehabilitation plan for the landfill. The plan must:

a) be revised after each cell is full, if necessary;
b) meet the requirements of Section 8 of Best Practice Environmental Management, Siting, Design, Operation and Rehabilitation of Landfills (EPA Publication 788.3, released August 2015);
c) set timeframes for placement of final capping of all completed cells, calculated from the date that the cell became full; and
d) set timeframes for the progressive capture and treatment of landfill gas and leachate from each completed cell.

LI_L23 You must place intermediate cover on all cells within one month of the date that the cell became full. The intermediate cover must comprise a minimum of 500 mm of compacted clay or compacted clay rich soil or alternative cover approved by EPA in writing.

LI_L24 In circumstances where the deposit of waste in a cell is likely to cease for a period of three months or more, you must place intermediate cover on the cell within one month of the date that waste was last placed in the cell. The intermediate cover must comprise a minimum of 500 mm of compacted clay or compacted clay rich soil or alternative cover approved by EPA in writing.

LI_L25 Prior to commencing construction of each new section of landfill cap you must submit the following to EPA for approval:

a) detailed designs of the landfill cap, meaning plans, technical specifications and a construction quality assurance plan which comply with Section 8 and Appendices D, E and F of the Best Practice Environmental Management, Siting, Design, Operation and Rehabilitation of Landfills (EPA Publication 788.3, released August 2015);
b) an assessment report of the detailed designs of the cap prepared by a person who has been appointed as an environmental auditor under the Environment Protection Act 1970 in accordance with Appendix 14 of the Landfill Licensing Guidelines (EPA Publication 1323.3, released September 2016); and
c) a completed and signed auditor declaration in the format shown in Appendix 15 of the Landfill Licensing Guidelines (EPA Publication 1323.3, released September 2016).

LI_L26 Upon approval by EPA to construct each new landfill cap you must engage a person who has been appointed as an environmental auditor under the Environment Protection Act 1970 to conduct and submit an environmental audit report to EPA. The environmental audit report must:

a) verify that the construction of the cap is in accordance with EPA approved designs;
b) assess any potential risks associated with the construction; and
c) be prepared in accordance with Section 53V of the Environment Protection Act 1970.

LI_L27 You must complete final capping of Cell 5 within 2 years of the date that cell became full, in compliance with the approved rehabilitation plan.

LI_L28 You must provide EPA with at least 6 month's notice of your intention to cease accepting waste at the premises.

Air Conditions

Licence does not have any discharge to air conditions.

Water Conditions

LI_DW1 You must ensure that surface water discharged from the premises is not contaminated with waste.

Land Conditions

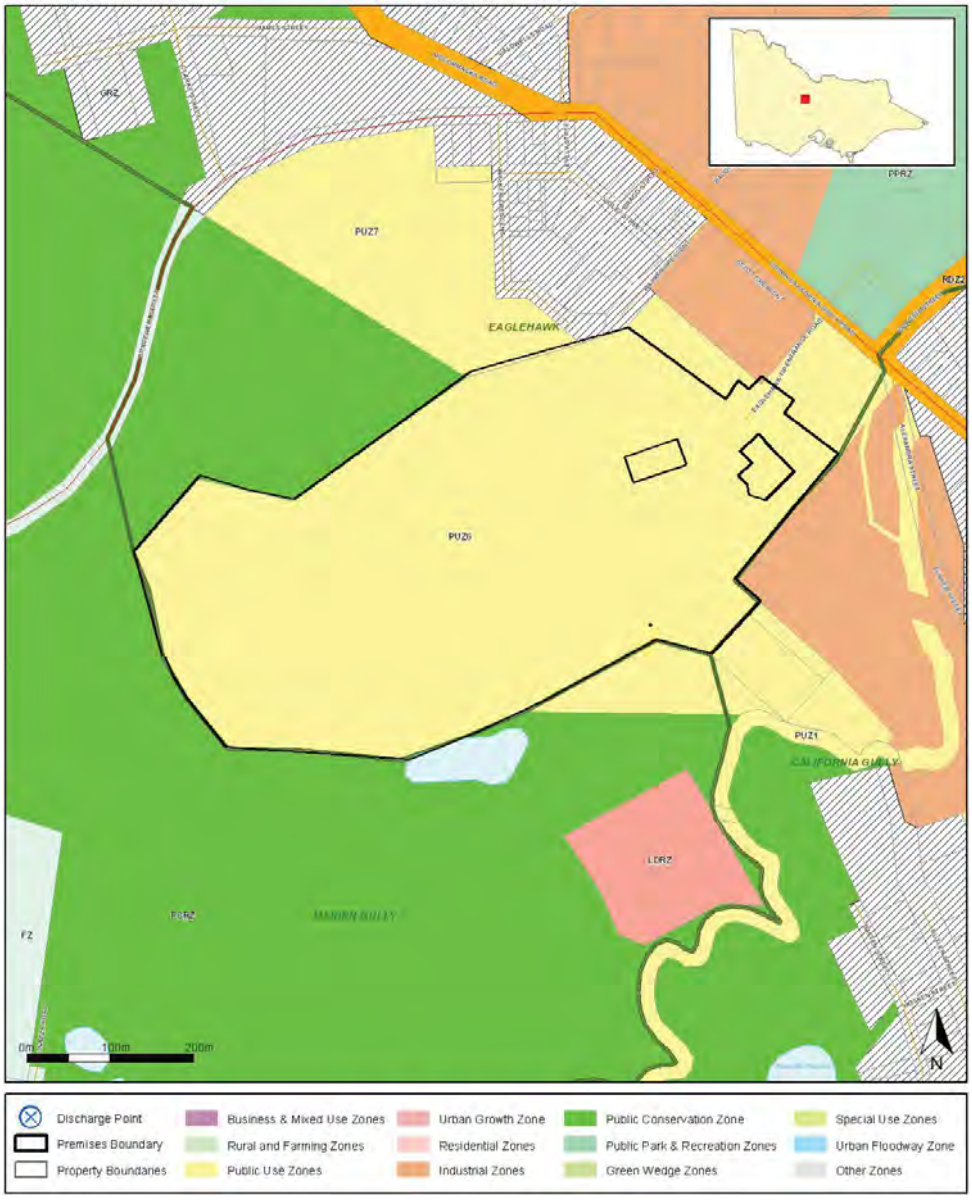
LI_DL1.2 You must ensure that the activities carried on at the premises do not do either of the following:

a) cause detriment to any beneficial use which may be made of the land on the premises outside of the boundary of any landfill cells; and
b) pollute land on the premises contrary to section 45 of the Environment Protection Act 1970.

LI_DL1.3 You must ensure that the activities carried on at the premises do not do either of the following:

a) cause detriment to any beneficial use which may be made of groundwater both within and beyond the boundary of the premises.
b) pollute groundwater both within and beyond the boundary of the premises contrary to section 39 of the Environment Protection Act 1970.

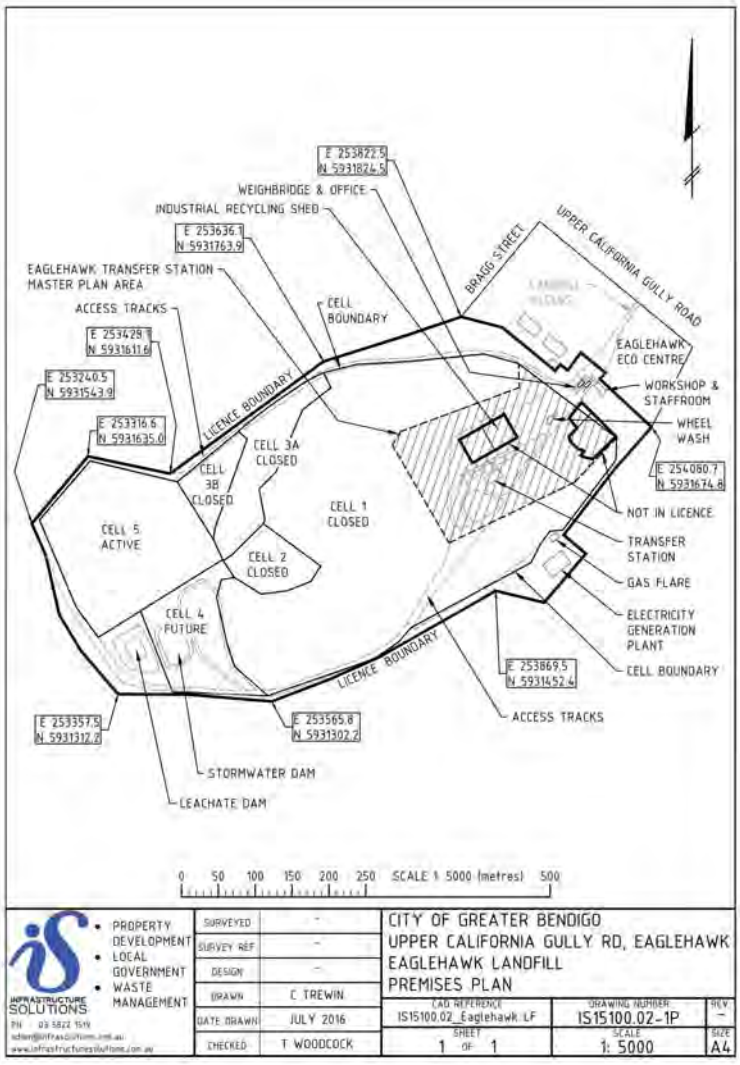
SCHEDULE 1A - LOCALITY PLAN



Licence:	46490
Company Name:	GREATER BENDIGO CITY COUNCIL
ABN:	74 149 638 164
Premises Address:	191-193 UPPER CALIFORNIA GULLY RD, EAGLEHAWK VIC 3556
Issued:	09/05/1975
Last Amended:	22/11/2017

Before relying on the information in this map, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances.

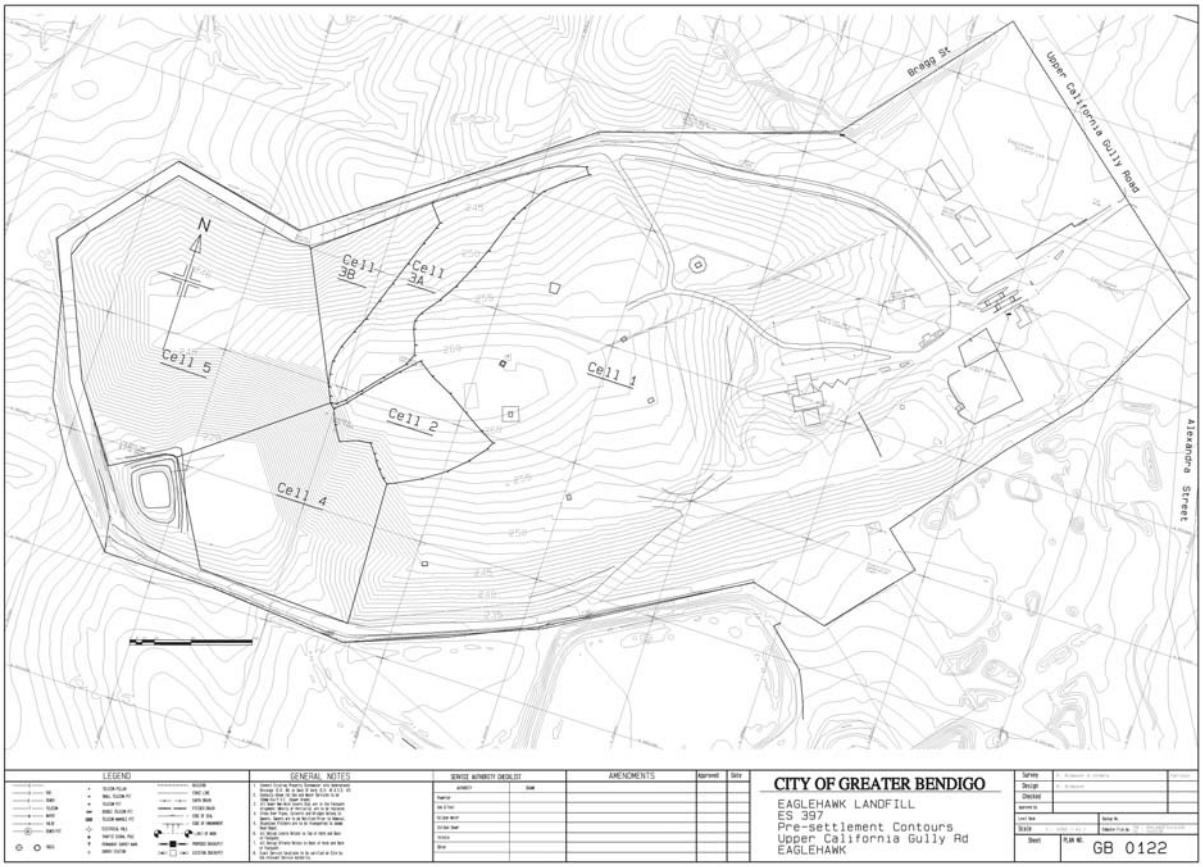
SCHEDULE 1B - PREMISES PLAN



Licence:	46490
Company Name:	GREATER BENDIGO CITY COUNCIL
ABN:	74 149 638 164
Premises Address:	191-193 UPPER CALIFORNIA GULLY RD, EAGLEHAWK VIC 3556
Issued:	09/05/1975
Last Amended:	22/11/2017

Before relying on the information in this map, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances.

SCHEDULE 1C - CONTOUR PLAN



Licence:	46490
Company Name:	GREATER BENDIGO CITY COUNCIL
ABN:	74 149 638 164
Premises Address:	191-193 UPPER CALIFORNIA GULLY RD, EAGLEHAWK VIC 3556
Issued:	09/05/1975
Last Amended:	22/11/2017

Before relying on the information in this map, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances.

SCHEDULE 2 - WASTE ACCEPTANCE TABLES

Prescribed Industrial Waste Acceptance and Treatment Types

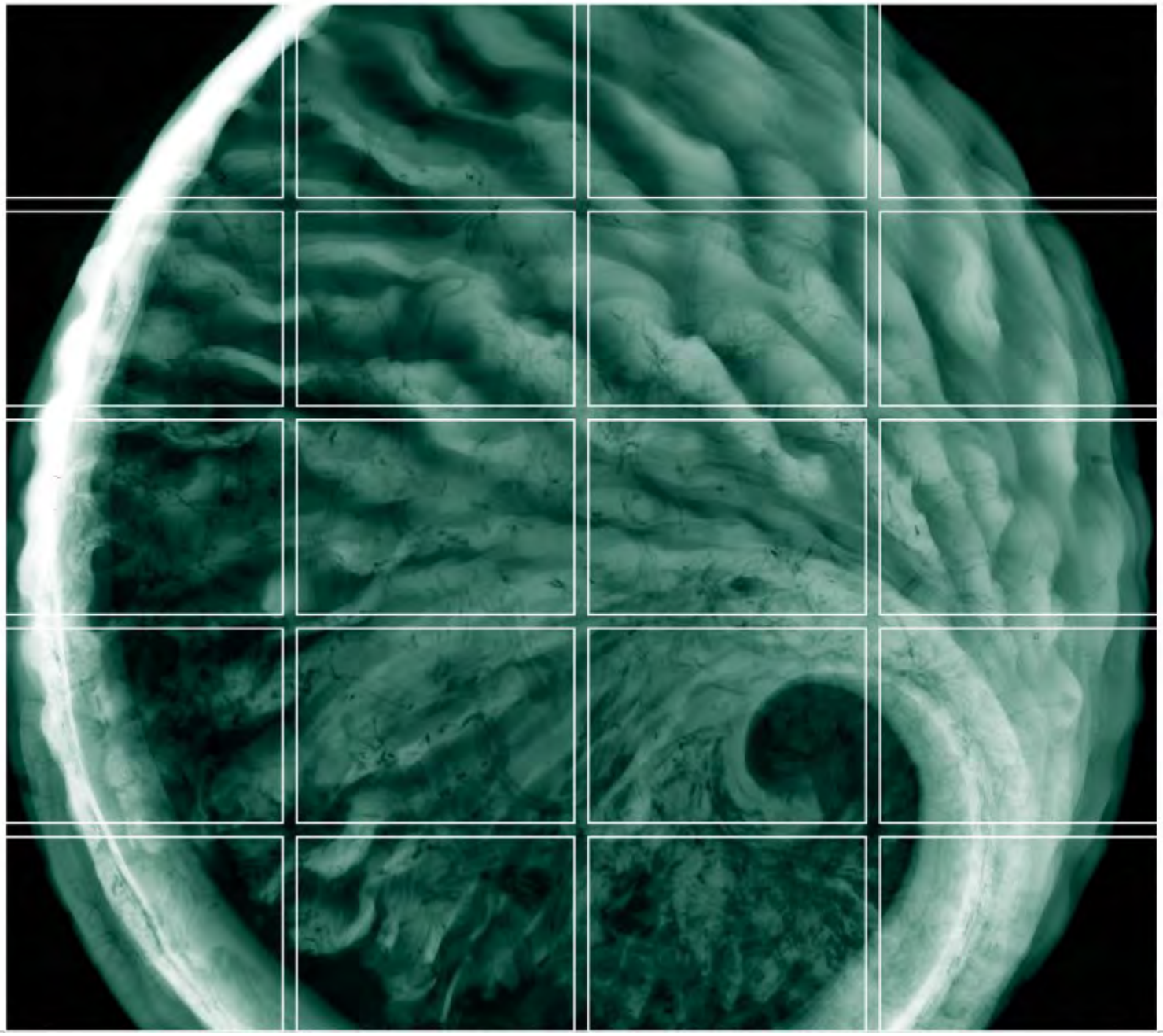
Waste Code	Waste Description	Treatment Code	Treatment Description
N121	Category C contaminated soil	D1	Landfill disposal of Category C waste
N220	Asbestos including asbestos in fill material soil	D1	Landfill disposal of Category C waste

Disposal to Landfill - General Waste

Landfill Cell	Waste Type
CELL 5	Asbestos waste of domestic origin
	Putrescible waste
	Solid inert waste
	Tyres shredded into pieces < 250 mm

Disposal to Landfill - Prescribed Waste

Landfill Cell	Waste Code	Waste Description	Hazard Category
CELL 5	N121	Contaminated soil (Category C)	C
	N220	Asbestos (all forms)	C



City of Greater Bendigo, Eaglehawk Landfill

Voluntary s53V Audit Scope

EPA Victoria

Service Order: 8005693
CARMs: 60409-9

May 2018

Reference: 0448421_R01

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City of Greater Bendigo, Eaglehawk Landfill

Voluntary s53V Audit Scope

Service Order: 8005693

CARMs: 60409-9

Prepared by:	*Nicole Bradley*
Position:	*Project Manager*
Signed:	
Date:	*17/05/2018*
Approved by:	*Paul Fridell*
Position:	*Partner*
Signed:	
Date:	*17/05/2018*

EPA Victoria

May 2018

Reference: 0448421_R01

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ANNEXES

Annex A *– FIGURES*

1 INTRODUCTION

The City of Bendigo seeks to determine an appropriate buffer distance from the Eaglehawk Landfill considering the risks from the operational landfill, specifically landfill gas and amenity impacts, including noise, dust, litter and odour.

Paul Fridell, an Environmental Auditor (appointed pursuant to the *Environment Protection Act 1970*), has been engaged to conduct a voluntary environmental audit pursuant to section 53V with the objective of determining an appropriate buffer distance by assessing the likely extent of potentially uncontrolled subsurface landfill gas and amenity impacts in upset or abnormal conditions (e.g. a failure of landfill design or management or abnormal weather conditions) migrating from the site.

This audit scope was developed in accordance with EPA Victoria guidelines *Preparation on environmental audit report on risk to the environment* (EPA Publication 952.5, December 2015) and also in consideration of EPA Publication 1642 *Assessing planning proposals within the buffer of a landfill* (October 2017) and *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills* (the Landfill BPEM) (EPA Publication 788.3, 2015).

2 BRIEF SITE DESCRIPTION

The site is located at 191 – 193 Upper California Gully Road, Eaglehawk, Victoria. (Refer to *Annex A,* Figure 1 for a site Location Plan). The site operates as a waste landfill under EPA Licence 46490 by the City of Greater Bendigo. The site occupies a total area of approximately 28 hectares (ha), with the current landfilling area comprising 3.2 ha (Cell 5 area) of the total site area. Cell 5 was constructed in December 2014 and began accepting waste in March 2015.

The site is bound by native bushland to the north-west, west, south-west and south of the site; residents/industrial buildings to the north-east of the site and a recovery centre to the east of the site. A liquid waste treatment facility and the Eaglehawk industrial recycle centre are located within the site, however are outside of the licence boundary.

The site is licensed to accept general waste including asbestos waste of domestic origin, putrescible waste, solid inert waste and tyres shredded into pieces <250 mm and prescribed waste including contaminated soil (category C) and asbestos (all forms). The site currently accepts waste from the City of Greater Bendigo.

Prior to landfilling, the gully where the site is located was used for the disposal of mine waste (tailings) and by local residents as a waste dump. The gully has been partially backfilled with old mine tailings prior to landfilling.

The landfill has been developed as a valley-fill landfill. The landfill has five cells (Cell 1, Cell 2, Cell 3a, Cell 3b and Cell 5). Cells 1, 2 and 3 have been completed with Cell 5 currently being filled (refer to *Annex A*, *Figure 2* for a site features plan).

The site consists of:

- weighbridge and gatehouse;
- Green waste and mulching area;
- site office and shed – concrete foundations, including fuel bowser for diesel UST (understood to be 10,000 L) and approximately 20 years old (ERM 2012a). The fuel point is located outside in the road verge. A fuel bowser is located with the storage shed. A small mobile fuel tank , and trailer are stored in the shed;
- wheel wash facility;
- leachate pond and surface water pond;
- landfill gas extraction across the cells to LFG Generation Plant located across the closed cells 1, 2, 3A and 3B. The plant has a flare which is only required when the generator is down; and
- an industrial recycling centre is also located on the site and Recycling centre adjacent to the site, neither of which are included in the environmental licence for the site and are therefore not considered within this audit.

3 *AUDIT OBJECTIVES*

The overall audit objective will be limited to an assessment of the risk of possible harm or detriment to the land and air environment within 500 metres of the landfill posed by potential subsurface migration of uncontrolled landfill gas in the subsurface and amenity impacts, including offensive odour, noise dust and litter emissions.

The objectives of the audit are:

- Review landfill gas risk assessments and amenity risks (in particular odour, dust and noise) to determine the likely risks posed to any existing or proposed developments within the standard 500 metre buffer distance established in the Landfill BPEM guidelines for putrescible waste landfills;
- To assess the likely direction and extent of any landfill gas subsurface migration and amenity impacts that may be generated in the event reasonable worst case scenario such as an abnormal weather event or failure of a landfill operations risk mitigation measure; and
- Determine any appropriate landfill operations risk mitigation measures to be adopted by any future developments within the standard 500 metre buffer distance considering the likely direction and extent of any subsurface landfill gas migration or amenity impacts.

The audit will consider the adequacy of the assessment methodologies prepared by the assessor and confirm that the assessment is undertaken in accordance with applicable EPA Victorian guidelines, in particular the Landfill BPEM, as well as publication 1642 *Assessing planning proposals within the buffer of a landfill.*

4 AUDIT SCOPE

4.1 AUDITED ACTIVITY & ACTIVITY COMPONENTS

The activities undertaken on-site that are relevant to this audit primarily includes the operation of the landfill (waste placement) and green waste mulching, as well as leachate and landfill gas management.

The audit will consider the current licensed premises and the footprint of any future approved landfill operations (works approval or planning approval) that is not yet licensed.

4.2 SEGMENTS OF THE ENVIRONMENT TO BE AUDITED

The segments of the environment to be audited is the standard buffer area (500 m) surrounding the site to which the activity may pose a risk.

The segments of the environment audited include an approximately 500 m buffer around the site - land defined by the premises boundary of the site on 191-193 Upper California Gully Rd, Eaglehawk, as detailed in EPA Licence 46490 - which the facility may pose a risk.

4.3 ELEMENTS OF THE ENVIRONMENT TO BE CONSIDERED

The elements of the environment considered relevant to this audit are listed in the table below.

Table 4.1 Elements of the Environment

Segment	Element		On-Site	Off-Site
Land	Soil	Excluded		
	Sediment	Excluded		
	Landfill Gas	Included		✓
	Human Health	Included		✓
	Ecosystems	Excluded		
	Aesthetics	Included		✓
Groundwater	All elements	Excluded		
Surface Water	All elements	Excluded		
Air	Odour	Included		✓
	Dust	Included		✓
	Climate	Excluded		
Noise	Sound	Included		✓

The onsite elements of the environment are audited separately under S53V Operations Landfill audit, last audit completed by ERM in 2017.

4.4 IDENTIFICATION OF BENEFICIAL USES

The actual and potential beneficial uses of the nominated segments of the environment need to be identified before any risk of possible harm or detriment to them can be assessed. This audit scope outlines provisional beneficial uses based on information at the time, however they may be subject to change as the investigation progresses.

The beneficial uses to be protected for the various nominated segments of the environment are declared in *State Environment Protection Policies* (SEPPs). SEPPs identify environmental quality objectives for each beneficial use.

4.4.1 Beneficial Uses of the Land Segment

The *State Environment Protection Policy (Prevention and Management of Contamination of Land) (Land SEPP)* identifies a number of land use beneficial uses for each land use category. A review of off-site land zoning surrounding the site within the buffer area are all land uses except for "*Commercial*" as shown in *Table 4.2* below.

Table 4.2 Protected Beneficial Uses of Land

Beneficial Use	Land Use						
			Sensitive use				
	Parks & Reserves	Agricultural	High density	Other	Recreation/Open space	Commercial	Industrial
Maintenance of ecosystems:							
Natural ecosystems	X						
Modified ecosystems	X	X		X	X		
Highly Modified ecosystems		X	X	X	X	X	X
Human Health	X	X	X	X	X	X	X
Buildings and structures	X	X	X	X	X	X	X
Aesthetics	X		X	X	X	X	
Production of food and fauna and fibre	X	X		X			

1. Highlighted segment(s) represent the land within the buffer surrounding the site.

4.4.2 Beneficial Uses of the Air Segment

The beneficial uses to be protected under the Air SEPP include:

a) life, health and well-being of humans;

b) life, health and well-being of other forms of life, including the protection of ecosystems and biodiversity;

c) local amenity and aesthetic enjoyment;

d) visibility;

e) the useful life and aesthetic appearance of buildings, structures, property and materials; and

f) climate systems that are consistent with human development, the life, health and well-being of humans, and the protection of ecosystem and biodiversity.

4.4.3 Noise from Industry in Regional Victoria (EPA Publication 1411)

The objective of this guideline is to provide the methods to set noise levels for industry in Regional Victoria to promote normal domestic use of the home and sleep at night. The guidelines set out recommended maximum noise levels which can be applied to manage the impacts of noise on the community. These guidelines have been applied as the site does not fall within the SEPP N-1 (State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1 ('SEPP N-1')) area.

5 *AUDIT CRITERIA*

The audit criteria will seek to meet the objectives of the audit, and will be derived from a number of sources including:

- The environmental quality objectives prescribed by the Land and Air SEPPs;
- Relevant Victorian EPA Publications, including:
    - EPA Publication 788.3, *Best Practice Environmental Management – Siting, Design, Operation and Rehabilitation of Landfills*, August 2015;
    - EPA Publication 1642, *Assessing planning proposals within the buffer of a landfill,* October 2017;
    - EPA Publication 1411, *Noise from Industry in Regional Victoria*;
    - EPA Publication 1518, March 2013, *Recommended separation distances for industrial residual air emissions;*
    - EPA Publication 1684, February 2018, *Landfill gas fugitive emissions monitoring guideline.*
- Any relevant site specific risk assessment criteria.

The above State Environment Protection Policies identify indicators to be employed in measuring environmental quality, set out the environmental quality objectives for sustaining designated beneficial uses, and nominate criteria that may be used when assessing risk. Additional guidance will be sought from international guidelines, standards and best practice (ie. UK and US) where available and deemed appropriate.

Any exceedances of the above Audit criteria does not necessarily indicate a significant risk of harm to the relevant beneficial uses and the Auditor may accept revised Audit criteria that have been developed by the assessor through a robust site assessment and risk assessment process considering site specific conditions

6 *COMMUNITY AND STAKEHOLDER ENGAGEMENT*

Broad community and stakeholder engagement is not currently envisaged as required.

It is planned for the auditor to attend a meeting with Council and local EPA representatives to discuss proposed development within the current standard 500 m buffer.

The audit may involve additional liaison with adjacent and local landholders, the planning and environmental authorities and other statutory authorities. Should the need for broader community and stakeholder engagement by the auditor be identified, a project specific community and stakeholder engagement plan will be developed by the project team which includes the lead consultant, City of Greater Bendigo and the Auditor.

7 CONDUCTING THE AUDIT

7.1 AUDIT SCOPE

The auditor's scope of works will comprise the following:

- Meet with Council planners and local EPA officers in Bendigo to discuss the nature and extent of development being considered within the 500 metre landfill buffer;
- Submission of this proposed audit scope to EPA audit unit and local EPA regional office in Bendigo for review and comment;
- Review and comment on the scope of a landfill gas risk assessment, and amenity impacts risk assessment, in particular an odour risk assessment including odour modelling, to be undertaken by an assessor to ensure the scope is aligned with the agreed audit scope;
- Audit of a landfill gas risk assessment report and amenity risk assessment report prepared by an assessor against the agreed audit scope;
- Conduct a section 53V environmental audit in accordance with Part IXD of the *Environmental Protection Act 1970* and the agreed scope;
- Prepare an environmental audit report consistent with EPA Publication 952.5;
- Make recommendations on any mitigation measures required.

An environmental audit report will be prepared in draft by the auditor for discussion with the City of Greater Bendigo (if required) and a final report will be prepared and forwarded to EPA (with a copy forwarded to the City of Bendigo). The contents of the audit report will include information listed in the Act and the Guidelines, and will outline the results of the environmental audit with respect to the audit objectives.

The report will advise on the audit findings with respect to:

- the likely risks posed to any existing or proposed developments within the standard 500 metre buffer distance for putrescible waste landfills;
- the likely direction and extent of any landfill gas subsurface migration and amenity impacts that may be generated in the event reasonable worst case scenario such as an abnormal weather event or failure of a landfill risk mitigation measure; and
- appropriate risk mitigation measures to be adopted by any future developments within the standard 500 metre buffer distance considering the likely direction and extent of any subsurface landfill gas migration.

7.2 *AUDIT PERIOD*

The assessment and audit is expected to be undertaken over a 6 month period. The audit report will be compiled following the completion of the assessment of the lead consultant's field works and risk assessments, which is anticipated to be in 2018. It is anticipated that an audit report will be submitted to EPA in the first quarter of 2019.

7.3 *EXCLUSIONS FROM THE AUDIT SCOPE*

The Audit:

- does not include an environmental assessment of the site;
- a total environmental assessment of the site nor its surrounds to determine suitability for future use of the parcel of land at the site or surrounding areas;
- is restricted to assessing potential landfill gas and amenity impacts (if any) within the buffer area surrounding the site ; and
- does not include a community consultation process.

7.4 *MANDATORY AUDITOR REPORTING REQUIREMENTS*

Regardless of the exclusions of this audit, the obligations on the auditor to report imminent environmental hazards will remain.

7.5 *AUDIT SUPPORT TEAM*

The auditor is expecting to rely on expert support comprising Dr Iain Cowan (Odour Assessment). Nicole Bradley will manage the project and be the auditor's assistant.

Annex A

Figures

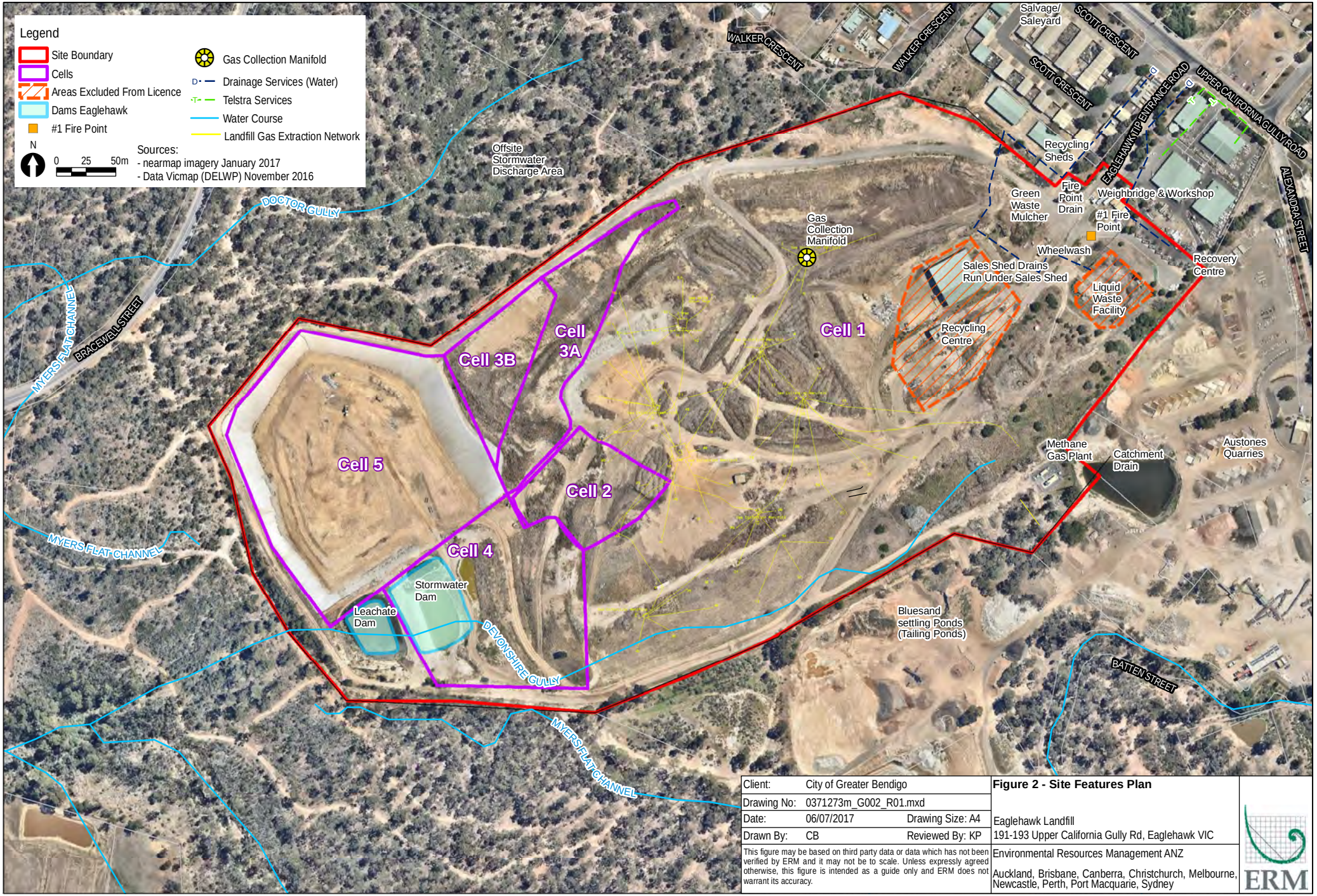




N

Client:	City of Greater Bendigo		**Figure 1 - Site Locality Map**
Drawing No:	0371273m_G001_R01.mxd		
Date:	06/07/2017	Drawing Size: A4	Eaglehawk Landfill
Drawn By:	CB	Reviewed By: KP	191-193 Upper California Gully Rd, Eaglehawk VIC
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.			Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney

ERM



Client:	City of Greater Bendigo		**Figure 2 - Site Features Plan**
Drawing No:	0371273m_G002_R01.mxd		
Date:	06/07/2017	Drawing Size: A4	Eaglehawk Landfill
Drawn By:	CB	Reviewed By: KP	191-193 Upper California Gully Rd, Eaglehawk VIC

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney

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US
Vietnam

ERM's Melbourne Office

Level 6, 99 King Street,
Melbourne, Victoria 3000
T: +61 0 9696 8011
F: +61 3 9696 8022

www.erm.com

Ofusina Ikitoelagi

From: Paul Fridell
Sent: Wednesday, 27 June 2018 7:40 PM
To: Nicole Bradley
Subject: Fwd: Eaglehawk Landfill Encroachment Audit - Voluntary Audit Scope - SON 8005693 / CARMS 60409-9
Attachments: EPA consolidated scope review feedback.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Paul Fridell

Partner

ERM Australia Pty Ltd

0401 717 938

From: Julia Noel <Julia.Noel@epa.vic.gov.au>
Sent: Wednesday, June 27, 2018 6:02:06 PM
To: Paul Fridell
Cc: Kaylee Thompson
Subject: RE: Eaglehawk Landfill Encroachment Audit - Voluntary Audit Scope - SON 8005693 / CARMS 60409-9

Paul,

Thank you for the audit scope for the Eaglehawk landfill buffer (8005693), received on 25th May 2018.

EPA has now conducted internal consultation on the scope and can provide consolidated review comments (attached). Parties consulted included relevant field compliance and planning officers in the Bendigo Office, and the EPA principal experts for dust, odour, noise and landfill gas. We have also conducted an internal executive level briefing on the proposed way forward for managing encroachment of Eaglehawk landfill, and reviewed previous audit processes to vary landfill buffers. The scope review comments below are consolidated EPA comments taking into account feedback from the abovementioned sources.

As general feedback, we strongly feel regular meetings between the auditor, EPA, and Council are warranted during the course of this audit. From past experience with landfill buffer audits, this is critical if the findings of the audit are to be accepted and used by EPA, and Council as the landfill operator and planning authority. We will raise this at the next Environmental Significance Overlay steering group meeting that the auditor, EPA, and Council will be attending. Following from this, we consider the feedback items in our scope review (attached above) are best suited to face to face discussion with the auditor/EPA/Council and we have flagged these as “for further engagement”, rather than requesting your response via email.

As always we are happy to discuss the above and attached comments. Could you please let us know your initial thoughts on the above proposed approach.

Thanks and regards,

Julia

Julia Noel
Senior Environmental Audit Officer
Environmental Audit

Environment Protection Authority Victoria
200 Victoria Street, Carlton VIC 3053 | GPO Box 4395, Melbourne VIC 3001 | DX 210082
☎ 03 9695 2742 | **E** julia.noel@epa.vic.gov.au | www.epa.vic.gov.au
Follow us

A healthy environment that supports a liveable and prosperous Victoria, now and always.
EPA acknowledges the Traditional Owners and custodians of the land and we pay our respects to their Elders, past, present and emerging. We're an inclusive workplace that embraces diversity in all its forms.

From: Paul Fridell [mailto:Paul.Fridell@erm.com]
Sent: Friday, 25 May 2018 12:46 PM
To: Julia Noel <Julia.Noel@epa.vic.gov.au>; Kaylee Thompson <Kaylee.Thompson@epa.vic.gov.au>
Cc: Nicole Bradley <Nicole.Bradley@erm.com>; Nicholas Lee <Nicholas.Lee@epa.vic.gov.au>; Kylie Douglas (k.douglas@Bendigo.vic.gov.au) <k.douglas@Bendigo.vic.gov.au>; Emma Bryant (e.bryant@Bendigo.vic.gov.au) <e.bryant@Bendigo.vic.gov.au>; environmental.audit <environmental.audit@epa.vic.gov.au>
Subject: Eaglehawk Landfill Encroachment Audit - Voluntary Audit Scope - SON 8005693 / CARMS 60409-9

Hi Julia/Kaylee,

Please find attached the proposed voluntary audit scope for the above referenced audit.

Regards,

Paul Fridell
Environmental Auditor
(appointed under the Environment Protection Act 1970)

ERM
Level 6, 99 King Street | Melbourne | Victoria 3000
T +61 (3) 9696 8011 | **M** +61 (0) 401 717 938
E paul.fridell@erm.com | **W** www.erm.com

ERM The business of sustainability

From: Julia Noel <Julia.Noel@epa.vic.gov.au>
Sent: Monday, 23 April 2018 5:12 PM
To: Paul Fridell <Paul.Fridell@erm.com>
Cc: Nicole Bradley <Nicole.Bradley@erm.com>; Nicholas Lee <Nicholas.Lee@epa.vic.gov.au>
Subject: RE: Eaglehawk Landfill Encroachment Audit - North West EPA Officer Contact?

Hi Paul,

Thanks for the email and sorry for the delay due to being on leave.

As the purpose of this audit is to inform urban planning decisions in the buffer area, the North West EPA contact is Kaylee Thompson, Planning Assessment Officer.

I've spoken with Kaylee and she is expecting the scope.

Please don't hesitate to get in touch if you need anything further, otherwise we'll look out for the scope.

Thanks and regards,

Julia

Julia Noel
Senior Environmental Audit Officer
Environmental Audit

Environment Protection Authority Victoria
200 Victoria Street, Carlton VIC 3053 | GPO Box 4395, Melbourne VIC 3001 | DX 210082
☎ 03 9695 2742 | **E** julia.noel@epa.vic.gov.au | www.epa.vic.gov.au
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From: Paul Fridell [mailto:Paul.Fridell@erm.com]
Sent: Wednesday, 4 April 2018 9:45 AM
To: Julia Noel <Julia.Noel@epa.vic.gov.au>
Cc: Nicole Bradley <Nicole.Bradley@erm.com>; Nicholas Lee <Nicholas.Lee@epa.vic.gov.au>
Subject: RE: Eaglehawk Landfill Encroachment Audit - North West EPA Officer Contact?

Hi Julia,

I will have the scope into EPA in the next couple of weeks. Who is the best North West EPA officer I should cc the audit scope to? Can you provide an email address?

Thanks,

Paul Fridell
Environmental Auditor
(appointed under the Environment Protection Act 1970)

ERM
Level 6, 99 King Street | Melbourne | Victoria 3000
T +61 (3) 9696 8011 | **M** +61 (0) 401 717 938
E paul.fridell@erm.com | **W** www.erm.com

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From: Julia Noel [mailto:Julia.Noel@epa.vic.gov.au]
Sent: Thursday, 22 March 2018 4:17 PM
To: Paul Fridell <Paul.Fridell@erm.com>
Subject: FW: Notification of Landfill Encroachment Audits

Hi Paul,

I just wanted to let you know that I've briefly discussed your Eaglehawk buffer audit with EPA North West region, who are responsible for providing planning advice in the Bendigo area. Fortuitously North West had a current planning referral requesting EPA's advice on a proposal for a subdivision in the buffer, so this topic was front of mind.

They are generally open to the idea of an audit to vary the buffer distance but are keen to review the scope once it is submitted to EPA.

As discussed, if you can submit a scope when you are ready, we can discuss further at that stage.

Thanks for following up on our call-out in the newsletter, we appreciate it.

Regards,

Julia

Julia Noel
Senior Environmental Audit Officer
Environmental Audit

Environment Protection Authority Victoria
200 Victoria Street, Carlton VIC 3053 | GPO Box 4395, Melbourne VIC 3001 | DX 210082
☎ 03 9695 2742 | **E** julia.noel@epa.vic.gov.au | www.epa.vic.gov.au
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From: Julia Noel
Sent: Friday, 2 March 2018 6:29 PM
To: 'Paul Fridell' <Paul.Fridell@erm.com>
Subject: RE: Notification of Landfill Encroachment Audits

Great, I'll try you around noon on Wednesday.

Thanks,

Julia

Julia Noel
Senior Environmental Audit Officer
Environmental Audit

Environment Protection Authority Victoria
200 Victoria Street, Carlton VIC 3053 | GPO Box 4395, Melbourne VIC 3001 | DX 210082
☎ 03 9695 2742 | **E** julia.noel@epa.vic.gov.au | www.epa.vic.gov.au
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From: Paul Fridell [mailto:Paul.Fridell@erm.com]
Sent: Friday, 2 March 2018 6:26 PM
To: Julia Noel <Julia.Noel@epa.vic.gov.au>
Subject: Re: Notification of Landfill Encroachment Audits

Hi Julia,

Wednesday between 11-12:30 is best.

Paul

Paul Fridell

Partner

ERM Australia Pty Ltd

0401 717 938

From: Julia Noel <Julia.Noel@epa.vic.gov.au>
Sent: Friday, March 2, 2018 6:22:53 PM
To: Paul Fridell
Subject: RE: Notification of Landfill Encroachment Audits

Hi Paul,

Thanks for following up on our message. Is there a good time for me to call you next week, perhaps Tuesday afternoon (after 3) or Wednesday?

Regards,

Julia

Julia Noel
Senior Environmental Audit Officer
Environmental Audit

Environment Protection Authority Victoria
200 Victoria Street, Carlton VIC 3053 | GPO Box 4395, Melbourne VIC 3001 | DX 210082
☎ 03 9695 2742 | **E** julia.noel@epa.vic.gov.au | www.epa.vic.gov.au
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From: environmental.audit
Sent: Wednesday, 28 February 2018 5:36 PM
To: Julia Noel <Julia.Noel@epa.vic.gov.au>
Subject: FW: Notification of Landfill Encroachment Audits

From: Paul Fridell [mailto:Paul.Fridell@erm.com]
Sent: Wednesday, 28 February 2018 5:30 PM
To: environmental.audit <environmental.audit@epa.vic.gov.au>
Subject: Notification of Landfill Encroachment Audits

As noted in the recent Environmental Auditor News – Summer 2018 (below), I have been recently engaged to undertake an operational landfill encroachment audit for Eaglehawk Landfill (Bendigo). Let me know who to speak to at EAU and I will contact them to discuss or they can call me.

Operating landfill encroachment

The use of audits to manage encroachment proposals for operating landfills continues to be an evolving space. As we try to navigate this complex issue, we ask that any auditors currently undertaking – or thinking about undertaking – such an audit get in touch with EAU to discuss it.

Regards,

Paul Fridell
Environmental Auditor
(appointed pursuant to the Environment Protection Act 1970)

ERM
Level 6|99 King Street|Melbourne Vic 3000
T +61 3 9696 8011|**M** +61 (0) 401 717 938
E Paul.Fridell@erm.com | **W** www.erm.com



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EPA consolidated scope review feedback – Eaglehawk Buffer Audit – 8005693

	Topic	Your scope ref.	Feedback point
1	Introduction	S1	The audit objectives include consideration of upset conditions. EPA compliance officers have experience with some specific upset conditions that have occurred/may occur at this site, e.g. stockpiling of waste. For previous similar audits landfill operators have also identified scenarios they would like considered. For further engagement: Auditor/EPA compliance/Council to agree on upset conditions scenarios to be considered in the assessment/audit.
2	Objectives	S3	As the extent of impacts from the landfill will be dependent on the management practices at the landfill itself, is it appropriate to include in the scope recommendations or requirements for landfill management that would need to be met for any change in buffer distance to be supported? EPA has had some compliance follow up with this landfill in the past associated with management practices. For further engagement: Auditor and Council landfill team perspective on this approach.
3	Audited activity	S4.1	a) Future changes We note the scope includes consideration of current and future approved landfill operations. We also note the old landfill cells currently have interim caps. A landfill rehabilitation plan is due in July. We would like to confirm whether the audit will address these upcoming changes. More generally, we recognise the difficulty of predicting how impacts to the buffer change with future works at the landfill, but also recognise the audit will not be useful to the planning authority unless it addresses this. For further engagement: Future changes in landfill operations and if/how these can be dealt with through the audit. b) Other sources of impact We are aware of other sources of impact in the landfill area which may be contributing to impacts to the buffer area – e.g. ASQ landscape supplies, transfer station, recycling centres. The audit is clear these are excluded but based on experience the practicability/utility of isolating one source of impact needs to be considered. For further engagement: Scope limitation to consider only landfill impacts.
4	Segments	S4.2	The segment (or site area) is defined as the buffer area surrounding the landfill, can we confirm this also includes the landfill itself? As described above, any variation in buffer distance will be contingent on management at the landfill itself.

5	Elements	S4.3	We recognise the elements included reflect policy and will be appropriate for most landfill buffers. However, experience has shown that in site specific circumstances, contamination of other elements may affect the suitability of the buffer land for development. For example, where groundwater is very shallow, or where topography means surface water flows from the landfill to the surrounding area. In this case, an audit that excludes these elements may be of limited use to planning authorities. For further engagement: Based on learning from previous cases, we request that elements be considered on a site specific basis at this early scoping phase based on existing knowledge of the site. For example, there has recently been an issue at this site with leachate discharge to a creek (i.e. surface water impact)
6	Beneficial uses	S4.4	We recognise that beneficial uses of land have been selected based on what the current zoning would allow. For further engagement: Confirm with Council this meets their needs, and they understand that should commercial use be proposed in future a further audit maybe required.
7	Audit criteria	S5	Specific criteria have been proposed by EPA's designated principal experts. Landfill gas: a) Data collection: Gas migration data from the site must be obtained from perimeter bores at BPEM spacings, and where perimeter bores show breaches of BPEM gas action levels, bores further out from the landfill must be installed to assess attenuation of this gas. Data must also be gathered form sub-surface services/structures. b) The risk assessment process must follow BS 8485: 2015. A through diagrammatical CSM is required. Gas concentration and gas flow must be compared with the CSM, with detailed further investigations if the initial CSM is not supported by gas data findings. Odour: c) Due to the nature of the odour sources, modelling should only be used if a formal field assessment program validates it. This may be conducted according to European Standard EN16841-2-2016: Determination of odour in ambient air by using field inspection – Part 2: Plume method, or a suitable equivalent subject to agreement with EPA. Dust d) The recommended criteria is EPA Publication 1911: Protocol for Environmental Management State Environment Protection Policy (Air Quality Management) Mining And Extractive Industries. It is likely that management measures will need to be recommended for the source/s to manage dust. Noise e) Our noise expert is available for direct discussion with you regarding noise methodology.

			For further engagement: We propose a direct discussion between the auditor and EPA's principle experts to work through assessment and audit methodology.
8	Audit period	S7	The assessment/audit period is listed as 6 months, we note that some of the advice on audit criteria from EPA experts may impact this. For further engagement: Expected timeframe for audit.
9	Exclusions	S7.3	We would like to confirm whether the landfill gas extraction system is in scope for this audit, we understand this is privately operated.

Ofusina Ikitoelagi

From: Paul Fridell
Sent: Monday, 27 May 2019 9:13 AM
To: Nicole Bradley
Subject: FW: Follow up from Monday's meeting

Follow Up Flag: Follow up
Flag Status: Completed

From: Julia Noel <Julia.Noel@epa.vic.gov.au>
Sent: Monday, May 27, 2019 9:00 AM
To: Paul Fridell <Paul.Fridell@erm.com>
Cc: Matthew Kennedy <Matthew.Kennedy@epa.vic.gov.au>
Subject: Follow up from Monday's meeting

Hi Paul,

Thank you for the discussion on Monday regarding the Eaglehawk landfill buffer audit. Here are a few notes on the matters discussed, and EPA follow up since then.

Planning provisions relating to landfill gas – approach to referencing 8485

- The last version of the provisions we have is that provided by Raph on 22/4 – you were also cc'd. This took into account Steven Davis's comments of 10/4 and there was a table provided attempting to address them. Could you confirm whether this has resolved your comments, or if there are outstanding issues?
- We've indicated to Council that EPA, and potentially also the auditor, have further feedback on the 22/4 version, and asked them to specify the process to provide this.

AECOM's approach and difficulties in obtaining justification of the 250m buffer

- We are raising this through higher level EPA/Council discussions currently to try to expedite resolution with Council and AECOM.

Buffer measurement approach for amenity buffer

- As discussed the amenity consultant has measured the default buffer as 500m from the landfill boundary.
- As you'd know, BPEM provisions on default buffer measurement (5.1.5) have been subject to quite a bit of consideration at VCAT and panel processes. My understanding of the outcome is that the amenity buffer is measured from the nearest active cell – though taking into account any other activity on the landfill with potential impact. The rationale being that closed cells and unused areas of the landfill don't generate amenity impacts.
- If the 500m from the boundary represents the actual extent of impacts, this could be justified based on the site specific assessment conducted – but presenting as a maintenance of the default distance may prove more difficult. Could you let us know how you'd like to proceed on this one? Happy to have a further discussion.

Thanks and regards,

Julia

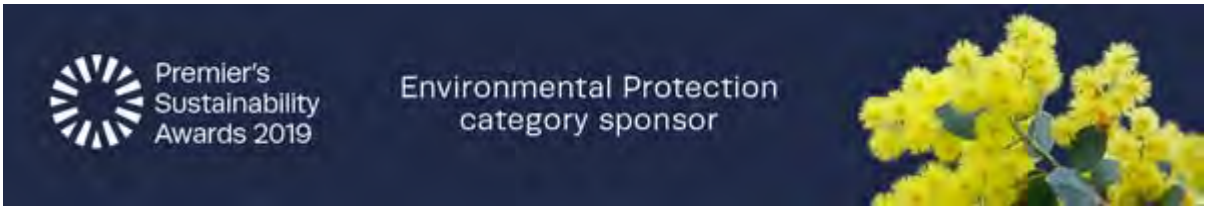
Julia Noel
Planning Assessment Officer
North West Region

Environment Protection Authority Victoria
200 Victoria Street, Carlton VIC 3053 | GPO Box 4395, Melbourne VIC 3001 | DX 210082
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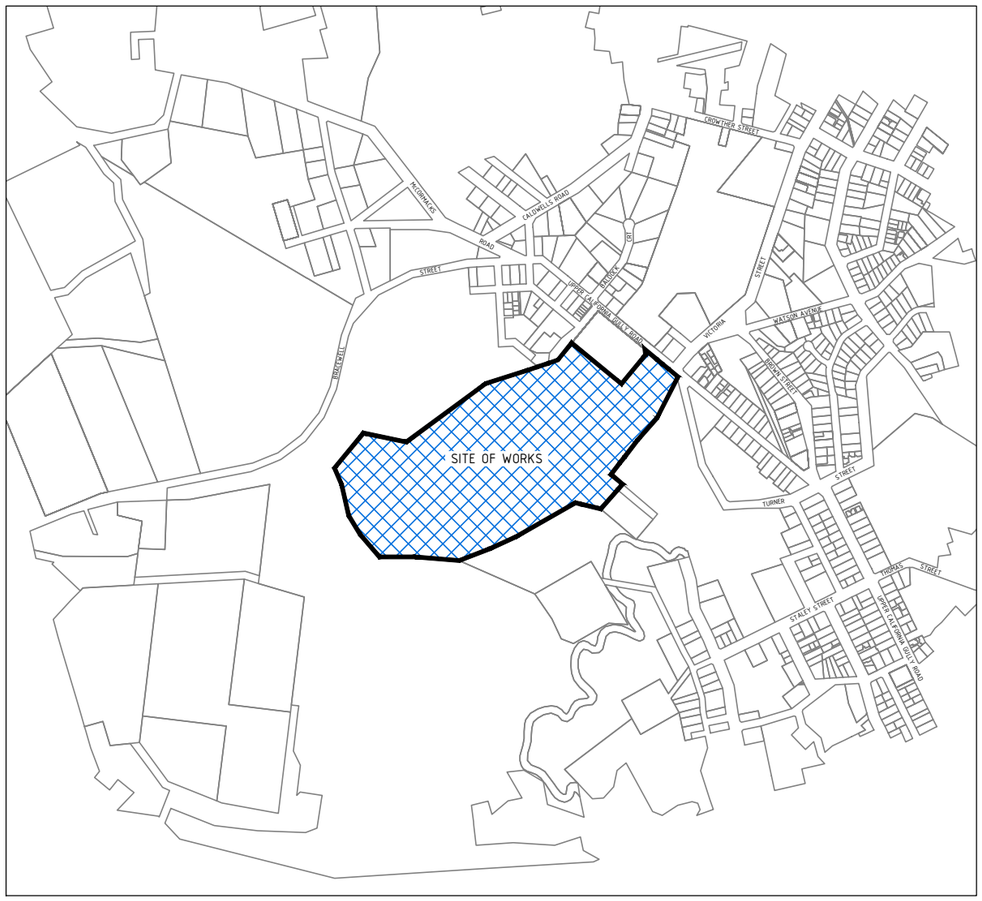
APPENDIX C REHABILITATION PLAN

DO NOT SCALE DRAWING

CITY OF GREATER BENDIGO

EAGLEHAWK LANDFILL REHABILITATION CONCEPTUAL TOP OF LANDFILL CAP PRE-SETTLEMENT CONTOUR PLAN AT UPPER CALIFORNIA GULLY ROAD, EAGLEHAWK

EPA LICENCE NO.: 46490



LOCALITY PLAN
NOT TO SCALE

DRAWING INDEX	
DRAWING No.	DRAWING DESCRIPTION
IS18105-01C	FACE SHEET, LOCALITY PLAN & DRAWING INDEX
IS18105-02C	EXISTING CONDITIONS PLAN
IS18105-03C	TOP OF LANDFILL CAP PRE-SETTLEMENT CONTOUR PLAN
IS18105-04C	TOP OF WASTE CONTOUR PLAN
IS18105-05C	SECTIONS

GENERAL DETAILED DESIGN NOTES

1. THE EPA ACCREDITED AUDITOR APPROVED CONCEPTUAL REHABILITATION PLAN (CRP) IS TO ALSO BE IN CONJUNCTION WITH THE AUDITOR VERIFICATION RECOMMENDATIONS WHEN UNDERTAKING DETAIL DESIGN INCLUDING DRAWINGS, SPECIFICATIONS AND CQA PLAN.
2. POST SETTLEMENT CONTOURS ARE TO BE MODELLED AS PART OF THE DETAILED DESIGN PROCESS INCLUDING CAP PROFILE MODELLING FOR CELL 5.
3. THE CRP IS TO BE REVIEWED IF CIRCUMSTANCES CHANGE AS A RESULT OF ADDITIONAL INVESTIGATIONS AND DURING THE DETAILED DESIGN PROCESS.
4. THE LANDFILL REHABILITATION FINAL SURFACE CONTOUR IS NOT TO EXCEED A 1 IN 3 GRADIENT.
5. THE LEACHATE DAM AND GAS EXTRACTION SYSTEM IS TO REMAIN FULLY OPERATIONAL DURING AND AFTER THE LANDFILL CAP CONSTRUCTION UNTIL NOTIFIED OTHERWISE IN THE FUTURE BY THE EPA ACCREDITED AUDITOR.
6. THE LANDFILL CPA IS TO BE MAINTAINED IN ACCORDANCE WITH THE REHABILITATION MANAGEMENT PLAN. ANY DEPRESSIONS HOLDING WATER ARE TO BE FILLED AND GRADED OUT.
7. THE AREA SHOWN FOR FUTURE TRANSFER STATION DEVELOPMENT HAS THE REQUIRED CAP PROFILE OF GREATER THAN 0.5M SELECT FILL AND 0.1M OF TOPSOIL OR MULCH, HOWEVER WILL BE DESIGNED WITH A MUCH THICKER CAP WHEN THE NEW TRANSFER STATION DESIGN IS COMPLETED. THE DESIGN OF THIS AREA IS TO BE FORWARDED TO THE EPA ACCREDITED AUDITOR FOR APPROVAL
8. PART OF THE WESTERN BATTER SLOPE HAS TO BE CONSTRUCTED PRIOR TO STAGE 1 CONSTRUCTION COMMENCING SO THAT GARBAGE TRUCKS CAN CONTINUE DELIVERY TO CELL 5 AND GREENWASTE OPERATIONS CAN CONTINUE.
9. THE CONCEPTUAL REHABILITATION PLAN TOP OF LANDFILL CAP PRE-SETTLEMENT CONTOURS (REFER TO SHEET 3) MAY CHANGE AS A RESULT OF DETAILED DESIGN.

ISSUED FOR E.P.A. LICENCED AUDITOR APPROVAL

NOTES:
1. DATE OF SURVEY - AUGUST 2017
2. LEVELS SHOWN ARE IN METRES AND TO A.H.D. DATUM.
3. CO-ORDINATES SHOWN ARE IN METERS AND TO M.G.A 94 DATUM (ZONE 55).
4. LOCATIONS OF UNDERGROUND SERVICES (WHERE SHOWN) ARE APPROXIMATE ONLY, AND HAVE BEEN ESTIMATED USING SURVEYED LOCATIONS OF UTILITY ASSETS VISIBLE AT GROUND LEVEL. EXACT LOCATIONS SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL SERVICES ARE SHOWN.

CITY OF GREATER BENDIGO

REV.	AMENDMENT DESCRIPTION	BY	APP.	DATE

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SCALE: NTS

SURVEYED	ONLEYS
SURVEY REF.	3766
DESIGN	T WOODCOCK & C TREWIN
DRAWN	C TREWIN
DATE DRAWN	JUNE 2018
CHECKED	T WOODCOCK
APPROVED	ORIGINAL SIGNED BY TREVOR WOODCOCK
DATE	12 / 06 / 2018

CITY OF GREATER BENDIGO
UPPER CALIFORNIA GULLY ROAD, EAGLEHAWK
EAGLEHAWK LANDFILL
CONCEPTUAL REHABILITATION PLAN
FACE SHEET, LOCALITY PLAN & DRAWING LIST

CAD REFERENCE	REVISION	SHEET	DRAWING NUMBER	SIZE
IS18105_Eaglehawk LF	-	1 OF 5	IS18105-01C	A1

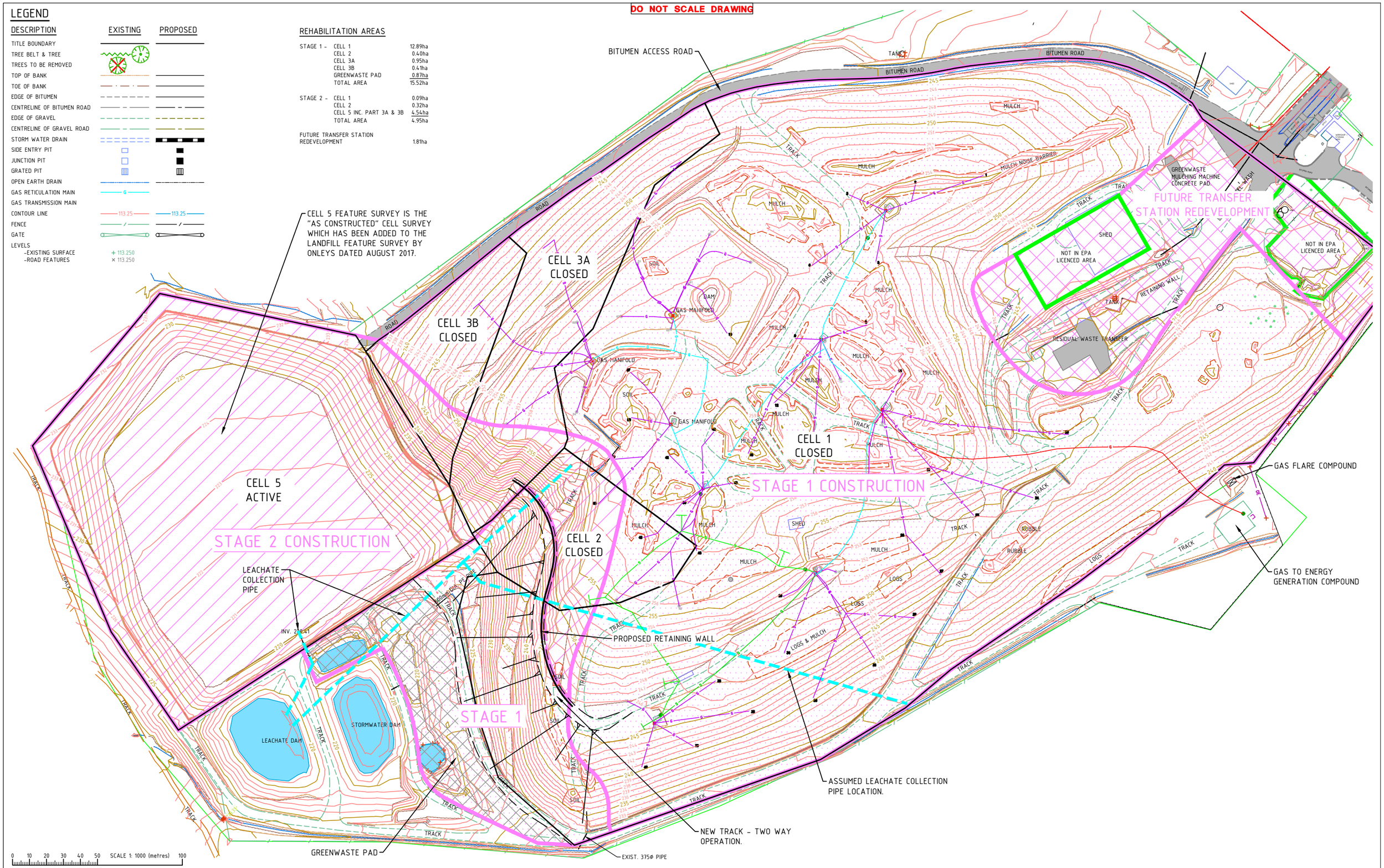
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LEGEND

DESCRIPTION	EXISTING	PROPOSED
TITLE BOUNDARY		
TREE BELT & TREE		
TREES TO BE REMOVED		
TOP OF BANK		
TOE OF BANK		
EDGE OF BITUMEN		
CENTRELINE OF BITUMEN ROAD		
EDGE OF GRAVEL		
CENTRELINE OF GRAVEL ROAD		
STORM WATER DRAIN		
SIDE ENTRY PIT		
JUNCTION PIT		
GRATED PIT		
OPEN EARTH DRAIN		
GAS RETICULATION MAIN	G	
GAS TRANSMISSION MAIN		
CONTOUR LINE	113.25	113.25
FENCE		
GATE		
LEVELS -EXISTING SURFACE	+ 113.250	
-ROAD FEATURES	× 113.250	

REHABILITATION AREAS

STAGE 1 -	CELL 1	12.89ha
	CELL 2	0.40ha
	CELL 3A	0.95ha
	CELL 3B	0.41ha
	GREENWASTE PAD	0.87ha
	TOTAL AREA	15.52ha
STAGE 2 -	CELL 1	0.09ha
	CELL 2	0.32ha
	CELL 5 INC. PART 3A & 3B	4.54ha
	TOTAL AREA	4.95ha
FUTURE TRANSFER STATION REDEVELOPMENT		1.81ha



0 10 20 30 40 50 SCALE 1: 1000 (metres) 100

NOTES:
1. DATE OF SURVEY - AUGUST 2017
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PH. 03 5822 1519
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SCALE 1: 1000

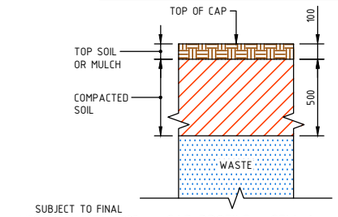
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DRAWN	C TREWIN
DATE DRAWN	JUNE 2018
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APPROVED	ORIGINAL SIGNED BY TREVOR WOODCOCK
DATE	12 / 06 / 2018

CITY OF GREATER BENDIGO
UPPER CALIFORNIA GULLY ROAD, EAGLEHAWK
EAGLEHAWK LANDFILL
CONCEPTUAL REHABILITATION PLAN
EXISTING CONDITIONS PLAN

CAD REFERENCE	REVISION	SHEET	DRAWING NUMBER	SIZE
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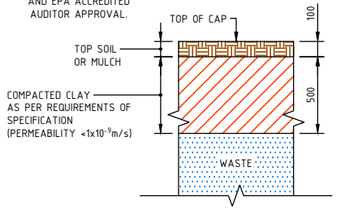
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STAGE 2 CONSTRUCTION - CAP PROFILES

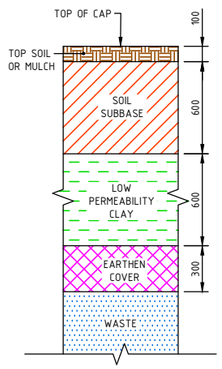


SUBJECT TO FINAL WESTERN BATTER SLOPE ANALYSIS, CAP DESIGN AND EPA ACCREDITED AUDITOR APPROVAL.

CAP PROFILE - CELL 1
NTS



CAP PROFILE - CELL 2, 3A & 3B
NTS



CAP PROFILE - CELL 5
NTS
SUBJECT TO HELP MODEL ANALYSIS & EPA ACCREDITED AUDITOR APPROVAL

CELL 3A CLOSED

CELL 3B CLOSED

CELL 5 ACTIVE

STAGE 2 CONSTRUCTION

CELL 2 CLOSED

FUTURE SOLAR ARRAY

CELL 1 CLOSED

STAGE 1 CONSTRUCTION

FUTURE TRANSFER STATION REDEVELOPMENT

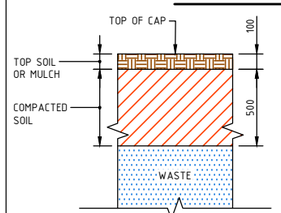
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STAGE 1

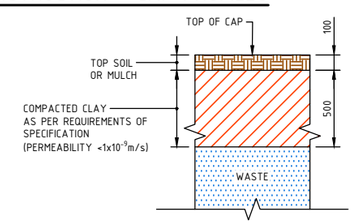
NEW TRACK - TWO WAY OPERATION.

GREENWASTE PAD

STAGE 1 CONSTRUCTION - CAP PROFILES



CAP PROFILE - CELL 1
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CAP PROFILE - CELL 2, 3A & 3B
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CITY OF GREATER BENDIGO

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www.infrastructuresolutions.com.au

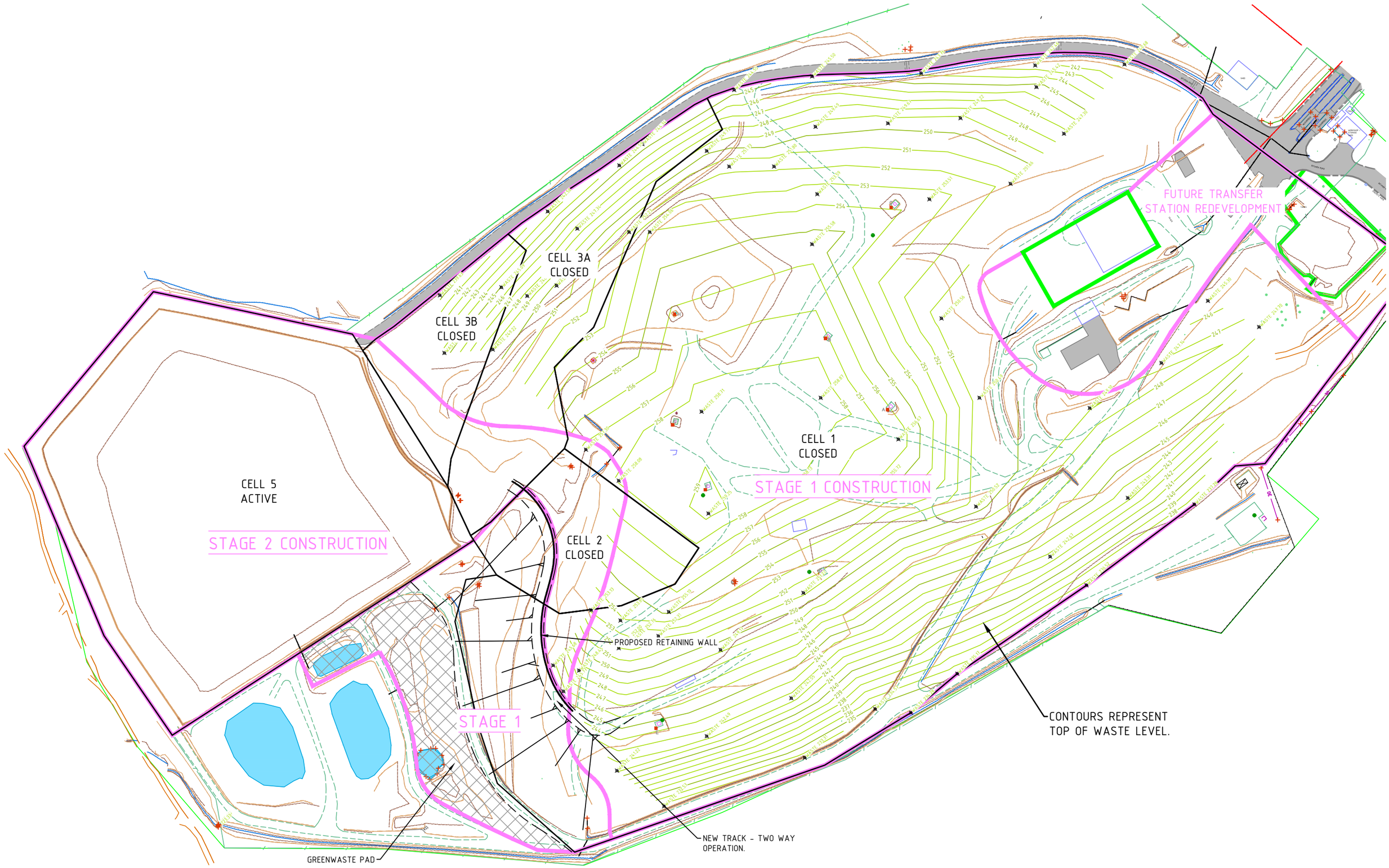
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CITY OF GREATER BENDIGO
UPPER CALIFORNIA GULLY ROAD, EAGLEHAWK
EAGLEHAWK LANDFILL
CONCEPTUAL REHABILITATION PLAN
TOP OF LANDFILL CAP PRE-SETTLEMENT CONTOUR PLAN

CAD REFERENCE	REVISION	SHEET	DRAWING NUMBER	SIZE
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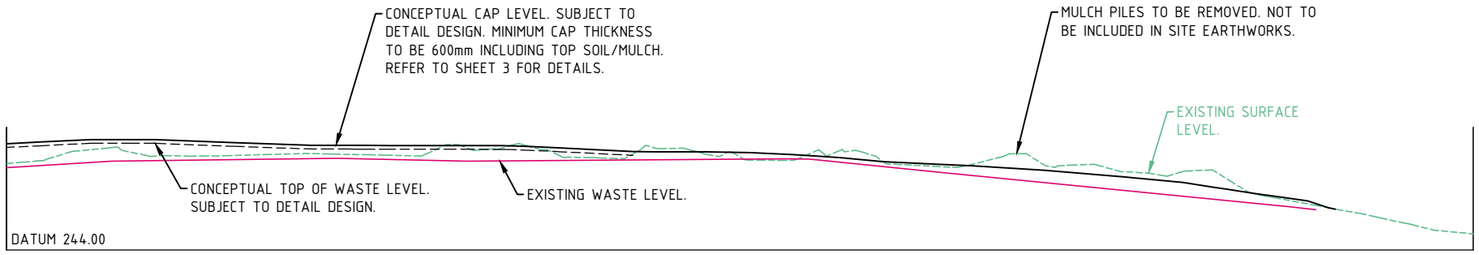
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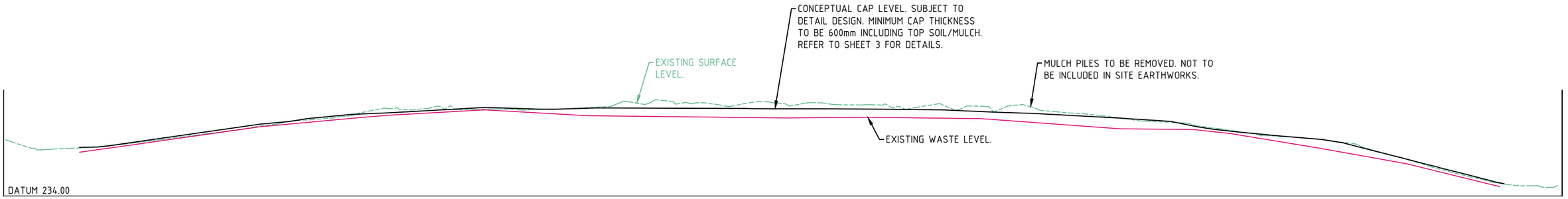
CITY OF GREATER BENDIGO
UPPER CALIFORNIA GULLY ROAD, EAGLEHAWK
EAGLEHAWK LANDFILL
CONCEPTUAL REHABILITATION PLAN
TOP OF WASTE CONTOUR PLAN

CAD REFERENCE	REVISION	SHEET	DRAWING NUMBER	SIZE
IS18105_Eaglehawk LF	-	4 OF 5	IS18105-04C	A1

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SECTION B / 3
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SECTION A / 3
SCALE 1:500

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CITY OF GREATER BENDIGO
UPPER CALIFORNIA GULLY ROAD, EAGLEHAWK
EAGLEHAWK LANDFILL
CONCEPTUAL REHABILITATION PLAN
SECTIONS

SCALE	CAD REFERENCE	REVISION	SHEET	DRAWING NUMBER	SIZE
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APPENDIX D ASSESSOR REPORTS

DUST

EAGLEHAWK LANDFILL

Dust Impact Assessment

Prepared for:

City of Greater Bendigo
PO Box 733
Bendigo Vic 3552



SLR Ref: 640.11831-R01
Version No: -v3.0
May 2019

PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Suite 2, 2 Domville Avenue
Hawthorn VIC 3122 Australia

T: +61 3 9249 9400
E: melbourne@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

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

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

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

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
640.11831-R01-v3.0	31 May 2019	A Radford / J Shepherd	K Lawrence	G Starke
640.11831-R01-v2.0	2 April 2019	A Radford / J Shepherd	K Lawrence	G Starke
640.11831-R01-v1.0	21 January 2019	A Radford	G Starke	

EXECUTIVE SUMMARY

The Greater City of Bendigo require a dust impact assessment to address the requirements of the Environment Protection Act Licence 46490, namely conditions LI_A3 and LI_A3.1 at Eaglehawk Landfill at 191-193 Upper California Gully Road, Eaglehawk, Bendigo. This dust impact assessment has been prepared to provide an assessment of potential dust impacts associated with the Facility from current operations and proposed future operations.

The results of the dust modelling study performed for the Facility are summarised below.

- The maximum monthly dust deposition rates predicted at all sensitive receptor locations are below the relevant assessment criteria. No nuisance dust impacts would therefore be expected as a result of dust emissions from the Facility.
- The maximum 24-hour average cumulative PM_{10} concentrations predicted at the nearest sensitive receptors are below the relevant ambient air quality criterion of 60 $\mu g/m^3$ at all receptors for both existing and proposed operations under normal and upset conditions.
- The maximum 24-hour average cumulative $PM_{2.5}$ concentrations predicted at the nearest sensitive receptors are below the relevant ambient air quality criterion of 36 $\mu g/m^3$ at all receptors for both existing and proposed operations under normal and upset conditions.
- Compliance with the PEM criteria at all the sensitive receptors, when modelling upset conditions, implies the 500 m separation distance requirement adequately protects the human health and amenity of local residents. In addition, given compliance with the PEM criterion at locations approximately 65 m from the site boundary, the 500 m separation distance requirement may be reduced in relation to the impacts of nuisance dust, PM_{10} and $PM_{2.5}$.

The modelling study has incorporated a number of conservative assumptions and the predicted off-site impacts are anticipated to be conservative predictions of potential worst-case impacts. The results of the modelling indicate that the potential for dust and particulate matter impacts at the nearest sensitive receptors is negligible. Regular communication is recommended to ensure that dust from the Facility is being managed to acceptable levels.

Given that negligible off-site impacts have been predicted at the nearest sensitive receptors, and as only a very small number of complaints have been made regarding air emissions from the current Facility operations, no instrument-based air quality monitoring programs are recommended. Regular inspections of visible dust emissions from the Facility should be performed by site personnel to ensure that mitigation measures are being appropriately implemented, and any complaints received regarding air quality issues appropriately addressed and documented.

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1 Introduction

The City of Greater Bendigo ('Council') require a dust impact assessment to address the requirements of the Environment Protection Act Licence 46490, namely conditions LI_A3 and LI_A3.1 at Eaglehawk Landfill (the Facility) at 191-193 Upper California Gully Road, Eaglehawk, Bendigo. This Dust Impact Assessment (DIA) has been prepared by SLR Consulting (Australia) Pty Ltd (SLR) to provide an assessment of potential dust impacts associated with the Facility from current operations and proposed future operations.

The Environment Protection Act Licence 46490 conditions LI_A3 and LI_A3.1 state that the Facility:

- must ensure that nuisance dust and/or nuisance airborne particles are not discharged or emitted beyond the boundaries of the premises, except as permitted by this licence.
- must implement dust management controls that accord with the requirements of Section 6.7.4 of the Best Practice Environmental Management, Siting, Design, Operation and Rehabilitation of Landfills (EPA Publication 788) including, but not limited to:
  - vegetating exposed areas and forming internal roads
  - ensuring waste is covered appropriately and on time
  - using water or other dust suppressants.

This report has been prepared with reference to the following regulatory and guideline documents:

- *State Environment Protection Policy (Air Quality Management)* (SEPP AQM) (EPAV, 2001)
- *State Environment Protection Policy for (Ambient Air Quality)* (SEPP AQM) (EPAV, 2016)
- *Protocol for Environmental Management: Mining and Extractive Industries* (EPAV, 2007)
- *Recommended Separation Distances for Industrial Residual Air Emissions* (EPAV, 2013)
- *Guidance notes for using the regulatory air pollution model AERMOD in Victoria* (EPAV, 2013)
- *Construction of input meteorological data files for EPA Victoria's regulatory air pollution model (AERMOD)* (EPAV, 2013).

2 Site Description

2.1 Site Location

The Eaglehawk Landfill (the Facility) services the Bendigo Local Government Area is located at 191-193 Upper California Gully Road, Eaglehawk, approximately 1.2 kilometres (km) to the southwest of central Eaglehawk and 5 km to the northwest of the Bendigo CBD. The location of the Facility is shown in **Figure 1**.

The Facility is located in close proximity to a mix of vegetated crown land, residential land and long-established industrial development to the north. The Albert Roy Reserve to the northeast is used for active recreation purposes. Land to the east of the landfill along Upper California Gully Road has long established residential and industrial uses. The land to the southeast and south is occupied by All Stone Quarries (ASQ) as a plant nursery and for sand and soil supplies. The land to the west beyond the vegetated Crown land is zoned Farming and contains several dwellings on large allotments. Most of the land immediately to the northwest, west and southwest of the landfill is vegetated Crown land. Sensitive receptors identified for this assessment are discussed in **Section 2.4**.

Figure 1 Facility Location and Land Uses



SLR
Suite 2, 2 Domville Avenue
Hawthorn
Vic 3122
T: +61 3 9249 9400
F: +61 3 9249 9499
www.slrconsulting.com

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Location	Bendigo, Vic
Other Information	
Projection	GDA 1994 MGA Zone 55
Date	17/01/2019

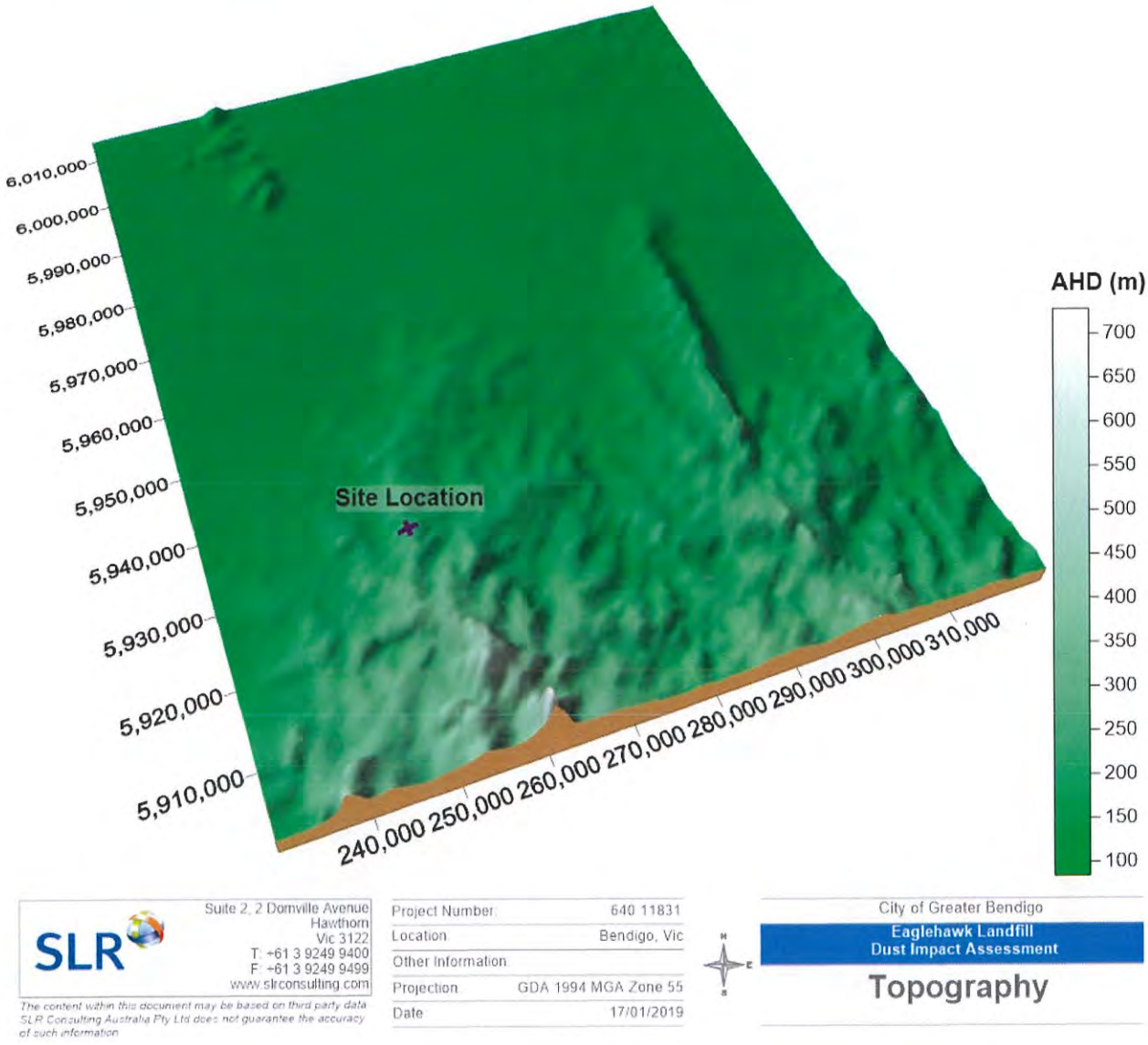
City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment

Facility Location

2.2 Local Topography

A three-dimensional representation of the topographical features in the region surrounding the Facility is presented in **Figure 2**.

Figure 2 Site Topography



2.3 Local Meteorology

Local wind speed and direction influence the dispersion of air pollutants. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of 'plume' stretching. Wind direction, and the variability in wind direction, determines the general path pollutants will follow and the extent of crosswind spreading. Surface roughness (characterised by features such as the topography of the land and the presence of buildings, structures and trees) affects the degree of mechanical turbulence, which also influences the rate of dispersion of air pollutants.

In relation to dust emissions due to wind erosion, temperature, rainfall and relative humidity all influence the soil moisture content and hence the threshold friction velocity, which is the minimum friction velocity required to initiate movement of soil particles by wind.

The climate in Bendigo is relatively dry and temperate with warm to hot summers and cool to cold winters. The local climate at the Facility is affected by broader regional patterns of synoptic pressure and wind with embedded weather systems. Synoptic features vary in intensity and location according to the season. For instance, during summer subtropical easterlies cover most of the continent. In winter, westerly winds and occasional to frequent strong cold fronts affect southern Australia.

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The nearest available automatic weather station (AWS) collecting data suitable for use in a quantitative air dispersion modelling study operated by the BoM is located at Bendigo Airport, approximately 7.5 km to the east of the Facility. Given the proximity and lack of significant terrain features between the AWS and the Facility, it's likely that weather at the AWS would be similar to that experienced at the Facility.

The Bendigo Airport AWS (Station 81123, elevation 209 m), has data available from 1991 to 2018 for the following parameters:

- Temperature (°C)
- Rainfall (mm)
- Relative humidity (%)
- Wind speed (m/s) and wind direction (degrees).

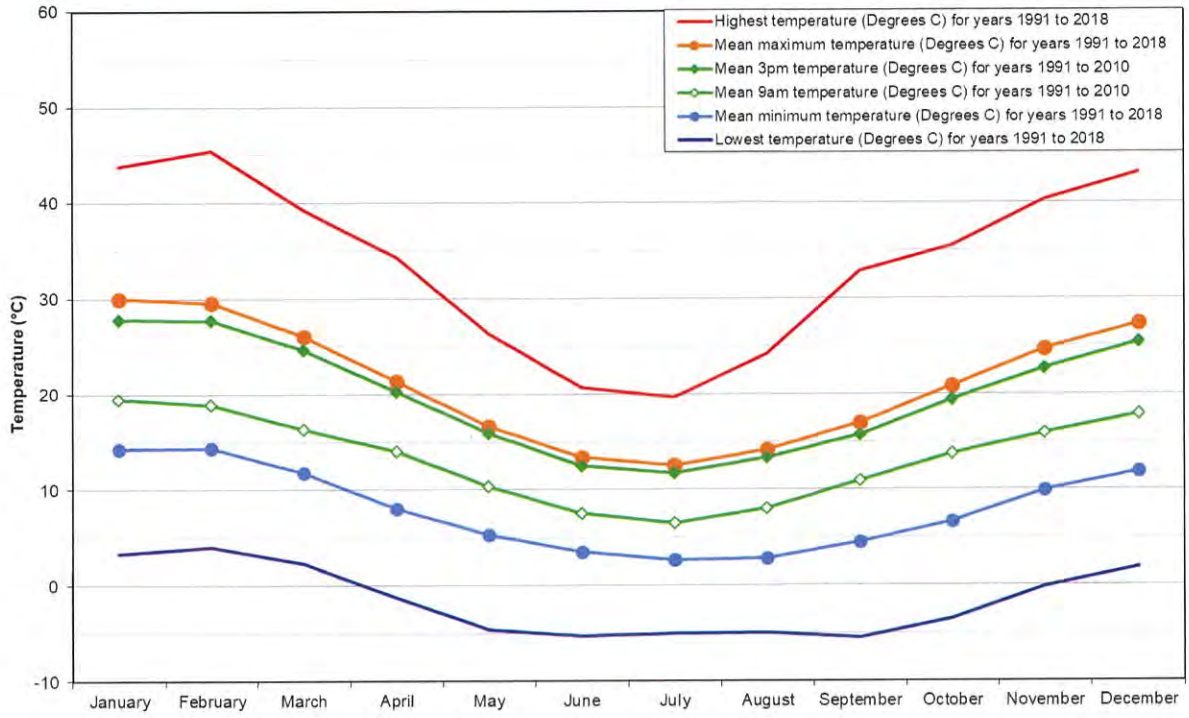
A review of the long-term data collected by this AWS is provided in the following sections.

2.3.1 Temperature

Long-term temperature statistics for Bendigo Airport are summarised in **Figure 3**. Mean maximum temperatures range from 12.6°C in winter to 30°C in summer, while mean minimum temperatures range from 2.6°C in winter to around 14.4°C in summer. Ballarat's highest maximum recorded temperature was 45.4°C on 7 February 2009, during the 2009 southeastern Australia heat wave. The lowest-ever recorded minimum was −5.5°C on 6 September 1998.

Longer periods of higher temperatures can dry out soil resulting in both higher background dust and on-site dust emissions.

Figure 3 Long Term Temperature Data for Bendigo Airport



2.3.2 Rainfall

Long-term rainfall statistics for Bendigo Airport (1991-2018) are summarised in **Figure 4**. The mean annual rainfall is 515 millimetres (mm), with the highest average monthly rainfall of 52 mm/month in August and an average of 13.5 rain days recorded in this month. The average monthly rainfall is relatively high in winter, reducing from spring through to early autumn, with the lowest average of 29.4 mm/month recorded in March. This month also recorded an average of around 5.3 rain days per month. The highest monthly rainfall recorded over the time period examined was 177.8 mm recorded in January 2011. Peak rainfall events occur during summer, with the maximum daily rainfall of 66.4 mm recorded on 5 February 2011.

Like much of Australia, Ballarat experiences cyclical drought and heavy rainfall. A series of great floods occurred in Bendigo in 1859 and substantial flooding also occurred in 1903. Bendigo was in severe drought from 2006 to 2010. Bendigo was affected by the Black Saturday bushfires in 2009 when a fire to the west of the city burned out 500 hectares (1,200 acres). Flash floods occurred across Bendigo during 2010, the first in March and the most severe at the beginning of September. Snowfalls are virtually unknown in Bendigo however frosts can be a common occurrence during the winter months.

Rainfall suppresses on-site dust emissions but has conservatively not been considered in this assessment.

2.3.3 Relative Humidity

Long-term humidity statistics (9 am and 3 pm monthly averages) for Bendigo Airport are summarised in **Figure 5**. Morning humidity levels range from an average of around 85% in winter to around 60% in summer. Afternoon humidity levels are lower, at around 60% in winter and dropping to a low of 30% in summer.

Figure 4 Long Term Monthly Rainfall Data for Bendigo Airport

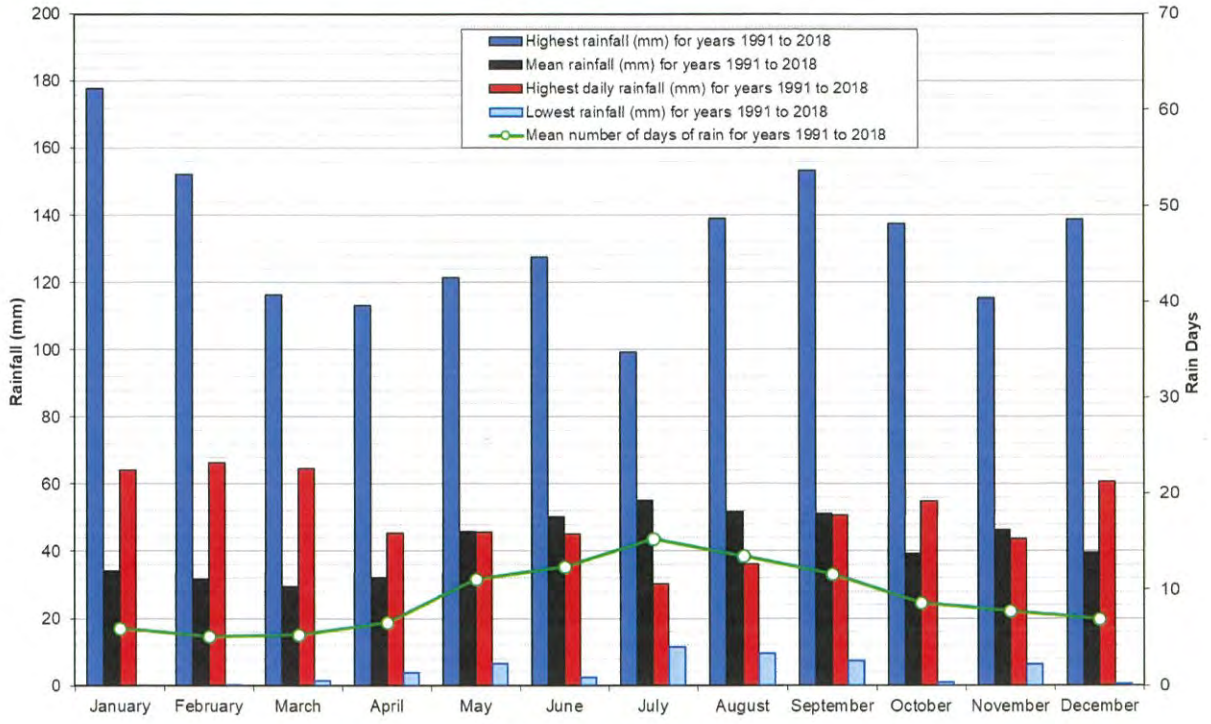


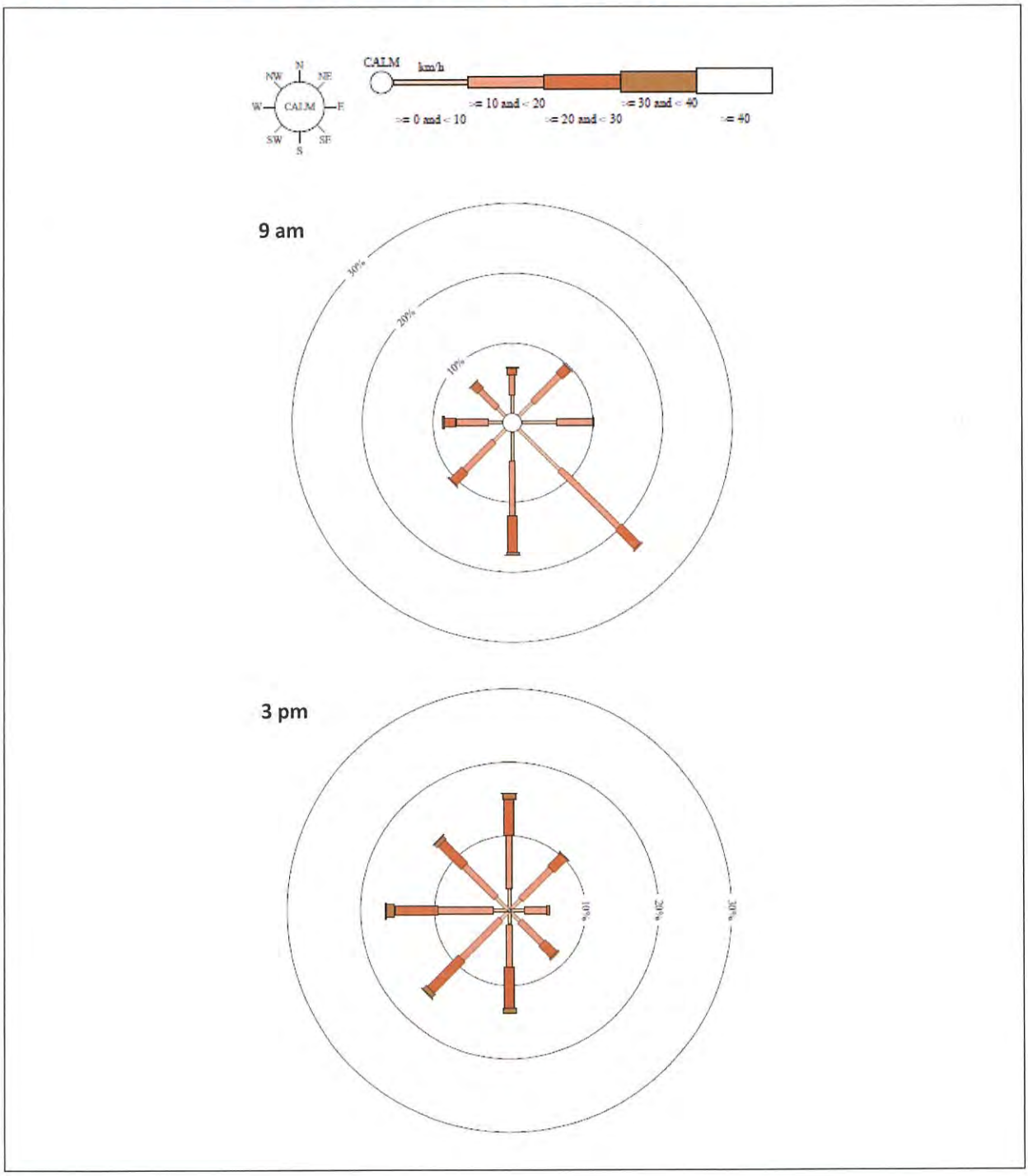
Figure 5 Long Term Humidity Data for Bendigo Airport



2.3.4 Wind Speed and Direction

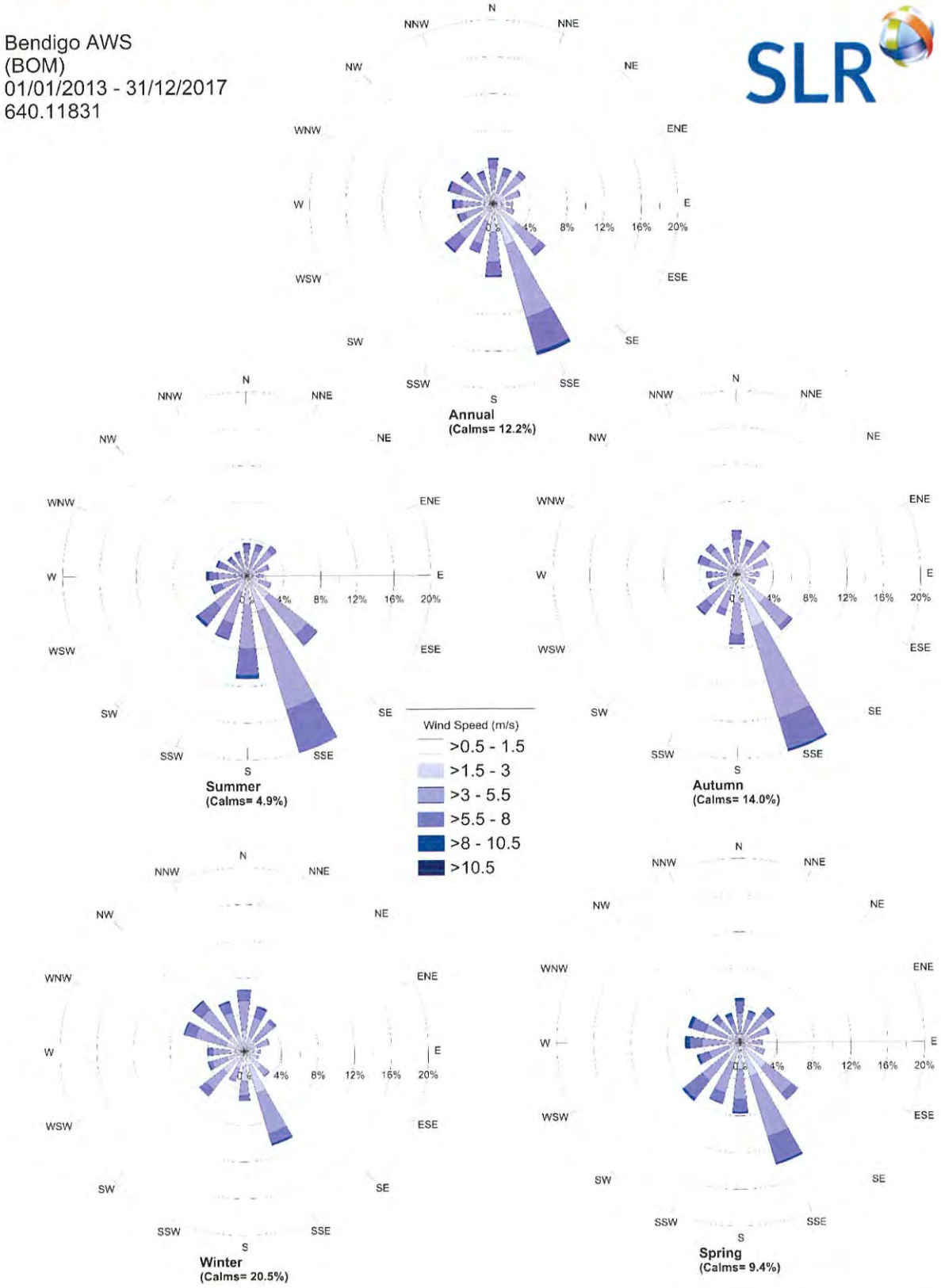
Long term wind data (9 am and 3 pm) for Bendigo Airport from the years 1991-2018 are presented in **Figure 7**. The wind roses show that winds from the southeast are predominant in the morning, with a relatively high frequency of winds from the westerly quadrant in the afternoon.

Figure 6 9:00 am and 3:00 pm Wind Roses - Bendigo Airport AWS (1991 – 2018)



Annual and seasonal wind roses for Bendigo Airport from the years 2013-2017 are presented in **Figure 7**. The wind roses show that overall, winds from the south-southeast are predominant, with few winds from the east. Summer and autumn winds are similar to the overall distribution. Winter and spring are less dominated by winds from the south-southeast; with more winds from the northern sector during winter.

Figure 7 Annual and Seasonal Wind Roses - Bendigo Airport AWS (2013 – 2017)



2.4 Sensitive Receptors

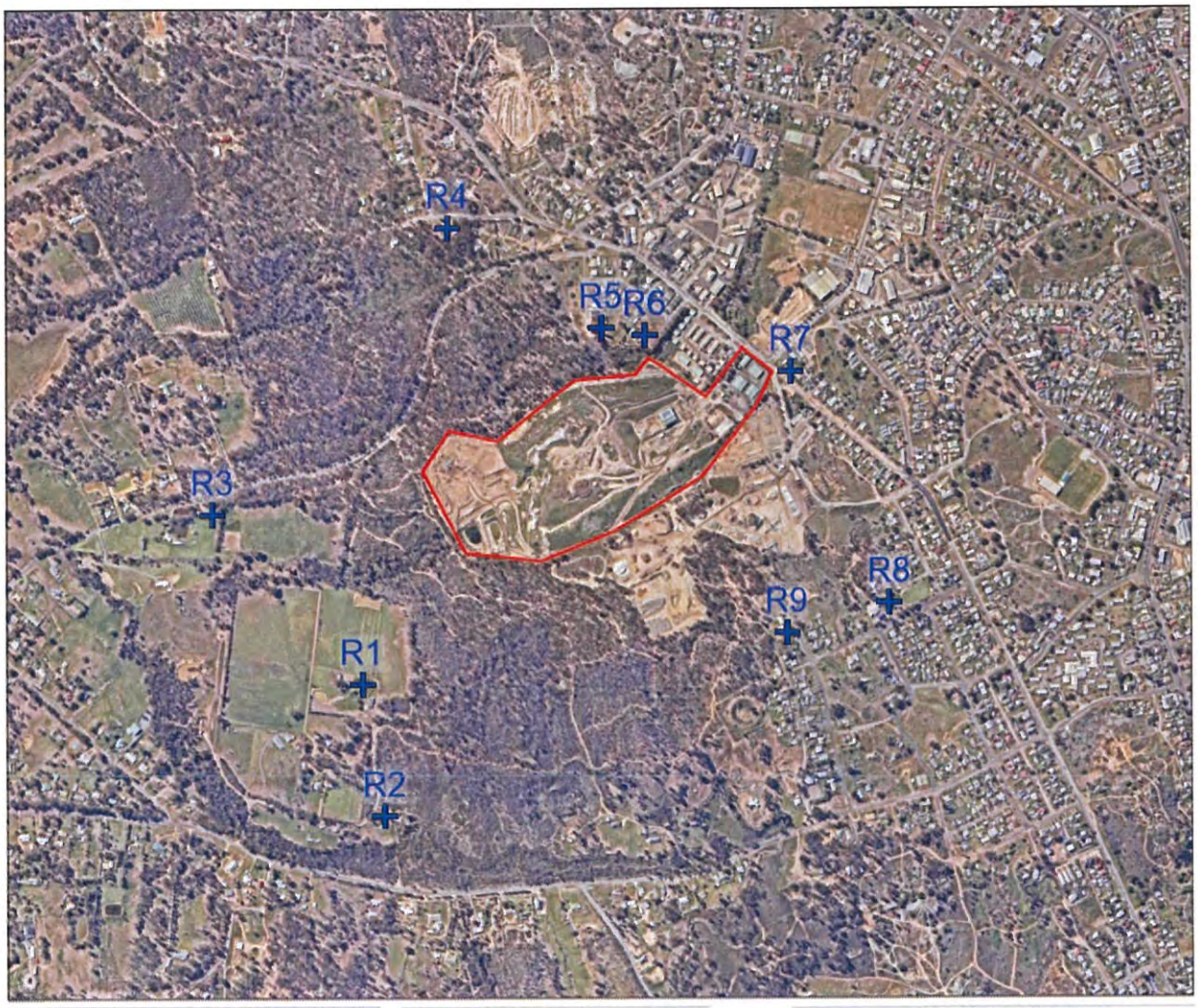
Sensitive receptors must be included in the modelling as discrete receptors, according to the SEPP AQM, in order to assess the impact at any nearby sensitive locations such as hospitals, schools or residences.

The nearest existing sensitive receptors to the Facility are shown in **Figure 8** and listed in **Table 1**. The closest residential receptor is located approximately 65 m to the north of the Facility boundary.

Table 1 Nearest Sensitive Receptors

ID	Name	UTM Coordinates Zone 55s (mE, mS)	Distance/Location from Facility
R1	69 Bonazza Road, Maiden Gully	253,101, 5,930,995	420 m southwest
R2	44 Bonazza Road, Maiden Gully	253,157, 5,930,661	700 m southwest
R3	64 Bracewell Street, Maiden Gully	252,720, 5,931,424	560 m west
R4	12 James Street, Eaglehawk	253,318, 5,932,147	510 m northwest
R5	16 Walker Crescent, Eaglehawk	253,709, 5,931,894	115 m north
R6	Walker Crescent, Eaglehawk	253,817, 5,931,876	65 m north
R7	196 Upper California Gully Road, Eaglehawk	254,187, 5,931,784	200 m northeast
R8	California Gully Primary School	254,434, 5,931,199	560 m southeast
R9	32 Butler Street, Eaglehawk	254,176, 5,931,124	435 m south-southeast

Figure 8 Sensitive Receptors



SLR
Suite 2, 2 Domville Avenue
Hawthorn
Vic 3122
T: +61 3 9249 9400
F: +61 3 9249 9499
www.slrconsulting.com

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Project Number	640 11831
Location	Bendigo, Vic
Other Information	
Projection	GDA 1994 MGA Zone 55
Date	17/01/2019

City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment

Sensitive Receptors

3 Existing and Proposed Operations

Four operational scenarios of the Facility have been outlined for investigation in this assessment, including:

- Existing operations - normal conditions (including current mitigation measures)
- Existing operations - upset conditions
- Proposed operations - normal conditions
- Proposed operations - upset conditions

The details of these scenarios are outlined in the following sections.

Modelling of the existing and proposed scenarios when the Facility is operating under normal conditions gives an indication of compliance with the relevant air quality criteria and any potential impact to air quality experienced at the nearest sensitive receptors. Whereas, modelling of the existing and proposed scenarios when the Facility is operating under upset conditions can be used to assess against separation distance requirements for the Facility in relation to particulate matter and nuisance dust.

3.1 Existing Operations

3.1.1 Normal Conditions

The Facility is operated by Council and the existing site activities include a recycle shop, resource recovery centre / transfer station, organics shed, active landfill cell (Cell 5), and leachate pond. The landfill currently receives putrescible waste, solid inert waste, tyres shredded into pieces <250 mm, prescribed waste (asbestos all forms) and lightly contaminated soil (Category C). The sources and types of materials currently handled at the site are shown in **Table 2**.

Cell 5 was constructed in 2014 and is located at the western boundary of the site. The landfill has a lifespan of approximately 4-6 years. At present, approximately 85% of the household waste received at the site is transferred into the active cell of the landfill, and the remaining 15% is transferred to a major landfill at Patho in Campaspe Shire to the north. 69% of the incoming green waste is sent to Stanhope for composting.

The existing site layout is shown in **Figure 9**.

Table 2 Incoming and Outgoing Waste from Existing Operations

Waste	Throughput (tonnes/annum)	Vehicle Movements (trips/annum)	Assumed Payload (tonnes)
Incoming			
Domestic car tip-face	3,480	43,498	0.08
Domestic concrete/rubble	6,668	667	10
Domestic green waste	2,369	29,611	0.08
Commercial green waste	11,248	1,125	10
Landfill (active cell)	87,941	8,794	10
Patho transfer station	15,656	1,566	10
Total Incoming	**127,363**	**85,260**[1]	
Waste	**Throughput (tonnes/annum)**	**Vehicle Movements (trips/annum)**	**Assumed Number of Vehicles per Day**
Outgoing			
Organics shed	9,373	730	2
Patho transfer station	15,656	1,095	3
Total Outgoing	**25,029**	**1,825**	

1. The total number of vehicles recorded was 85,260 (estimated vehicles numbers are within 0.8% of the recorded numbers).

Figure 9 Existing Operations



3.1.2 Upset Conditions

Operations occurring at the Facility that could be considered to lead to 'upset conditions' include the mulching of green waste, which occurs for approximately 3-5 days every 3 months at the green waste storage and mulching area. The mulching is undertaken by a contractor with mulching equipment fitted with inbuilt watering systems to suppress dust. In addition, one watering truck is used to continuously spray the green waste before it enters the mulcher. The mulching operations have been included in this scenario in addition to the normal operations to indicate an appropriate separation distance for development from the Facility, in relation to particulate matter and nuisance dust.

3.2 Proposed Operations

3.2.1 Normal Conditions

Proposed operations include the relocation of the domestic car face, Patho transfer station and organics receival activities within the site. Under the proposed operations approximately 71% of the household waste received at the site will be transferred into the active cell of the landfill, and the remaining 29% transferred to a major landfill at Patho in Campaspe Shire to the north. 69% of the incoming green waste is sent to Stanhope for composting.

The sources and types of materials proposed to be handled at the site are shown in **Table 3**. The proposed site layout for future operations is shown in **Figure 10.**

Table 3 Incoming and Outgoing Waste from Proposed Operations

Waste	Throughput (tonnes/annum)	Vehicle Movements (trips/annum)	Assumed Payload (tonnes)
Incoming[1]			
Domestic car tip-face[4]	6,350	79,376	0.08
Domestic concrete/rubble[4]	12,169	1,217	10
Domestic green waste[4]	4,323	54,036	0.08
Commercial green waste[4]	20,527	2,053	10
Landfill (active cell)	120,845	12,085	10
Patho transfer station	51,100[2]	5,110	10
Total Incoming	**215,313**	**153,876**	
Waste	**Throughput (tonnes/annum)**	**Vehicle Movements (trips/annum)**	**Assumed Payload (tonnes)**
Outgoing			
Organics shed	17,104	1332[3]	-
Patho transfer station	51,100	1022	50
Total Outgoing	**68,204**	**2,354**	

1. Total waste received to car face, patho, landfill and organics (stanhope) was estimated to be 195,400 tpa (from client provided spreadsheet "yearly transaction data.xlsx" on 12/12/2018).
2. Approximately 140 tonne per day will be transferred to Patho (per comms Kylie Douglas 14/12/2018).
3. Outgoing trips per year have been ratioed against the increase in tonnes per annum from the existing to the proposed scenarios.
4. Previous percentage/ratio of incoming volume multiplied by projected volume.

Figure 10 Proposed Future Operations



3.2.2 Upset Conditions

As with **Section 3.1.2**, mulching operations have been included in this scenario in addition to the proposed future normal operations to indicate an appropriate separation distance for development from the Facility, in relation to particulate matter and nuisance dust.

3.3 Operating Hours

There are activities on-site from 7.30 am to 5.00 pm and the Facility is open to the public from 8.00 am to 4.00 pm.

4 Air Quality Criteria

4.1 Pollutants Assessed

The main air emissions associated with the current and proposed operations at the Facility are odour, particulate matter and nuisance dust emissions. This report considers particulate matter and dust emissions only, with odour from the Facility being considered in a separate report. These pollutants are discussed in **Section 4.1.1** and **4.1.2**. The potential for these emissions to result in off-site air quality impacts have been assessed utilising a detailed atmospheric dispersion model as described in the following sections.

Emissions of particulate matter associated with diesel combustion in vehicles and mobile machinery working on the site are likely to be very low in comparison to particulate and dust from wind erosion and wheel-generated dust. Similarly, the burning of landfill gas in the on-site generator and flare is not expected to produce significant quantities of particulate matter. The potential of these sources to result in significant off-site particulate impacts is therefore considered very low and they have not been considered further.

4.1.1 Suspended Particulate Matter

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms "dust" and "particulates" are often used interchangeably. The term "particulate matter" refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is termed total suspended particulate (TSP).

Emissions of particulate matter less than 10 µm and 2.5 µm in diameter (referred to as PM_{10} and $PM_{2.5}$ respectively) are considered important pollutants due to their ability to penetrate into the respiratory system. In the case of the $PM_{2.5}$ category, recent health research has shown that this penetration can occur deep into the lungs. Potential adverse health impacts associated with exposure to PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

4.1.2 Deposited Particulate

The preceding section is concerned in large part with the health impacts of airborne particulate matter. Nuisance impacts also need to be considered, mainly in relation to deposited dust, which is measured in grams per square metre per month (g/m^2/month).

4.2 Assessment Criteria

4.2.1 State Environment Protection Policy (Ambient Air Quality)

The intent of the *State Environment Protection Policy (Ambient Air Quality)* (SEPP (AAQ)) is to measure and report the concentration of environmental indicators in the ambient air to protect the beneficial uses of the atmosphere. The common pollutants to be assessed under this policy include: nitrogen dioxide (NO_2), particulate matter (PM_{10}), carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2), and lead (Pb).

The main aim of the SEPP (AAQ) is compliance with the *Ambient Air Quality National Environmental Protection Measure* (NEPM) (NEPC, 2016). As such, it contains standards that are considered to apply to background monitoring data that describe concentrations of environmental indicators in the air that are representative of an air catchment area (or 'airshed'). The concentrations of environmental indicators in the air are to be measured at performance monitoring stations, and these concentrations are to be compared to the environmental quality objectives outlined in the SEPP (AAQ). Performance monitoring stations must be located so that they obtain a representative measure of air quality likely to be experienced by the general population in the region or sub-region.

On 15 December 2015, the National Clean Air Agreement (NCAA) was endorsed by Commonwealth, state and territory Environment Ministers. In the NCAA, the Ministers agreed to strengthen national ambient air quality reporting standards for airborne fine particles as outlined in **Table 4**. All jurisdictions have agreed to implement strengthened standards for particulate matter, as well as move to even tighter standards for annual average and 24-hour $PM_{2.5}$ in 2025. As such, in February 2016, a variation to the Ambient Air Quality NEPM was made to extend its coverage to $PM_{2.5}$, setting reporting standards for $PM_{2.5}$ with no allowable exceedances (NEPC, 2016) as outlined in **Table 4**. In addition, the Ambient Air Quality NEPM revised the standard for annual average PM_{10} to be in line with the NCAA.

These standards were adopted by EPA Victoria and incorporated into the SEPP (AAQ) in 2016, along with a slightly more stringent annual average requirement for PM_{10}.

Any air quality monitoring undertaken for the Project should be assessed against the SEPP (AAQ) criteria.

Table 4 Federal and State Assessment Goals

Pollutant	Averaging Period	Assessment Goal (µg/m³)		
		SEPP (AAQ) 2016	National Clean Air Agreement 2015	National Environment Protection Measure (2016)
PM_{10}	Maximum 24-hour	50	50	50
	Annual	20	25	25
$PM_{2.5}$	Maximum 24-hour	25	25	25
	Annual	8	8	8

4.2.2 State Environment Protection Policy (Air Quality Management)

The *State Environment Protection Policy (Air Quality Management)* (SEPP (AQM)) is the instrument which the State Government uses to achieve the Ambient Air Quality SEPP goals. It is the intent of the SEPP (AQM) to manage the emissions to the air environment so that "*the beneficial uses of the air environment are protected, Victoria's air quality goals and objectives are met, our quality continues to improve and we achieve the cleanest air possible, having regard to the State's social and economic development*".

The protected beneficial uses of the air environment are defined in Part 1 of the SEPP (AQM) as protection of the following:

- Life, health and well-being of humans;
- Life, health and well-being of other forms of life, including the protection of ecosystems and biodiversity;

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

The SEPP (AQM) defines design criteria (Schedule A) that are to be used in assessing the impact of new or modified sources on ground level concentrations of emitted pollutants. Compliance with the design criteria is considered to imply that the beneficial use of the atmosphere is preserved. Where exceedance of the design criteria occurs, the SEPP (AQM) allows the proponent to undertake a risk assessment to demonstrate that the beneficial use of the atmosphere has not been harmed.

However, the particulate matter design criteria contained in the SEPP (AQM) relate to emissions from a point or stack source only and are therefore not considered to be applicable to emissions from volume / linear sources such as haul roads and stockpiles. The SEPP (AQM) states that *"for area-based sources and roads, applicable criteria are specified in the relevant industry Protocol for Environmental Management (PEM)"*.

The activities proposed to be undertaken on the site are described in the only relevant PEM, the PEM for the Mining and Extractive Industries (EPAV, 2007).

4.2.3 Protocol for Environmental Management - Mining and Extractive Industries

A PEM is an incorporated document of the SEPP (AQM). It supports the interpretation of the SEPP (AQM) and sets out the statutory requirements for the management of emissions to the air environment arising from the described activities. All references to the PEM from this point onward refer to the PEM for Mining and Extractive Industries.

The assessment criteria applicable to landfill activities (volume sources) and roads, according to the PEM, are outlined in **Table 5**.

Air quality modelling undertaken for the Project should be assessed against the PEM criteria as an incorporated document of the SEPP (AQM).

Table 5 PEM Assessment Criteria for Particulate Matter Mining and Extractive Industries

Pollutant	Averaging Period	Air Quality Standard	
PM_{10}	24-hour	60 µg/m^3	
$PM_{2.5}$	24-hour	36 µg/m^3	
Pollutant	**Averaging Period**	**Maximum Increase in Deposited Dust Level**	**Maximum Total Deposited Dust Level**
Dust deposition	Annual	2 g/m^2/month	4 g/m^2/month

4.3 Recommended Separation Distances

In accordance with Clause 13.06 (Air Quality) of Victoria's State Planning Policy Framework, all planning must consider the EPA's *Recommended Separation Distances for Industrial Residual Air Emissions* (2013). In their document, the EPA makes recommendations for assessing appropriate separation distances where amenity may be reduced for sensitive or incompatible land uses. Sensitive land uses which warrant protection from amenity-reducing off-site effects of industry by maintenance of a buffer distance include residential areas and zones, hospitals and schools.

Industrial Residual Air Emissions (IRAEs) are defined by the EPA as unintended or accidental emissions (i.e. due to equipment failure, abnormal weather conditions etc) which are often episodic in occurrence and may originate near ground level. While routine emissions may be controlled in-house to ensure emissions meet SEPP (AQM) and licence requirements, provision of an adequate buffer distance allows for unintended emissions to dissipate without adverse impacts on sensitive land uses.

The EPA states that where the appropriate buffer distance is unable to be provided by the emitter, the impact on neighbouring land uses may be reduced by careful site layout. For a substantial residential development, surrounding land uses and zones should be carefully assessed to determine their compatibility with the residential proposal, while also taking into consideration the need to prevent sensitive land uses encroaching on industry as well as industry encroaching on sensitive uses.

The EPA document lists several industries with their recommended IRAE separation distances and recommends EPA consultation where site-specific circumstances indicate a lesser buffer distance may be appropriate (i.e. where there is no history of complaints arising from residual emissions or where the plant is significantly smaller than that used in the recommendations etc).

For landfills, the IRAE separation distance document refers to the *Best Practice Environmental Management - Siting, Design, Operation and Rehabilitation of Landfills* (EPAV, 2015) for appropriate separation distances, which are provided in **Table 6**. As the document states, "appropriate buffer distance must be maintained between the landfill and sensitive land uses (receptors) to protect those receptors from any impacts resulting from a failure of landfill design or management or abnormal weather conditions. These failures might constitute discharge from the site of potentially explosive landfill gas, offensive odours, noise, litter and dust".

For the purposes of this assessment, the landfill is a type 2 municipal waste landfill with a recommended separation distance of 500 m from buildings and structures. Buffers are measured from the sensitive land use to the edge of the closest cell. All cells, including closed cells, need to be considered in calculating buffers. While it is understood that generally the buffers are set to manage odour and landfill gas impacts, the buffers required for protection from dust fall within the buffer required for odour and landfill gas. Given this assessment only addresses dust emissions, the stated 500 m separation distance will be applied noting that the distance may be more applicable to odour and landfill gas rather than dust and particulate matter.

Table 6 Recommended Separation Distances

Type of Landfill Site	Recommended Separation Distance
Municipal (putrescible) waste (Type 2 landfill)	100 m from surface waters. 500 m from building or structures. 1500 m from an aerodrome for piston-engine propeller-driven aircraft[1]. 3000 m from an aerodrome for jet aircraft[1].
Solid inert waste (Type 3 landfill)	100 m from surface waters. 200 m from buildings and structures. 1500 m from an aerodrome for piston-engine propeller-driven aircraft[1]. 3000 m from an aerodrome for jet aircraft[1].

5 Background Air Quality

Existing air quality in the area surrounding the Facility will be affected by a combination of emissions from sources in the local area, as well as emissions that flow into the area from the wider region.

In relation to local sources of air emissions, the Facility is located close to a few commercial land uses that have the potential to generate dust and particulate matter emissions (as identified in **Section 2.1**). Air emissions from these local sources, and associated traffic movements, have the potential to have an impact on the existing air quality at the Facility.

The regional air environment will be affected by:

- Dust from agricultural activities, wind erosion and long-range transport of fine particulate matter from other regions.
- Intermittent and short-term emissions of particulate matter and products of combustion from grass/bush fires, controlled burns and dust storms.

A review of the National Pollutant Inventory (NPI) Database identified no industrial and commercial sources of air emissions, that meet the threshold for reporting to NPI, within a 2 km radius of the Facility. This distance is inclusive of sources that would have potential to impact on the existing air quality at the Facility.

5.1.1 Ambient Air Quality Monitoring Data - Bendigo

There is no current ambient air quality data available for the Facility. However, a mobile air quality monitoring station (AQMS) was deployed to Garden Gully Reserve in Ashley Street (residential area) from May 2004 to July 2005. Several common pollutants with known health impacts were monitored. The results showed that Bendigo had generally good air quality but was locally impacted by wind-blown dust and, on colder evenings, contributions from domestic wood smoke.

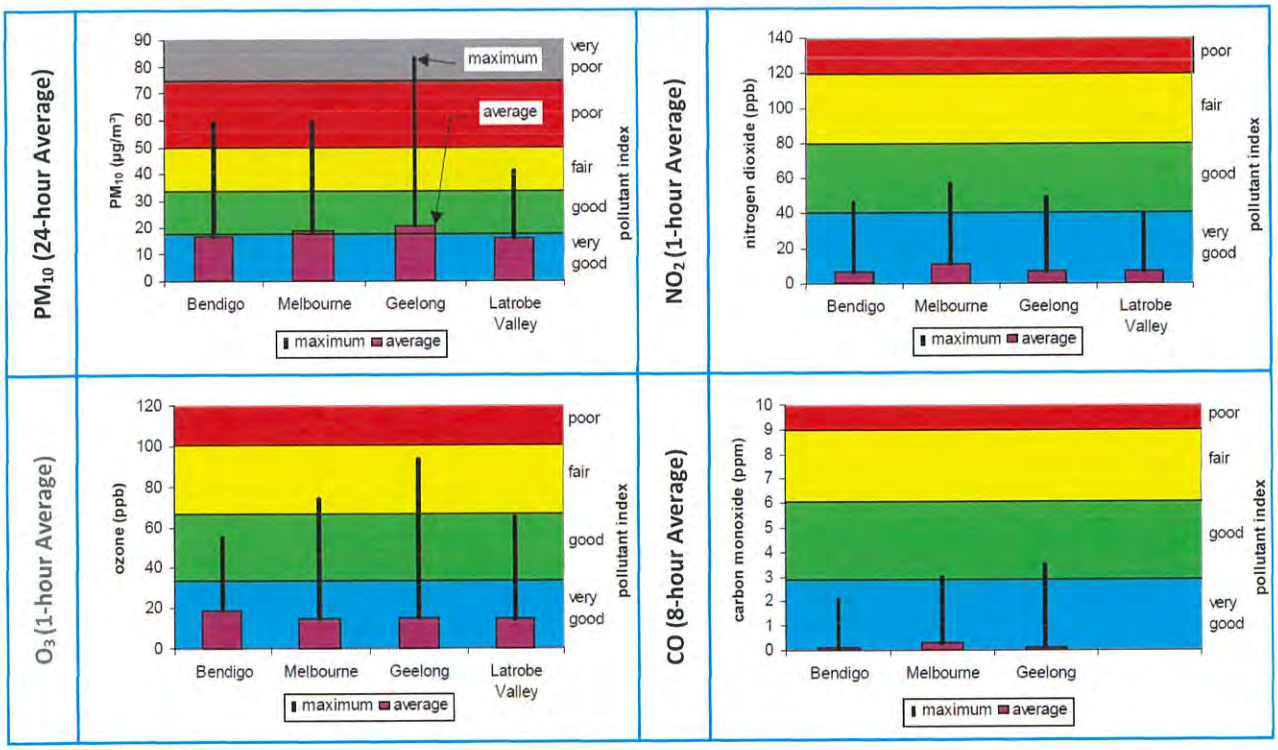
The data recorded at Bendigo was compared to data recorded by similar AQMSs in Melbourne, Geelong and Latrobe Valley over the same time period. A comparison of the monitored pollutant concentrations at Bendigo to the monitoring data from Melbourne, Geelong and the Latrobe Valley is shown in **Figure 11**. The concentrations of common air pollutants in Bendigo were generally lower than in Melbourne and Geelong.

During the 13 months of monitoring at Bendigo in 2004-2005:

- Air quality objectives were met on 92% of days, with the Air Quality Index being 'Good' to 'Very Good' on most days.
- Visibility met the objective in Bendigo (ie no more than three days failing to meet the objective for visibility). Visibility was Good to Very Good on 98% of days. Visibility did not meet the objective (Airborne particle index (API) equal to 2.35) on one day, 12 June 2005 (between 6 and 7 pm). Concentrations of other pollutants were also elevated during that time.

- Good to Very Good particle levels were recorded on 93% of the days in Bendigo. The policy goals for particles were achieved in Bendigo (namely, no more than five days failing to meet the objective). On three days, particles in Bendigo did not meet the 24-hour objective (50 µg/m³) (**Figure 11**). Particle levels above the objective occurred on 20 May 2005 (51 µg/m³) and 28 June 2004 (59 µg/m³) where levels peaked during the evenings on cold days. Wood smoke most likely contributed to these high levels. The maximum particle level in Bendigo was similar to peak levels in Melbourne and higher than peak levels in the Latrobe Valley.
- Maximum carbon monoxide, nitrogen dioxide and ozone levels at Bendigo all met the air quality objectives (**Figure 11**). Air quality for these pollutants was 'Good' to 'Very Good' at all times. As expected, the monitoring indicated that in summer, carbon monoxide and nitrogen dioxide levels were generally lower, due to better dispersion and more efficient operation of catalytic converters in cars. Ozone concentrations were lower in winter due to lower levels of sunlight.
- Average carbon monoxide levels in Bendigo were lower than levels in Melbourne, and similar to levels in Geelong (**Figure 11**). The maximum carbon monoxide level was lower than peak levels in both Melbourne and Geelong. The maximum and average nitrogen dioxide levels in Bendigo were similar to levels in Geelong and the Latrobe Valley, and lower than levels in Melbourne. Bendigo's maximum ozone level was lower than peak levels in Melbourne and Geelong. The average ozone levels in the four regions were similar. These results are consistent with the lower population and vehicle traffic in Bendigo.

Figure 11 Comparison of Monitored Data at Bendigo, Melbourne, Geelong and Latrobe Valley Mobile AQMS



Source: (EPAV, 2006)

5.1.2 Ambient Air Quality Monitoring Data – Geelong South

While the mobile monitoring performed in Bendigo in 2004-2005 gives an indication of what the expected air quality may be like, the lack of current data means that there are no data to show if, or how, the ambient air quality has changed in the last 13 years.

The comparison of ambient air quality monitoring data shown in **Figure 11**, suggests that ambient air quality data from Geelong provides an indication of likely ambient air quality in Bendigo. While the Geelong South AQMS is located approximately 160 km south of the Facility, the station is located in a more urbanised area. It is recognised that Geelong South is impacted by a local dust source, which may give higher averages and maximums etc. For example, high levels of localised dust have been attributed to an unsealed carpark and high levels of vehicle movement associated with the Geelong races. It is therefore considered that the air pollutant concentrations currently measured at Geelong South would be a conservative representation of ambient air quality in Bendigo, and hence, the Facility.

Table 7 and **Table 8** present a summary of the available 24-hour average PM_{10} and $PM_{2.5}$ concentrations recorded at Geelong South AQMS over the period 2013 to 2017, including the 70th percentile 24-hour measurements. The PEM notes that for PM_{10} and $PM_{2.5}$ assessments, a screening assessment of cumulative impacts may be performed using the 70th percentile of 12 months of background data to determine the potential for the relevant assessment criteria to be exceeded. Due to the lack of background monitoring data for the Facility, and given that data from Geelong South is expected to overestimate background concentrations at the Facility, the 70th percentile of the 24-hour measurements from Geelong South have been used for the assessment of cumulative PM_{10} and $PM_{2.5}$ impacts.

The annual average PM_{10} concentrations recorded at Geelong South were used to assess cumulative annual average concentrations at each sensitive receptor location.

For $PM_{2.5}$, only two years of data was provided by the EPA, with incomplete data provided for both 2016 and 2017 (**Table 8**). Therefore, the average of the whole data set was used to assess cumulative annual average concentrations at each sensitive receptor location.

Table 7 24-Hour PM_{10} Concentrations – January 2013 to December 2017

Year	24-hour Average PM_{10} (µg/m^3)			Number of Valid Measurements	Monitoring Location
	Average	70th Percentile	Maximum		
2013	18.6	22.0	108	8648	Geelong
2014	19.3	21.7	76	8603	Geelong
2015	18.8	19.5	299	8458	Geelong
2016	17.2	19.2	69	8175	Geelong
2017	17.3	20.0	74	7228	Geelong

Note * Negative concentrations were removed from the raw 1-hour average dataset received from EPA Victoria. This will result in more conservative 24-hour average, annual average and 70th percentile concentrations

Table 8 24-Hour $PM_{2.5}$ Concentrations – August 2016 to December 2017

Year	24-hour Average $PM_{2.5}$ ($\mu g/m^3$)			Number of Valid Measurements	Monitoring Location
	Average	70th Percentile	Maximum		
2016	6.5	7.6	14.0	2751	Geelong
2017	7.4	8.3	28.6	6922	Geelong
2016-2017	7.1	8.0	28.6	9674	Geelong

Note * Negative concentrations were removed from the raw 1-hour average dataset received from EPA Victoria. This will result in more conservative 24-hour average, annual average and 70th percentile concentrations

5.2 Complaints

The Facility has supplied complaints data from January 2017 – November 2018 and these are listed in **Table 9**. This complaints profile indicates that the residences surrounding the Facility are not routinely subjected to significant nuisance dust.

The residence to the north of the landfill would potentially be impacted by dust from the landfill during southerly winds, however under these conditions, dust emissions from the landfill would be in addition to any emissions from the neighbouring All Stone Quarries (ASQ) Garden & Landscaping business. It's unclear how a residence to the southwest of the landfill would be impacted by dust emissions from the landfill under southeasterly winds, however, it's possible the resident reported dust leaving the site which was not necessarily impacting the residence. The third complaint highlights the importance of dust management procedures and the need for redundancies during upset conditions (ie extremely busy days, staff constraints, only one water truck available).

Table 9 Complaints History (2017- November 2018)

Date	Location of Complainant	Complainant's Suspected Source of Dust	Landfill Site Comments
2/03/2017	North of the landfill	Dust is coming from the direction of the landfill.	EPA received a pollution report. The reporter said dust is coming into shed and home residence and is unable to have windows and doors open. They believe the dust is coming from the Eaglehawk Landfill.
28/02/2018	Southwest of the landfill	Dust believed to be from the landfill's active face.	Wind direction from the southeast, dust was observed arising from the ASQ site where 2 x loaders were operational. Video footage of the dust was taken. Water truck was applied to the active face as a precautionary measure.
14/10/2018	Southwest of the landfill	Dust was arising from the cell and blowing towards complainant's house	Site is currently down to one water truck which was operating but use was limited due to staff constraints and site was extremely busy. Complainant was advised that we would monitor the dust and try and get some extra water over the site to limit the production of the dust.

5.3 Current Ambient Air Quality in Bendigo

The ambient air quality data recorded at the Geelong South AQMS in 2017 is considered to be a conservative representation of ambient air quality in Bendigo. The maximum CO and NO_2 levels at Geelong South all met the air quality objectives in 2017, and this is likely to be the case in Bendigo.

With the number and frequency of fire events and planned burns increasing due to a changing climate, it is likely that PM_{10} and $PM_{2.5}$ concentrations will likewise have increased in Bendigo compared with 2004-2005 concentrations. However, Bendigo wouldn't be impacted by the same local dust sources as Geelong South, such as the two sources identified as contributing to the two exceedances of the PM_{10} criteria recorded in 2017 (unsealed car park and traffic due to Geelong races). Domestic wood heaters may still be a predominant source of $PM_{2.5}$ concentrations in Bendigo, depending on the uptake of alternative sources of heating in the years since 2004-2005.

Fire events and planned burns are considered to be exceptional events in relation to compliance with the air quality objectives, and hence it's likely that PM_{10} and $PM_{2.5}$ concentrations met the air quality objectives in Bendigo in recent years.

In addition, the low frequency of complaints within the vicinity of the Facility indicates that the ambient air quality is not being adversely affected by a significant number of routine or upset conditions from the Facility or surrounding facilities.

Dust deposition monitoring data is not available for the Facility or surrounding area. The modelling results have therefore been compared to the incremental guideline of 2 g/m^2/month, expressed as an annual average.

A summary of the background PM_{10} and $PM_{2.5}$ data used in this assessment is provided in **Table 10**.

Table 10 Background Concentrations Assumed in this Assessment

Pollutant	Averaging Period	Year	Background Concentration Assumed (µg/m^3)	Comment
PM_{10}	Annual average	2013	18.6	Yearly variable (**Table 7**)
		2014	19.3	
		2015	18.8	
		2016	17.2	
		2017	17.3	
	24-hour average	2013	22.0	Yearly variable 70th percentile (**Table 7**)
		2014	21.7	
		2015	19.5	
		2016	19.2	
		2017	20.0	
$PM_{2.5}$	Annual average	2016 - 2017	7.1	9,674 hours of data
	24-hour average	2016 - 2017	8.0	70th percentile

6 Assessment Methodology

6.1 Meteorological Modelling

To adequately characterise the dispersion meteorology of the Facility, information is needed on the prevailing wind regime, atmospheric stability, mixing depth and other meteorological parameters. With no on-site meteorological data or representative meteorological stations near the Facility, the meteorology of the study area was characterised based on site representative datasets generated through prognostic meteorological modelling in accordance with EPA Victoria's Publication 1550 (EPAV, 2013).

6.1.1 TAPM

The Air Pollution Model (TAPM), a prognostic model developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), was used to generate the meteorological data required for modelling. TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses), which are subsequently used in the model input to generate site-specific hourly meteorological observations.

Prognostic modelling using TAPM was undertaken for a five-year period (1 January 2013 to 31 December 2017 inclusive) adopting the setup prescribed by EPA Victoria Publication 1550 (EPAV, 2013). A five-year dataset was compiled to provide sufficient data to understand the inter-annual variation in the off-site impacts predicted by the dispersion modelling. **Table 11** details the parameters used in the TAPM modelling.

Table 11 Meteorological Parameters used for the AQIA

TAPM (v 4.0.4)	
Number of grids (spacing)	4 (10 km, 3 km, 1 km and 0.3 km)
Number of grid points	41 x 41 x 25
Year of analysis	1 January 2013 to 31 December 2017
Centre of analysis	252948 m E, 5931140 m S
Observational data assimilation station (radius of influence)	None

6.1.1.1 TAPM Validation

The distribution of wind speeds and directions predicted by TAPM can be 'validated' against a local observed source of meteorology, if available. The nearest Bureau of Meteorology Station, Bendigo Airport, is located 7.5 km east of the Facility. The TAPM wind solution extracted at this location was compared with actual data from this station.

Table 12 TAPM Validation Parameters

Parameter	Bendigo Airport
BOM Station No.	81123
Period	1 January 2015 – 31 December 2015
BOM Station dataset valid hour count (of possible 8760)	8719 (>99%)
Location of meteorological station	261297 m E, 5930692 m S
Location of extracted profile for validation against observations	260948 m E, 5931140 m S

Annual wind roses of the observed data for Bendigo Airport BOM and the predicted data from the TAPM simulated meteorological file for the year 2015 are presented in **Figure 12**. The general features of the BOM wind rose are well represented in the TAPM solution, with some prevalence of winds from the south-southeast, noting a slight shift in some of these winds to the south east.

Figure 12 Wind Roses of Bendigo Airport BOM and TAPM Solution (2015)

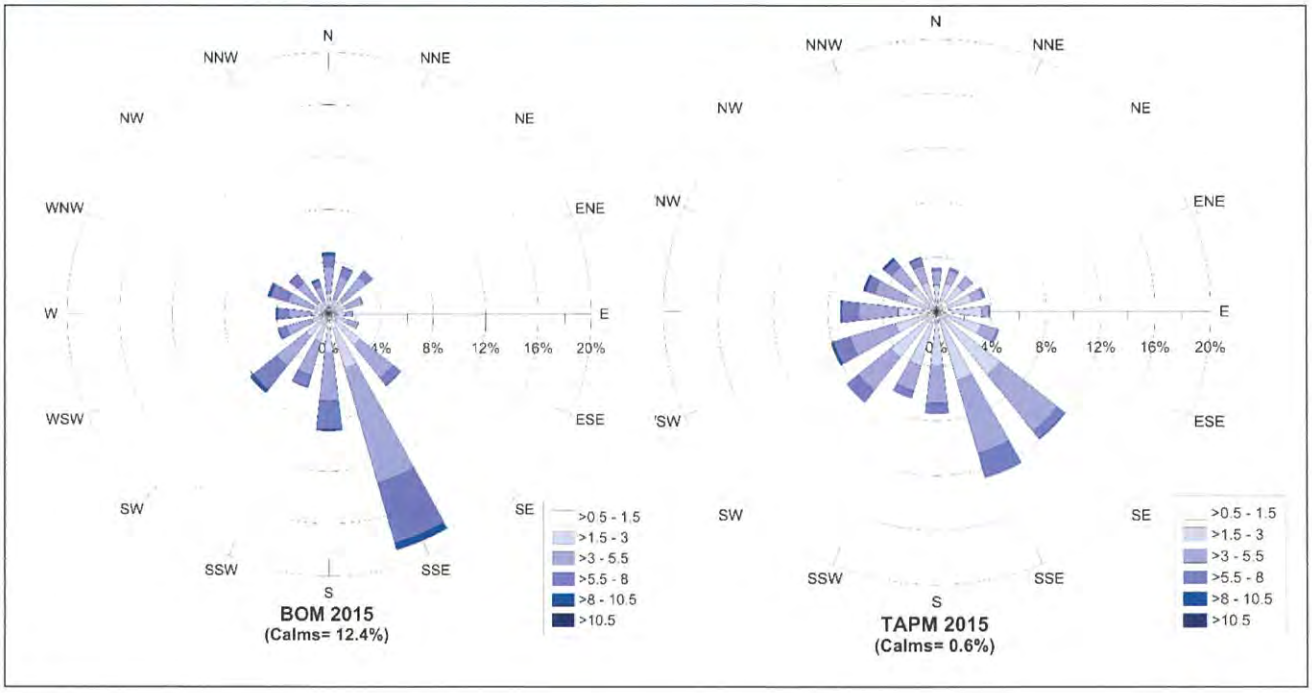


Table 13 provides a summary of the model performance statistics, while **Figure 13** and **Figure 14** present the observed and modelled wind speed and wind direction frequencies, respectively. The TAPM predictions generally under-predict the wind speeds and could therefore be considered conservative for modelling purposes (less dispersion will be predicted during lower wind speeds). Overall, TAPM is concluded to be adequately representing the observed wind speeds and wind directions recorded by the Bendigo Airport BOM station.

Table 13 Model Performance Statistics

Parameter	Statistic	Observed	Predicted
Wind Speed	Mean	3.6	3.3
	Standard deviation	2.2	1.7
	Index of agreement[1]	0.84	
Wind Direction	Mean[2]	170	188
	Standard deviation	95.7	87.1
	Index of agreement[1]	0.68	

1. The index of agreement (IOA) is a measure of the overall agreement between modelled and observed time series. It ranges between zero for no agreement and 1 if the two timeseries are identical. The IOA shows no agreement if the timeseries are different by orders of magnitude, even if they happen to be correlated, and hence is a more stringent measure of performance than the correlation coefficient. IOAs of 0.7 - 0.8 are considered to indicate good dispersion model performance.

2 Scalar mean.

Figure 13 Wind Speed Frequency Comparison

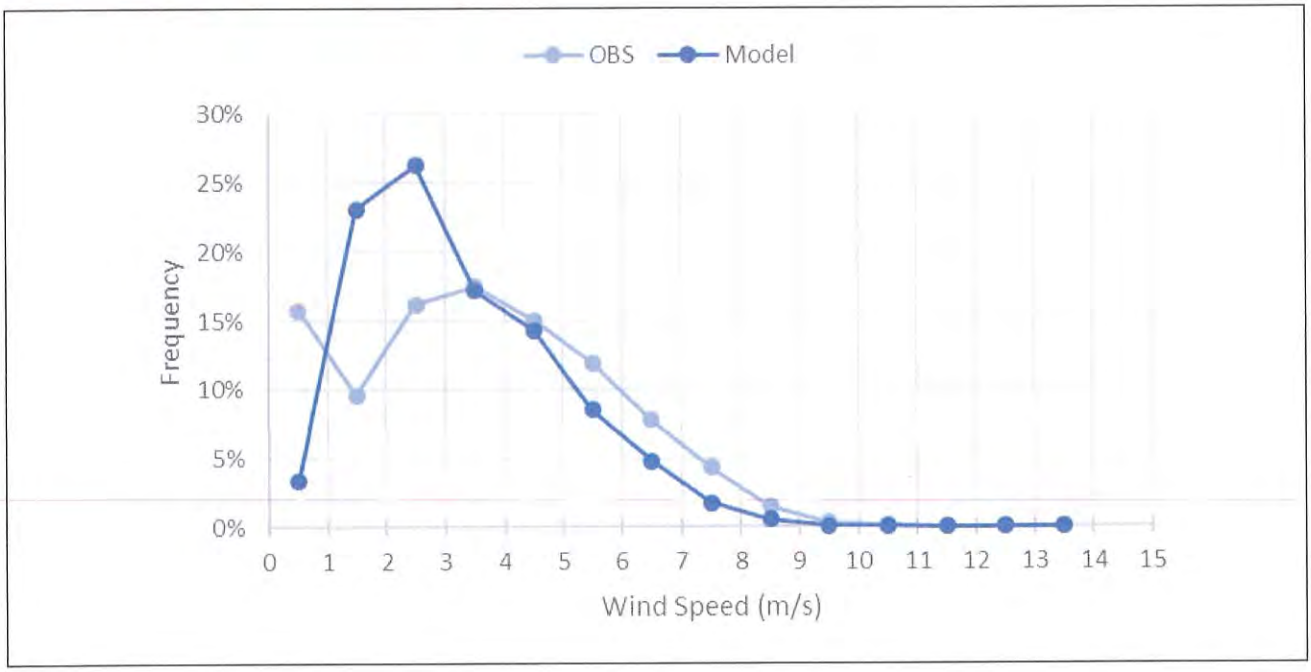
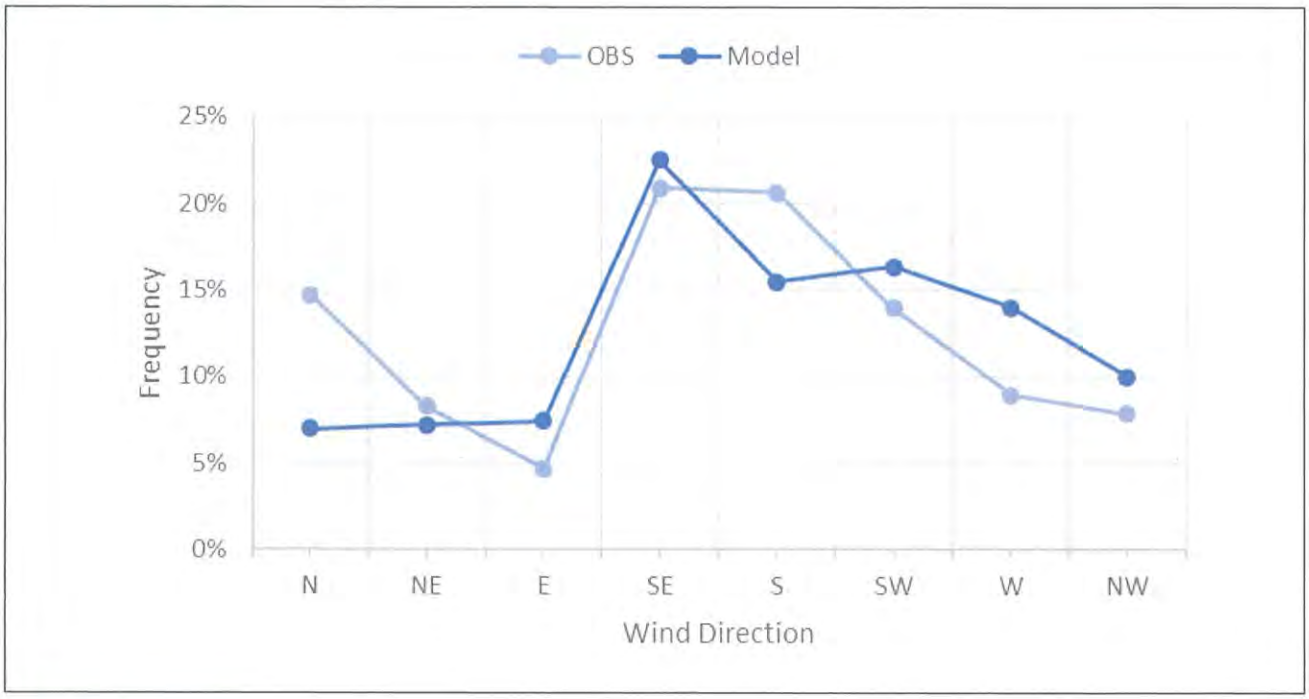


Figure 14 Wind Direction Frequency Comparison



6.1.2 AERMET

TAPM output extracted at the Facility from the innermost grid (0.3 km), together with surface parameters (Bowen Ratio, Surface Roughness and Albedo) and scalar parameters were used in accordance with EPA Victoria's Publication 1550 (EPAV, 2013). AERMET (v16016) was used to generate AERMOD-ready surface (.SFC) and profile (.PFL) data files for the five-year period. The default adjusted U* (surface friction) option was used.

6.1.3 AERMOD

Off-site suspended particulate concentrations and dust deposition rates due to fugitive particulate emissions from the Facility were determined through atmospheric dispersion modelling using the latest version of EPA Victoria's regulatory model AERMOD v18081. AERMOD is a steady-state plume model. Special features of AERMOD include its ability to treat the vertical non-homogeneity of the planetary boundary layer, special treatment of surface releases, an ability to include irregularly-shaped area sources, inclusion of a three-plume model for the convective boundary layer and limitation of vertical mixing in the stable boundary layer.

AERMOD was configured in accordance with the requirements of EPA Victoria Publication 1551 (EPAV, 2013). A 3.0 km x 3.0 km modelling domain was used, centred on the Facility. A uniform Cartesian grid with 30 m grid spacing was used to provide a sufficiently fine computational resolution to calculate near field impacts. Additionally, concentrations were predicted at the various discrete receptor locations listed in **Table 1**.

The AERMOD model incorporated terrain information with heights being applied to all receptors and sources. In order to account for the potential influence on pollution dispersion and varying receptor elevations across the modelling domain, a topography file with 20 m terrain data was obtained from VicMap and was included in the modelling process (**Figure 2**).

Simulations using site-representative meteorological data and variable emissions were undertaken for a 5-year period between 1 January 2013 and 31 December 2017.

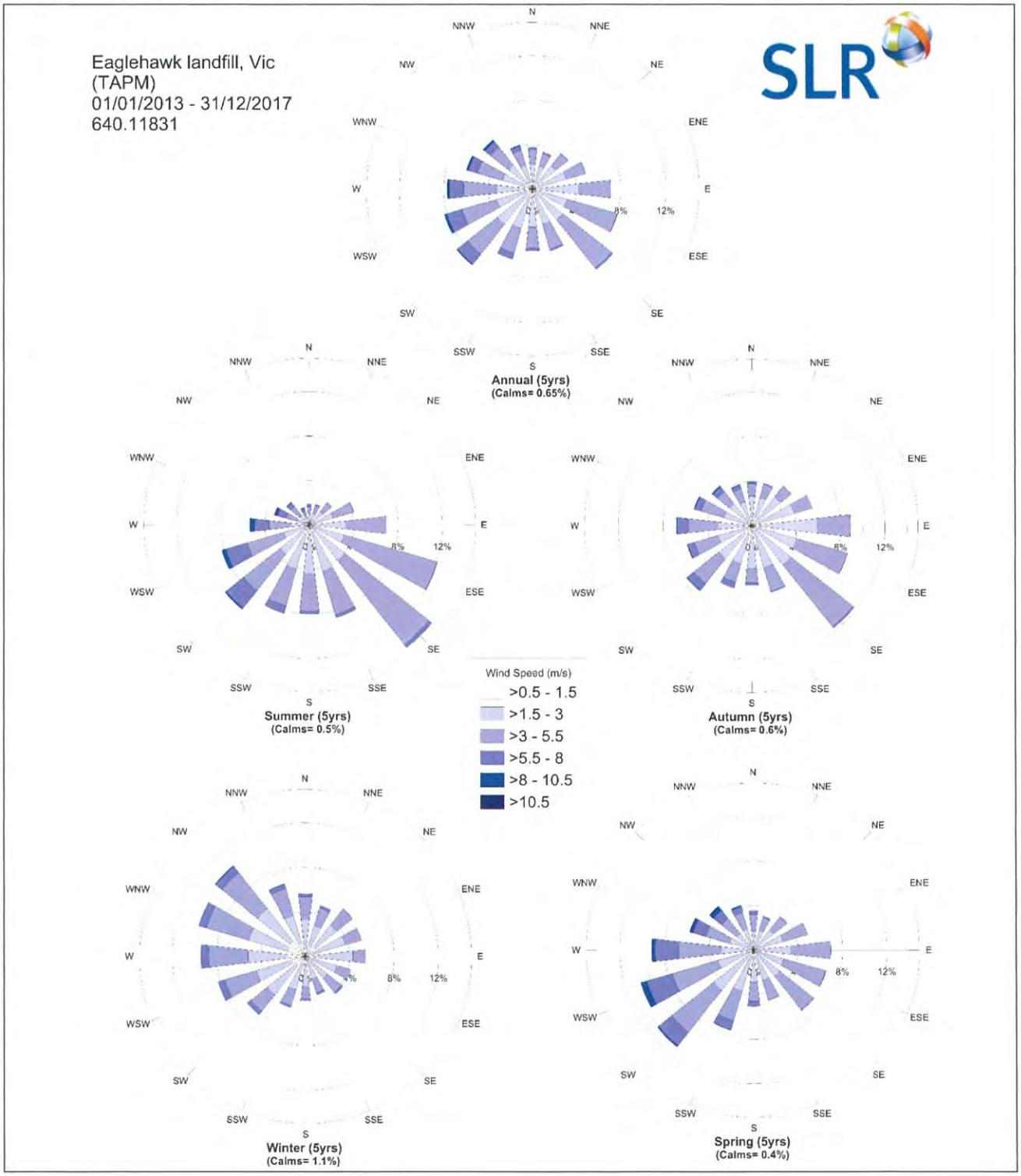
6.2 Meteorological Data Used in the Modelling Study

6.2.1 Wind Regime

Wind is the primary driver that carries air pollutants away from a source towards a receptor. A seasonal summary of the site-representative wind behaviour predicted using TAPM for the five year period of 2013-2017 (based on hourly-varying data) is presented as wind roses in **Figure 15**. These wind roses display occurrences of winds from all quadrants and indicate that the model predicts a high frequency of winds towards nearby sensitive receptors to the northeast, east and southeast of the site, increasing the likelihood of impacts at these receptors.

As illustrated in **Figure 15**, winds are predominately light to moderate (between 1.5 metres per second (m/s) and 5.5 m/s) throughout the year, with predominant winds from the east to southeast quadrant during summer and autumn, northwest to westerly quadrants in winter and west to southwest quadrant in spring. Calm wind conditions (wind speed less than 0.5 m/s) were predicted to occur 0.65% of the time throughout the 2013-2017 time period. The annual variation in wind behaviour at the Facility was predicted to be minimal, as presented in **Appendix A**.

Figure 15 Annual Wind Roses for the Facility – 2013-2017



6.2.2 Rainfall

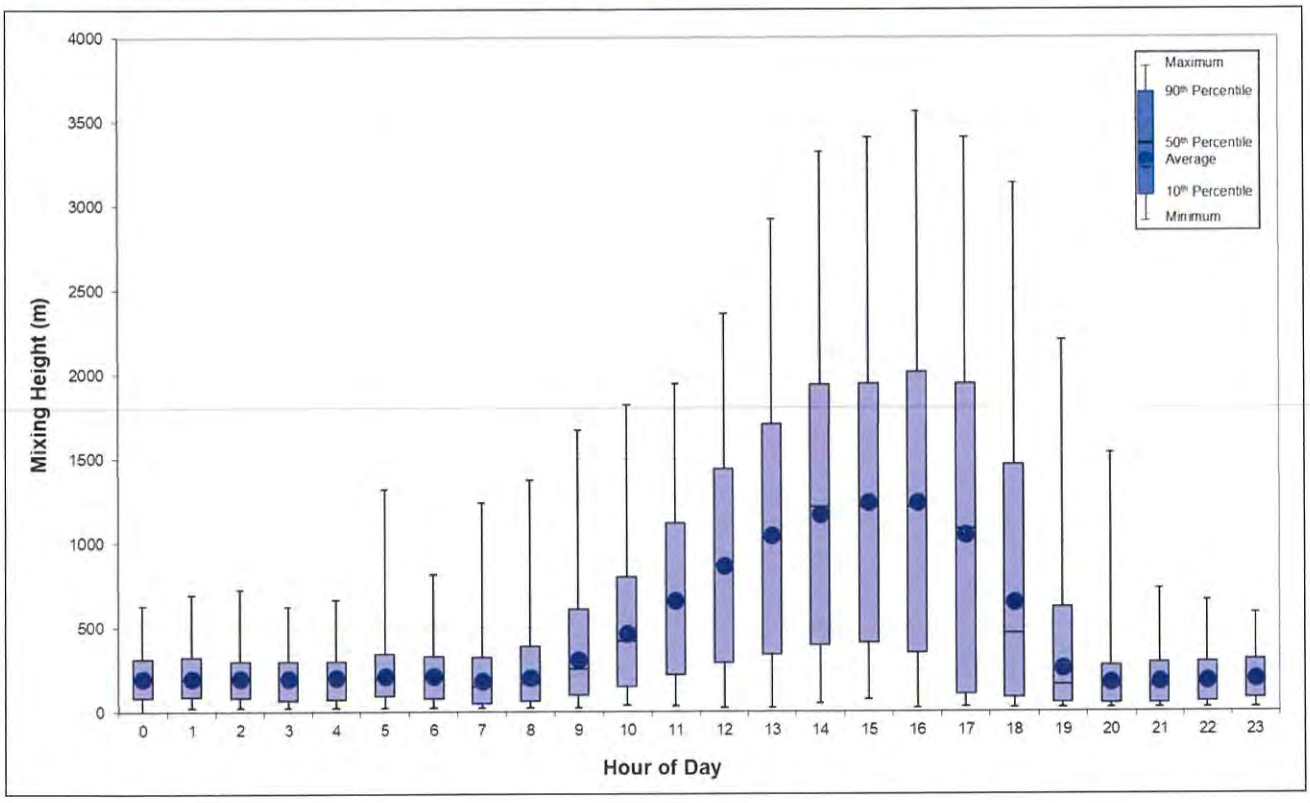
Precipitation reduces the potential for fugitive dust emissions and can be an effective removal mechanism of particulate matter from the air. Rainfall reported at Bendigo Airport AWS (**Section 2.3.2**) suggests the area is subject to moderate rainfall throughout the year ranging between 29.4 mm/month and 52 mm/month.

In order to provide a conservative estimate of the ambient particulate matter concentrations occurring due to the operations at the Facility, removal of particles from the air by rainfall (wet deposition) was excluded from the dispersion modelling simulations.

6.2.3 Mixing Height

An example of diurnal variations in maximum and average mixing depths predicted by TAPM at the Facility during 2013-2017 are illustrated in **Figure 16**. An increase in the mixing depth during the morning is apparent, arising due to the onset of vertical mixing following sunrise. The maximum average mixing heights occur in the early to mid-afternoon, then begin to decrease due to the dissipation of ground-based temperature inversions and the growth of the convective mixing layer. The annual variation in mixing depths predicted by TAPM at the project site is presented in **Appendix A**.

Figure 16 Example TAPM Predicted Diurnal Variation in Mixing Height for the Facility



6.3 Accuracy of Modelling

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

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

- **Oversimplification of physics:** This can lead to both under-prediction and over-prediction of ground level pollutant concentrations. Errors are greater in Gaussian plume models as they do not include the effects of non-steady-state meteorology (i.e., spatially- and temporally-varying meteorology).
- **Errors in emission rates:** Ground level concentrations are proportional to the pollutant emission rate. In addition, most modelling studies assume constant worst case emission levels or are based on the results of a small number of stack tests, however operations (and thus emissions) are often quite variable. Accurate measurement of emission rates and source parameters requires continuous monitoring.
- **Errors in wind direction and wind speed**: Wind direction affects the direction of plume travel, while wind speed affects plume rise and dilution of plume. Errors in these parameters can result in errors in the predicted distance from the source of the plume impact, and magnitude of that impact. In addition, aloft wind directions commonly differ from surface wind directions. The preference to use rugged meteorological instruments to reduce maintenance requirements also means that light winds are often not well characterised.
- **Errors in mixing height:** If the plume elevation reaches 80% or more of the mixing height, more interaction will occur, and it becomes increasingly important to properly characterise the depth of the mixed layer as well as the strength of the upper air inversion.
- **Errors in temperature:** Ambient temperature affects plume buoyancy, so inaccuracies in the temperature data can result in potential errors in the predicted distance from the source of the plume impact, and magnitude of that impact.
- **Errors in stability estimates:** Gaussian plume models use estimates of stability class, and 3D models use explicit vertical profiles of temperature and wind (which are used directly or indirectly to estimate stability class for Gaussian models). In either case, errors in these parameters can cause either under-prediction or over-prediction of ground level concentrations. For example, if an error is made of one stability class, then the computed concentrations can be off by 50% or more.

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

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

This AQIA utilises the AERMOD dispersion model, incorporating meteorological output from TAPM. The meteorological dataset has been compiled using observations from a nearby automatic weather station for a five-year period.

7 Sources and Emissions Estimation

The dust emission sources modelled for the existing and proposed operations, as they have been represented in the AERMOD model, are presented in **Figure 17** and **Figure 18**, respectively.

Figure 17 Location of Existing Operations Modelled Emission Sources



Figure 18 Location of Proposed Operations Modelled Emission Sources



Fugitive emissions of total suspended particulate (TSP), PM_{10} and $PM_{2.5}$ were estimated using published emission factors from the National Pollutant Inventory (NPI) Emission Estimation Technique Manual "*NPI Emission Estimation Technique Manual for Mining*" V 3.1, Jan 2012 (DSEWPC, 2012), as appropriate. A summary of the emission factors used is provided in **Table 14**.

Table 14 NPI Emission Factor Summary

Site Operation/Activity	NPI Emission Operation/Activity	Units	TSP[1]	PM_{10}[1]	$PM_{2.5}$[2]
Hauling (light vehicles)	Wheel generated dust from unpaved roads (used by light vehicles)	kg/VKT	0.94	0.33	0.033
Hauling (trucks)	Wheel generated dust from unpaved roads at industrial sites	kg/VKT	4.23	1.25	0.125
Compactor	Bulldozer on material other than coal[3]	kg/hr	17	4.1	0.02
Mulching	Bulldozer on material other than coal[3]	kg/hr	17	4.1	0.02
Exposed surfaces	Wind erosion	kg/ha/hr	0.4	0.2	0.02

1. Default emission factor.
2. In the absence of $PM_{2.5}$ emission factors, a value equal to 10% of the PM_{10} emission factor was used
3. In the absence of emission factors for the site operation/activity, TSP and PM_{10} emission factors representing a bulldozer have been used. This is considered very conservative. A less conservative $PM_{2.5}$ emission rate was estimated.

The activity data used in the calculations are summarised in **Table 15** and **Table 16**. Further details on assumptions used in estimating the fugitive particulate emissions are noted below.

- Haulage distances (total vehicle kilometres travelled (VKT)) on internal paved and unpaved roads were estimated based on the length of each haul route and number of trips per day.
- A 50% control factor was applied to the wind erosion and unpaved haul road estimates based on an assumption that a minimum of Level 1 watering would be maintained during dry, windy conditions (2 L/m^2/hour).
- In the modelling, the base wind erosion emission rate provided in **Table 14** was varied hourly based on a cubic relationship with the wind speed for that hour to accurately simulate the increased dust generation at higher wind speeds. That is, for each hour, *h, the hourly emission rate, E* is

$$E(h) = E_{base} * u(h)^3 / \overline{u^3}$$

where E_{base} is base emission rate, u is the hourly wind speed. Note that although increased wind speed generates increased wind erosion emission rates, it also promotes increased plume dispersion. This offsetting effect generally leads to reduced ground level concentrations. The TAPM sourced wind regime used for this study indicates that overall wind speeds are underpredicted and therefore can be considered conservative.

The resulting emission inventories used in the dispersion modelling study are summarised in **Table 17** and **Table 18.**

Table 15 Existing Operations Dust Emission Estimation – Activity Data

Source/Activity	Value	Units	Source/Basis
Incoming			
Hauling to car face	21,749	VKT/annum	3,480 t moved/annum, 0.08 t payload, 43,498 vehicle movements/annum, 0.5 km/return trip.
Hauling green waste - domestic	2,369	VKT/annum	2,369 t moved/annum, 0.08 t payload, 29,611 vehicle movements/annum, 0.08 km/return trip.
Hauling green waste - commercial	900	VKT/annum	11,248 t moved/annum, 10 t payload, 1,125 vehicle movements/annum, 0.8 km/return trip.
Hauling rubble	400	VKT/annum	6,668 t moved/annum, 10 t payload, 667 vehicle movements/annum, 0.6 km/return trip.
Hauling to landfill	15,829	VKT/annum	87,941 t moved/annum, 10 t payload, 8,794 vehicle movements/annum, 1.8 km/return trip.
Hauling to Patho transfer station	783	VKT/annum	15,656 t moved/annum, 10 t payload, 1,566 vehicle movements/annum, 0.5 km/return trip.
Hauling from car face to landfill	1,183	VKT/annum	3,480 t moved/annum, assumed 5 t payload, 696 vehicle movements/annum, 1.7 km/return trip.
Hauling domestic green waste to stockpile	426	VKT/annum	2,369 t moved/annum, assumed 5 t payload, 474 vehicle movements/annum, 0.9 km/return trip.
Outgoing			
Hauling offsite -Patho	548	VKT/annum	15,656 t moved/annum, 1,095 vehicle movements/annum, 0.5 km/return trip.
Hauling offsite -Stanhope	365	VKT/annum	9,373 t moved/annum, 730 vehicle movements/annum, 0.5 km/return trip.
Other			
Compactor on active cell	3,285	hrs/annum	9 hours/day, 365 days/annum
Wind erosion - active face	0.5	ha	
Wind erosion - processing area	0.2	ha	
Dust Mitigation Measures			
Watering on unpaved haul roads	50% control		Level 1 watering (< 2 L/m^2/hour)
Watering during compaction on active cell	75% control		Dust is likely negligible due high moisture of waste/soil
Watering on all wind erosion sources	50% control		Level 1 watering (< 2 L/m^2/hour)
Watering of green waste prior to mulching	50% control		Level 1 watering (< 2 L/m^2/hour)
Upset Conditions			
Hauling offsite -Mulch	1,672	VKT/annum	13,617 t moved/annum, 2,090 vehicle movements/annum, 0.8 km/return trip.
Mulching	2,920	hrs/annum	8 hours/day, 365 days/annum

Table 16 Proposed Operations Dust Emission Estimation – Activity Data

Source/Activity	Value	Units	Source/Basis
Incoming			
Hauling to car face	7,938	VKT/annum	6,350 t moved/annum, 0.08 t payload, 79,376 vehicle movements/annum, 0.1 km/return trip.
Hauling green waste - domestic	4,323	VKT/annum	4,323 t moved/annum, 0.08 t payload, 54,036 vehicle movements/annum, 0.08 km/return trip.
Hauling green waste - commercial	3,079	VKT/annum	20,527 t moved/annum, 10 t payload, 2,053 vehicle movements/annum, 1.5 km/return trip.
Hauling rubble	730	VKT/annum	12,169 t moved/annum, 10 t payload, 1,217 vehicle movements/annum, 0.6 km/return trip.
Hauling to landfill	21,752	VKT/annum	120,845 t moved/annum, 10 t payload, 12,085 vehicle movements/annum, 1.8 km/return trip.
Hauling to Patho transfer station	2,555	VKT/annum	51,100 t moved/annum, 10 t payload, 5,110 vehicle movements/annum, 0.5 km/return trip.
Hauling from car face to landfill	694	VKT/annum	6,350 t moved/annum, 365 vehicle movements/annum (minimum 1 trip/day), 1.9 km/return trip.
Hauling domestic green waste to stockpile	548	VKT/annum	4,323 t moved/annum, 365 vehicle movements/annum (minimum 1 trip/day), 1.5 km/return trip.
Outgoing			
Hauling offsite -Patho	511	VKT/annum	51,100 t moved/annum, 1,332 vehicle movements/annum, 0.5 km/return trip.
Hauling offsite -Stanhope	666	VKT/annum	17,104 t moved/annum, 1,022 vehicle movements/annum, 0.5 km/return trip.
Other			
Compactor on active cell	3,285	hrs/annum	9 hours/day, 365 days/annum
Wind erosion - active face	0.5	ha	
Wind erosion - processing area	0.2	ha	
Dust Mitigation Measures			
Watering on unpaved haul roads	50% control		Level 1 watering (< 2 L/m^2/hour)
Watering during compaction on active cell	75% control		Dust is likely negligible due high moisture of waste/soil
Watering on all wind erosion sources	50% control		Level 1 watering (< 2 L/m^2/hour)
Watering of green waste prior to mulching	50% control		Level 1 watering (< 2 L/m^2/hour)
Upset Conditions			
Hauling offsite -Mulch	5,722	VKT/annum	24,849 t moved/annum, 3,815 vehicle movements/annum, 1.5 km/return trip.
Mulching	2,920	hrs/annum	8 hours/day, 365 days/annum

Table 17 Dust Emission Inventory – Existing Operations Normal & Upset Conditions

Activity[2,3]	Emission Factor				Peak Emission Rate (kg/annum)		
	TSP	PM_{10}	$PM_{2.5}$	Unit	TSP	PM_{10}	$PM_{2.5}$
Incoming							
Hauling to car face[1]	0.94	0.33	0.033	kg/VKT	10,222	3,589	359
Hauling green waste - domestic[1]	0.94	0.33	0.033	kg/VKT	1,113	391	39
Hauling green waste - commercial[1]	4.23	1.25	0.125	kg/VKT	1,903	562	56
Hauling rubble[1]	4.23	1.25	0.125	kg/VKT	846	250	25
Hauling to landfill[1]	4.23	1.25	0.125	kg/VKT	33,479	9,893	989
Hauling to Patho transfer station[1]	4.23	1.25	0.125	kg/VKT	1,656	489	49
Hauling from car face to landfill[1]	4.23	1.25	0.125	kg/VKT	2,502	739	74
Hauling domestic green waste to stockpile[1]	4.23	1.25	0.125	kg/VKT	902	267	27
Outgoing							
Hauling offsite -Patho[1]	4.23	1.25	0.125	kg/VKT	1,158	342	34
Hauling offsite -Stanhope[1]	4.23	1.25	0.125	kg/VKT	772	228	23
Other							
Compactor - active cell[1]	17	4.1	0.02	kg/hr	13,961	3,367	16
Wind erosion (base rate) - active cell[1,5]	0.4	0.2	0.02	kg/ha/hr	790	395	39
Wind erosion (base rate) - processing area[1,5]	0.4	0.2	0.02	kg/ha/hr	350	175	18
Normal Conditions Total					**69,655**	**20,688**	**1,749**
Upset Conditions[4]							
Hauling offsite -Mulch[1]	4.23	1.25	0.125	kg/VKT	3,537	1,045	105
Mulching[1]	17	4.1	0.02	kg/hr	24,820	5,986	599
Upset Conditions Total					**98,012**	**27,719**	**2,452**

1. Emission factors sourced from "*NPI Emission Estimation Technique Manual for Mining*" V 3.1, Jan 2012 (DSEWPC, 2012).
2. Dust emissions from paved road assumed to be negligible.
3. Dust emissions from loading and unloading assumed to be negligible.
4. No emission factor for mulching is publicly available. Based on our experience, emissions from mulching were assumed to be similar to that of a bulldozer. This is likely to be significantly overestimated as the typical fine particulate (PM_{10} and $PM_{2.5}$) emissions are negligible for woodworks (shaving, sawing, milling etc), however it has been adopted to represent a worst case scenario.
5. Base emission rate is subject to hourly cubic wind speed relationship when input into the model.

Table 18 Dust Emission Inventory – Proposed Operations Normal & Upset Conditions

Activity[2,3]	NPI Emission Factor				Peak Emission Rate (kg/annum)		
	TSP	PM_{10}	$PM_{2.5}$	Unit	TSP	PM_{10}	$PM_{2.5}$
Incoming							
Hauling to car face[1]	0.94	0.33	0.033	kg/VKT	3,731	1,310	131
Hauling green waste - domestic[1]	0.94	0.33	0.033	kg/VKT	2,032	713	71
Hauling green waste - commercial[1]	4.23	1.25	0.125	kg/VKT	6,512	1,924	192
Hauling rubble[1]	4.23	1.25	0.125	kg/VKT	1,544	456	46
Hauling to landfill[1]	4.23	1.25	0.125	kg/VKT	46,006	13,595	1,360
Hauling to Patho transfer station[1]	4.23	1.25	0.125	kg/VKT	5,404	1,597	160
Hauling from car face to landfill[1]	4.23	1.25	0.125	kg/VKT	1,467	433	43
Hauling domestic green waste to stockpile[1]	4.23	1.25	0.125	kg/VKT	1,158	342	34
Outgoing							
Hauling offsite -Patho[1]	4.23	1.25	0.125	kg/VKT	1,081	319	32
Hauling offsite -Stanhope[1]	4.23	1.25	0.125	kg/VKT	1,409	416	42
Other							
Compactor - active cell[1]	17	4.1	0.02	kg/hr	13,961	3,367	16
Wind erosion (base rate) - active cell[1,5]	0.4	0.2	0.02	kg/ha/hr	790	395	39
Wind erosion (base rate) - processing area[1,5]	0.4	0.2	0.02	kg/ha/hr	350	175	18
				Normal Conditions Total	**85,444**	**25,044**	**2,184**
Upset Conditions[4]							
Hauling offsite -Mulch[1]	4.23	1.25	0.125	kg/VKT	12,102	3,576	358
Mulching[1]	17	4.1	0.02	kg/hr	24,820	5,986	29
				Upset Conditions Total	**121,270**	**34,300**	**2,540**

1. Emission factors sourced from "*NPI Emission Estimation Technique Manual for Mining*" V 3.1, Jan 2012 (DSEWPC, 2012).
2. Dust emissions from paved road assumed to be negligible.
3. Dust emissions from loading and unloading assumed to be negligible.
4. No emission factor for mulching is publicly available. Based on our experience, emissions from mulching were assumed to be similar to that of a bulldozer. This is likely to be significantly overestimated as the typical fine particulate (PM_{10} and $PM_{2.5}$) emissions are negligible for woodworks (shaving, sawing, milling etc), however it has been adopted to represent a worst-case scenario.
5. Base emission rate is subject to hourly cubic wind speed relationship when input into the model.

8 Assessment of Impacts

Model results are expressed as the maximum predicted concentration for each averaging period at the selected assessment locations over the 2013-2017 modelling periods. The Facility operating under normal conditions for both the existing and proposed operations will be assessed based on compliance with the PEM Criteria (refer to **Section 4.2**). For additional information, exceedances of the SEPP AAQ criteria (refer to **Section 4.2**) have also been presented in this DIA. However, it is noted that the SEPP AAQ criteria relate to ambient air quality at performance monitoring stations and are not to be applied to modelling predictions from one facility. This is because the SEPP AAQ criteria are not designed to be impact criteria, as they don't allow for conservatism in emission estimations and background air quality, or uncertainty in the modelling predictions.

For the assessment of upset conditions for both existing and proposed operations, reference is made to compliance at sensitive receptors. Receptors 5, 6 and 7 are located well inside the separation distance of 500 m from the site boundary (which has been used as a proxy for the distance from the active or closed cells of the landfill). Compliance with the PEM criteria at these receptors, when modelling upset conditions, implies the 500 m separation distance requirement conservatively protects human health (PM_{10}, $PM_{2.5}$) and amenity (dust deposition) for a facility like the project.

Receptors 1 and 9 are just inside and receptors 2, 3, 4 and 8 are just outside the 500 m separation distance requirement. Compliance with the PEM criteria at these receptors, when modelling upset conditions, would be expected. However, if the concentrations of pollutants are not compliant with the PEM criteria at this distance it would imply that the existing separation distance does not adequately protect human health or amenity of the local residence.

8.1 Deposited Dust

The maximum monthly incremental dust deposition rates predicted at surrounding sensitive receptors are presented in **Table 19**. The dust deposition rate predictions are shown as incremental impacts only and are compared to the incremental criterion of 2 g/m^2/month.

Modelling results presented in **Table 19** show that the incremental dust deposition rates predicted at each surrounding sensitive receptor comply with the relevant ambient air quality criteria outlined in **Section 4.2**. Contour plots showing the incremental dust deposition rates predicted for each scenario and year are presented in **Appendix C**.

Compliance with the PEM criterion for dust deposition at all the sensitive receptors, when modelling upset conditions, implies the 500 m separation distance requirement adequately protects the amenity of residents from nuisance dust. Given compliance with the PEM criterion at receptor 6, which is located approximately 65 m from the site boundary, the 500 m separation distance requirement may be reduced in relation to nuisance dust.

Table 19 Predicted Dust Deposition Rates

Receptor ID	Maximum Monthly Incremental Dust Deposition Rates (g/m²/month)			
	Current – Normal	Current – Upset	Proposed – Normal	Proposed – Upset
2013				
R1	0.08	0.1	0.1	0.2
R2	0.04	0.05	0.05	0.08
R3	0.07	0.1	0.10	0.1
R4	0.09	0.1	0.1	0.1
R5	0.4	0.7	0.4	0.6
R6	0.6	0.9	0.6	0.8
R7	0.6	0.7	0.7	0.8
R8	0.1	0.2	0.2	0.2
R9	0.2	0.3	0.2	0.3
2014				
R1	0.1	0.1	0.1	0.2
R2	0.04	0.06	0.06	0.09
R3	0.06	0.08	0.08	0.1
R4	0.1	0.1	0.1	0.2
R5	0.5	0.7	0.5	0.6
R6	0.7	1.0	0.6	0.8
R7	0.6	0.7	0.6	0.8
R8	0.1	0.2	0.1	0.2
R9	0.2	0.2	0.2	0.3
2015				
R1	0.1	0.1	0.1	0.2
R2	0.05	0.06	0.06	0.08
R3	0.06	0.08	0.08	0.1
R4	0.1	0.2	0.1	0.1
R5	0.5	0.8	0.5	0.6
R6	0.7	1.1	0.7	0.8
R7	0.6	0.8	0.7	0.8
R8	0.1	0.2	0.1	0.2
R9	0.2	0.2	0.2	0.3
2016				
R1	0.09	0.1	0.1	0.2
R2	0.04	0.06	0.06	0.09
R3	0.05	0.07	0.07	0.1
R4	0.08	0.1	0.1	0.1
R5	0.4	0.6	0.4	0.5
R6	0.6	0.9	0.6	0.7
R7	0.6	0.7	0.6	0.7
R8	0.2	0.2	0.2	0.3
R9	0.2	0.3	0.3	0.4
2017				
R1	0.09	0.1	0.1	0.2
R2	0.04	0.06	0.05	0.09
R3	0.08	0.1	0.1	0.1
R4	0.07	0.1	0.08	0.1
R5	0.4	0.6	0.4	0.5
R6	0.5	0.8	0.5	0.7
R7	0.6	0.8	0.7	0.7
R8	0.1	0.2	0.2	0.3
R9	0.2	0.2	0.2	0.4
PEM Criterion	2.0		2.0	

8.2 PM_{10}

The incremental and cumulative annual average and 24-hour average PM_{10} concentrations predicted at surrounding sensitive receptors are presented in **Table 20** and **Table 21**. Background PM_{10} data recorded at Geelong South have been used to calculate the cumulative impacts (refer **Section 5.1.2**). Contour plots showing the incremental 24-hour and annual average PM_{10} concentrations predicted for each scenario and each year are presented in **Appendix C**. These plots show the maximum downwind PM_{10} concentrations predicted in the area surrounding the Facility due to emissions from the operations, exclusive of local background PM_{10} concentrations.

As shown in **Table 21**, based on the emissions calculated in **Section 7**, no exceedances of the 24-hour average PM_{10} PEM criterion are predicted to be experienced at the identified receptors for the current and proposed operations during normal or upset conditions.

Compliance with the PEM criterion of predictions of the maximum 24-hour average PM_{10} concentrations at all the sensitive receptors, when modelling upset conditions, implies the 500 m separation distance requirement may be reduced in relation to the impacts of PM_{10}. The highest maximum 24-hour average PM_{10} concentrations occur at receptor 7. This receptor is not the closest receptor to the landfill but is located to the northeast of the Facility.

Table 20 Predicted Annual Average PM_{10} Concentrations

Receptor ID	Background Concentration Assumed[1] ($\mu g/m^3$)	Annual Average PM_{10} Concentrations ($\mu g/m^3$)							
		Incremental				Cumulative[1]			
		Existing – Normal	Existing – Upset	Proposed – Normal	Proposed – Upset	Existing – Normal	Existing – Upset	Proposed – Normal	Proposed – Upset
2013									
R1	18.6	0.3	0.4	0.4	0.7	18.9	19.0	19.0	19.3
R2	18.6	0.2	0.2	0.2	0.3	18.8	18.8	18.8	18.9
R3	18.6	0.2	0.3	0.3	0.4	18.8	18.9	18.9	19.0
R4	18.6	0.3	0.4	0.3	0.4	18.9	19.0	18.9	19.0
R5	18.6	1.0	1.6	1.0	1.3	19.6	20.2	19.6	19.9
R6	18.6	1.6	2.3	1.5	1.8	20.2	20.9	20.1	20.4
R7	18.6	1.3	1.7	1.5	1.8	19.9	20.3	20.1	20.4
R8	18.6	0.4	0.5	0.4	0.5	19.0	19.1	19.0	19.1
R9	18.6	0.5	0.6	0.6	0.8	19.1	19.2	19.2	19.4
2014									
R1	19.3	0.3	0.4	0.4	0.7	19.6	19.7	19.7	20.
R2	19.3	0.2	0.2	0.2	0.3	19.5	19.5	19.5	19.6
R3	19.3	0.2	0.3	0.3	0.4	19.5	19.6	19.6	19.7
R4	19.3	0.2	0.4	0.3	0.4	19.5	19.7	19.6	19.7
R5	19.3	1.1	1.7	1.1	1.4	20.4	21.0	20.4	20.7
R6	19.3	1.7	2.5	1.6	2.0	21.0	21.8	20.9	21.3
R7	19.3	1.4	1.7	1.6	1.9	20.7	21.0	20.9	21.2
R8	19.3	0.3	0.4	0.4	0.5	19.6	19.7	19.7	19.8
R9	19.3	0.4	0.6	0.5	0.7	19.7	19.9	19.8	20.0
2015									
R1	18.8	0.3	0.4	0.4	0.6	19.1	19.2	19.2	19.4
R2	18.8	0.2	0.2	0.2	0.3	19.0	19.0	19.0	19.1
R3	18.8	0.2	0.3	0.3	0.4	19.0	19.1	19.1	19.2
R4	18.8	0.3	0.4	0.4	0.5	19.1	19.2	19.2	19.3
R5	18.8	1.3	2.0	1.3	1.6	20.1	20.8	20.1	20.4
R6	18.8	2.0	2.9	1.9	2.3	20.	21.7	20.7	21.1
R7	18.8	1.6	2.0	1.8	2.1	20.4	20.8	20.	20.9
R8	18.8	0.4	0.5	0.4	0.6	19.2	19.3	19.2	19.4
R9	18.8	0.5	0.7	0.6	0.8	19.3	19.5	19.4	19.6
2016									
R1	17.2	0.3	0.3	0.4	0.6	17.5	17.5	17.6	17.8
R2	17.2	0.1	0.2	0.2	0.3	17.3	17.4	17.4	17.5
R3	17.2	0.2	0.2	0.2	0.3	17.4	17.4	17.4	17.5
R4	17.2	0.2	0.3	0.3	0.3	17.4	17.5	17.5	17.5
R5	17.2	0.9	1.4	0.9	1.2	18.1	18.6	18.1	18.4
R6	17.2	1.4	2.1	1.4	1.7	18.6	19.3	18.6	18.9
R7	17.2	1.4	1.7	1.5	1.8	18.6	18.9	18.7	19.0
R8	17.2	0.4	0.5	0.5	0.6	17.6	17.7	17.7	17.8
R9	17.2	0.5	0.7	0.6	0.9	17.7	17.9	17.8	18.1
2017									
R1	17.3	0.3	0.4	0.4	0.7	17.6	17.7	17.7	18.0
R2	17.3	0.2	0.2	0.2	0.3	17.5	17.5	17.5	17.6
R3	17.3	0.3	0.3	0.3	0.5	17.6	17.6	17.6	17.8
R4	17.3	0.2	0.3	0.3	0.3	17.5	17.6	17.6	17.6
R5	17.3	1.1	1.6	1.1	1.3	18.4	18.9	18.4	18.6
R6	17.3	1.6	2.3	1.5	1.9	18.9	19.6	18.8	19.2
R7	17.3	1.9	2.3	2.1	2.5	19.2	19.6	19.4	19.8
R8	17.3	0.4	0.6	0.5	0.6	17.7	17.9	17.8	17.9
R9	17.3	0.5	0.7	0.6	0.9	17.8	18.0	17.9	18.2

1 Includes yearly varying background annual average PM_{10} (see **Section 5.1.2**).

Table 21 Predicted Maximum 24-Hour Average PM_{10} Concentrations

Receptor ID	Background Concentration Assumed[1] ($\mu g/m^3$)	Maximum 24-Hour Average PM_{10} Concentrations ($\mu g/m^3$)							
		Incremental				Cumulative[1]			
		Current – Normal	Current – Upset	Proposed – Normal	Proposed – Upset	Current – Normal	Current – Upset	Proposed – Normal	Proposed – Upset
2013									
R1	22.0	6.1	7.3	8.2	11.7	28.1	29.3	30.2	33.7
R2	22.0	4.5	5.5	5.6	7.0	26.5	27.5	27.6	29.0
R3	22.0	4.9	6.3	6.2	8.7	26.9	28.3	28.2	30.7
R4	22.0	3.9	4.6	4.6	5.7	25.9	26.6	26.6	27.7
R5	22.0	7.7	16.3	7.9	9.3	29.7	38.3	29.9	31.3
R6	22.0	12.9	16.4	11.0	12.7	34.9	38.4	33.0	34.7
R7	22.0	25.6	33.6	25.2	28.9	47.6	55.6	47.2	50.9
R8	22.0	8.1	16.6	7.0	8.4	30.1	38.6	29.0	30.4
R9	22.0	7.5	8.5	9.2	10.9	29.5	30.5	31.2	32.9
2014									
R1	21.7	5.6	7.5	7.3	11.9	27.3	29.2	29.0	33.6
R2	21.7	4.7	6.6	6.5	11.3	26.4	28.3	28.2	33.0
R3	21.7	4.0	4.9	5.4	8.2	25.7	26.6	27.1	29.9
R4	21.7	3.8	7.2	3.4	4.1	25.5	28.9	25.1	25.8
R5	21.7	11.0	15.9	9.1	12.3	32.7	37.6	30.8	34.0
R6	21.7	14.0	27.9	14.5	17.6	35.7	49.6	36.2	39.3
R7	21.7	18.0	23.2	18.6	21.8	39.7	44.9	40.3	43.5
R8	21.7	5.2	6.0	5.1	6.3	26.9	27.7	26.8	28.0
R9	21.7	5.6	7.2	5.6	8.0	27.3	28.9	27.3	29.7
2015									
R1	19.5	3.1	3.7	4.2	6.2	22.6	23.2	23.7	25.7
R2	19.5	2.1	2.8	2.6	4.0	21.6	22.3	22.1	23.5
R3	19.5	4.1	5.5	5.3	7.9	23.6	25.0	24.8	27.4
R4	19.5	4.2	6.3	5.3	6.3	23.7	25.8	24.8	25.8
R5	19.5	12.5	18.4	11.2	13.6	32.0	37.9	30.7	33.1
R6	19.5	15.9	21.5	14.1	17.2	35.4	41.0	33.6	36.7
R7	19.5	16.5	21.4	18.6	23.5	36.0	40.9	38.1	43.0
R8	19.5	14.8	17.4	13.7	15.7	34.3	36.9	33.2	35.2
R9	19.5	9.7	21.2	11.0	16.7	29.2	40.7	30.5	36.2
2016									
R1	19.2	4.1	5.5	5.4	8.8	23.3	24.7	24.6	28.0
R2	19.2	3.0	3.8	3.7	5.6	22.2	23.0	22.9	24.8
R3	19.2	3.8	4.4	5.4	8.8	23.0	23.6	24.6	28.0
R4	19.2	2.1	3.4	2.9	4.7	21.3	22.6	22.1	23.9
R5	19.2	7.8	9.6	7.3	12.9	27.0	28.8	26.5	32.1
R6	19.2	10.1	17.2	9.3	16.1	29.3	36.4	28.5	35.3
R7	19.2	13.1	17.1	14.8	19.8	32.3	36.3	34.0	39.0
R8	19.2	5.6	6.5	7.0	10.8	24.8	25.7	26.2	30.0
R9	19.2	17.7	20.0	15.5	18.6	36.9	39.2	34.7	37.8
2017									
R1	20.0	4.5	6.2	6.1	10.0	24.5	26.2	26.1	30.0
R2	20.0	3.5	4.9	4.4	6.6	23.5	24.9	24.4	26.6
R3	20.0	4.0	5.6	5.1	7.9	24.0	25.6	25.1	27.9
R4	20.0	3.4	6.1	3.3	5.0	23.4	26.1	23.3	25.0
R5	20.0	12.6	15.2	12.4	13.8	32.6	35.2	32.4	33.8
R6	20.0	14.7	20.9	13.1	18.7	34.7	40.9	33.1	38.7
R7	20.0	28.0	33.8	32.9	39.3	48.0	53.8	52.9	59.3
R8	20.0	7.2	11.0	9.1	14.3	27.2	31.0	29.1	34.3
R9	20.0	10.0	13.2	9.9	12.3	30.0	33.2	29.9	32.3
PEM Criterion	-	-				60.0			

1 Includes yearly varying 70th percentile background PM_{10} concentrations based on data from Geelong South (see **Section 5.1.2**)

8.3 $PM_{2.5}$

The cumulative annual average and maximum 24-hour average $PM_{2.5}$ concentrations predicted at surrounding sensitive receptors are presented in **Table 22** and **Table 23**. Background $PM_{2.5}$ data recorded at Geelong South from 2016-2017 have been provided to enable an assessment of potential cumulative impacts (refer to **Section 5.1.2**).

Contour plots showing the incremental maximum 24-hour and annual average $PM_{2.5}$ concentrations predicted for each scenario and each year are presented in **Appendix C**. These plots show the maximum downwind $PM_{2.5}$ concentrations predicted in the area surrounding the Facility due to emissions from the operations, exclusive of local background $PM_{2.5}$ concentrations.

As shown in **Table 23**, no exceedances of the 24-hour average $PM_{2.5}$ PEM criterion are predicted to be experienced at the identified receptors for the current and proposed operations during normal or upset conditions.

Compliance with the PEM criterion of the maximum 24-hour average $PM_{2.5}$ concentrations at all the sensitive receptors, when modelling upset conditions, implies the 500 m separation distance requirement may be reduced in relation to the impacts of $PM_{2.5}$.

Table 22 Predicted Annual Average $PM_{2.5}$ Concentrations

Receptor ID	Background Concentration Assumed ($\mu g/m^3$)	Annual Average $PM_{2.5}$ Concentrations ($\mu g/m^3$)							
		Incremental				Cumulative[1]			
		Existing – Normal	Existing – Upset	Proposed – Normal	Proposed – Upset	Existing – Normal	Existing – Upset	Proposed – Normal	Proposed – Upset
2013									
R1	7.1	0.02	0.03	0.03	0.04	7.1	7.1	7.1	7.1
R2	7.1	0.01	0.02	0.02	0.02	7.1	7.1	7.1	7.1
R3	7.1	0.02	0.02	0.02	0.03	7.1	7.1	7.1	7.1
R4	7.1	0.02	0.03	0.03	0.03	7.1	7.1	7.1	7.1
R5	7.1	0.09	0.15	0.09	0.11	7.2	7.3	7.2	7.2
R6	7.1	0.15	0.22	0.14	0.16	7.3	7.3	7.2	7.3
R7	7.1	0.13	0.16	0.15	0.17	7.2	7.3	7.2	7.3
R8	7.1	0.04	0.05	0.04	0.05	7.1	7.2	7.1	7.1
R9	7.1	0.04	0.06	0.05	0.06	7.1	7.2	7.2	7.2
2014									
R1	7.1	0.02	0.03	0.03	0.04	7.1	7.1	7.1	7.1
R2	7.1	0.01	0.02	0.02	0.02	7.1	7.1	7.1	7.1
R3	7.1	0.01	0.02	0.02	0.03	7.1	7.1	7.1	7.1
R4	7.1	0.02	0.03	0.02	0.03	7.1	7.1	7.1	7.1
R5	7.1	0.10	0.16	0.10	0.11	7.2	7.3	7.2	7.2
R6	7.1	0.16	0.24	0.15	0.18	7.3	7.3	7.3	7.3
R7	7.1	0.14	0.17	0.15	0.17	7.2	7.3	7.3	7.3
R8	7.1	0.03	0.04	0.03	0.04	7.1	7.1	7.1	7.1
R9	7.1	0.04	0.05	0.05	0.06	7.1	7.2	7.1	7.2
2015									
R1	7.1	0.02	0.03	0.03	0.04	7.1	7.1	7.1	7.1
R2	7.1	0.01	0.02	0.02	0.02	7.1	7.1	7.1	7.1
R3	7.1	0.02	0.02	0.02	0.03	7.1	7.1	7.1	7.1
R4	7.1	0.02	0.04	0.03	0.03	7.1	7.1	7.1	7.1
R5	7.1	0.11	0.18	0.11	0.13	7.2	7.3	7.2	7.2
R6	7.1	0.19	0.28	0.18	0.20	7.3	7.4	7.3	7.3
R7	7.1	0.15	0.19	0.17	0.20	7.3	7.3	7.3	7.3
R8	7.1	0.03	0.05	0.04	0.05	7.1	7.1	7.1	7.1
R9	7.1	0.04	0.06	0.05	0.06	7.1	7.2	7.2	7.2
2016									
R1	7.1	0.02	0.03	0.03	0.04	7.1	7.1	7.1	7.1
R2	7.1	0.01	0.02	0.02	0.02	7.1	7.1	7.1	7.1
R3	7.1	0.01	0.02	0.02	0.02	7.1	7.1	7.1	7.1
R4	7.1	0.02	0.03	0.02	0.02	7.1	7.1	7.1	7.1
R5	7.1	0.09	0.13	0.08	0.10	7.2	7.2	7.2	7.2
R6	7.1	0.14	0.20	0.13	0.15	7.2	7.3	7.2	7.2
R7	7.1	0.14	0.17	0.15	0.17	7.2	7.3	7.2	7.3
R8	7.1	0.04	0.05	0.04	0.05	7.1	7.1	7.1	7.2
R9	7.1	0.05	0.07	0.06	0.07	7.2	7.2	7.2	7.2
2017									
R1	7.1	0.02	0.03	0.04	0.04	7.1	7.1	7.1	7.1
R2	7.1	0.01	0.02	0.02	0.02	7.1	7.1	7.1	7.1
R3	7.1	0.02	0.03	0.03	0.03	7.1	7.1	7.1	7.1
R4	7.1	0.02	0.03	0.02	0.03	7.1	7.1	7.1	7.1
R5	7.1	0.09	0.14	0.09	0.11	7.2	7.2	7.2	7.2
R6	7.1	0.14	0.22	0.14	0.16	7.2	7.3	7.2	7.3
R7	7.1	0.18	0.22	0.20	0.23	7.3	7.3	7.3	7.3
R8	7.1	0.04	0.06	0.05	0.05	7.1	7.2	7.1	7.2
R9	7.1	0.05	0.07	0.06	0.07	7.1	7.2	7.2	7.2

1 Includes annual average background $PM_{2.5}$ concentrations based on data from Geelong South in 2016-2017 (see **Section 5.1.2**)

Table 23 Predicted Maximum 24-Hour Average $PM_{2.5}$ Concentrations

Receptor ID	Background Concentration Assumed (µg/m³)	Maximum 24-Hour Average $PM_{2.5}$ Concentrations (µg/m³)							
		Incremental				Cumulative[1]			
		Existing– Normal	Existing – Upset	Proposed – Normal	Proposed – Upset	Existing – Normal	Existing – Upset	Proposed – Normal	Proposed – Upset
2013									
R1	8.0	0.5	0.6	0.7	0.8	8.5	8.6	8.7	8.8
R2	8.0	0.4	0.5	0.5	0.6	8.4	8.5	8.5	8.6
R3	8.0	0.3	0.5	0.5	0.6	8.3	8.5	8.5	8.6
R4	8.0	0.3	0.4	0.3	0.3	8.3	8.4	8.3	8.3
R5	8.0	0.8	1.6	0.8	0.9	8.8	9.6	8.8	8.9
R6	8.0	1.3	1.6	1.1	1.3	9.3	9.6	9.1	9.3
R7	8.0	2.3	3.1	2.3	2.6	10.3	11.1	10.3	10.6
R8	8.0	0.8	1.7	0.7	0.8	8.8	9.7	8.7	8.8
R9	8.0	0.7	0.8	0.9	1.0	8.7	8.8	8.9	9.0
2014									
R1	8.0	0.5	0.7	0.7	0.8	8.5	8.7	8.7	8.8
R2	8.0	0.4	0.5	0.5	0.7	8.4	8.5	8.5	8.7
R3	8.0	0.3	0.4	0.4	0.5	8.3	8.4	8.4	8.5
R4	8.0	0.4	0.7	0.3	0.4	8.4	8.7	8.3	8.4
R5	8.0	1.1	1.6	0.9	1.0	9.1	9.6	8.9	9.0
R6	8.0	1.4	2.8	1.4	1.7	9.4	10.8	9.4	9.7
R7	8.0	1.6	2.1	1.6	1.8	9.6	10.1	9.6	9.8
R8	8.0	0.5	0.6	0.5	0.6	8.5	8.6	8.5	8.6
R9	8.0	0.5	0.7	0.5	0.6	8.5	8.7	8.5	8.6
2015									
R1	8.0	0.3	0.3	0.4	0.5	8.3	8.3	8.4	8.5
R2	8.0	0.2	0.3	0.2	0.3	8.2	8.3	8.2	8.3
R3	8.0	0.3	0.4	0.4	0.5	8.3	8.4	8.4	8.5
R4	8.0	0.4	0.6	0.4	0.5	8.4	8.6	8.4	8.5
R5	8.0	1.2	1.8	1.1	1.3	9.2	9.8	9.1	9.3
R6	8.0	1.6	2.1	1.4	1.6	9.6	10.1	9.4	9.6
R7	8.0	1.6	2.0	1.8	2.1	9.6	10.0	9.8	10.1
R8	8.0	1.5	1.7	1.4	1.6	9.5	9.7	9.4	9.6
R9	8.0	0.9	2.1	1.1	1.3	8.9	10.1	9.1	9.3
2016									
R1	8.0	0.4	0.5	0.5	0.6	8.4	8.5	8.5	8.6
R2	8.0	0.3	0.4	0.3	0.4	8.3	8.4	8.3	8.4
R3	8.0	0.3	0.3	0.4	0.5	8.3	8.3	8.4	8.5
R4	8.0	0.2	0.3	0.2	0.3	8.2	8.3	8.2	8.3
R5	8.0	0.8	1.0	0.7	0.8	8.8	9.0	8.7	8.8
R6	8.0	1.0	1.7	0.9	1.0	9.0	9.7	8.9	9.0
R7	8.0	1.3	1.6	1.5	1.7	9.3	9.6	9.5	9.7
R8	8.0	0.5	0.6	0.7	0.8	8.5	8.6	8.7	8.8
R9	8.0	1.7	2.0	1.5	1.8	9.7	10.0	9.5	9.8
2017									
R1	8.0	0.4	0.6	0.6	0.7	8.4	8.6	8.6	8.7
R2	8.0	0.3	0.5	0.4	0.5	8.3	8.5	8.4	8.5
R3	8.0	0.3	0.4	0.4	0.5	8.3	8.4	8.4	8.5
R4	8.0	0.3	0.6	0.3	0.4	8.3	8.6	8.3	8.4
R5	8.0	1.0	1.3	1.0	1.1	9.0	9.3	9.0	9.1
R6	8.0	1.5	2.1	1.2	1.4	9.5	10.1	9.2	9.4
R7	8.0	2.6	3.2	3.1	3.6	10.6	11.2	11.1	11.6
R8	8.0	0.7	1.1	0.9	1.1	8.7	9.1	8.9	9.1
R9	8.0	0.9	1.3	0.9	1.1	8.9	9.3	8.9	9.1
PEM Criterion	-	-				36.0			

1 Includes background 24-hour average $PM_{2.5}$ concentrations from Geelong South (see **Section 5.1.2**).

9 Mitigation and Monitoring

9.1 Mitigation Measures

The results of the modelling indicate that all off-site cumulative annual average and maximum PM_{10} and $PM_{2.5}$ concentrations, and monthly dust deposition rates comply with the relevant guidelines at the nearest sensitive receptors.

Management practices recommended to minimise dust emissions from the Facility include the following:

- Include methods for the management of dust emissions into site inductions, training and daily toolbox meetings; perform daily inspections of visible dust emissions along the site boundary to identify whether dust is travelling off-site and where the main sources of dust are so that action can be taken to mitigate any impacts (i.e. additional watering etc.);
- Site staff should determine the frequency of water cart passes required, based on the following:
  - weather conditions;
  - volume of traffic on exposed or dusty surfaces;
  - extent of stripped area; and
  - extent of unprotected areas;
- Reduce dust production on site by scheduling work into stages to minimise land disturbance in the planning and design stage, including scheduling installation of control measures for dust prevention, while having regard for seasonal dryness;
- Retain as much vegetative screening between the Facility and the nearest sensitive receptors as possible;
- Limit vehicle movements to designated sealed entries and exits, haulage routes and parking areas;
- Use cattle/shaker grids and wheel wash in order to reduce the tracking of mud off-site onto public roads;
- Regularly water access roads to ensure material is not transported onto the roads around the site;
- Keep the areas of land cleared to a minimum, and the period of time areas remain cleared to a minimum;
- Rehabilitate cleared areas promptly;
- Locate stockpiles in areas that are protected from wind where possible and/or away from sensitive receptors; and
- Ensure appropriate use and management of temporary erosion control with fabrics or plastics (short-term only), vegetation or polymers (long term controls).

9.2 Monitoring

The dispersion modelling study performed indicates that, even including conservatism around future waste volumes, emission estimates, and background air quality, negligible off-site impacts are predicted at the nearest sensitive receptors. The annual and maximum 24-hour average PM_{10} and $PM_{2.5}$ concentrations, and monthly dust deposition rates predicted at all receptors comply with the PEM criteria. Comparison to the SEPP AAQ criteria have been provided for interest only, as the SEPP AAQ criteria are not impact criteria.

Given the above, and the very small number of complaints regarding air emissions from the existing Facility operations, no instrument-based air quality monitoring programs are recommended. Regular inspections of visible dust emissions from the Facility should be performed by site personnel to ensure that mitigation measures are being appropriately implemented, and any complaints received regarding air quality issues appropriately addressed and documented.

10 Conclusions

Council require a dust impact assessment to address the requirements of the Environment Protection Act Licence 46490, namely conditions LI_A3 and LI_A3.1 at Eaglehawk Landfill at 191-193 Upper California Gully Road, Eaglehawk, Bendigo. This dust impact assessment (DIA) has been prepared to provide an assessment of potential dust impacts associated with the Facility from current operations and proposed future operations.

The results of the dust modelling study performed for the Facility are summarised below.

- The maximum monthly dust deposition rates predicted at all sensitive receptor locations are below the relevant assessment criteria. No nuisance dust impacts would therefore be expected as a result of dust emissions from the Facility.
- The maximum 24-hour average cumulative PM_{10} concentrations predicted at the nearest sensitive receptors are below the relevant ambient air quality criterion of 60 $\mu g/m^3$ at all receptors for both existing and proposed operations under normal and upset conditions.
- The maximum 24-hour average cumulative $PM_{2.5}$ concentrations predicted at the nearest sensitive receptors are below the relevant ambient air quality criterion of 36 $\mu g/m^3$ at all receptors for both existing and proposed operations under normal and upset conditions.
- Compliance with the PEM criteria at all the sensitive receptors, when modelling upset conditions, implies the 500 m separation distance requirement adequately protects the human health and amenity of local residents. In addition, given compliance with the PEM criterion at locations approximately 65 m from the site boundary, the 500 m separation distance requirement may be reduced in relation to the impacts of nuisance dust, PM_{10} and $PM_{2.5}$.

As noted above, the modelling study has incorporated a number of conservative assumptions and the predicted off-site impacts are anticipated to be –over-predictions of potential worst-case impacts. The results of the modelling indicate that the potential for dust and particulate matter impacts at the nearest sensitive receptors is negligible. However regular communication with neighbouring land owners is still recommended to ensure that dust from the Facility is being managed to acceptable levels.

Given that negligible off-site impacts have been predicted at the nearest sensitive receptors, and as only a very small number of complaints have been made regarding air emissions from the current Facility operations, no instrument-based air quality monitoring programs are recommended. Regular inspections of visible dust emissions from the Facility should be performed by site personnel to ensure that mitigation measures are being appropriately implemented, and any complaints received regarding air quality issues appropriately addressed and documented.

11 References

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APPENDIX A

Meteorological Data

Figure A1 Annual Wind Roses for Project Site – 2013-2017

Eaglehawk Landfill, Vic
(TAPM)
01/01/2013 - 31/12/2017
640.11831

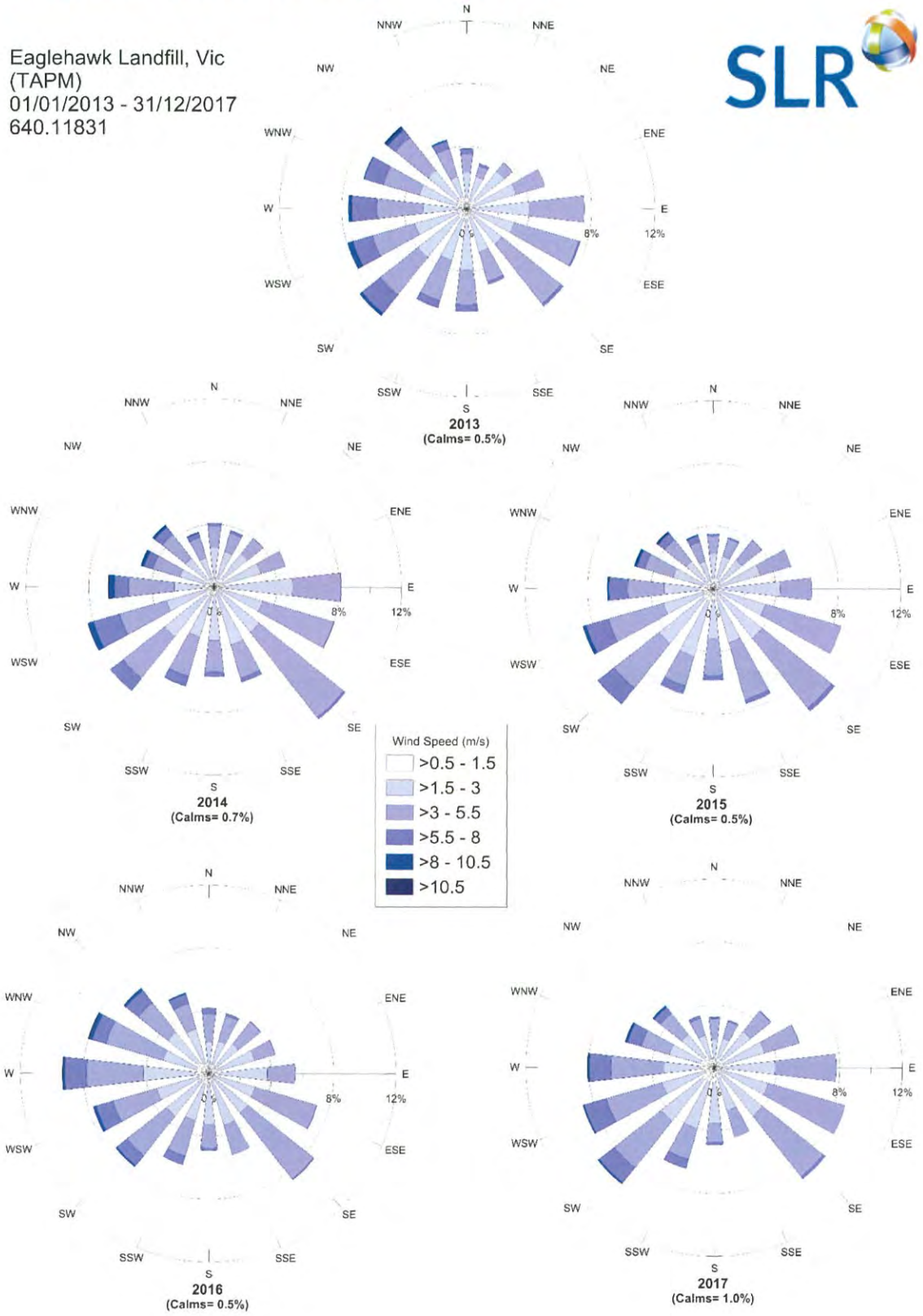


Figure A2 Diurnal Variation in Mixing Depth for the Project Site, 2013

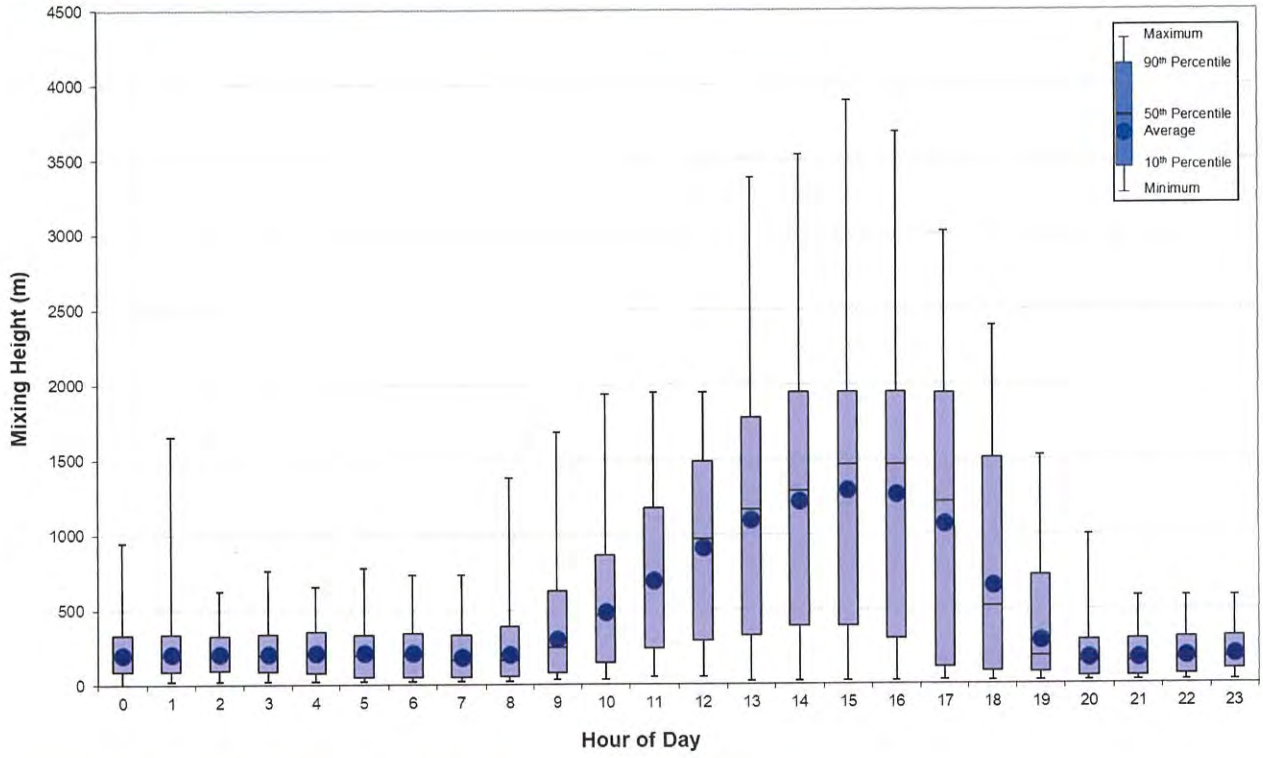


Figure A3 Diurnal Variation in Mixing Depth for the Project Site, 2014

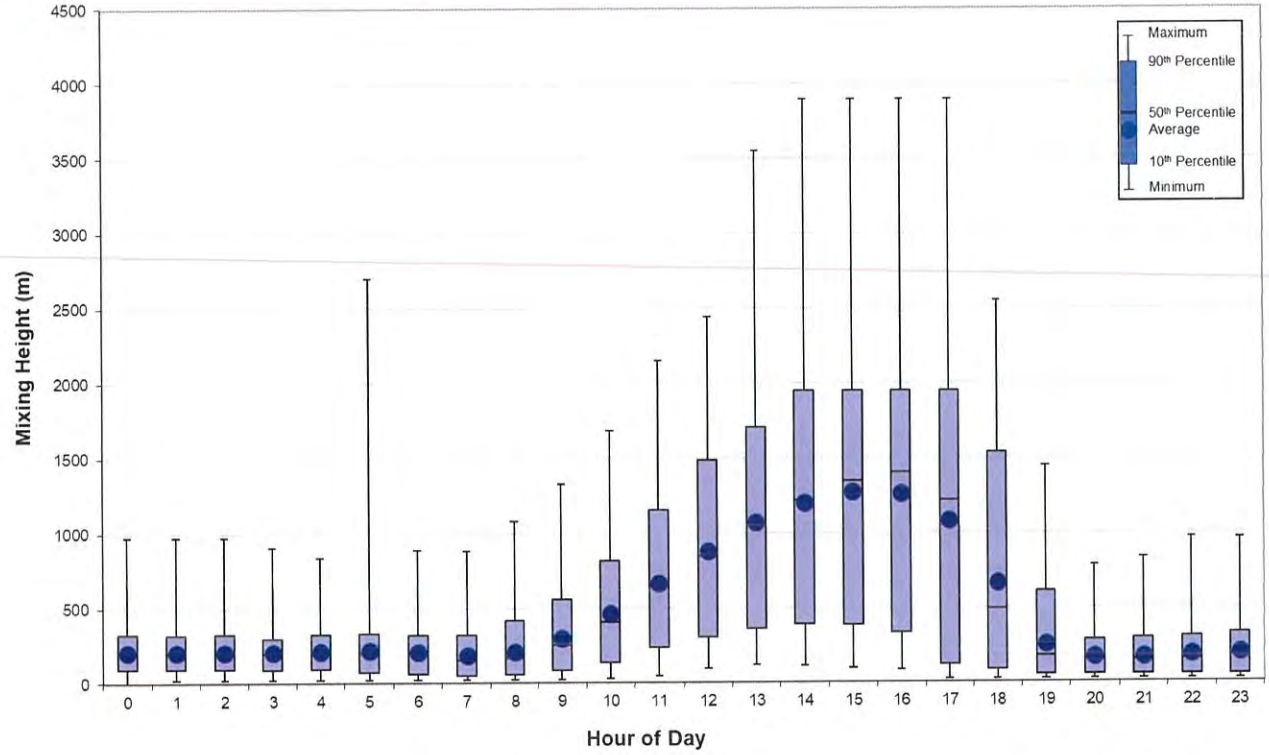


Figure A4 Diurnal Variation in Mixing Depth for the Project Site, 2015

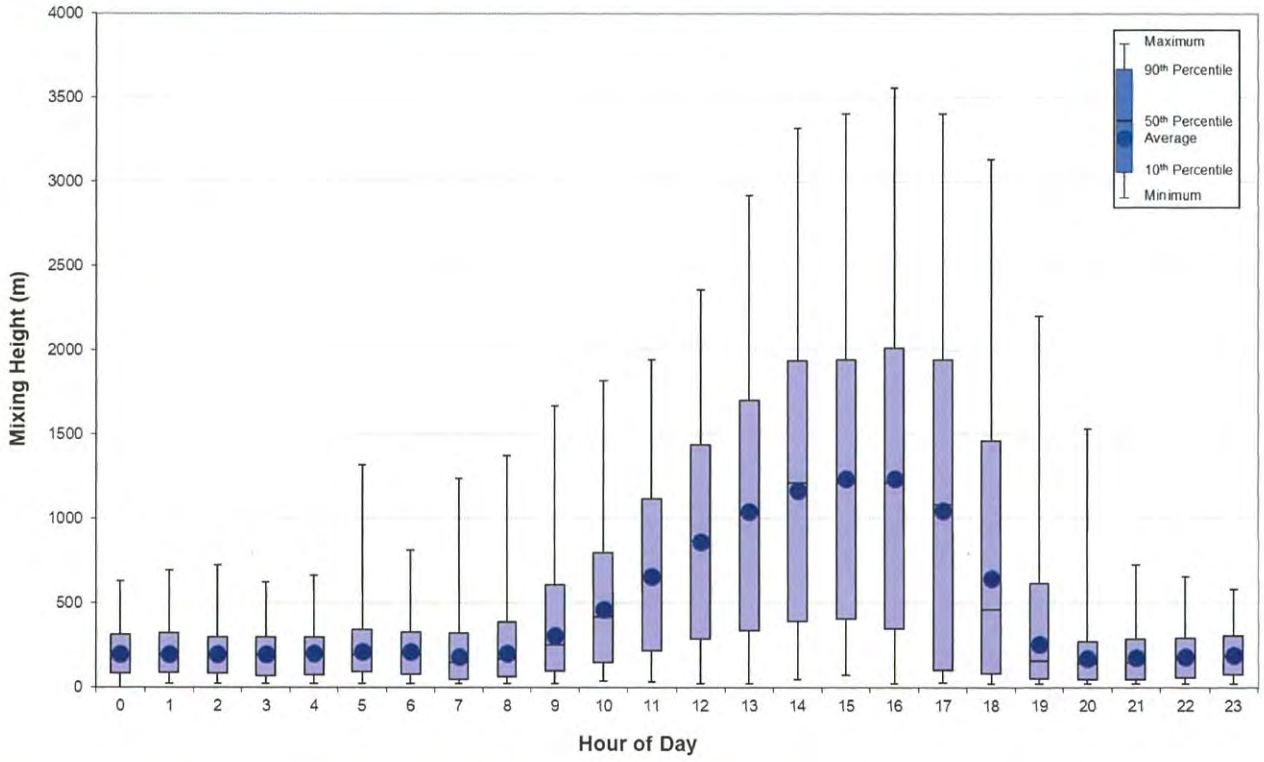


Figure A5 Diurnal Variation in Mixing Depth for the Project Site, 2016

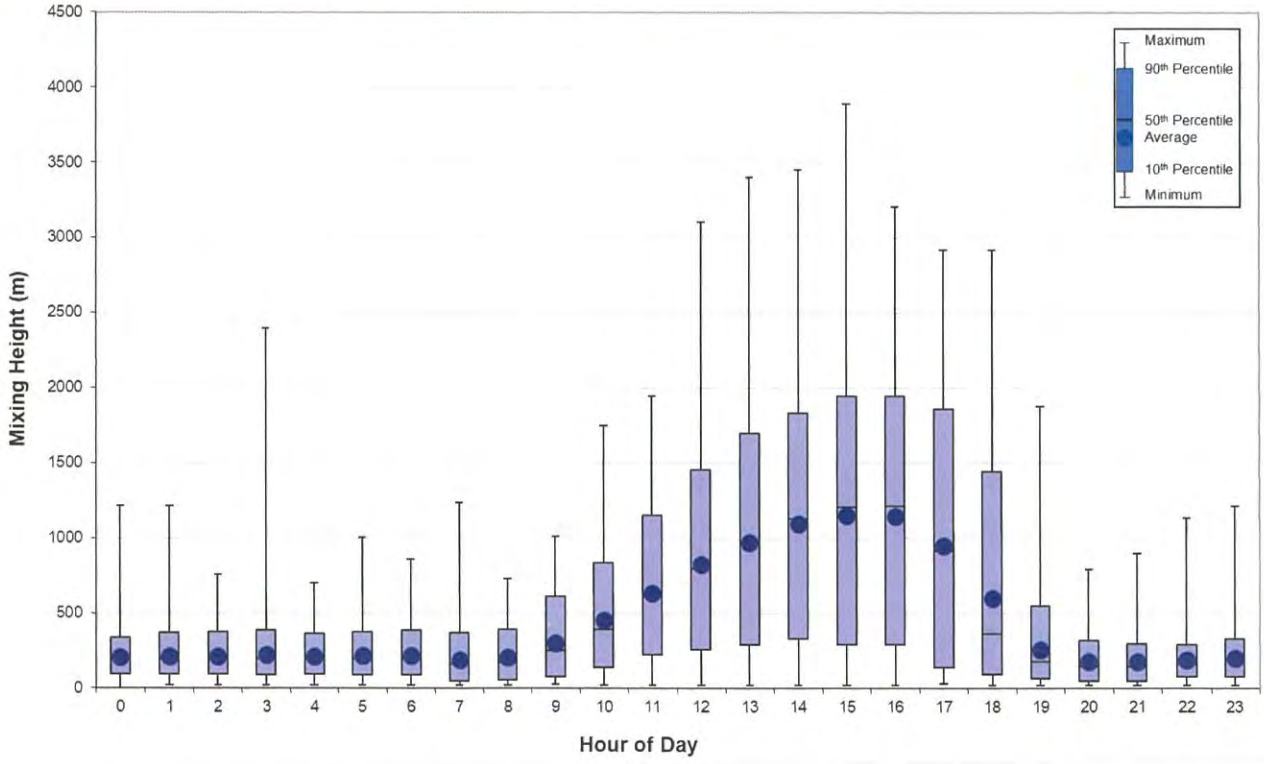
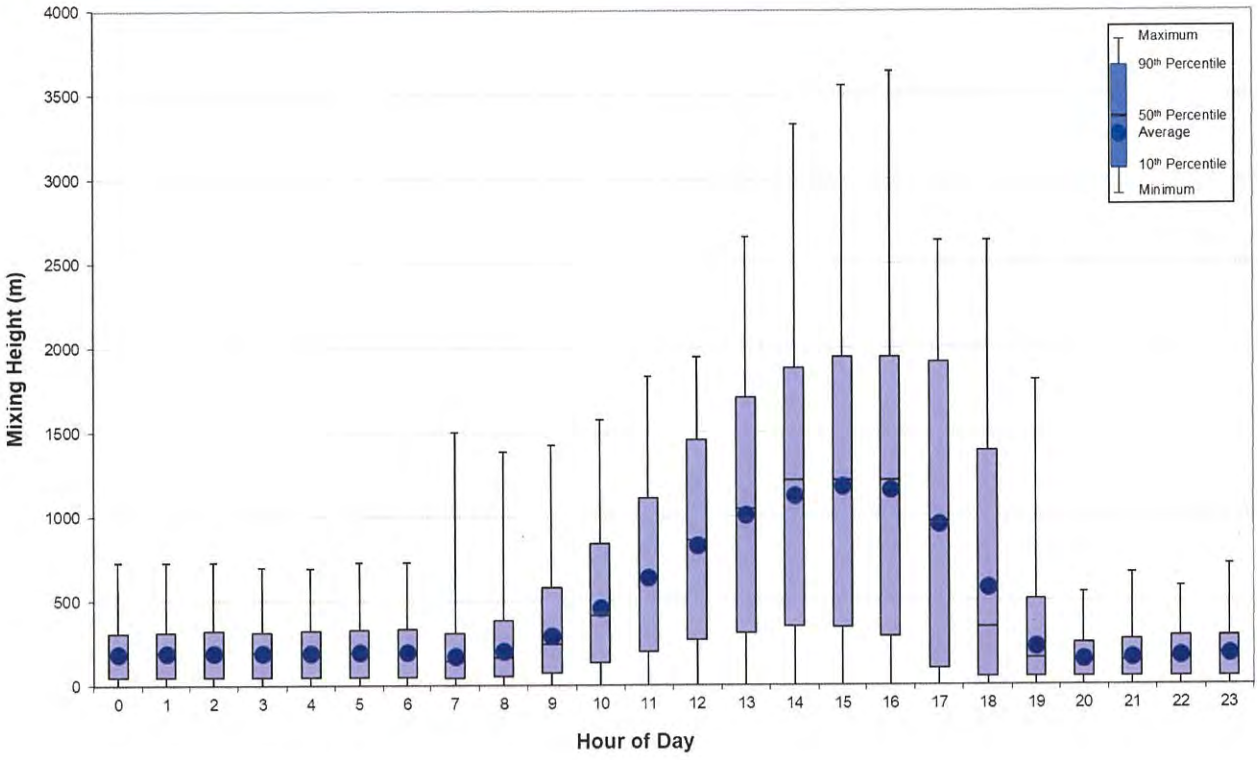


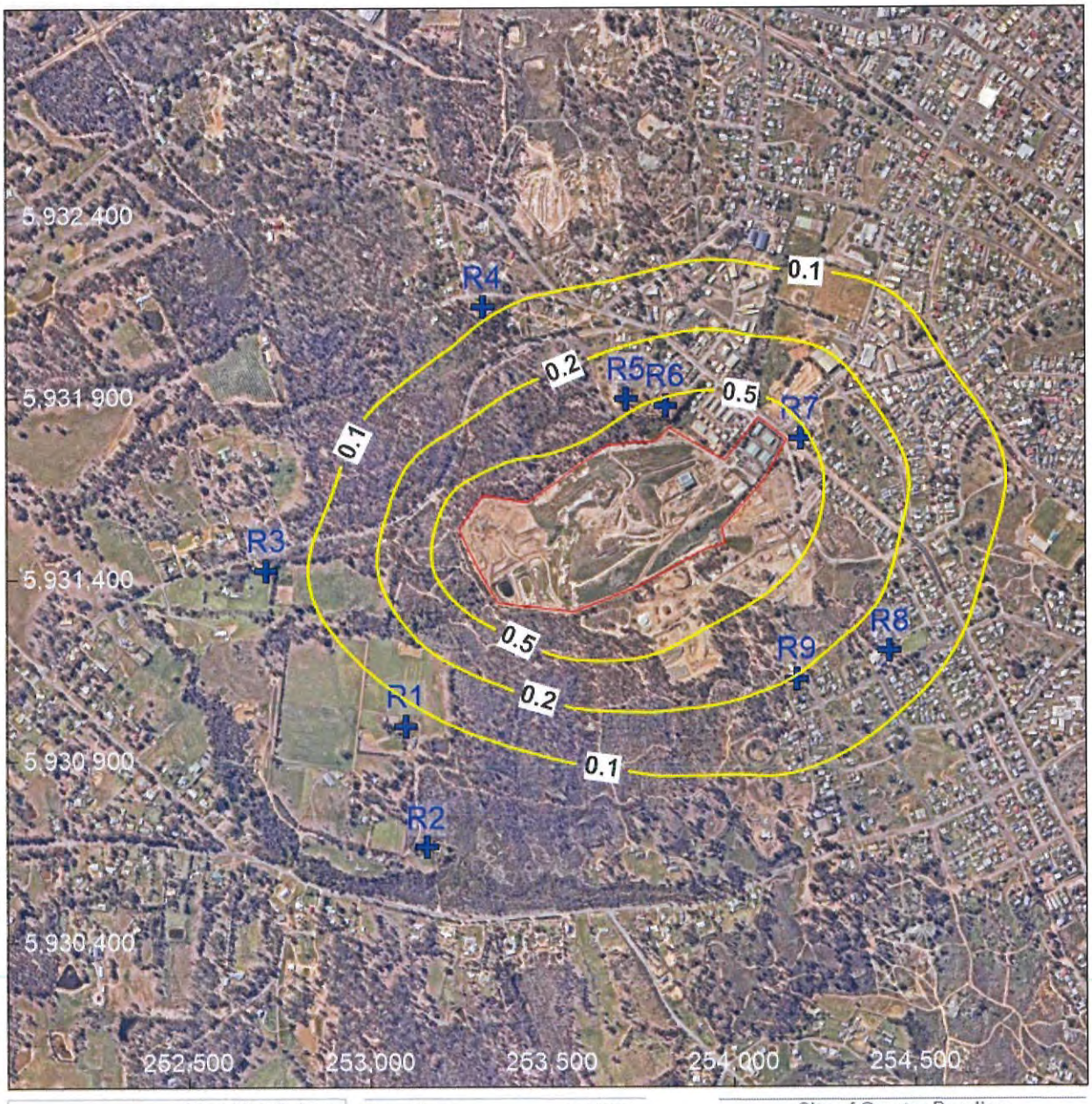
Figure A6 Diurnal Variation in Mixing Depth for the Project Site, 2017



APPENDIX B

Predicted Pollutant Isopleth Plots

Figure B1 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Existing Operations, Normal Conditions – 2013



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F: +61 3 9249 9499
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Project Number:	640.11831
Dispersion Model:	AERMOD
Modelling Period:	2013
Projection:	GDA 1994 MGA Zone 55
Date:	18/01/2019

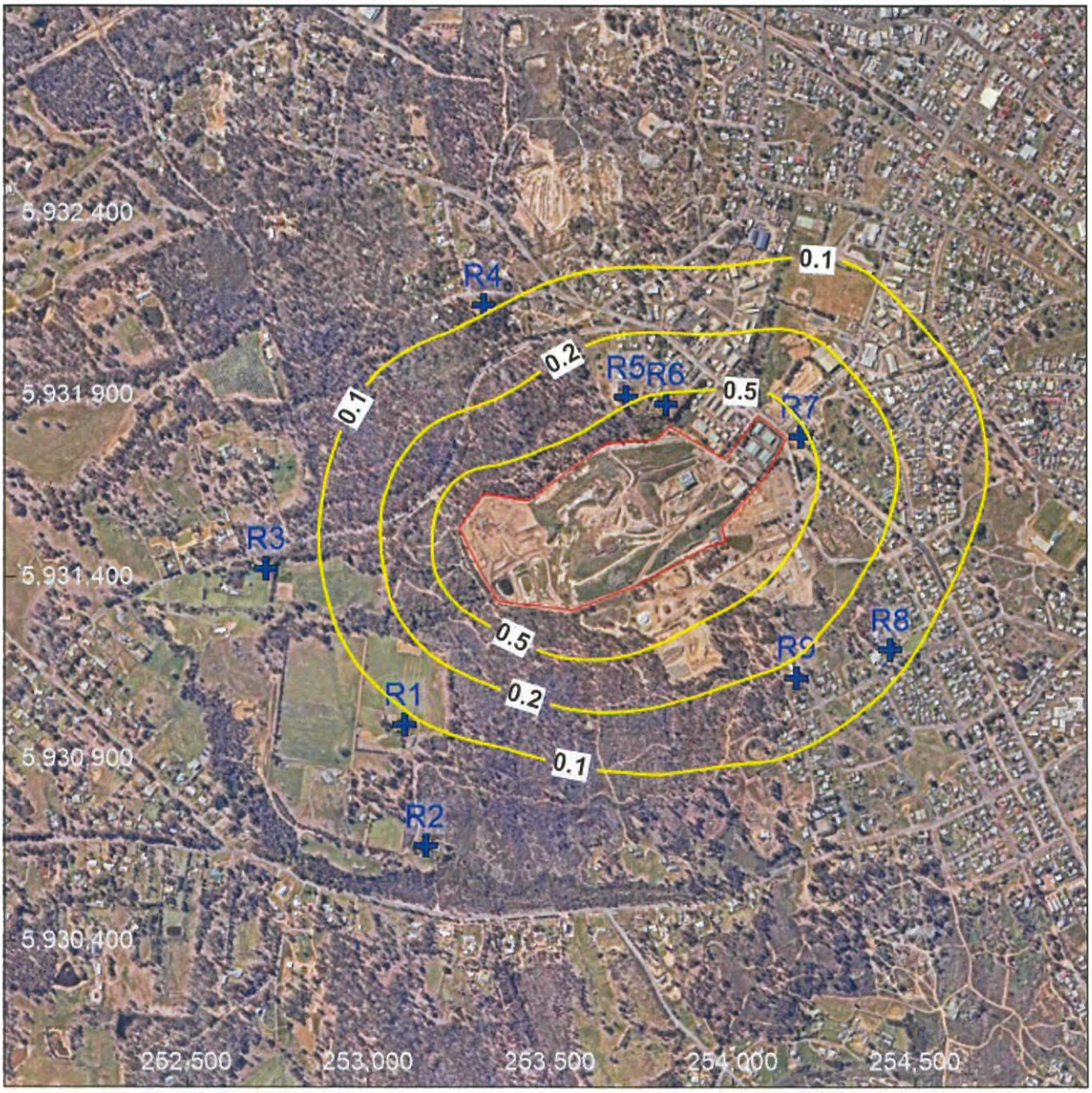
City of Greater Bendigo

Eaglehawk Landfill
Dust Impact Assessment

Incremental Impact - Existing Normal Operations

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B2 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Existing Operations, Normal Conditions – 2014



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Dispersion Model:	AERMOD
Modelling Period:	2014
Projection:	GDA 1994 MGA Zone 55
Date:	18/01/2019

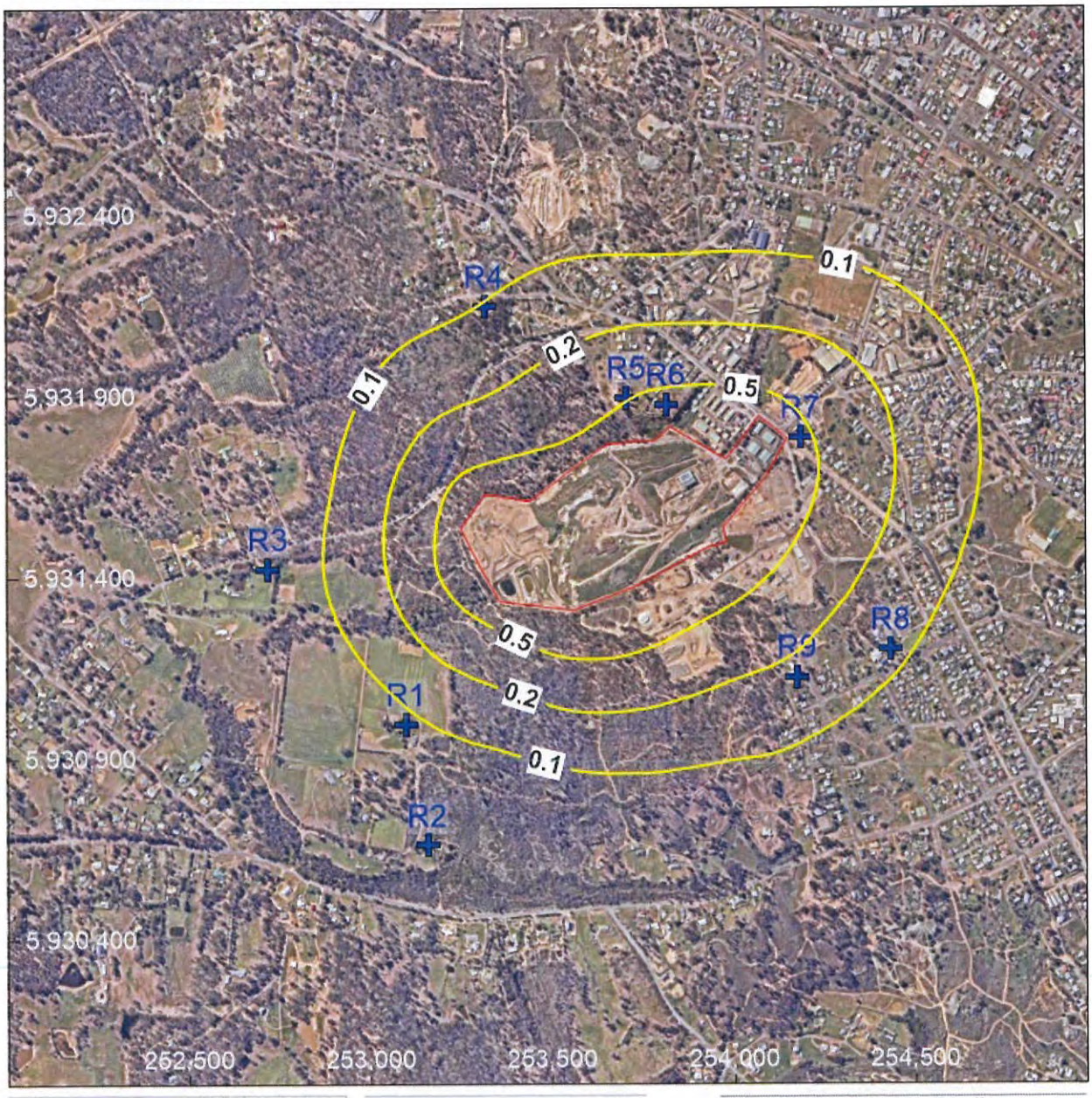
City of Greater Bendigo

Eaglehawk Landfill
Dust Impact Assessment

Incremental Impact - Existing Normal Operations

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B3 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Existing Operations, Normal Conditions – 2015



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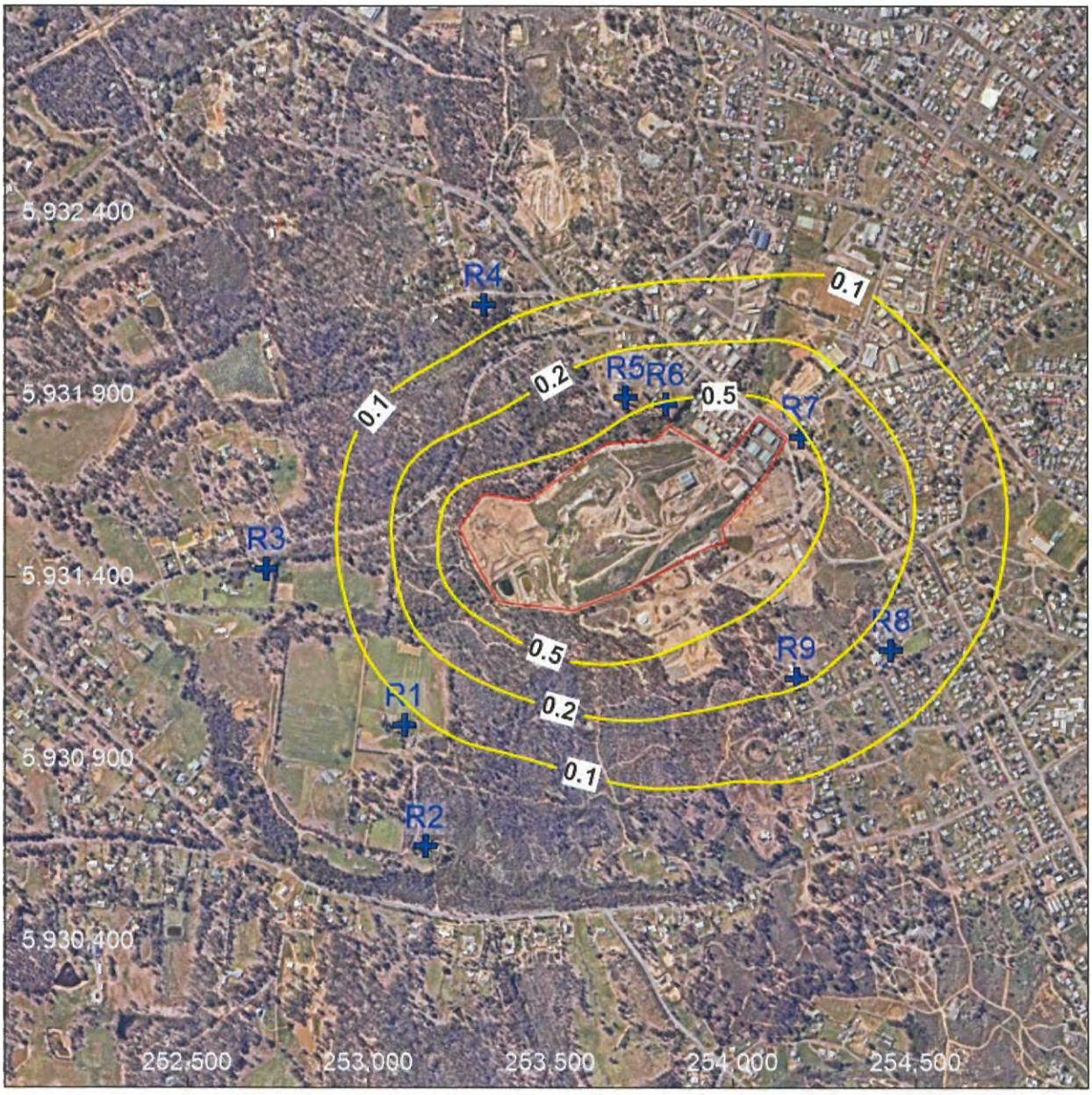
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Project Number:	640.11831
Dispersion Model:	AERMOD
Modelling Period:	2015
Projection:	GDA 1994 MGA Zone 55
Date:	18/01/2019

City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B4 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Existing Operations, Normal Conditions – 2016



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Modelling Period:	2016
Projection:	GDA 1994 MGA Zone 55
Date:	18/01/2019

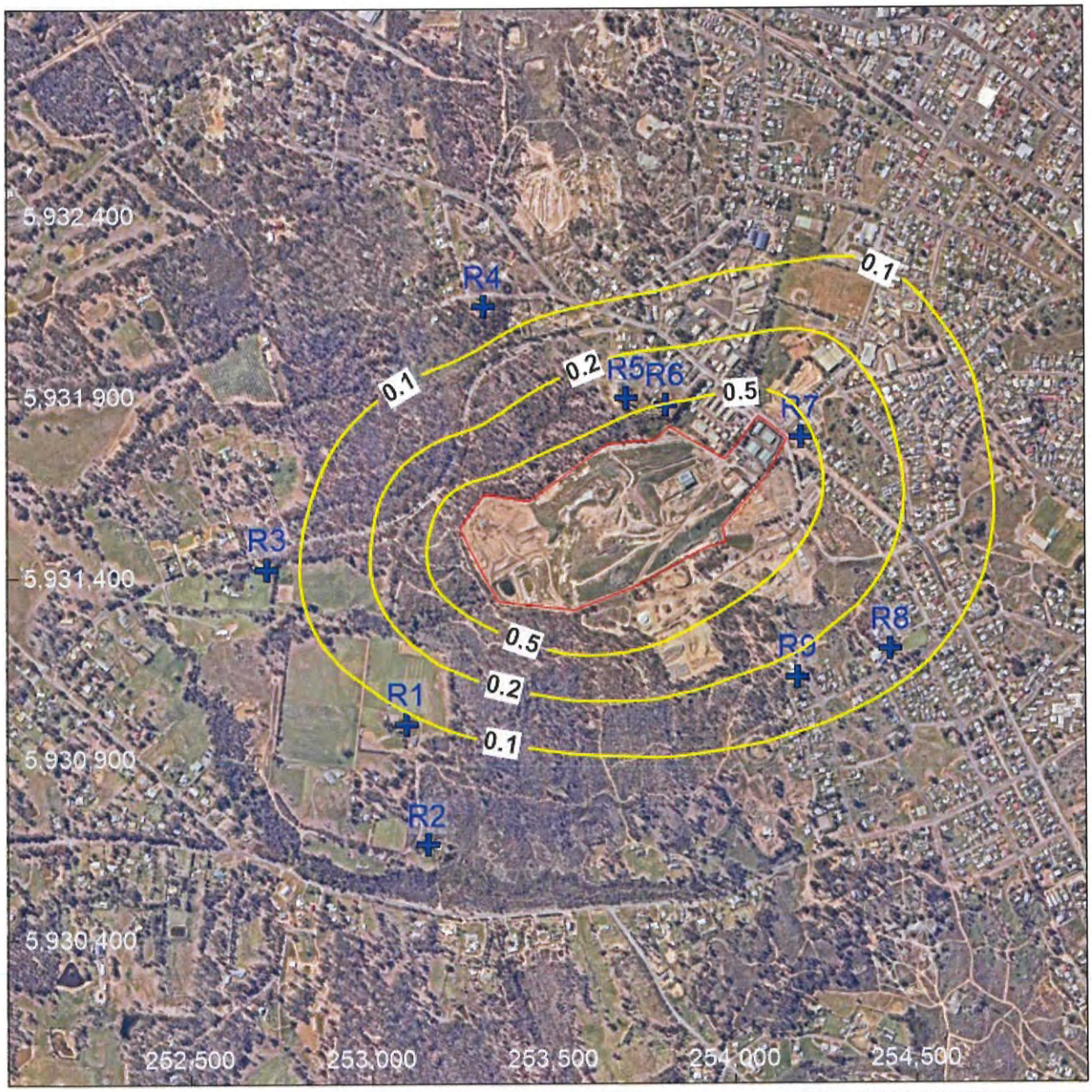
City of Greater Bendigo

Eaglehawk Landfill
Dust Impact Assessment

Incremental Impact - Existing Normal Operations

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B5 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Existing Operations, Normal Conditions – 2017



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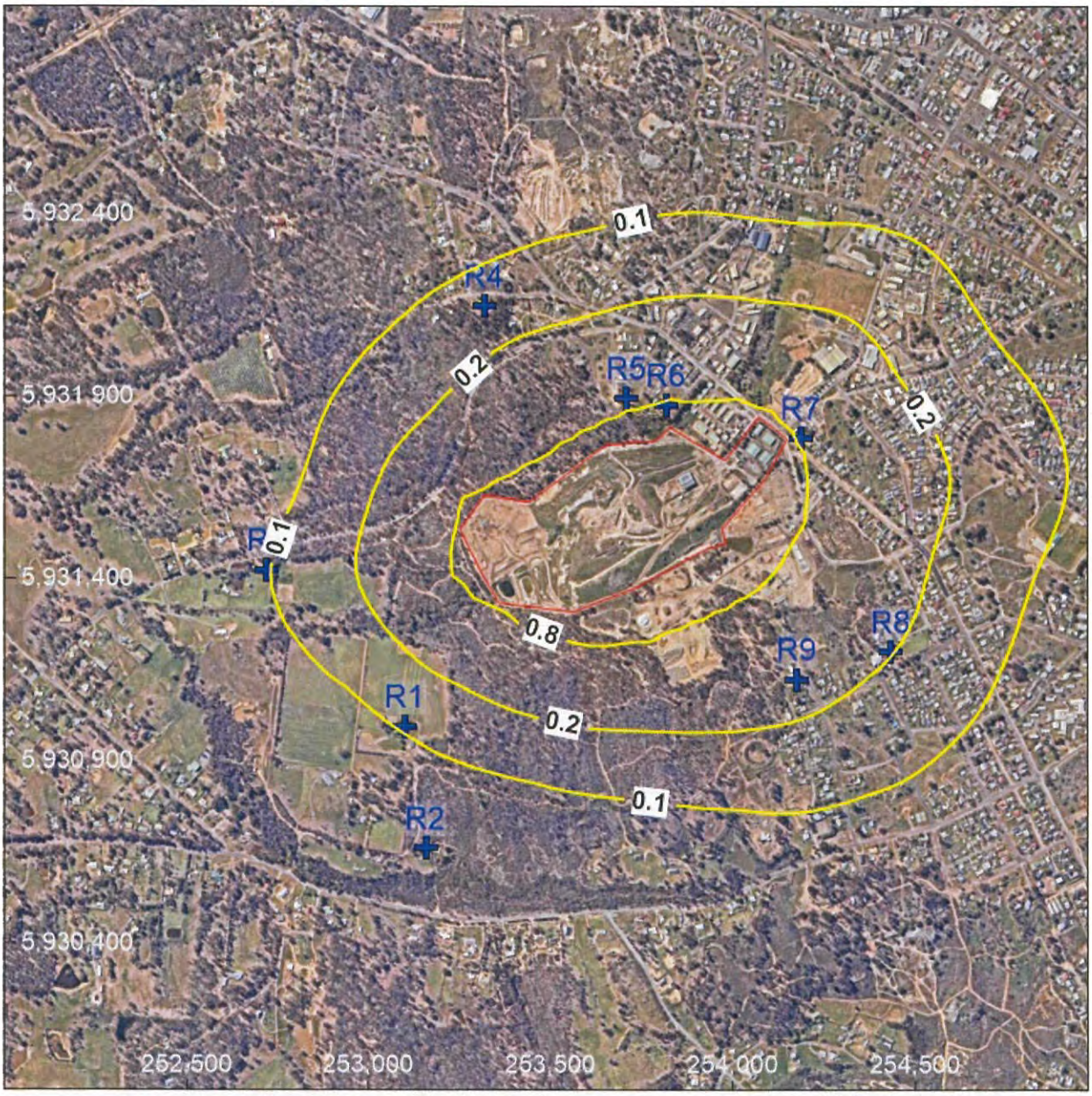
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Dispersion Model	AERMOD
Modelling Period	2017
Projection	GDA 1994 MGA Zone 55
Date	18/01/2019

City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B6 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Existing Operations, Upset Conditions – 2013



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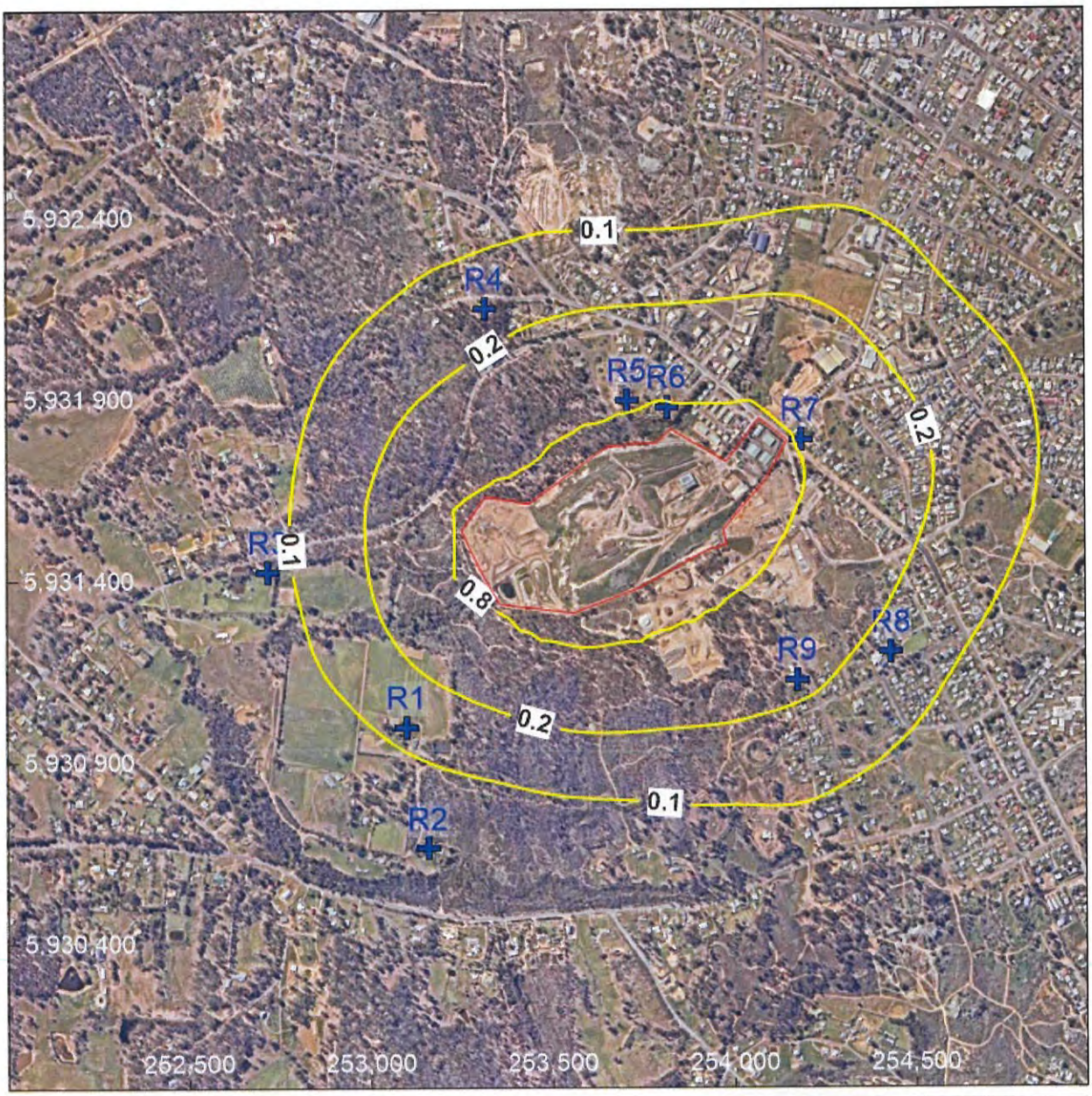
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Dispersion Model:	AERMOD
Modelling Period	2013
Projection:	GDA 1994 MGA Zone 55
Date:	18/01/2019

City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	TSP	Averaging Period	Annual	Unit: g/m²/month

Figure B7 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Existing Operations, Upset Conditions – 2014



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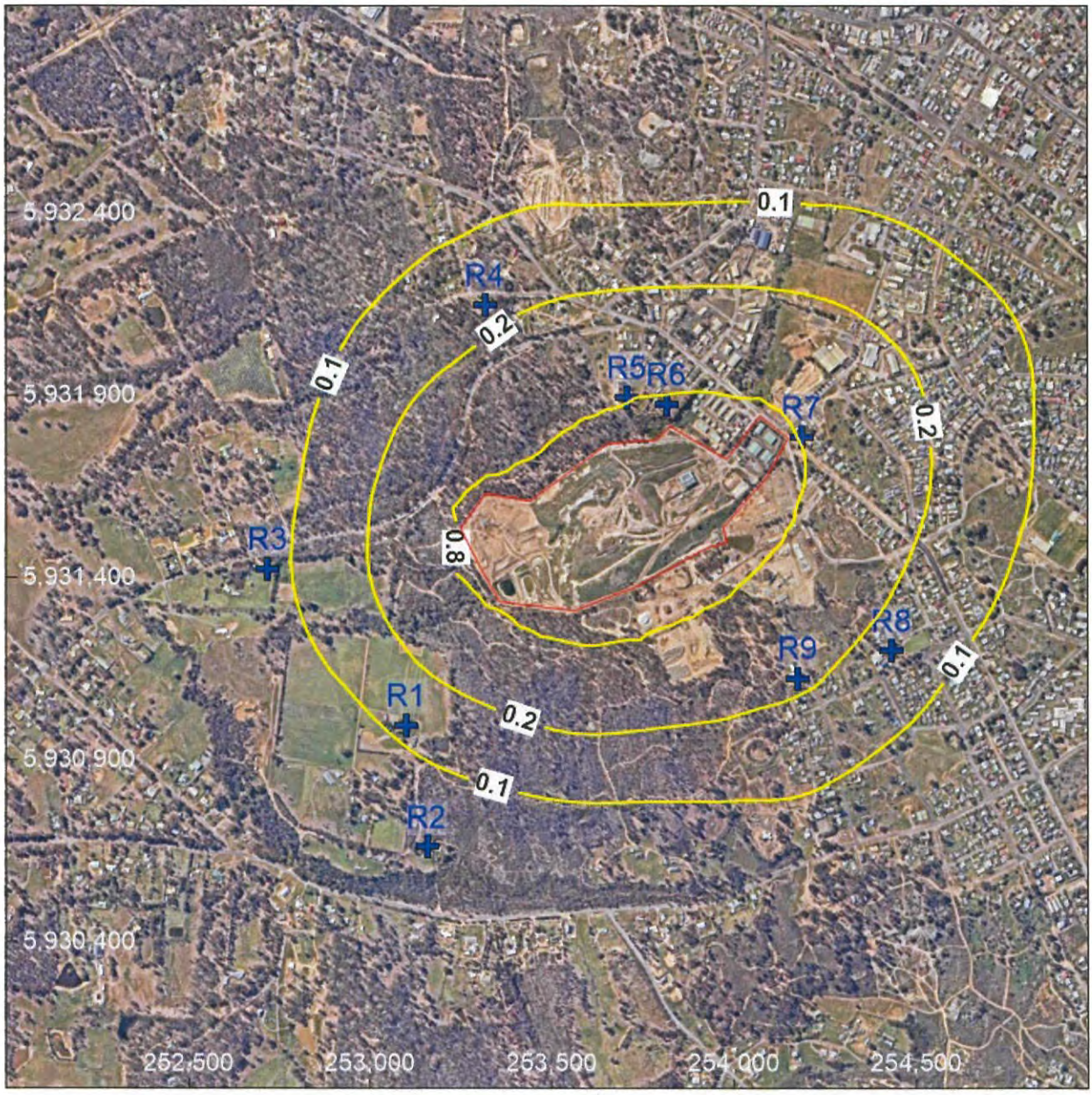
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Project Number:	640.11831
Dispersion Model:	AERMOD
Modelling Period:	2014
Projection:	GDA 1994 MGA Zone 55
Date:	18/01/2019

City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B8 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Existing Operations, Upset Conditions – 2015



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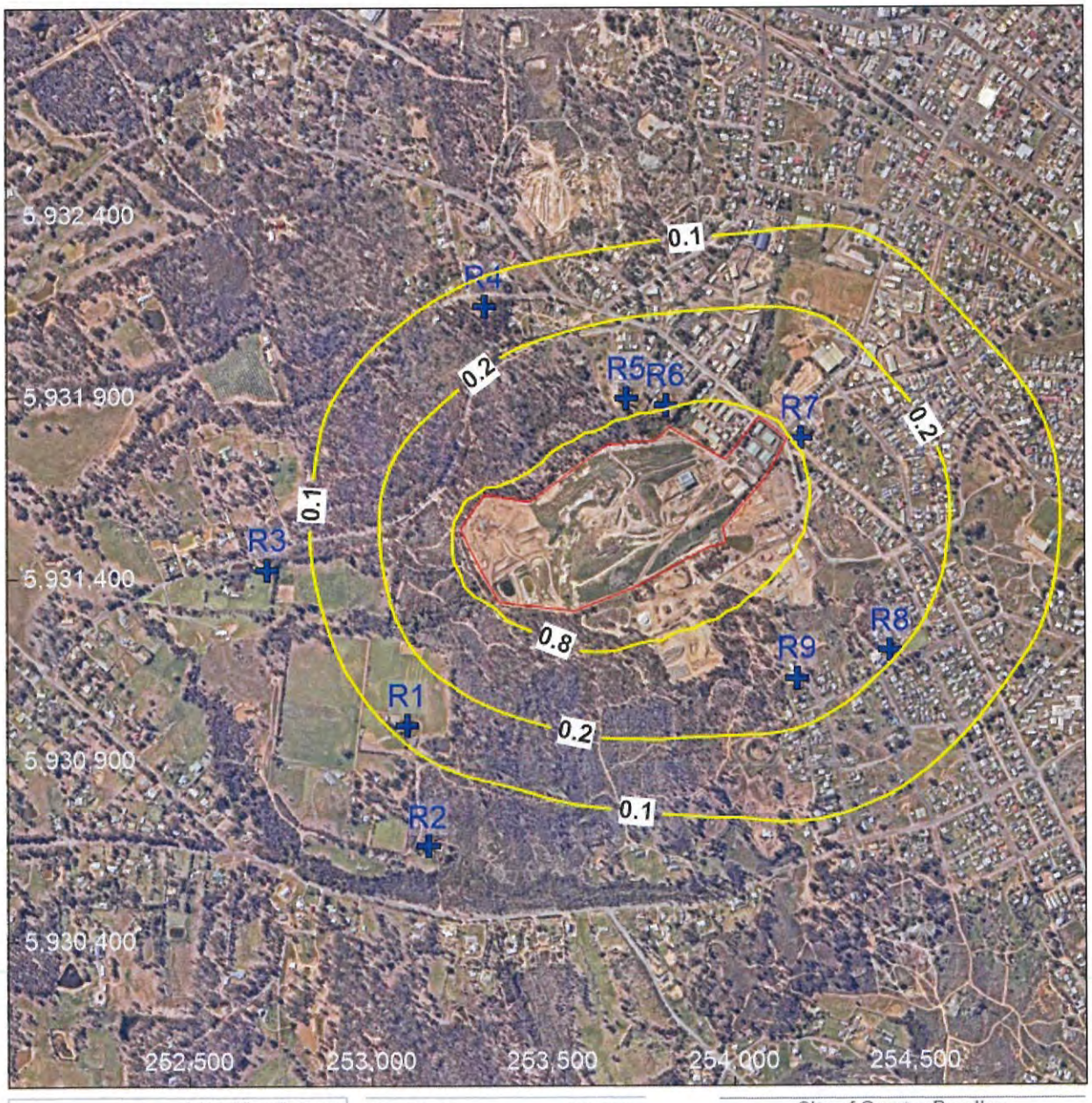
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Project Number:	640.11831
Dispersion Model:	AERMOD
Modelling Period:	2015
Projection:	GDA 1994 MGA Zone 55
Date:	18/01/2019

City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	TSP	Averaging Period	Annual	Unit: g/m²/month

Figure B9 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Existing Operations, Upset Conditions – 2016



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Project Number:	640.11831
Dispersion Model:	AERMOD
Modelling Period:	2016
Projection:	GDA 1994 MGA Zone 55
Date:	18/01/2019

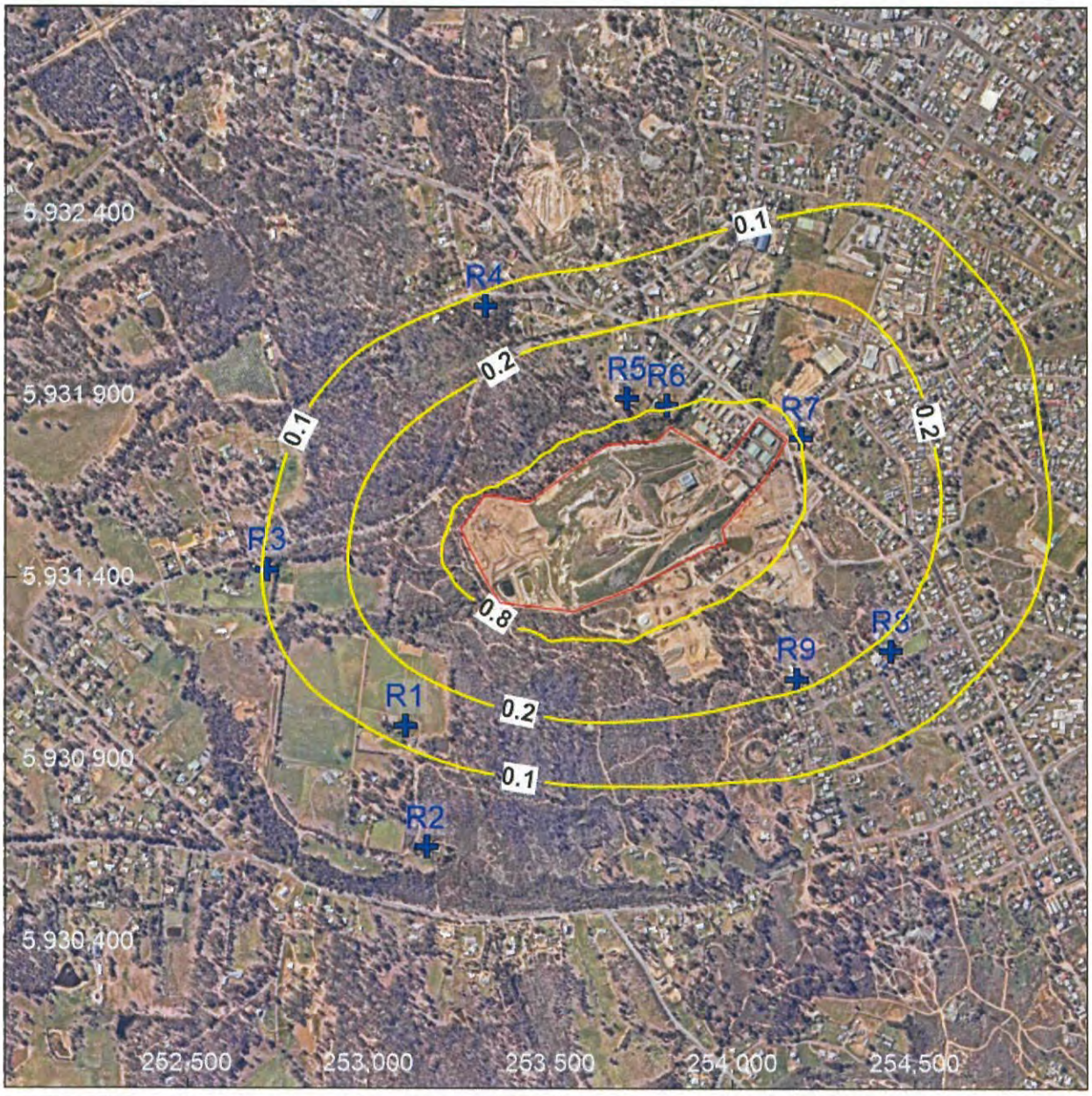
City of Greater Bendigo

Eaglehawk Landfill
Dust Impact Assessment

Incremental Impact - Existing Upset Conditions

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B10 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Existing Operations, Upset Conditions – 2017



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Project Number:	640.11831
Dispersion Model:	AERMOD
Modelling Period:	2017
Projection:	GDA 1994 MGA Zone 55
Date:	18/01/2019

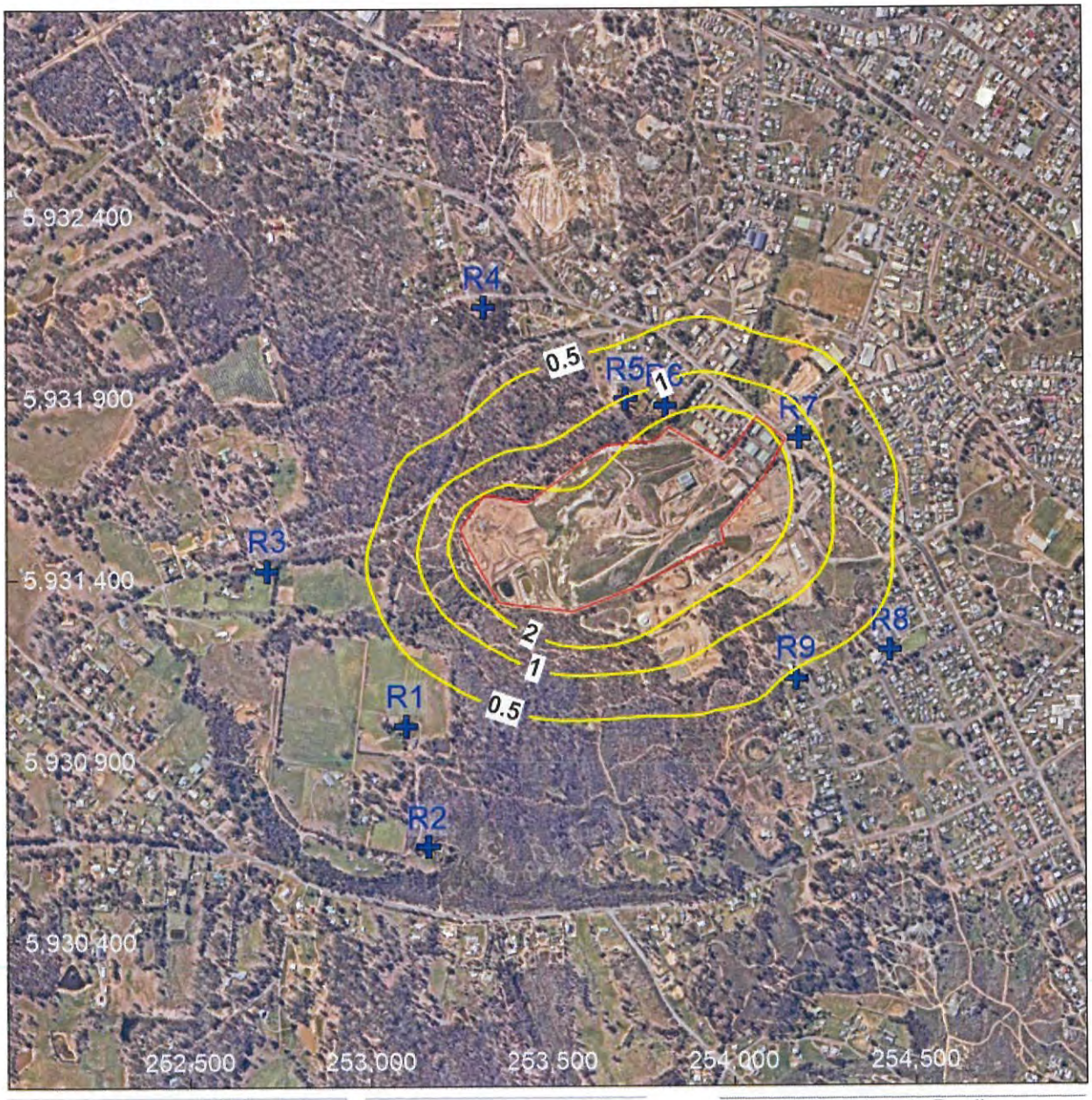
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Eaglehawk Landfill
Dust Impact Assessment

Incremental Impact - Existing Upset Conditions

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B11 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Existing Operations, Normal Conditions – 2013



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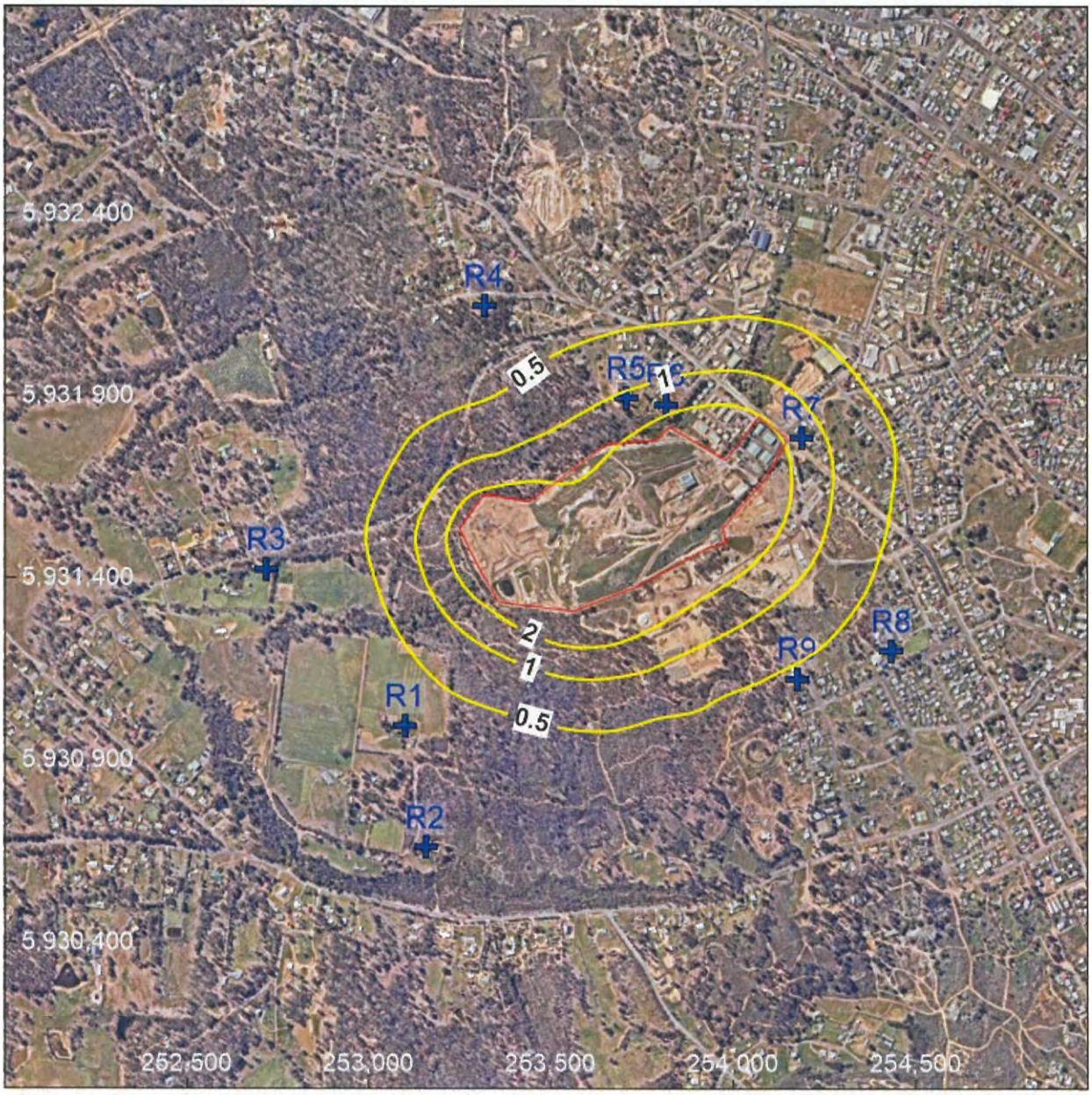
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Modelling Period:	2013
Projection:	GDA 1994 MGA Zone 55
Date:	18/01/2019

City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B12 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Existing Operations, Normal Conditions – 2014



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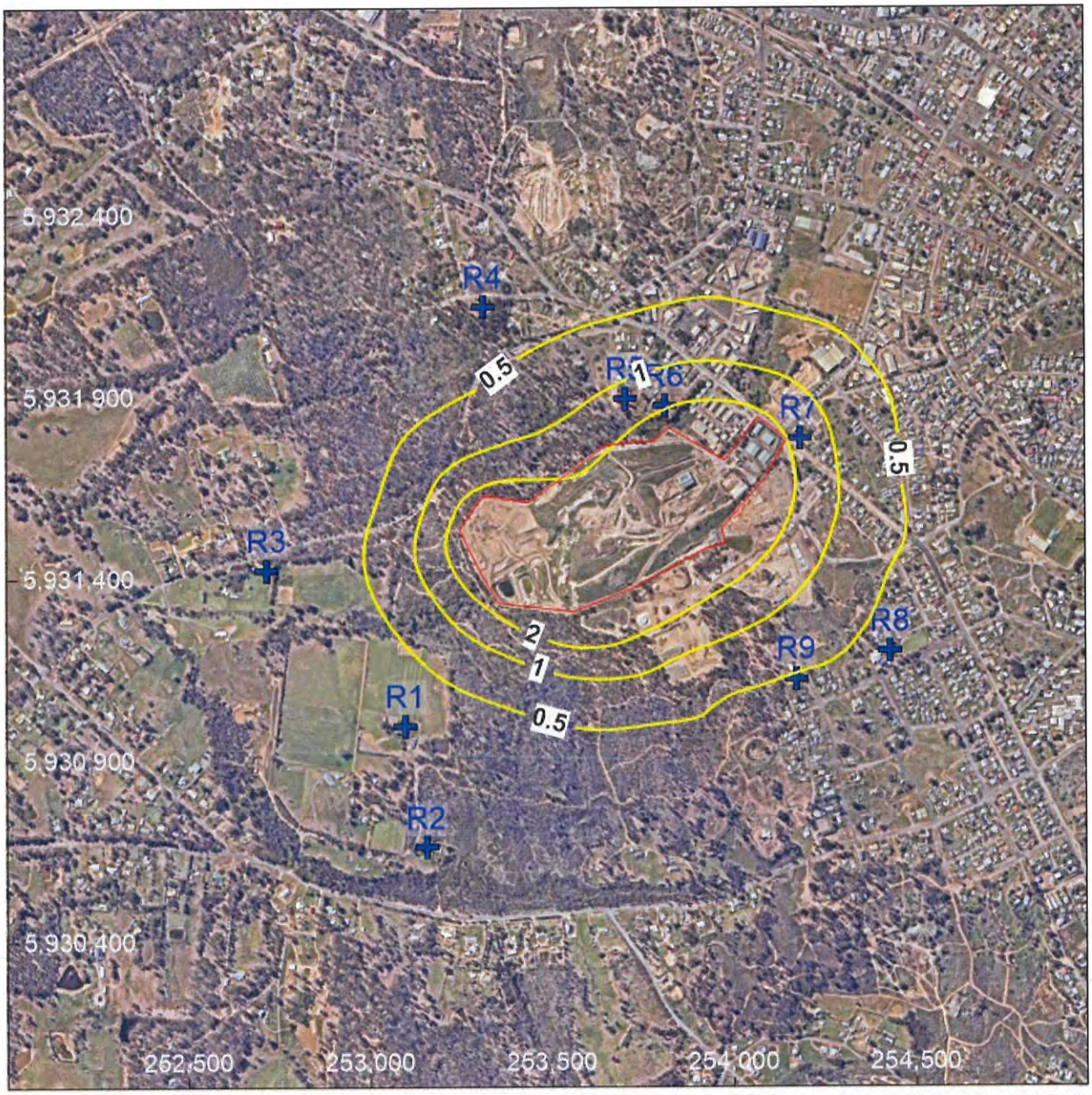
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant:	PM_{10}	Averaging Period:	Annual	Unit:	µg/m³

Figure B13 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Existing Operations, Normal Conditions – 2015



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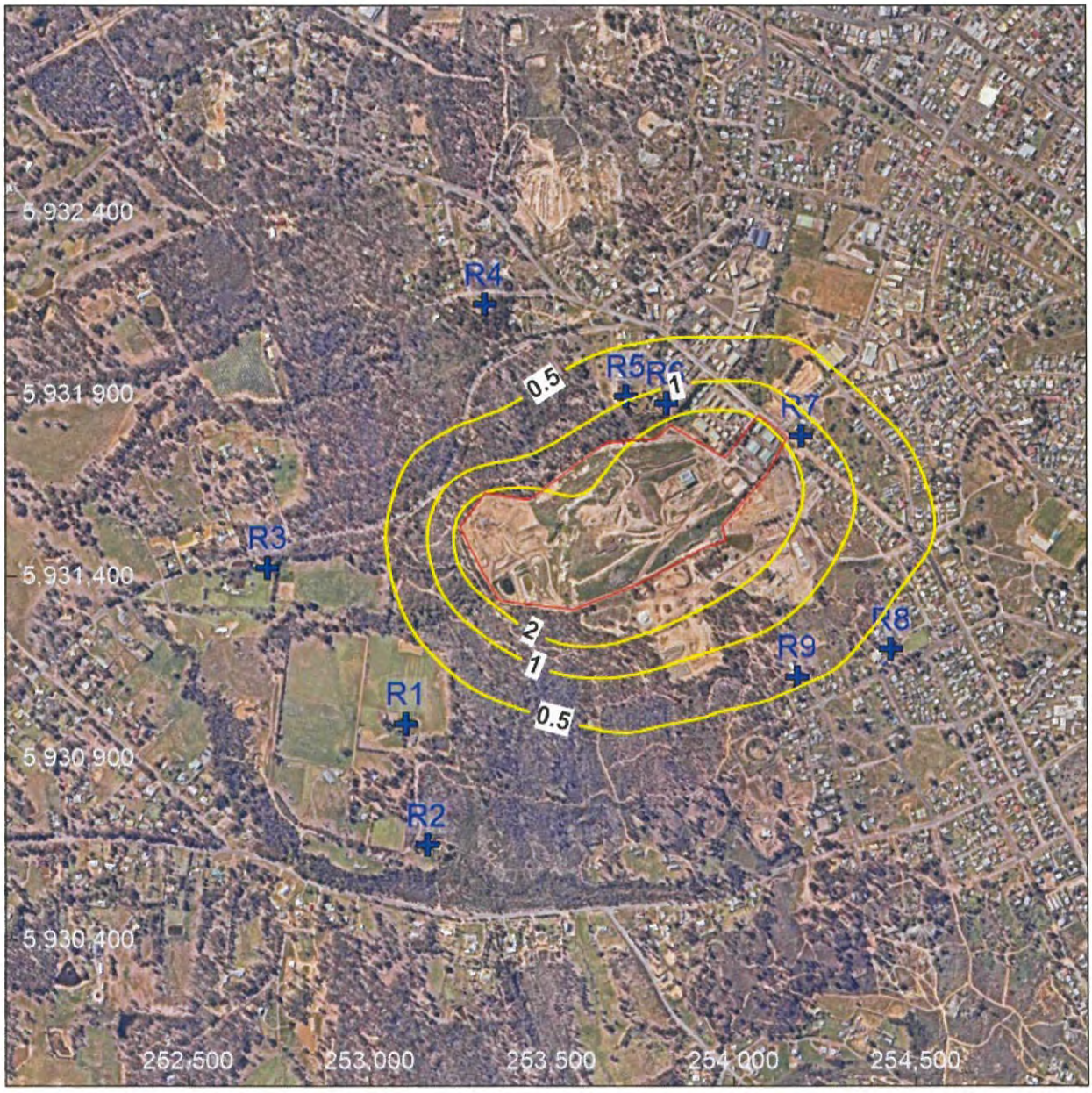
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B14 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Existing Operations, Normal Conditions – 2016



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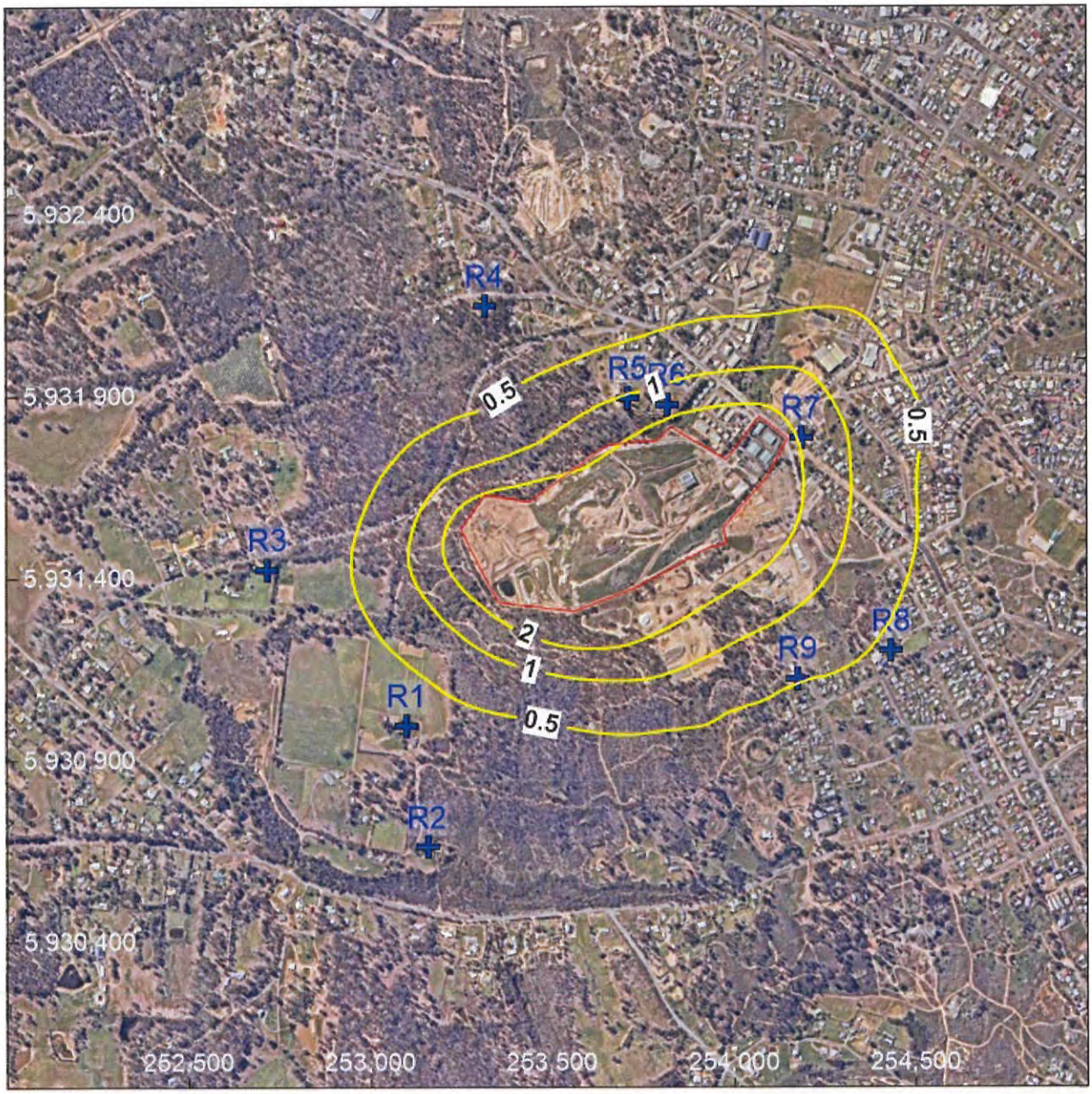
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B15 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Existing Operations, Normal Conditions – 2017



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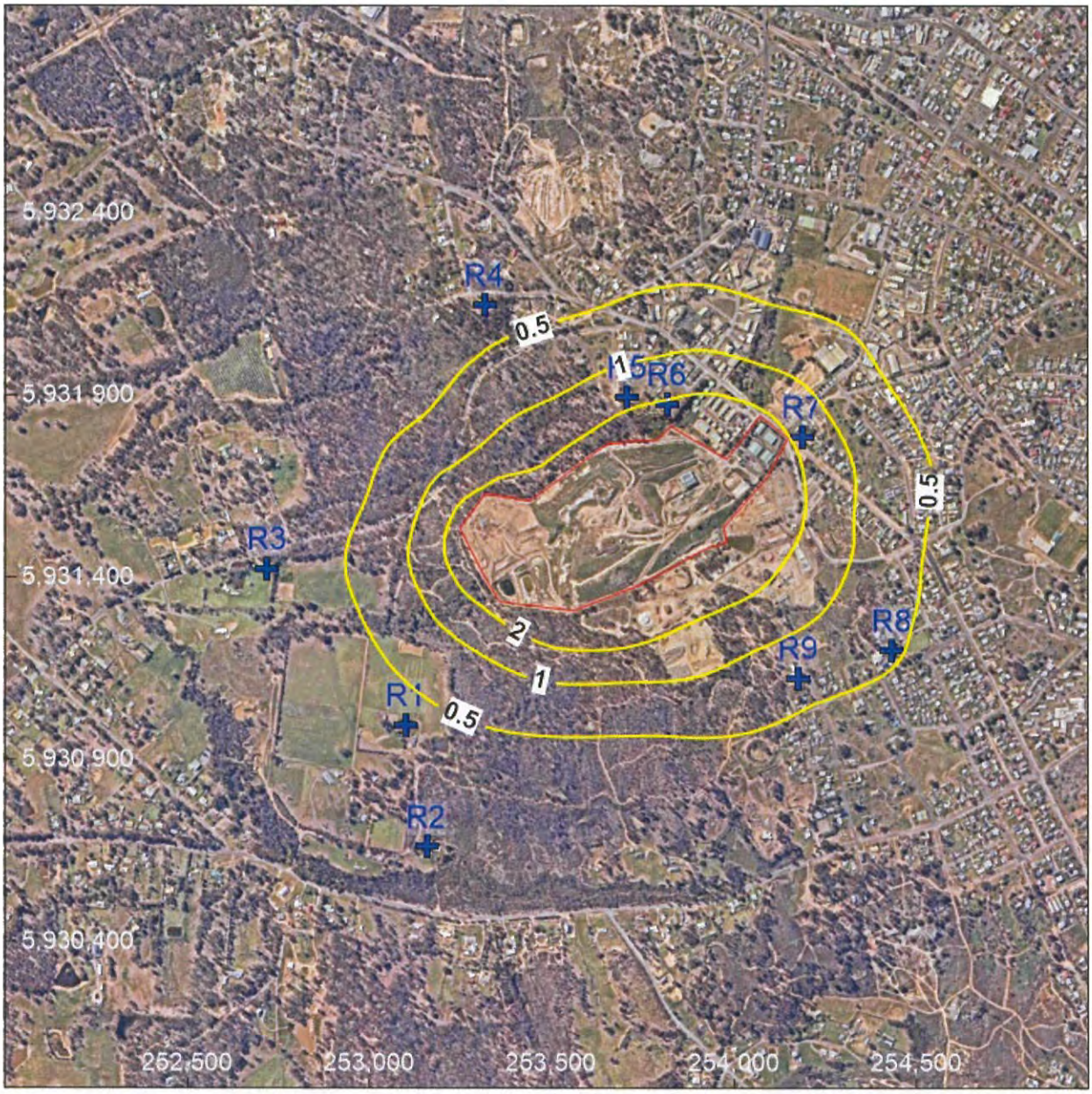
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B16 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Existing Operations, Upset Conditions – 2013



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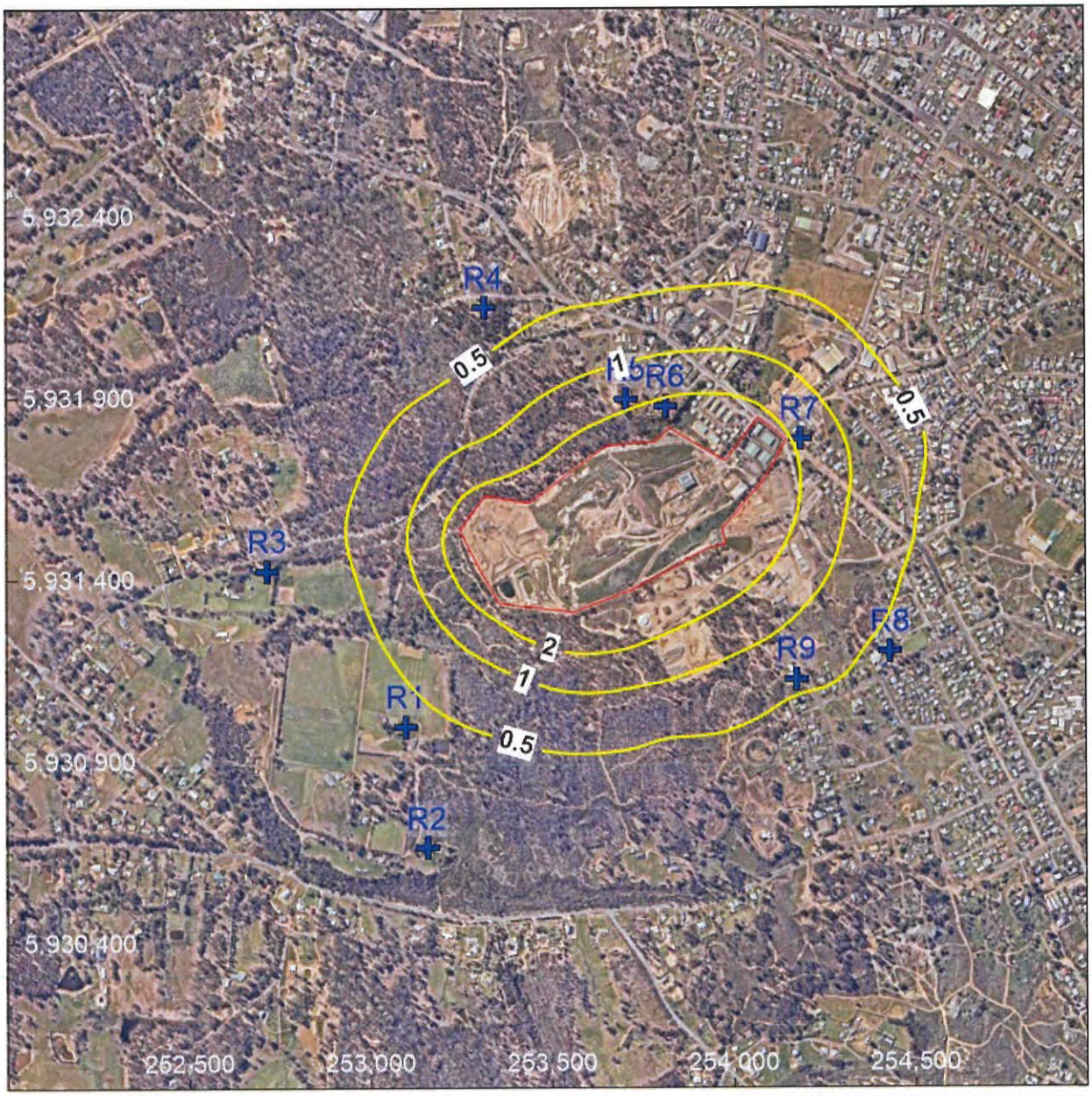
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B17 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Existing Operations, Upset Conditions – 2014



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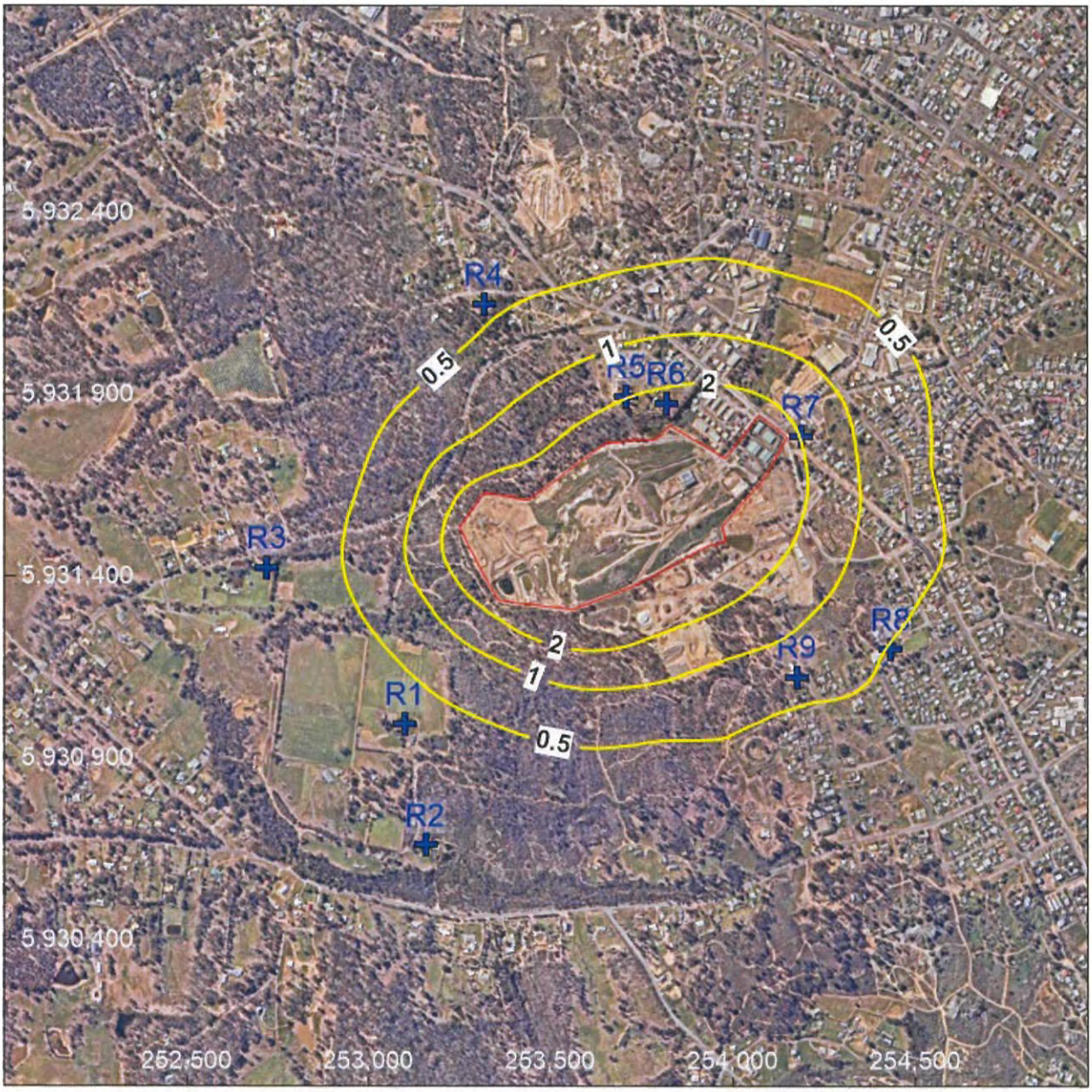
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B18 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Existing Operations, Upset Conditions – 2015



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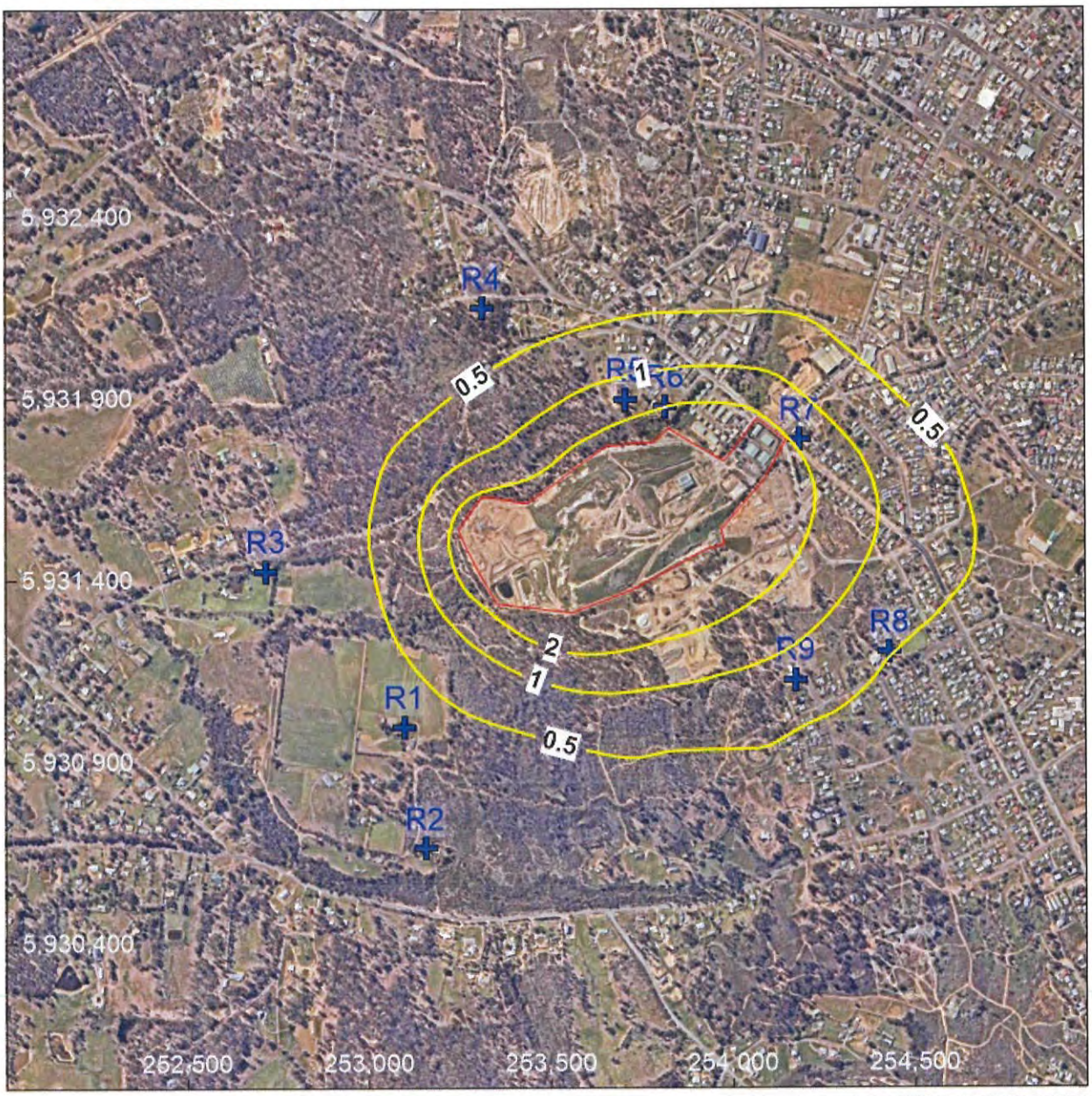
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B19 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Existing Operations, Upset Conditions – 2016



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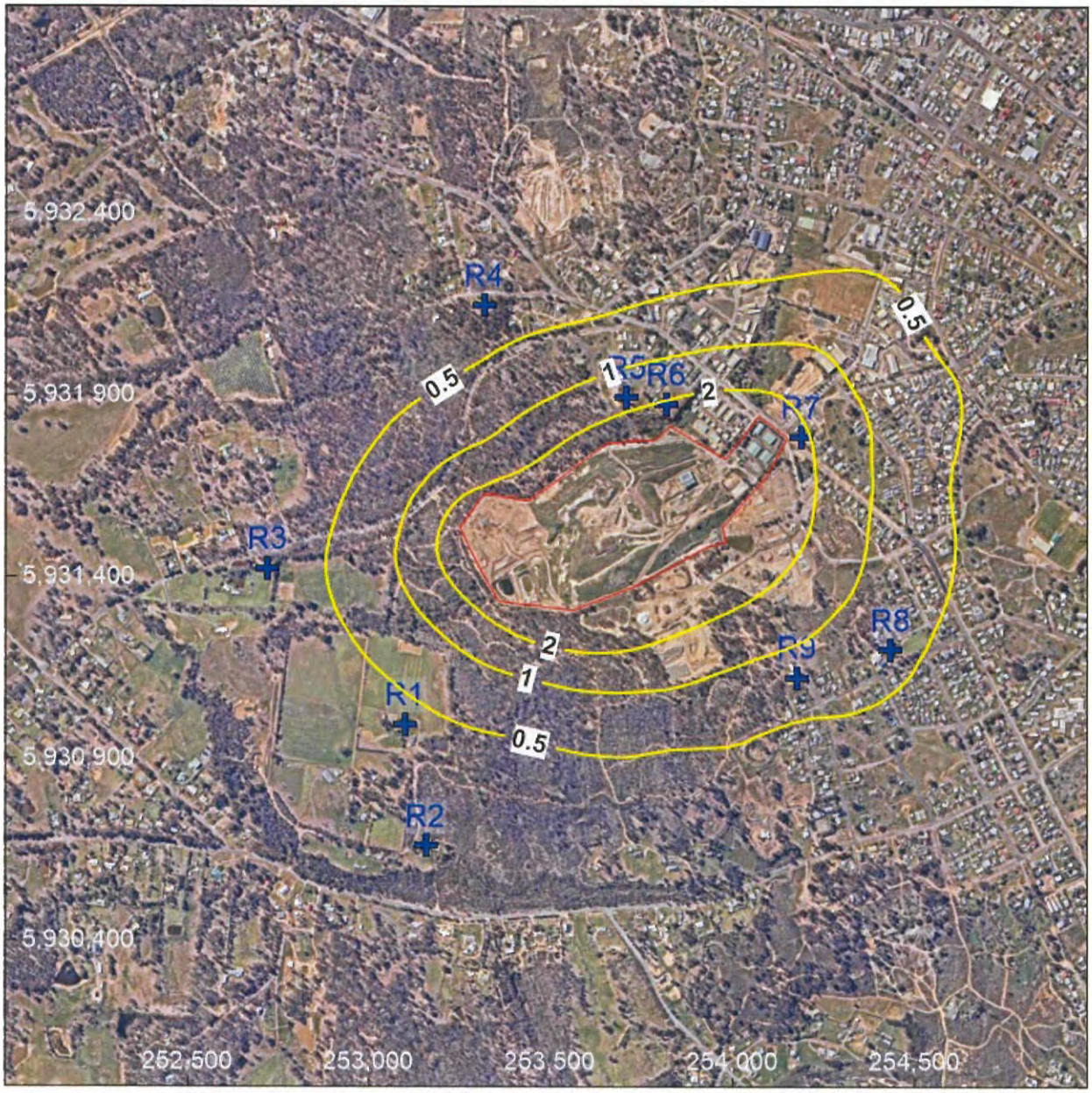
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Dust Impact Assessment

Incremental Impact - Existing Upset Conditions

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B20 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Existing Operations, Upset Conditions – 2017



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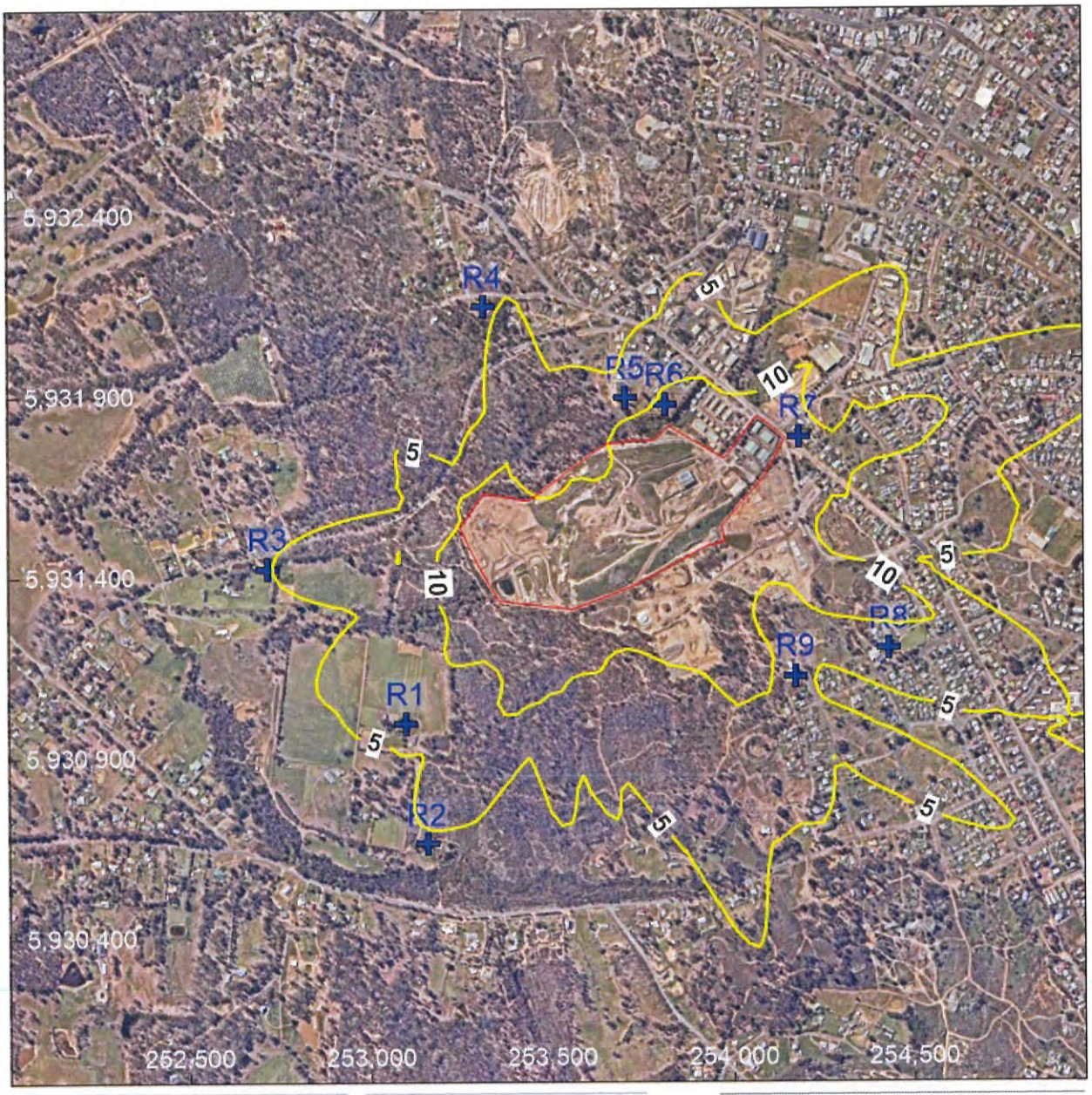
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B21 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Existing Operations, Normal Conditions – 2013



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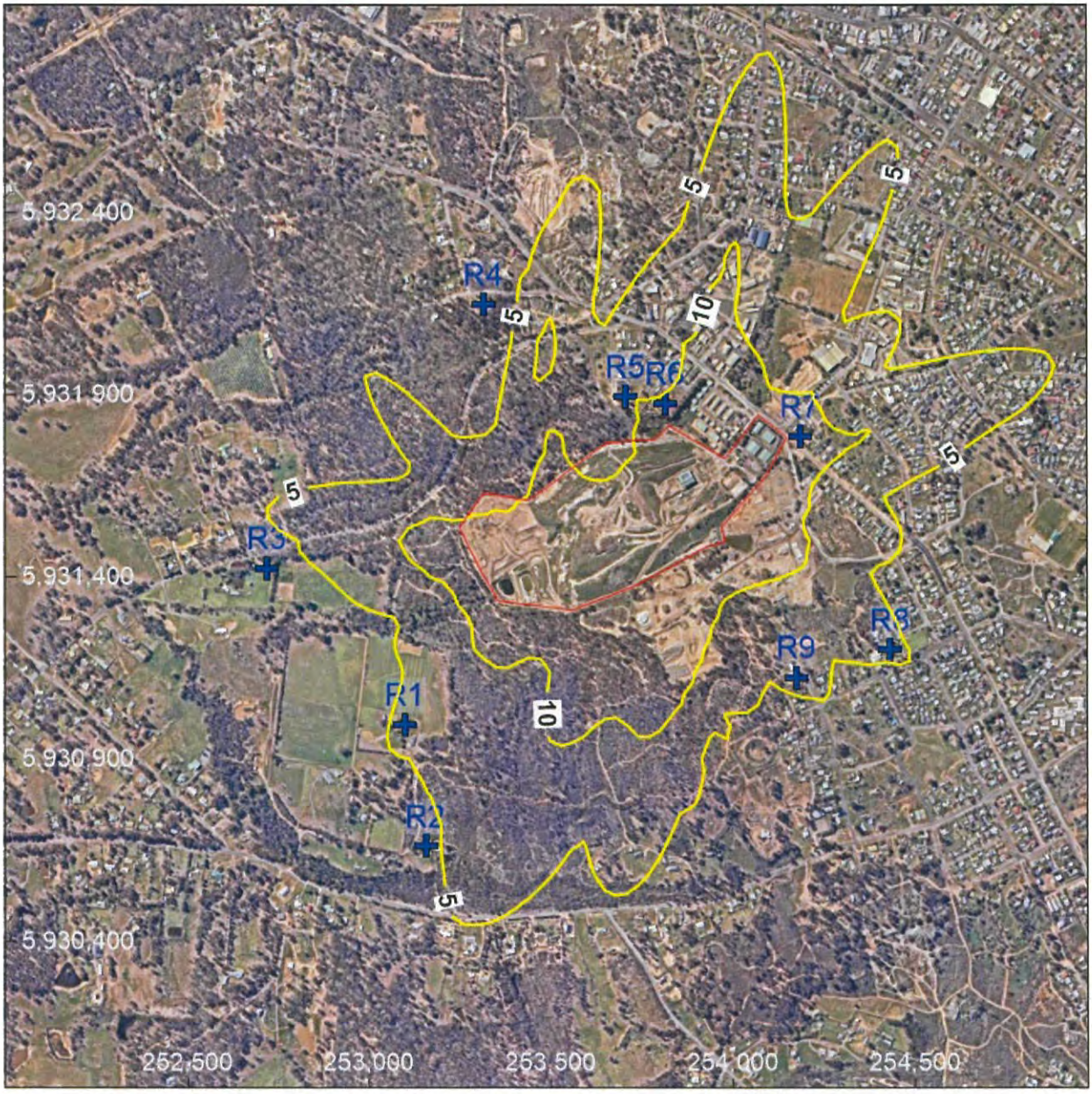
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B22 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Existing Operations, Normal Conditions – 2014



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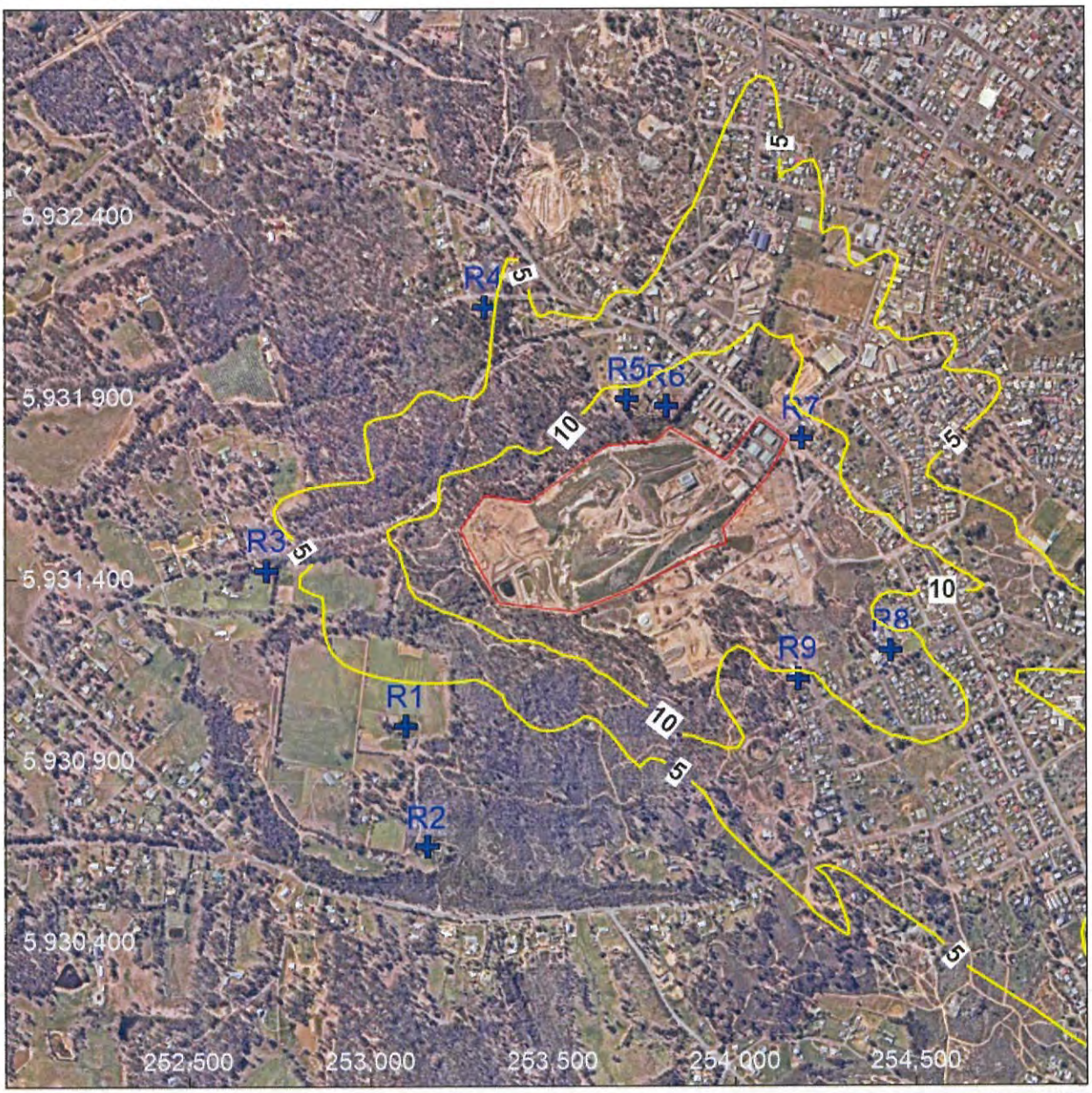
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B23 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Existing Operations, Normal Conditions – 2015



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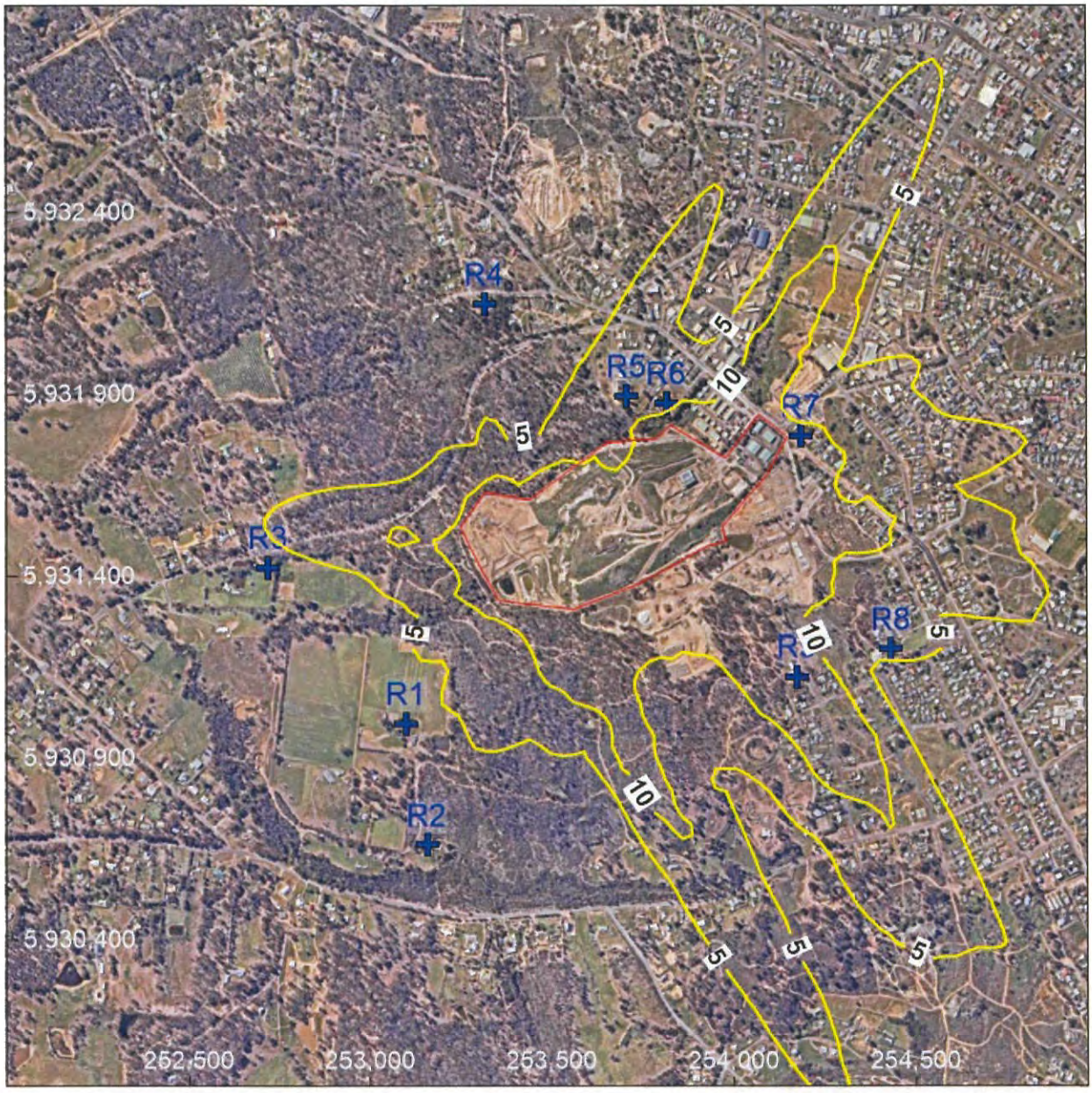
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B24 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Existing Operations, Normal Conditions – 2016



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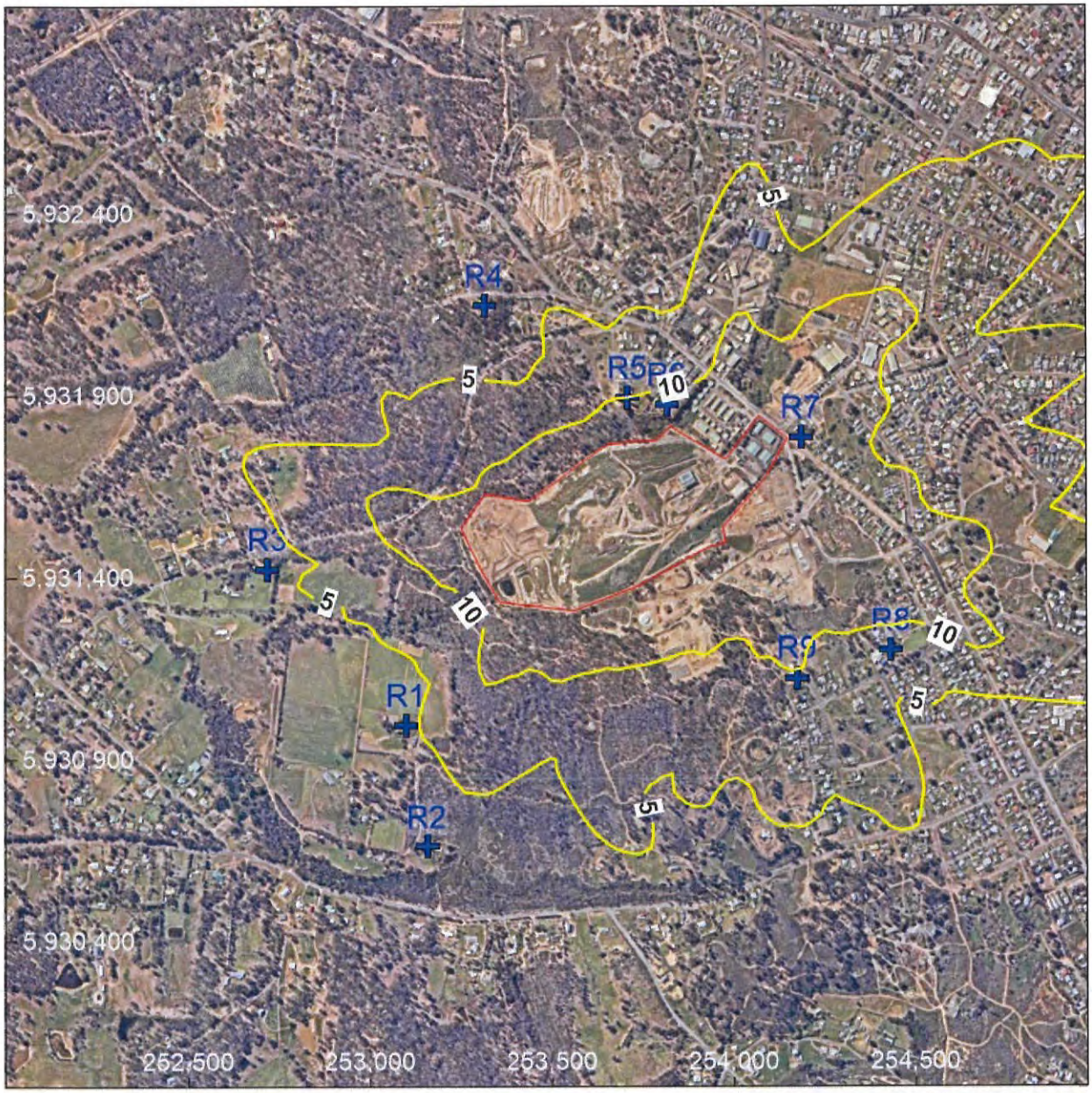
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B25 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Existing Operations, Normal Conditions – 2017



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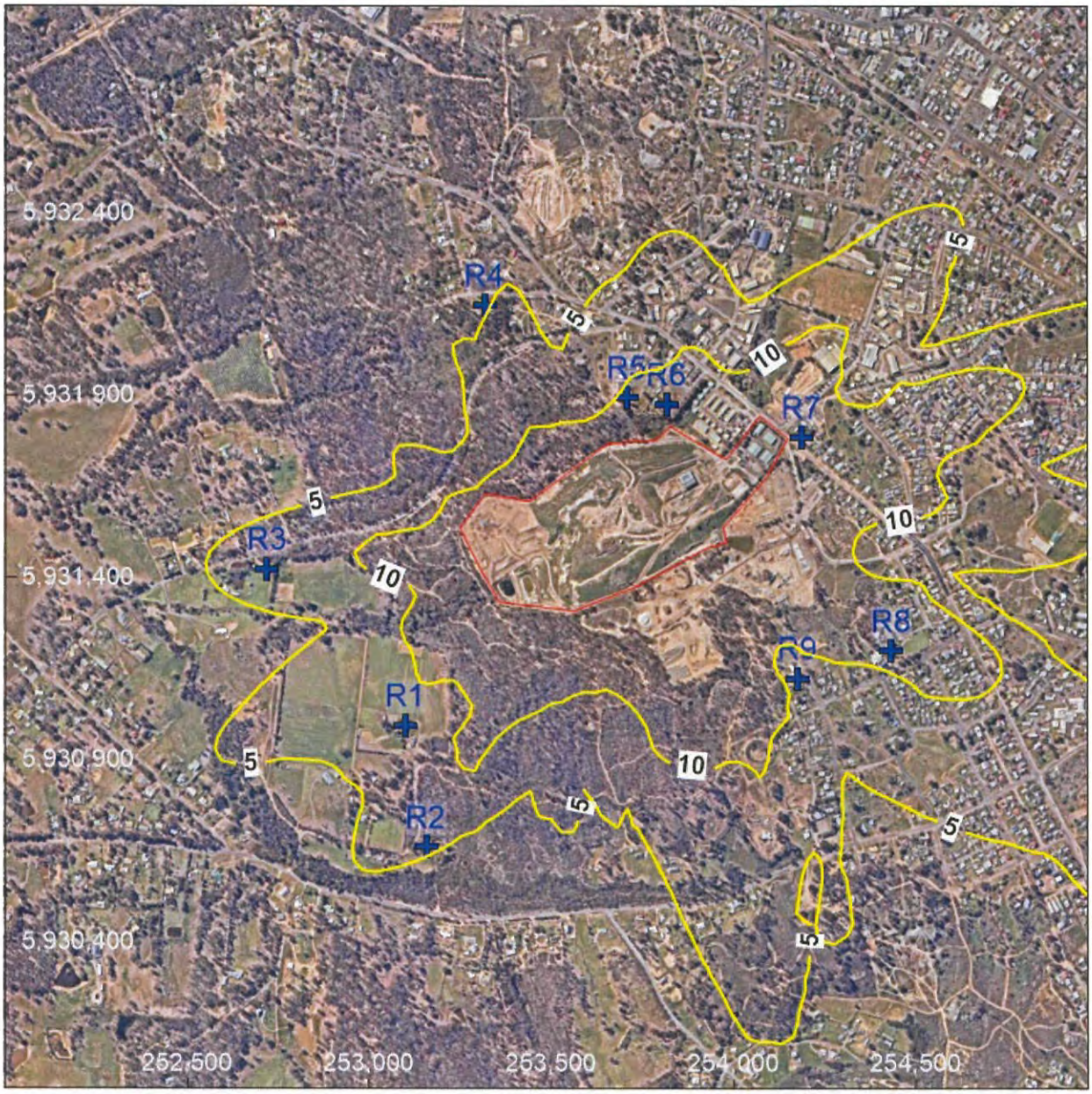
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B26 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Existing Operations, Upset Conditions – 2013



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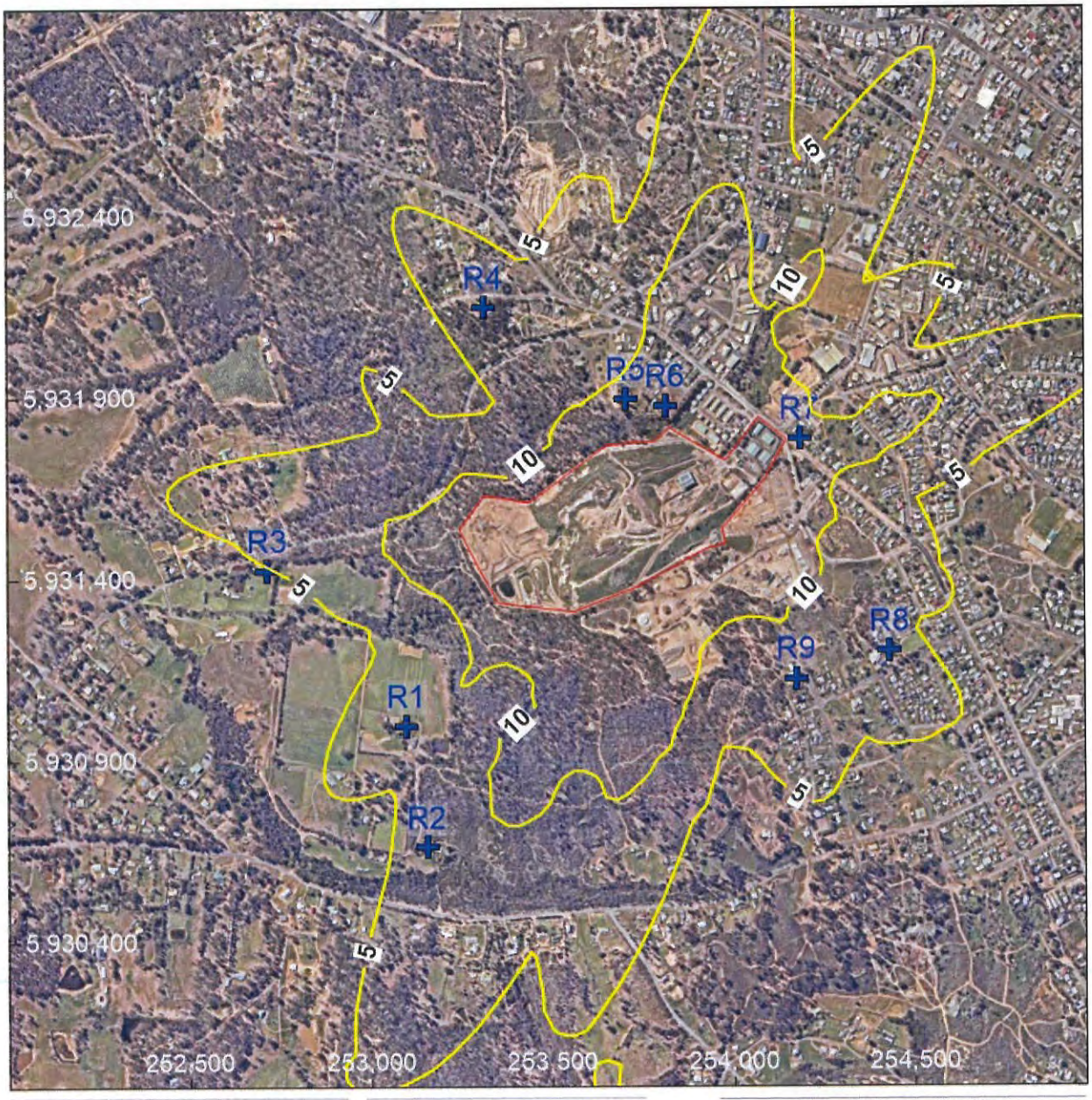
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B27 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Existing Operations, Upset Conditions – 2014



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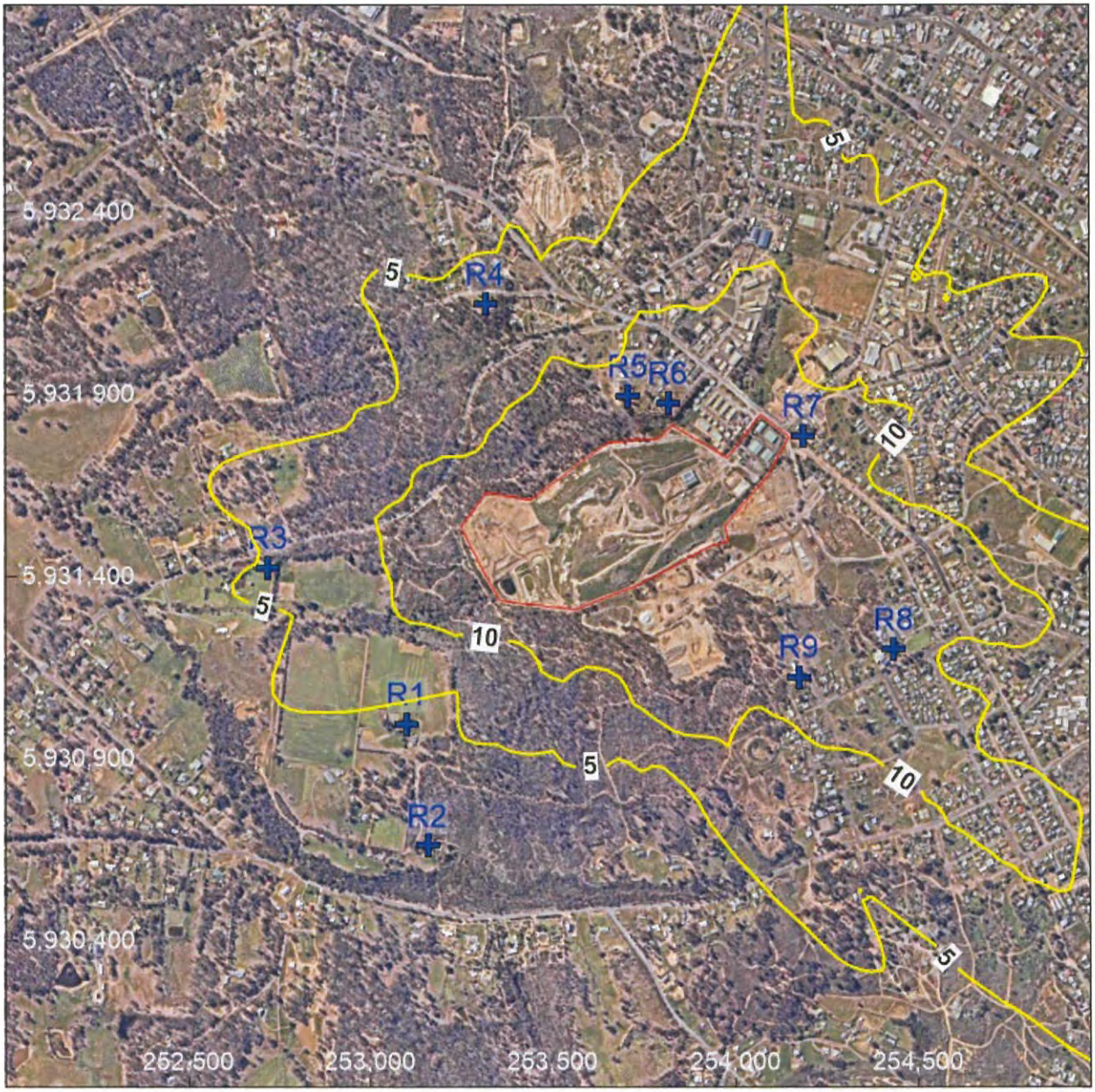
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	PM_{10}	Averaging Period	24-hour	Unit	µg/m³

Figure B28 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Existing Operations, Upset Conditions – 2015



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Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B29 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Existing Operations, Upset Conditions – 2016



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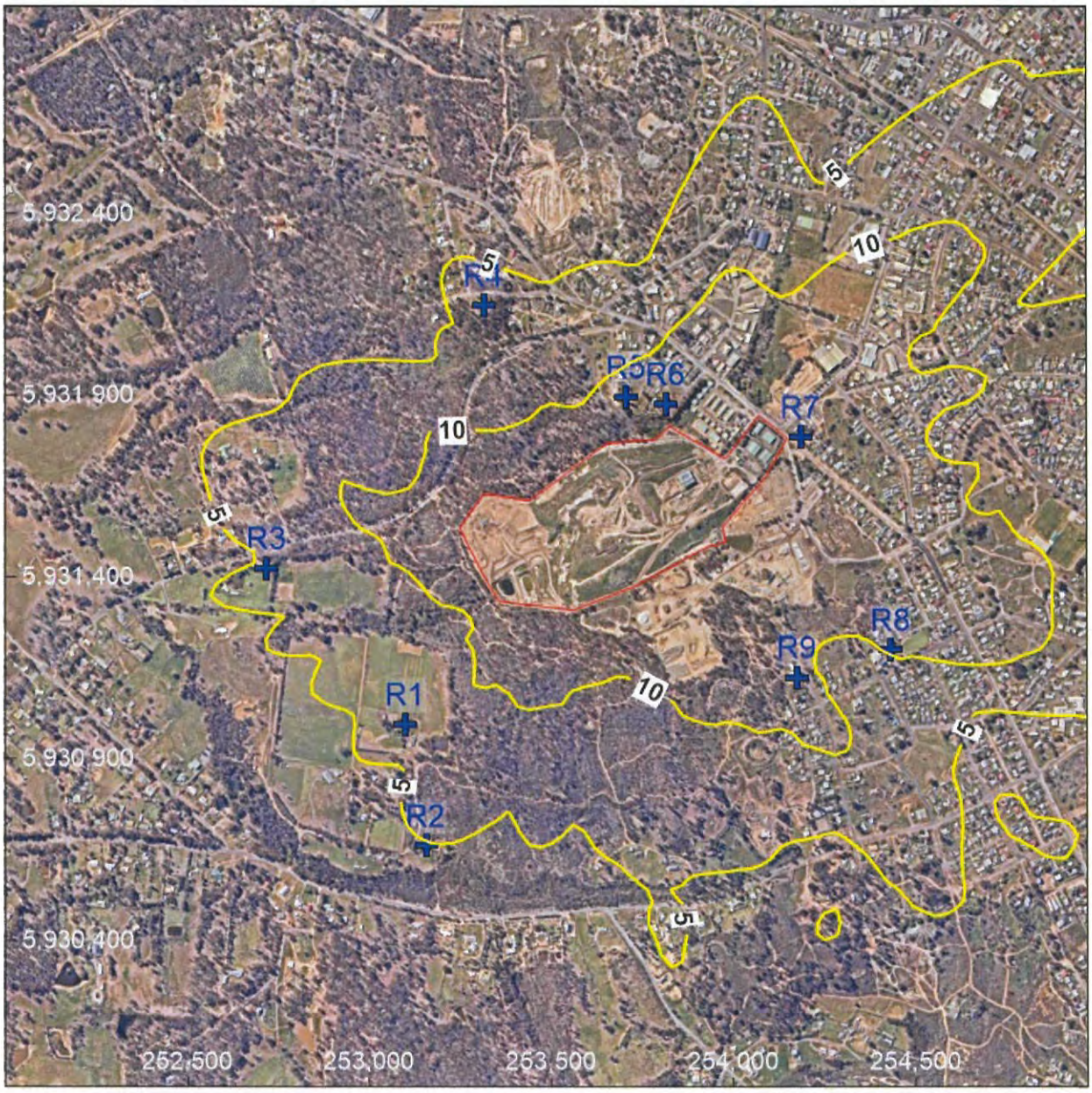
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Eaglehawk Landfill
Dust Impact Assessment

Incremental Impact - Existing Upset Conditions

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B30 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Existing Operations, Upset Conditions – 2017



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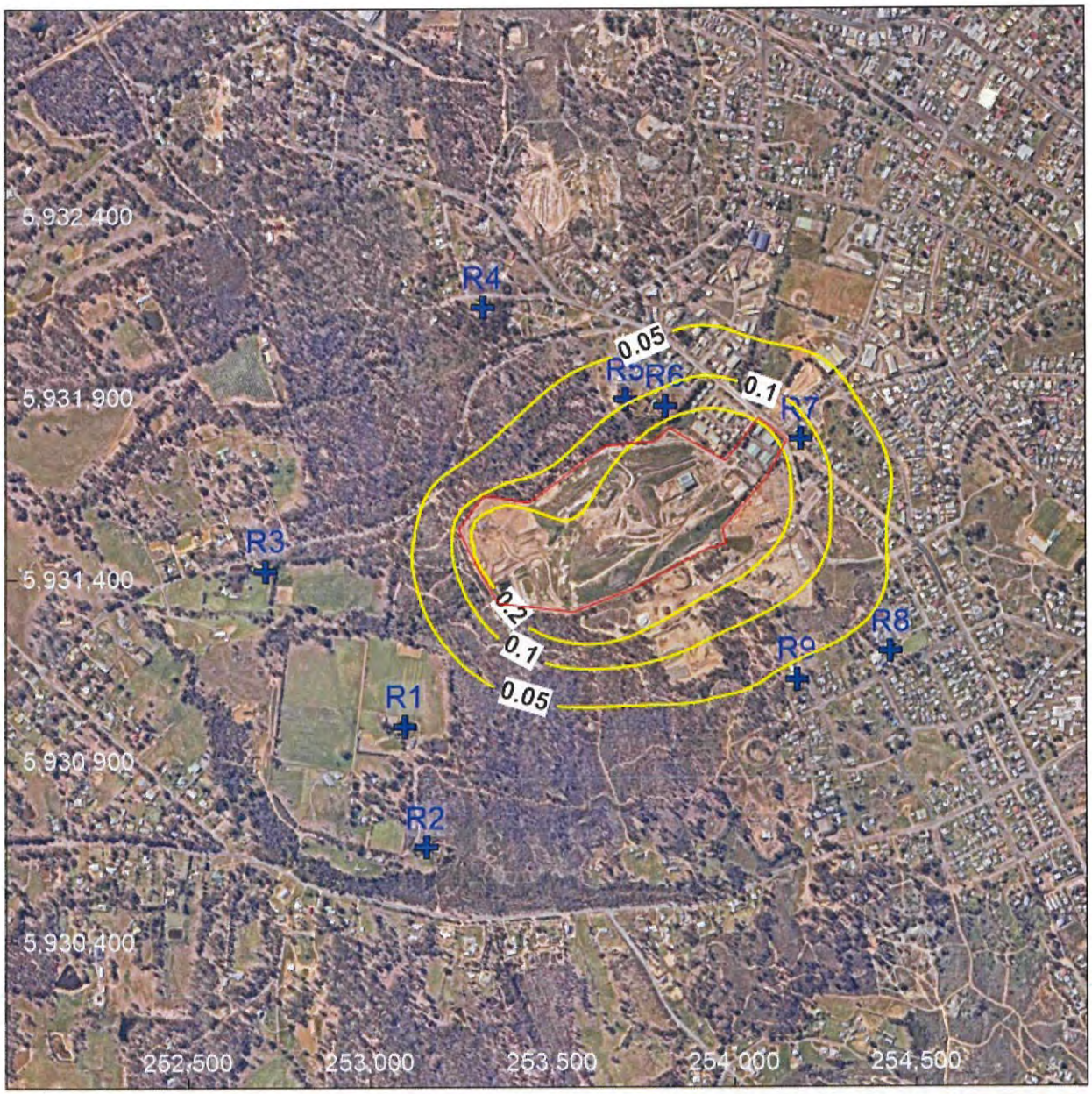
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B31 Predicted Incremental Annual Average $PM_{2.5}$ Concentration ($\mu g/m^3$) – Existing Operations, Normal Conditions – 2013



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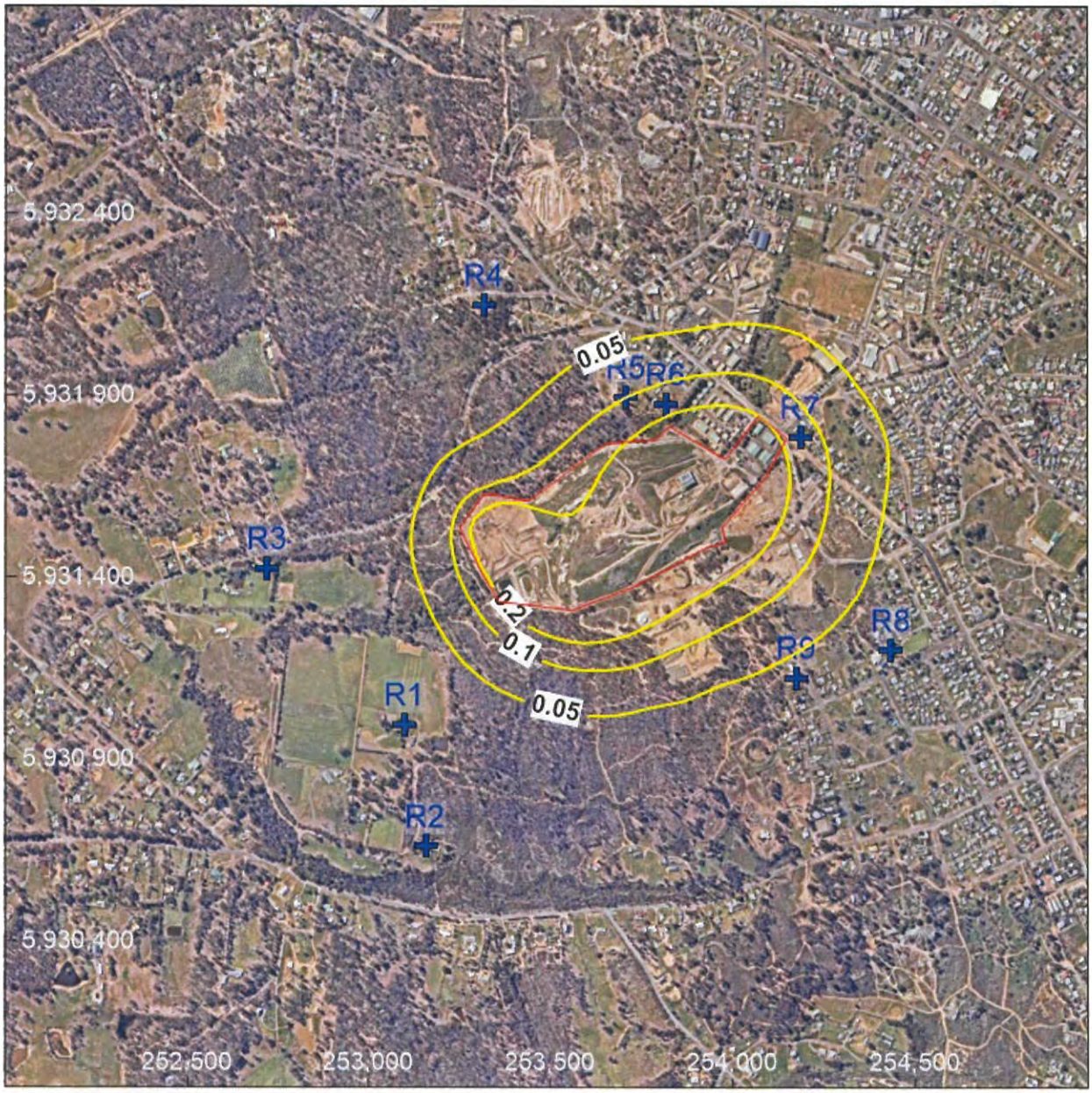
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	$\mu g/m^3$

Figure B32 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Normal Conditions – 2014



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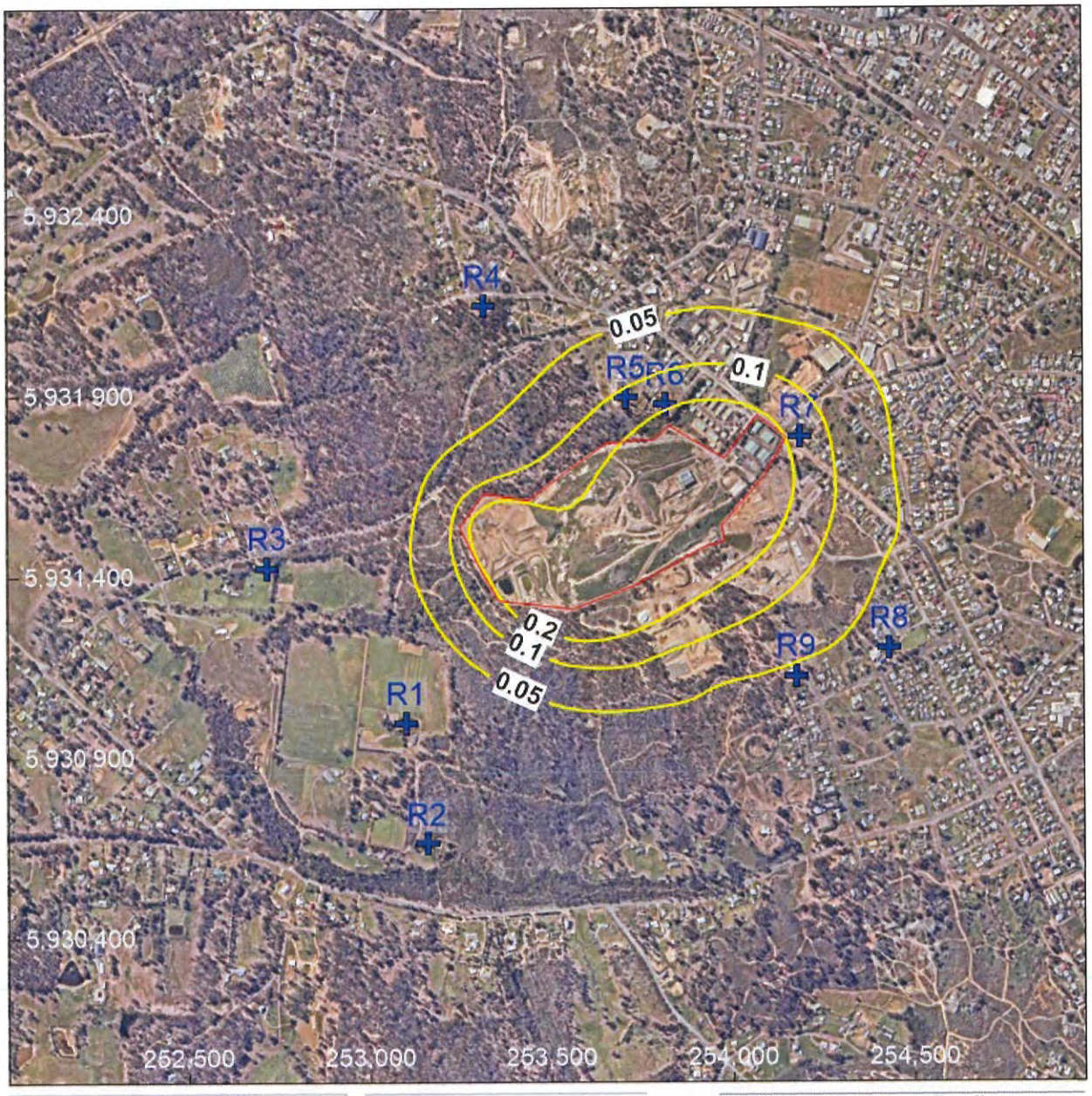
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Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B33 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Normal Conditions – 2015



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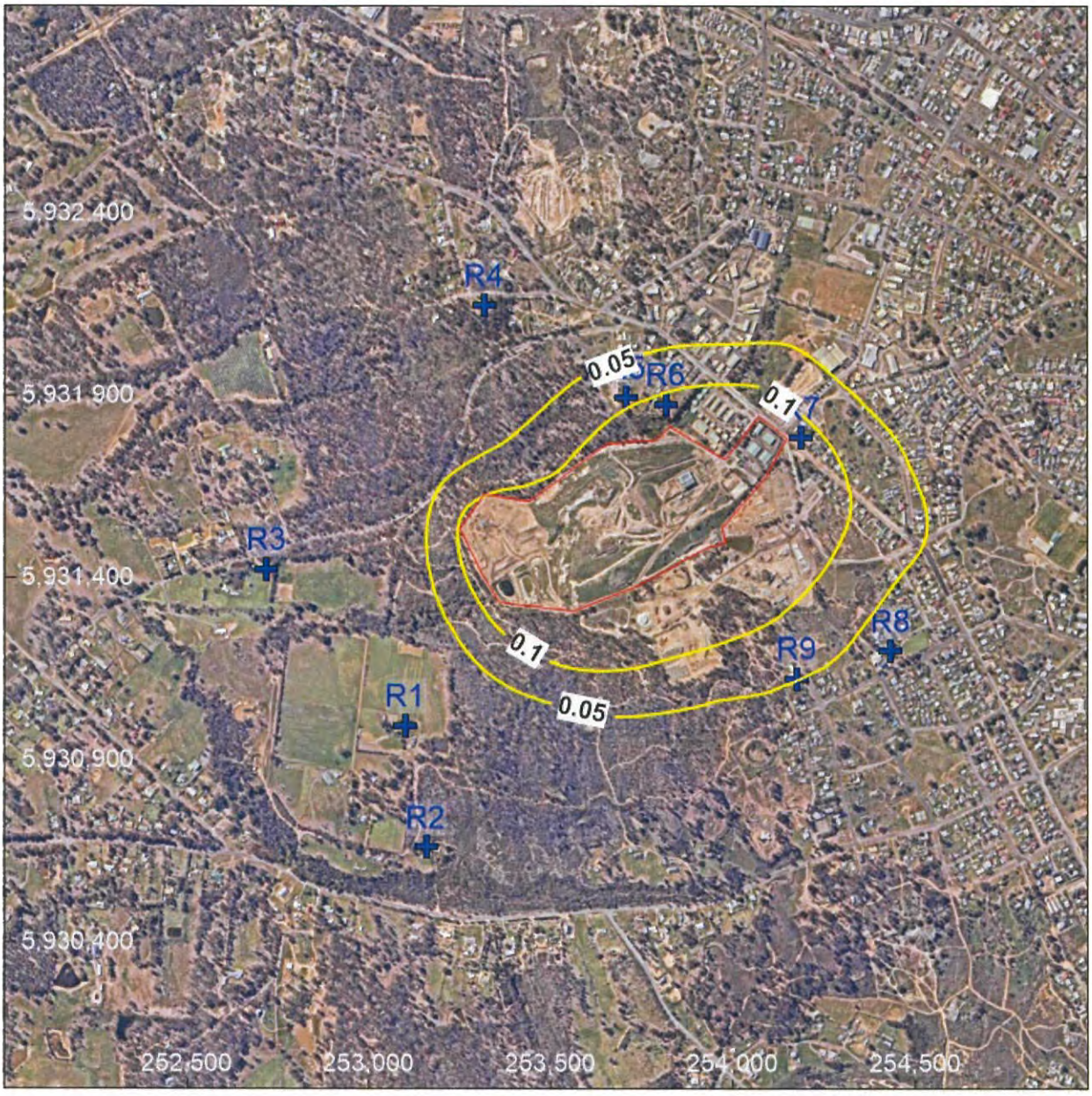
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Modelling Period:	2015
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Date:	18/01/2019

City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B34 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Normal Conditions – 2016



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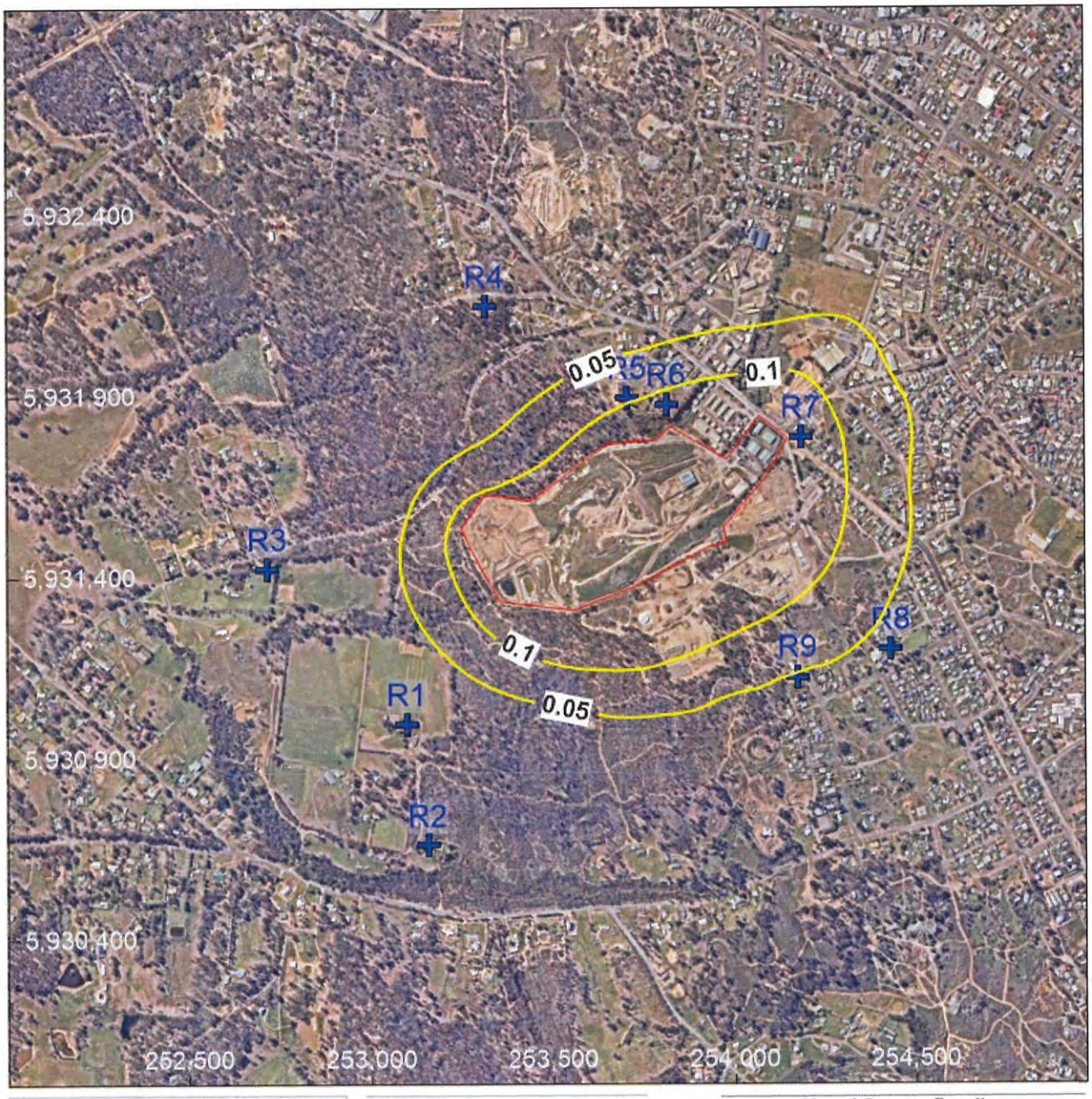
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B35 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Normal Conditions – 2017



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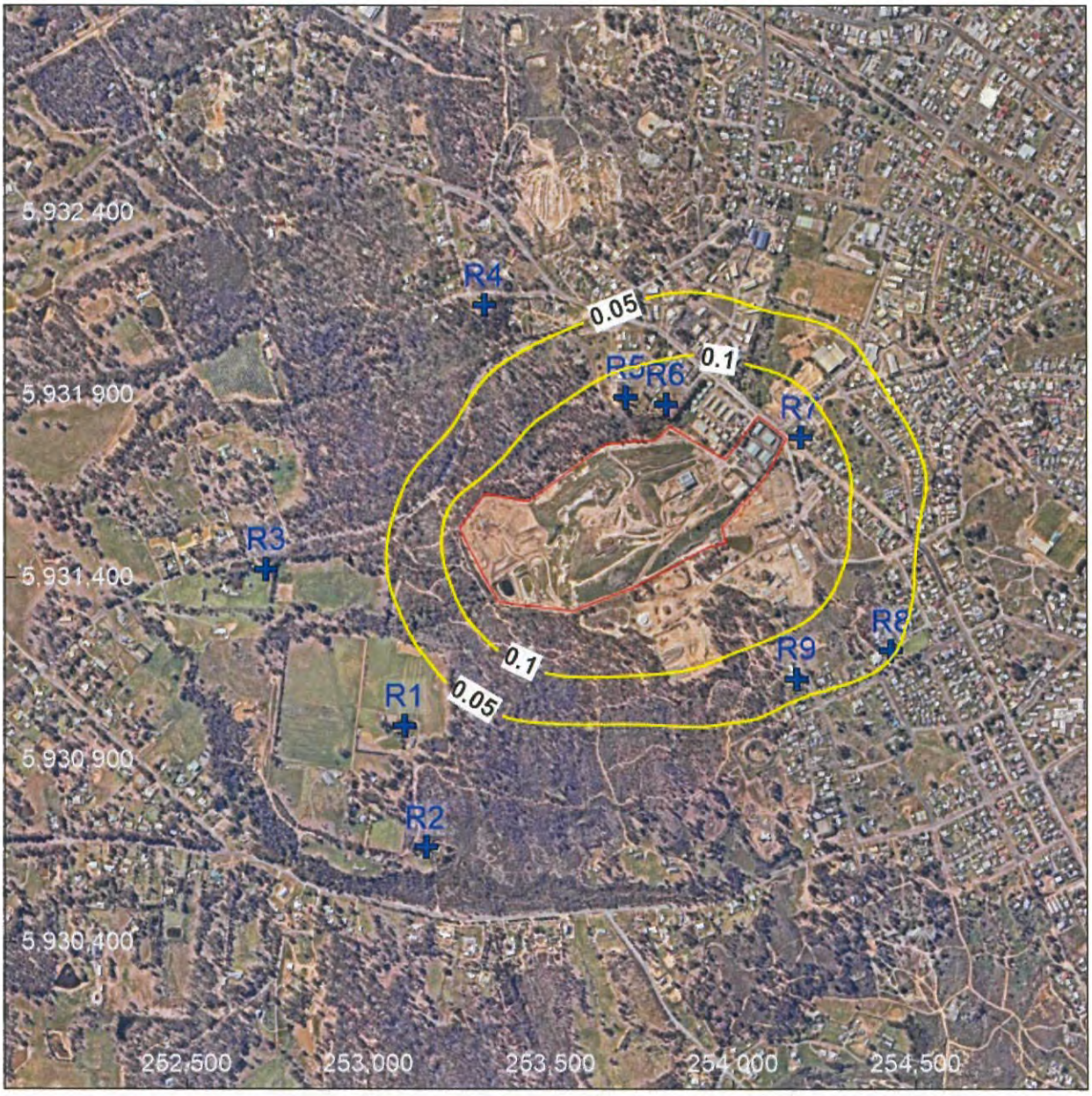
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B36 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Upset Conditions – 2013



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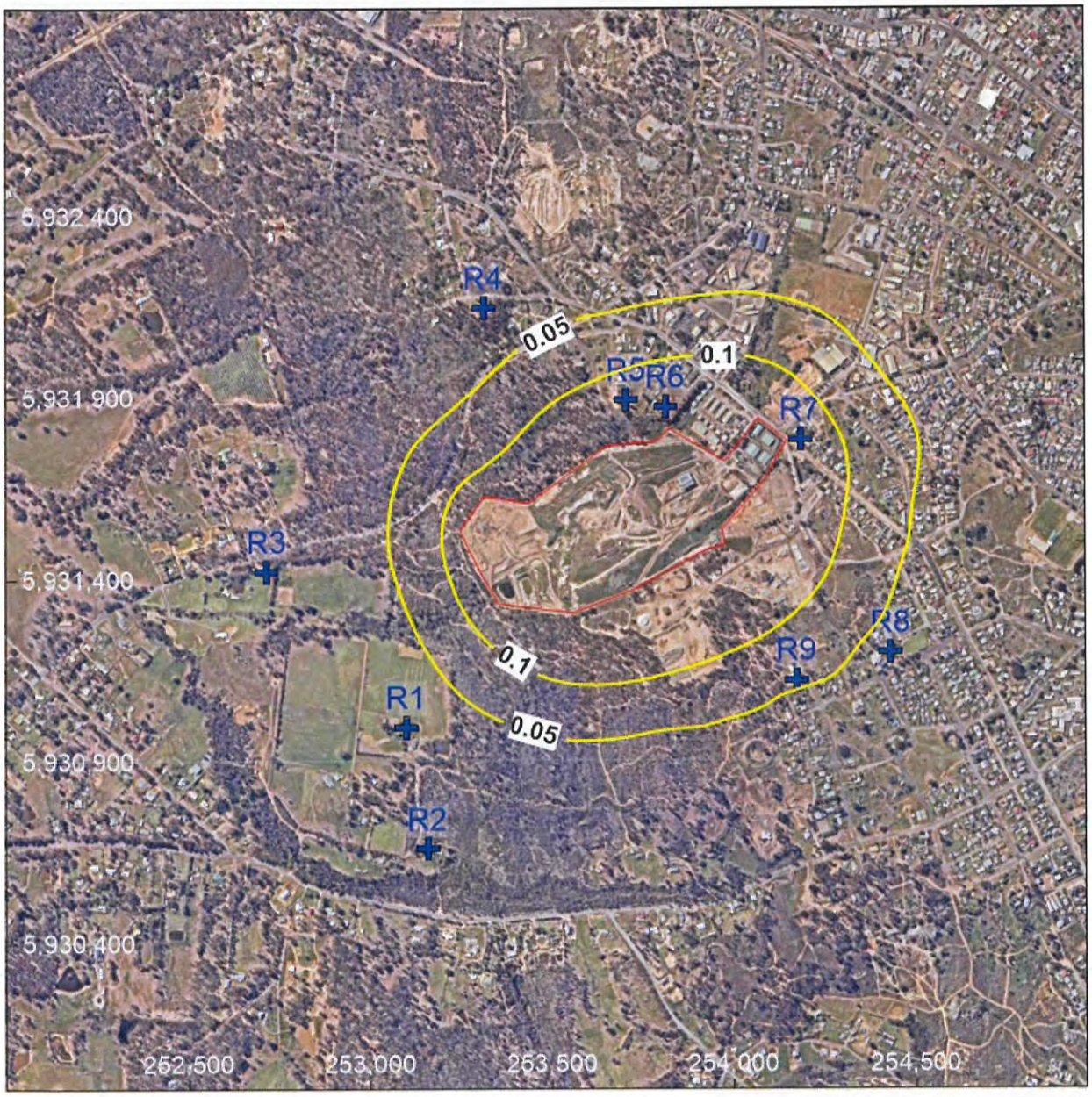
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B37 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Upset Conditions – 2014



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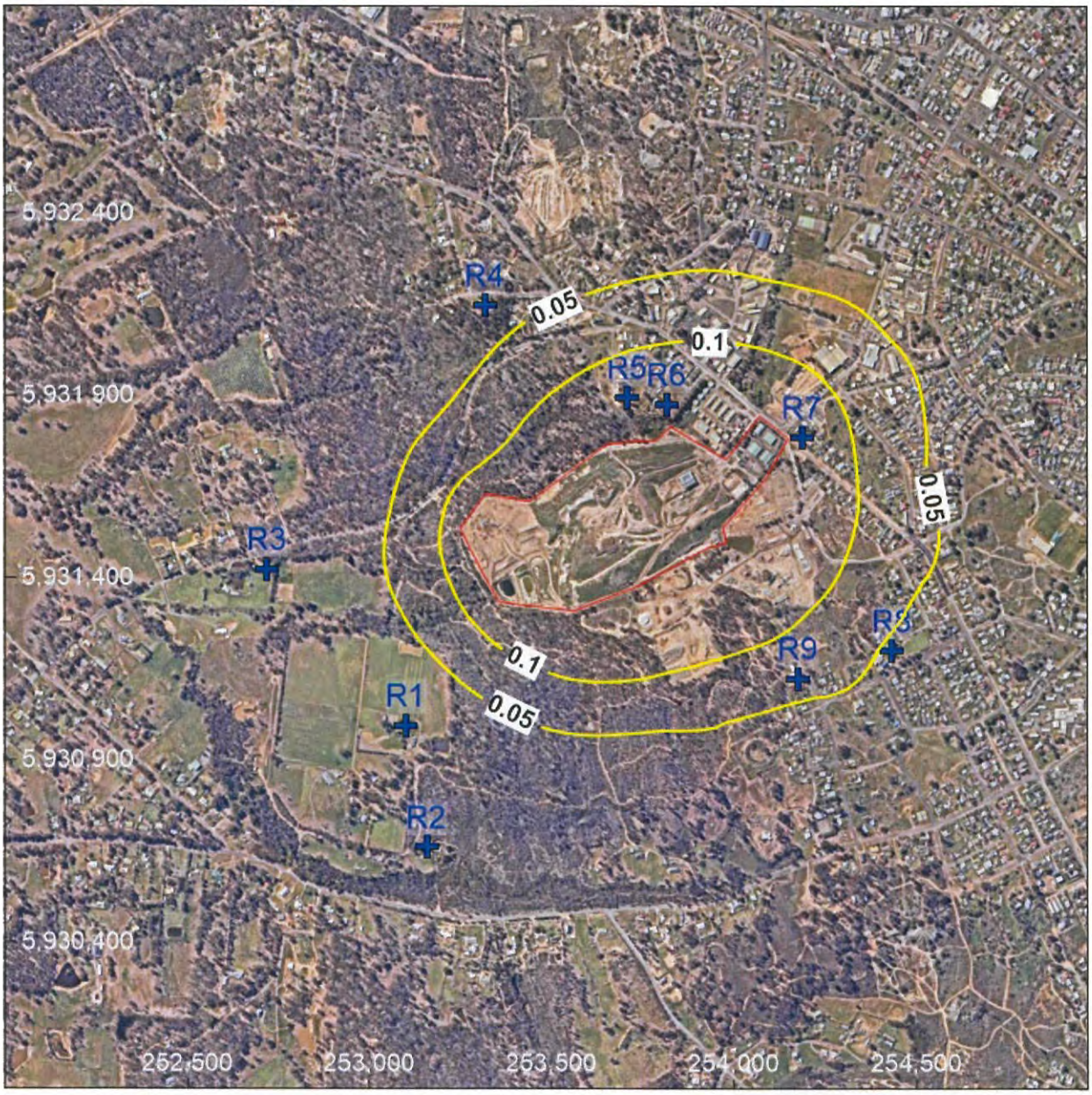
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B38 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Upset Conditions – 2015



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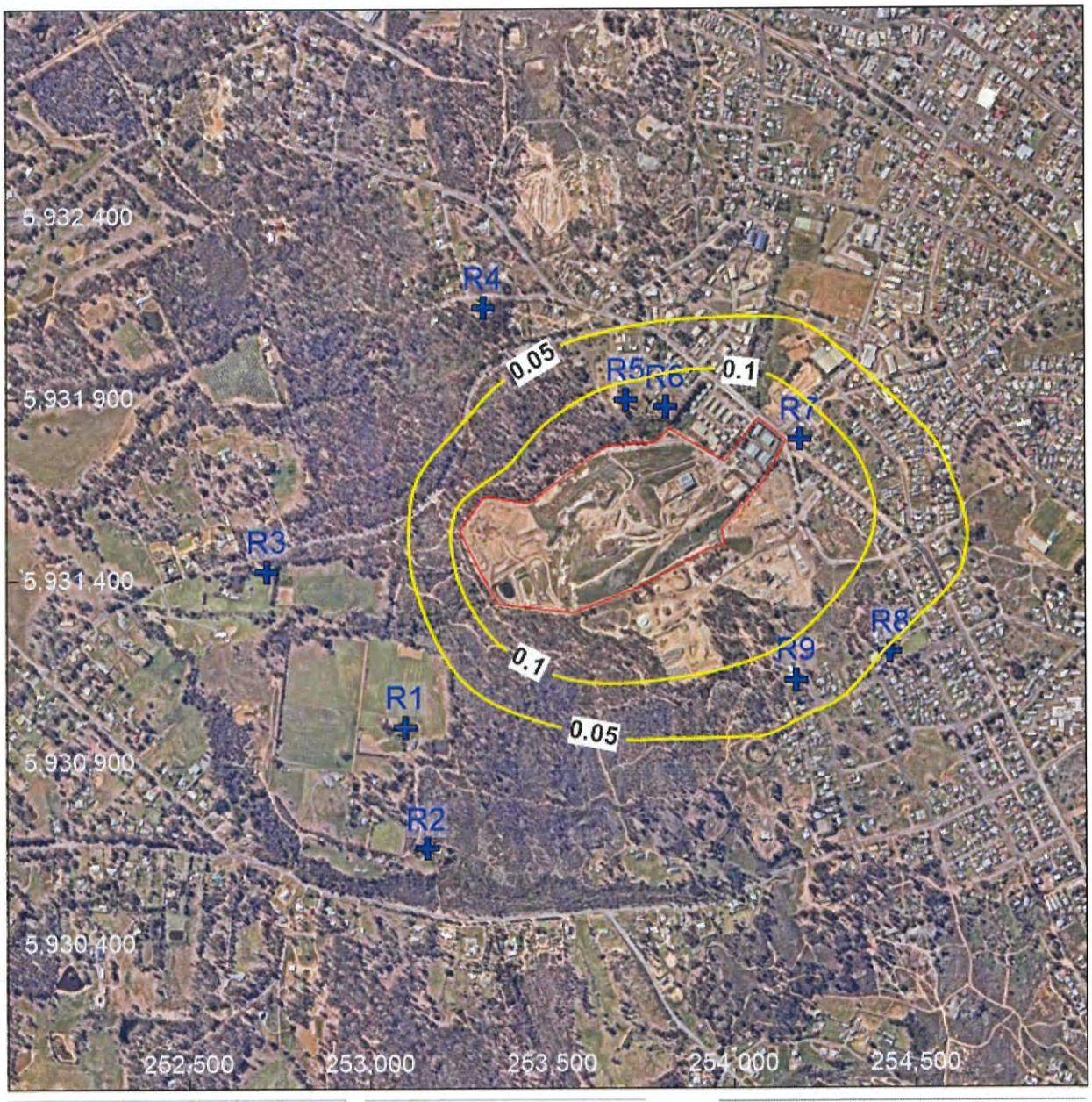
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B39 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Upset Conditions – 2016



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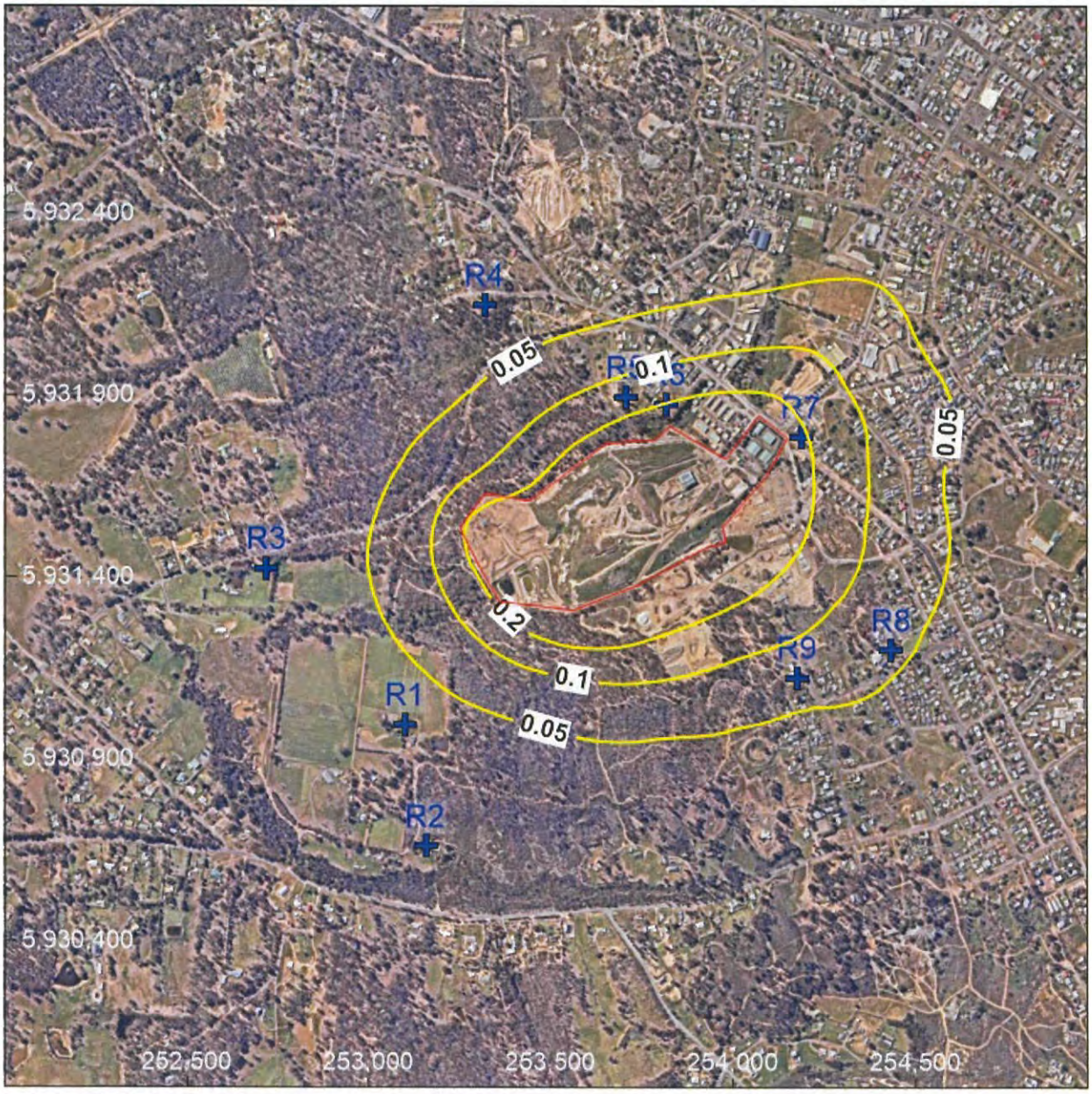
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B40 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Upset Conditions – 2017



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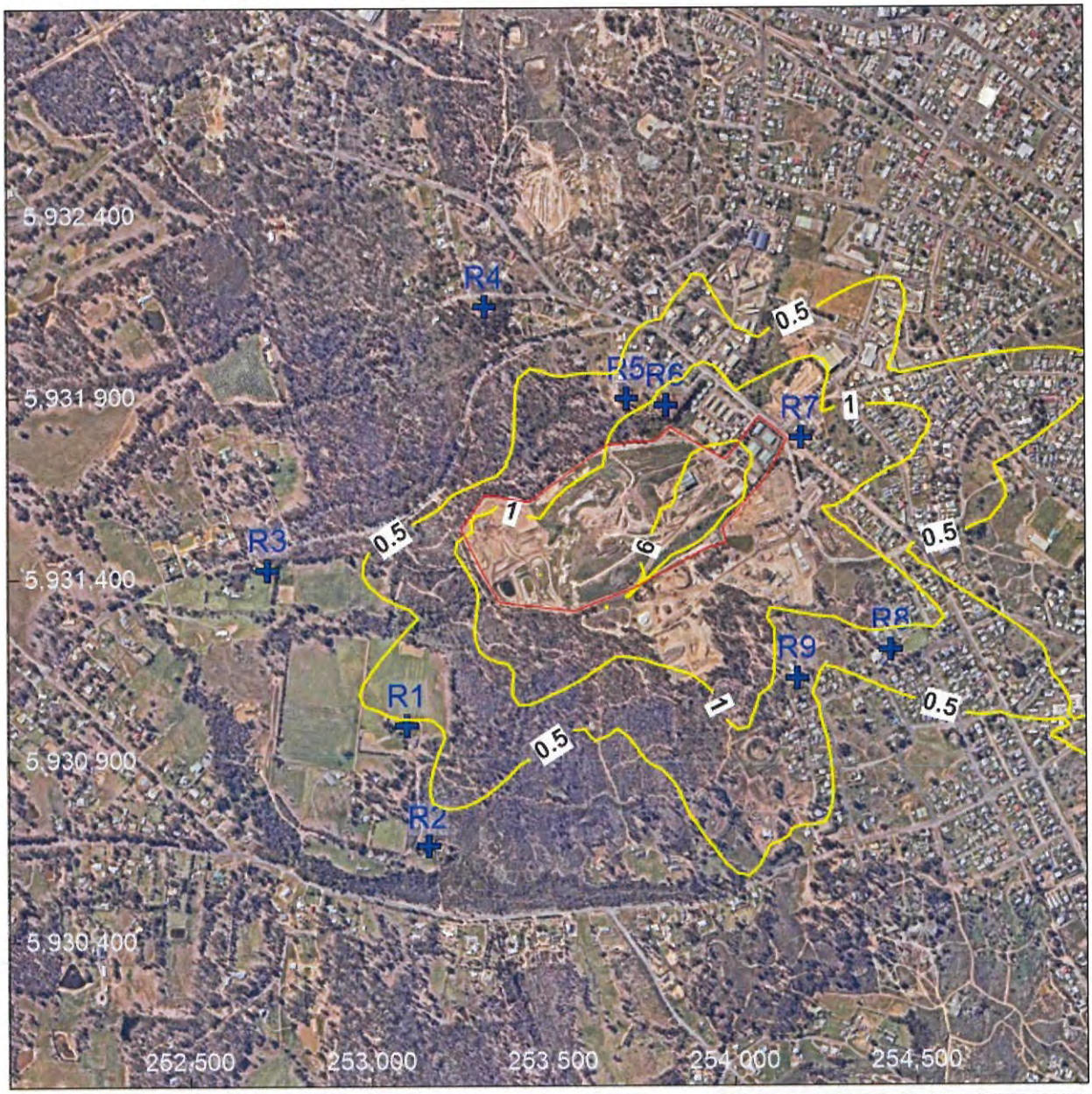
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B41 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Normal Conditions – 2013



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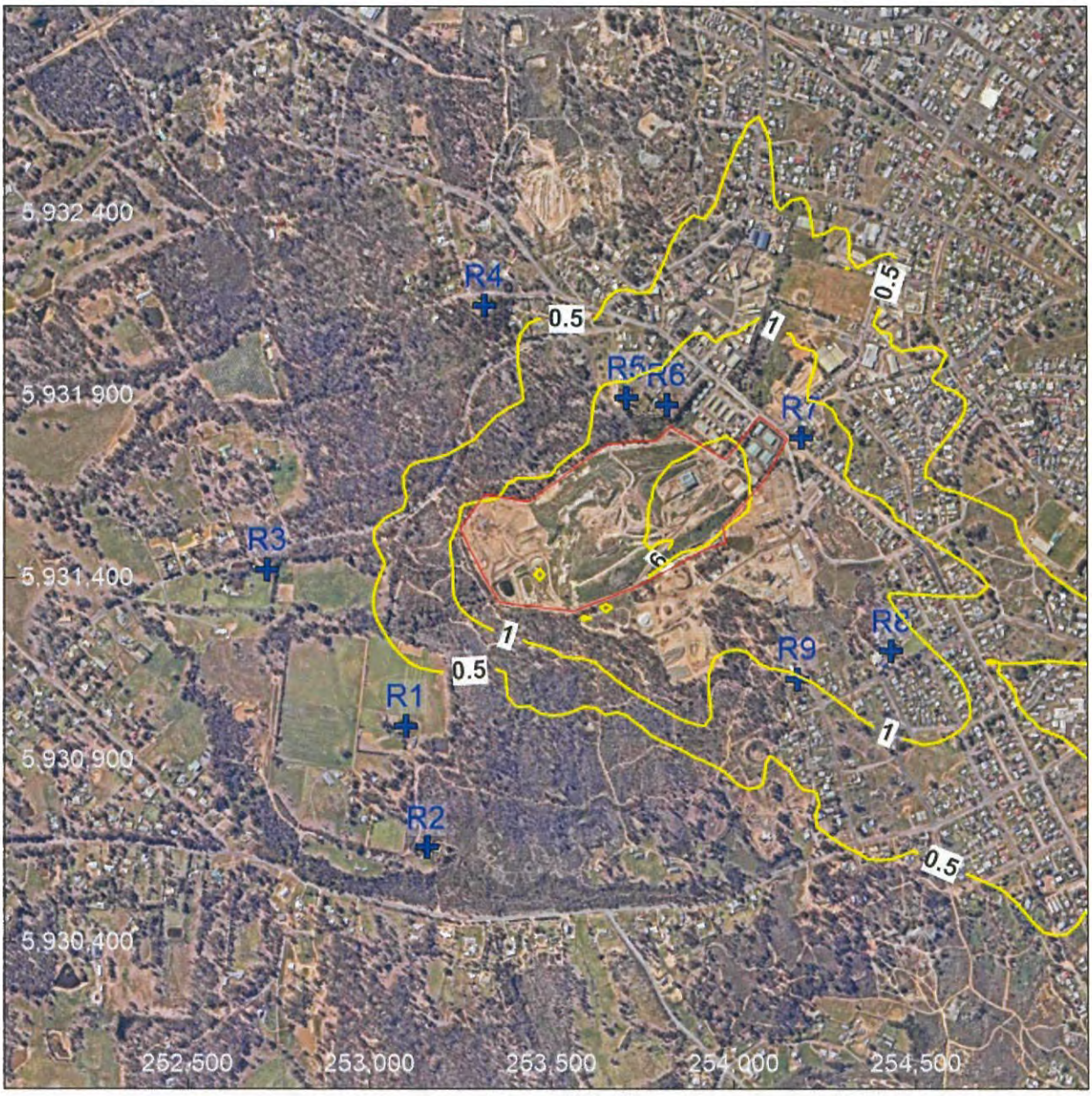
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B43 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Normal Conditions – 2015



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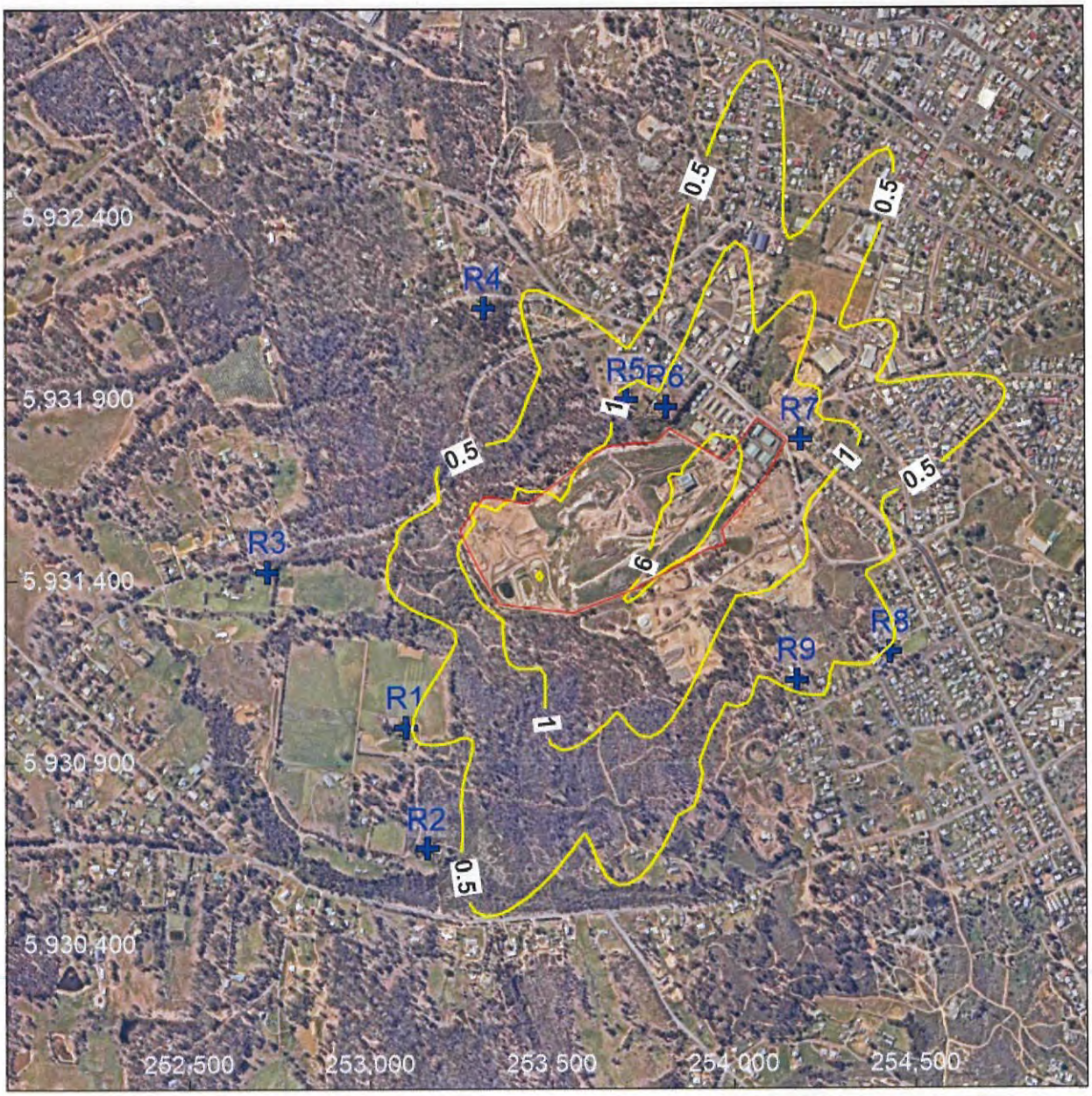
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B42 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Normal Conditions – 2014



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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B47 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Upset Conditions – 2014

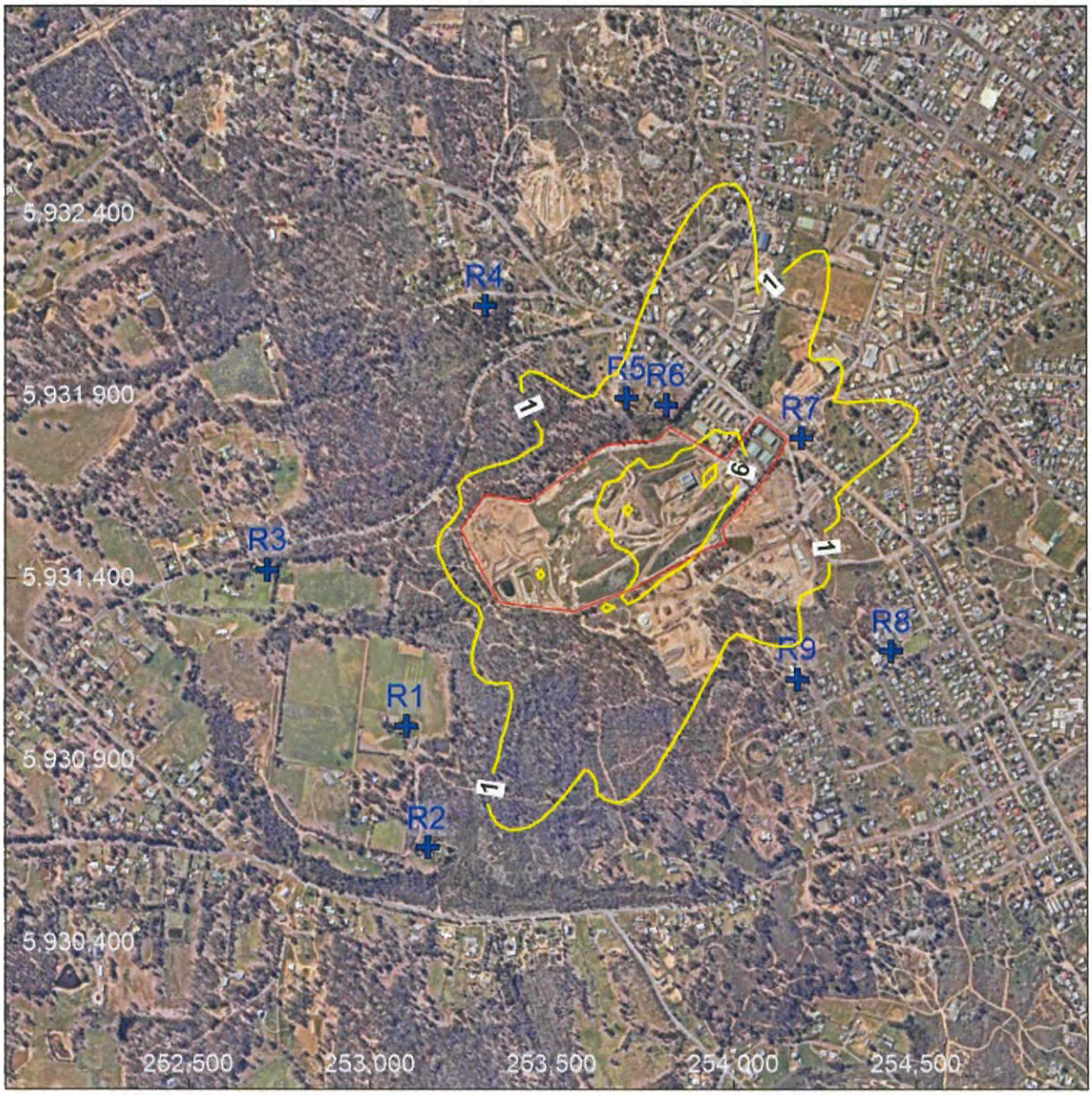
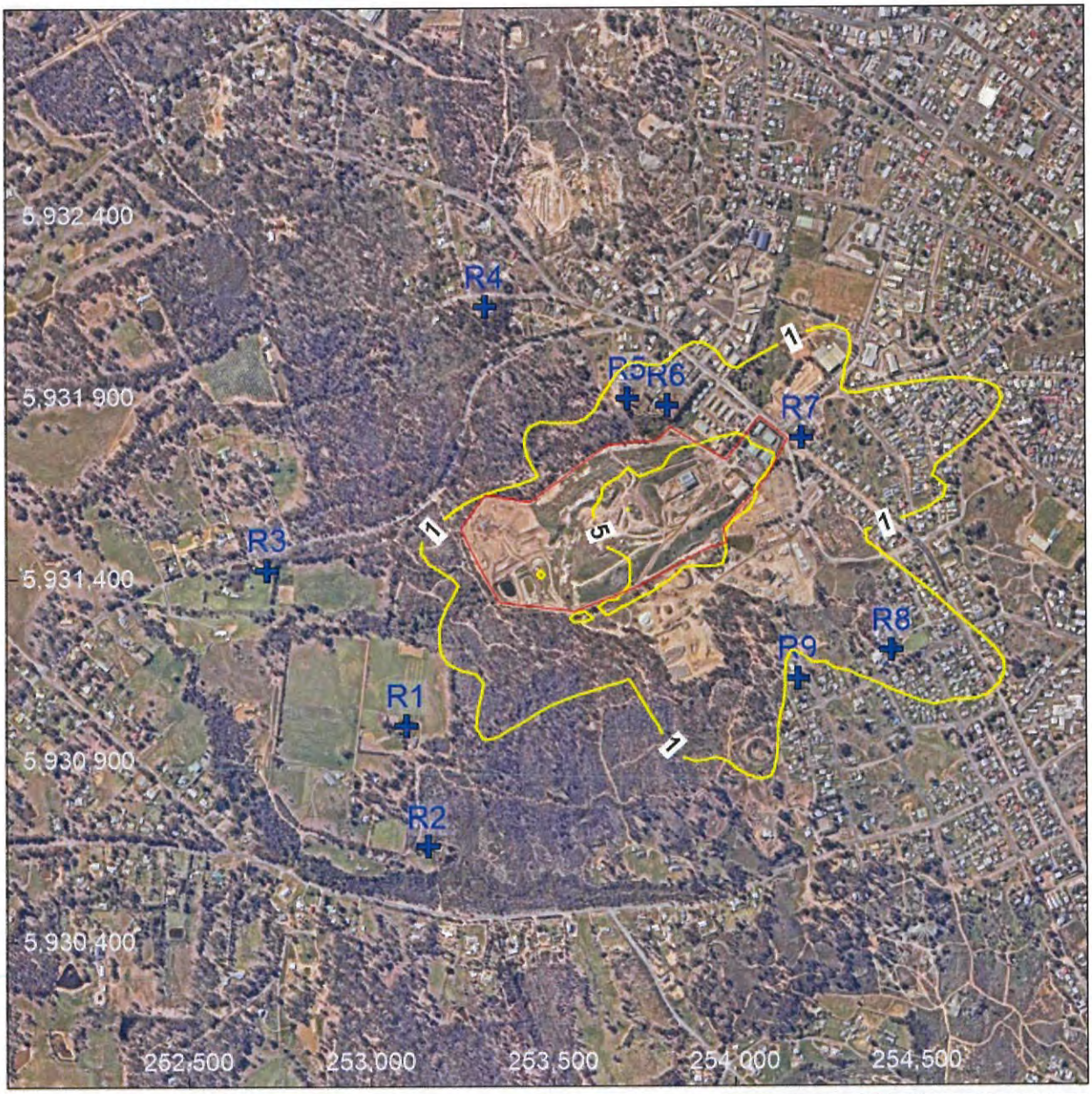


Figure B46 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Upset Conditions – 2013



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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B45 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Normal Conditions – 2017



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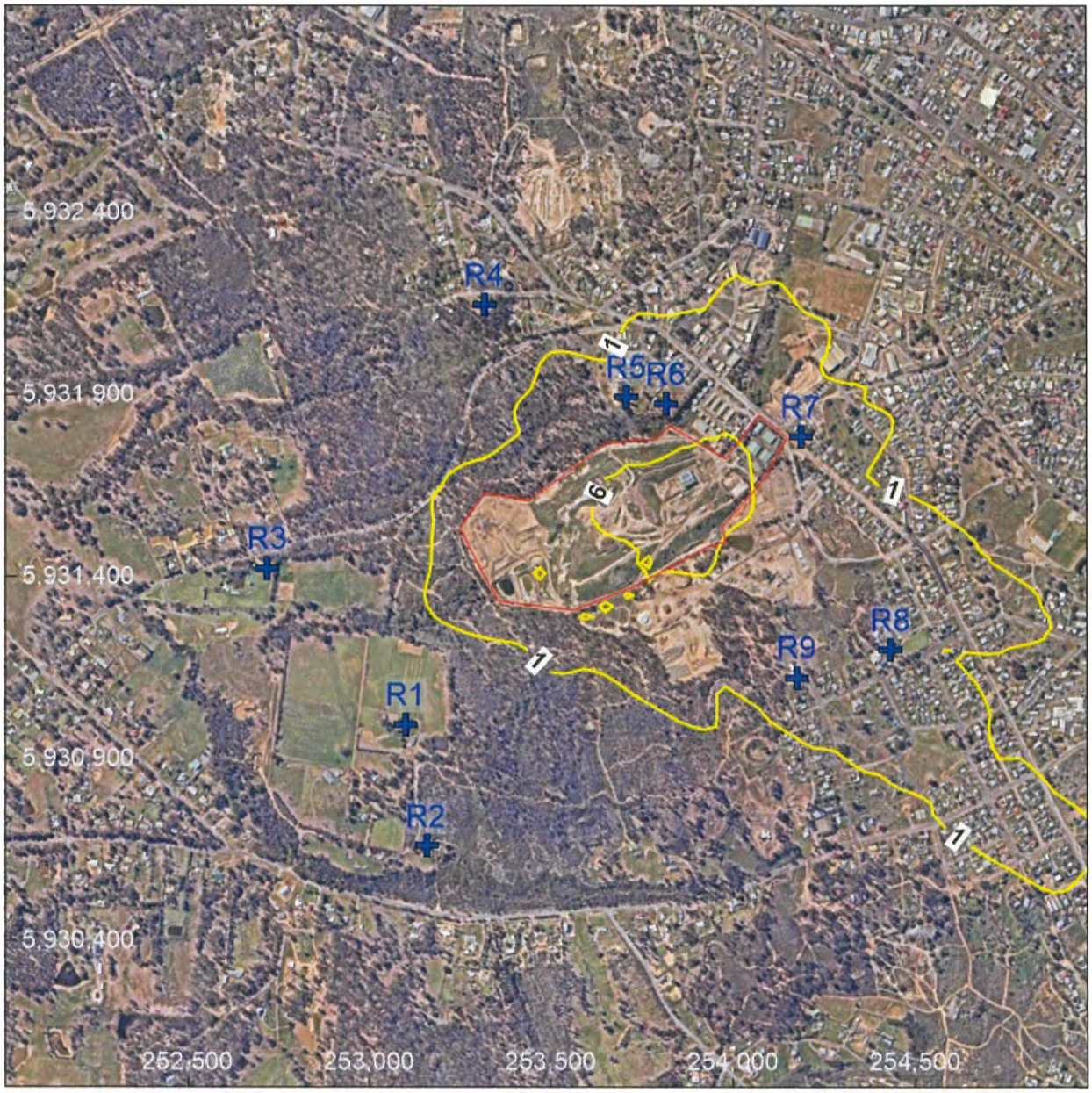
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Dust Impact Assessment
Incremental Impact - Existing Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B44 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Normal Conditions – 2016



Figure B48 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Upset Conditions – 2015



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Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	24-hour	Unit	µg/m³

Figure B49 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Upset Conditions – 2016



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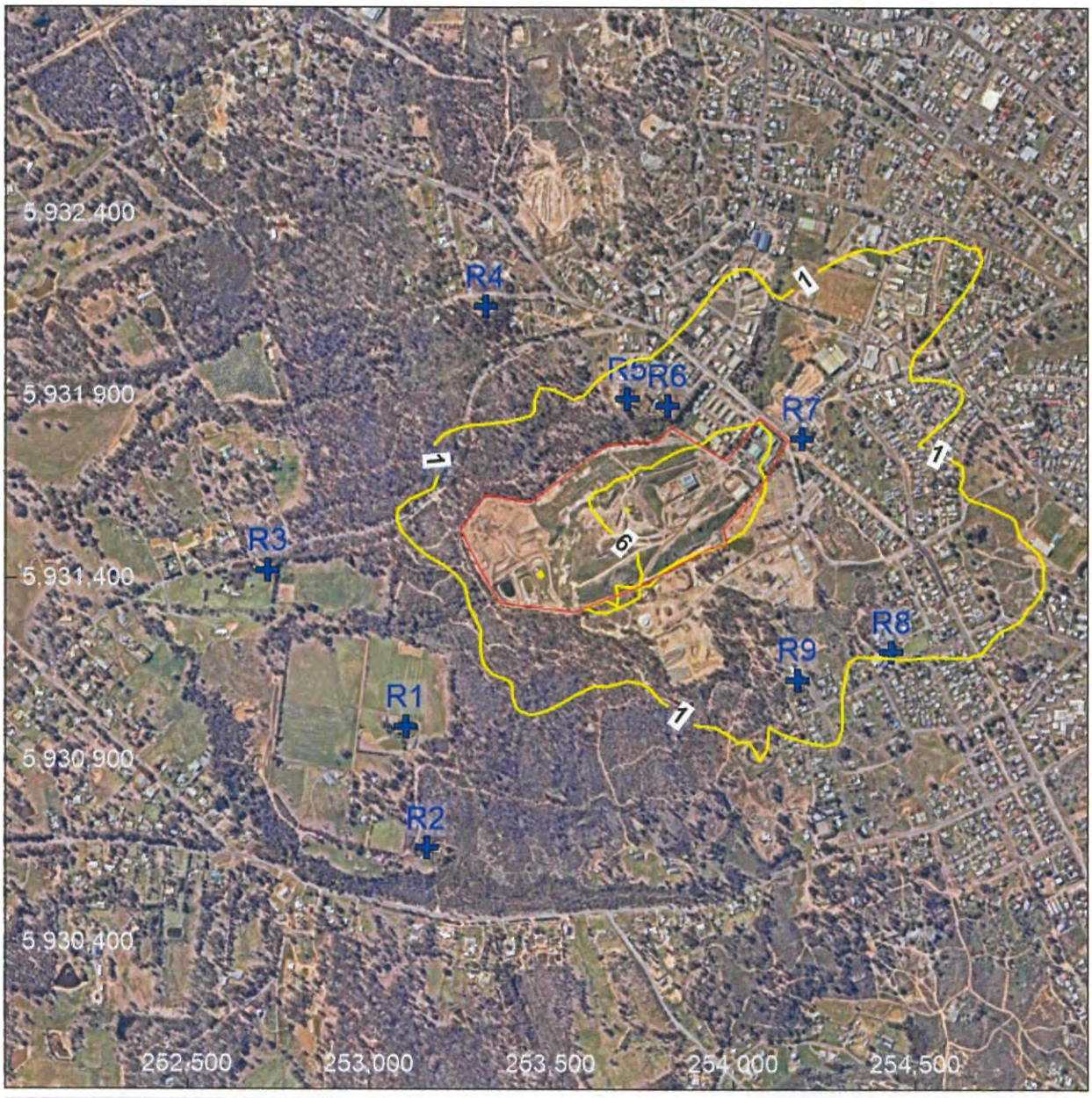
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B50 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Existing Operations, Upset Conditions – 2017



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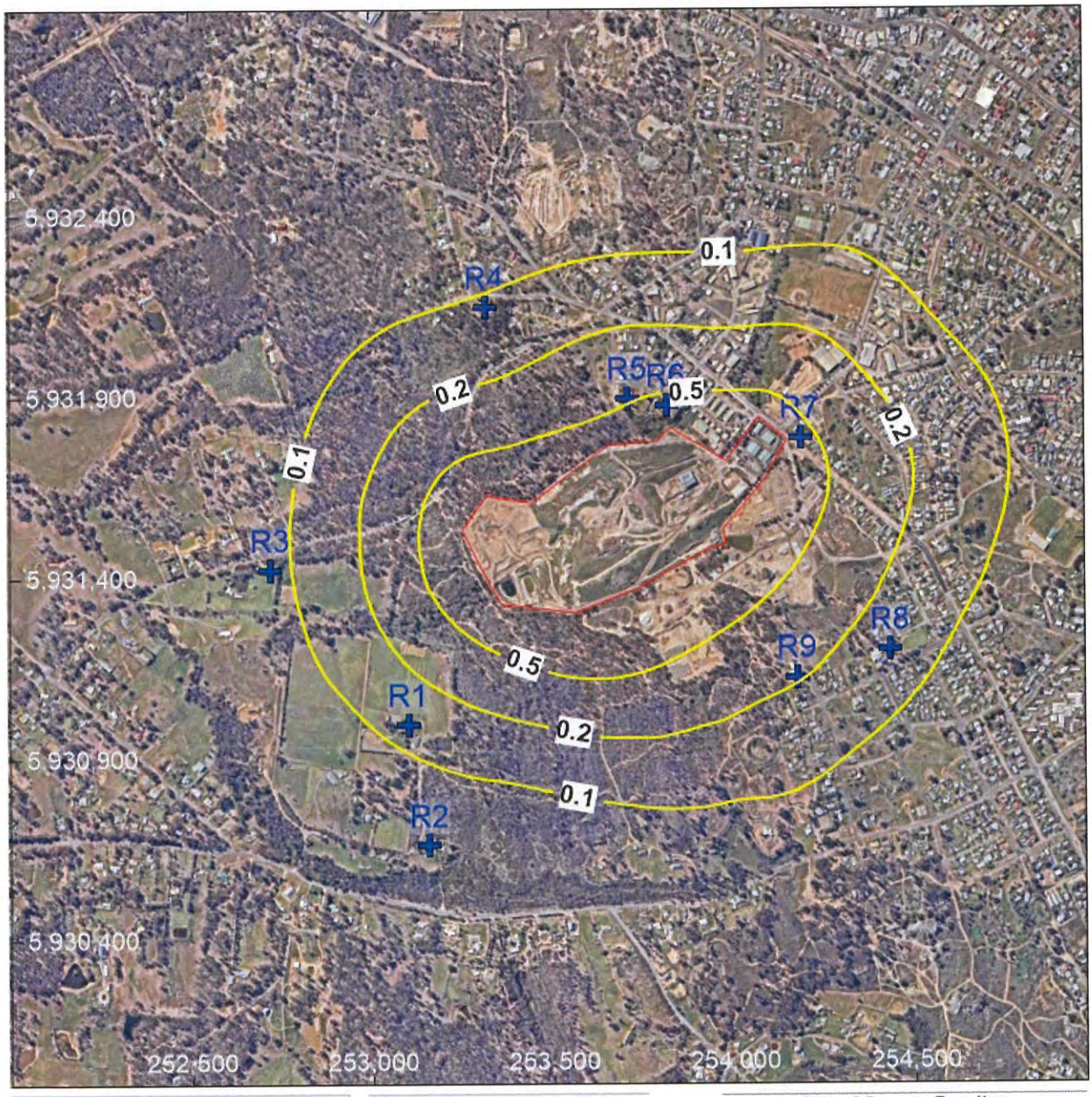
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Existing Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B51 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Proposed Operations, Normal Conditions – 2013



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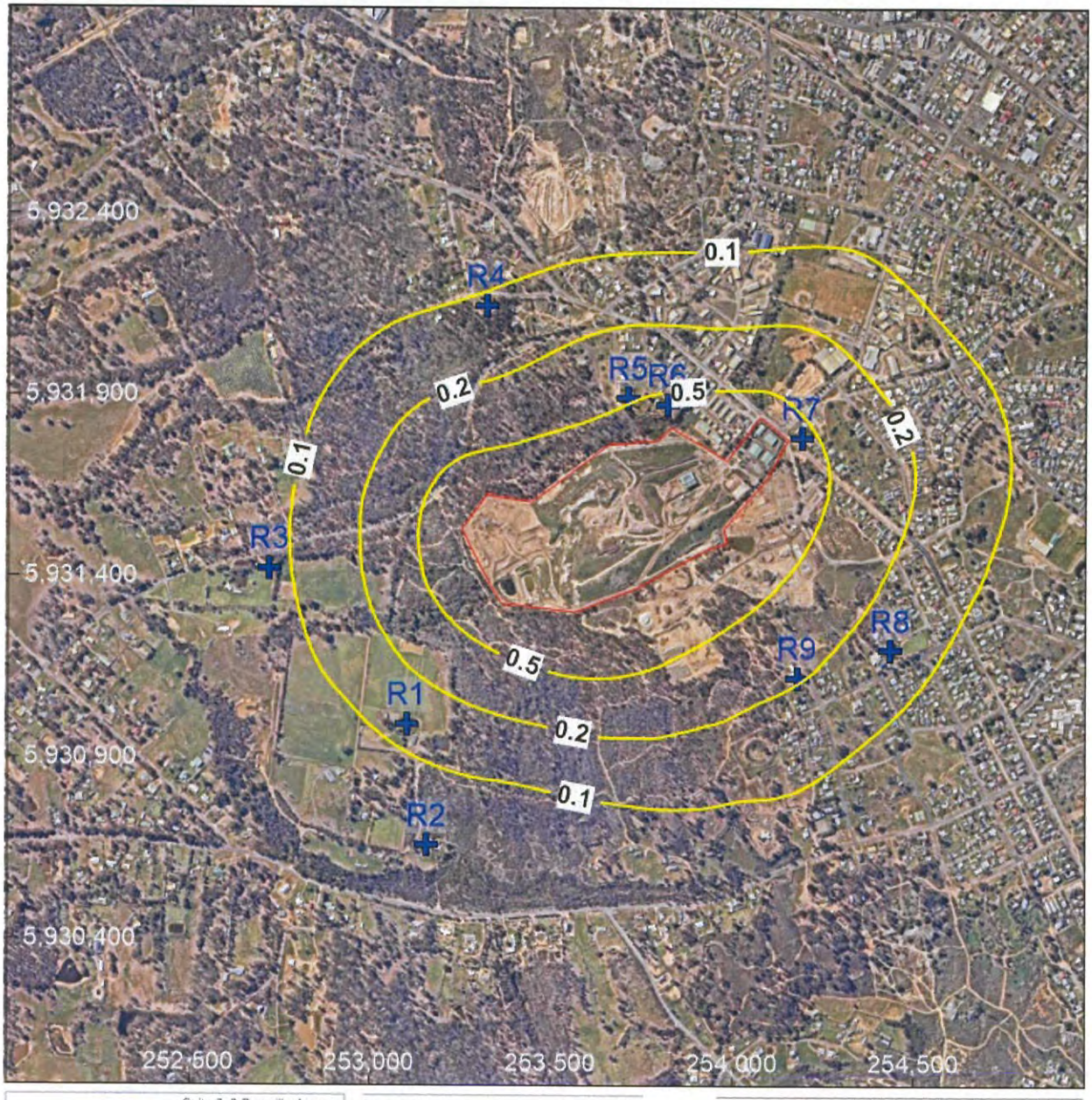
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B52 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Proposed Operations, Normal Conditions – 2014



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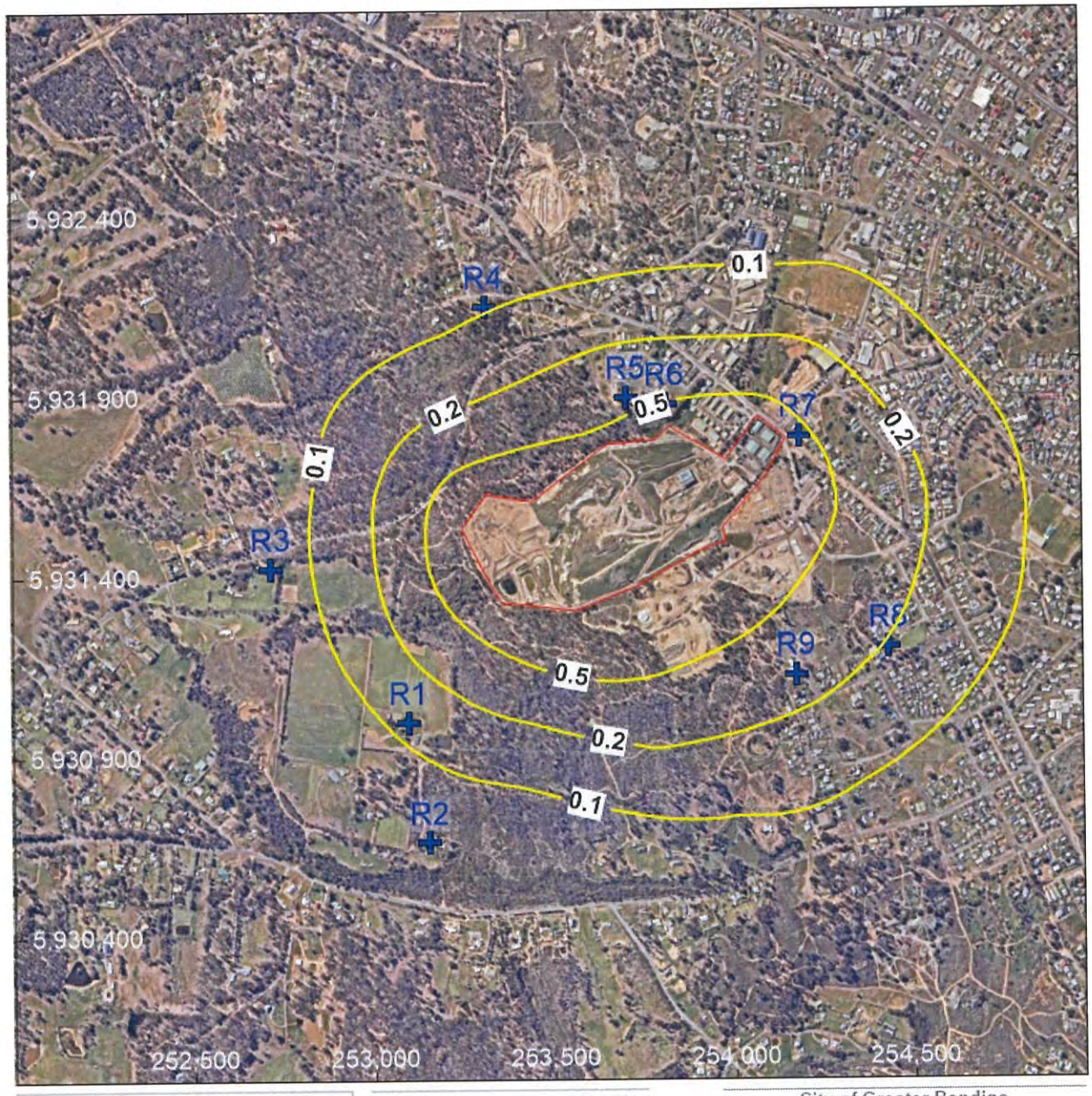
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B53 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Proposed Operations, Normal Conditions – 2015



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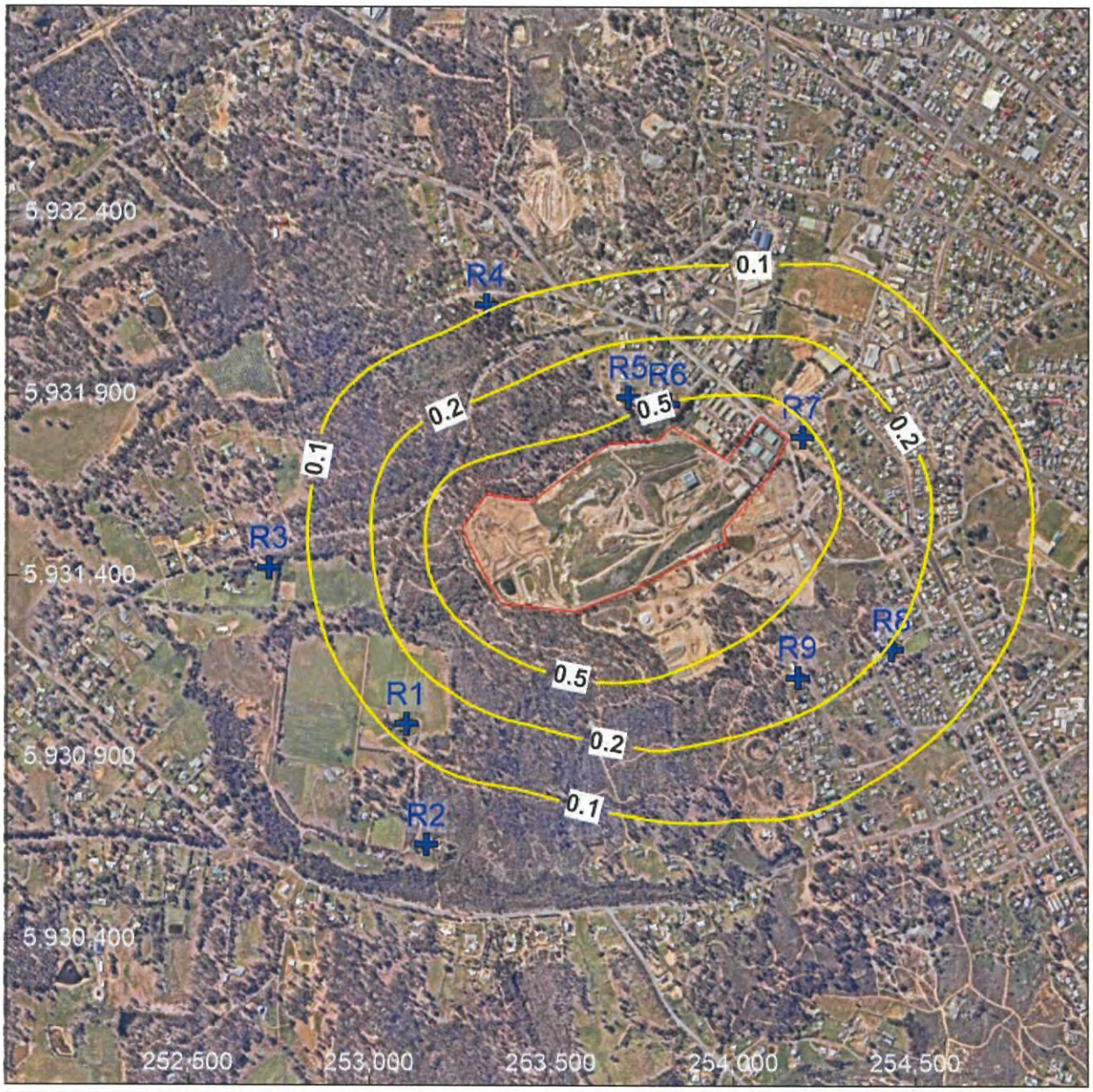
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B54 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Proposed Operations, Normal Conditions – 2016



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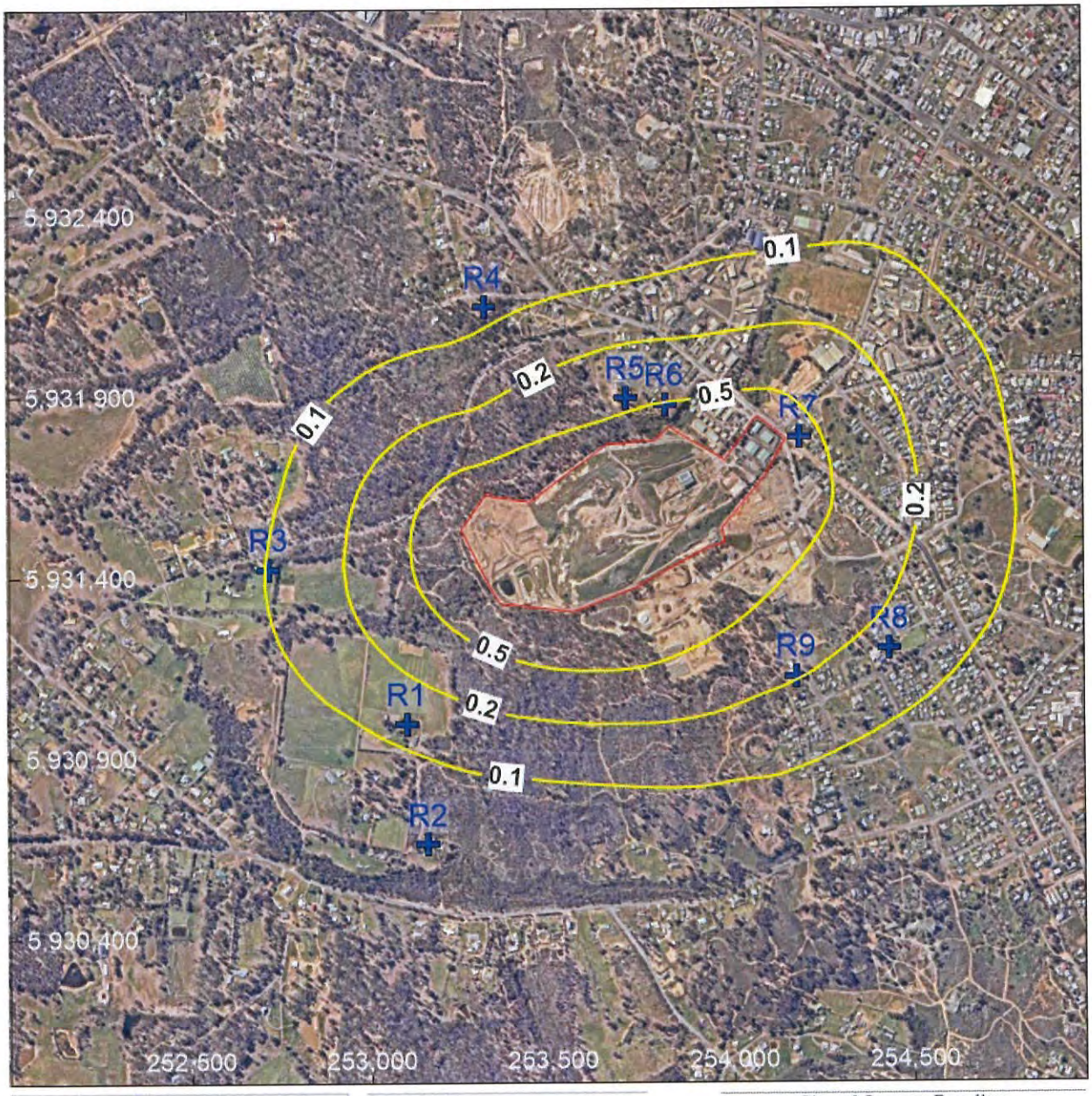
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B55 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Proposed Operations, Normal Conditions – 2017



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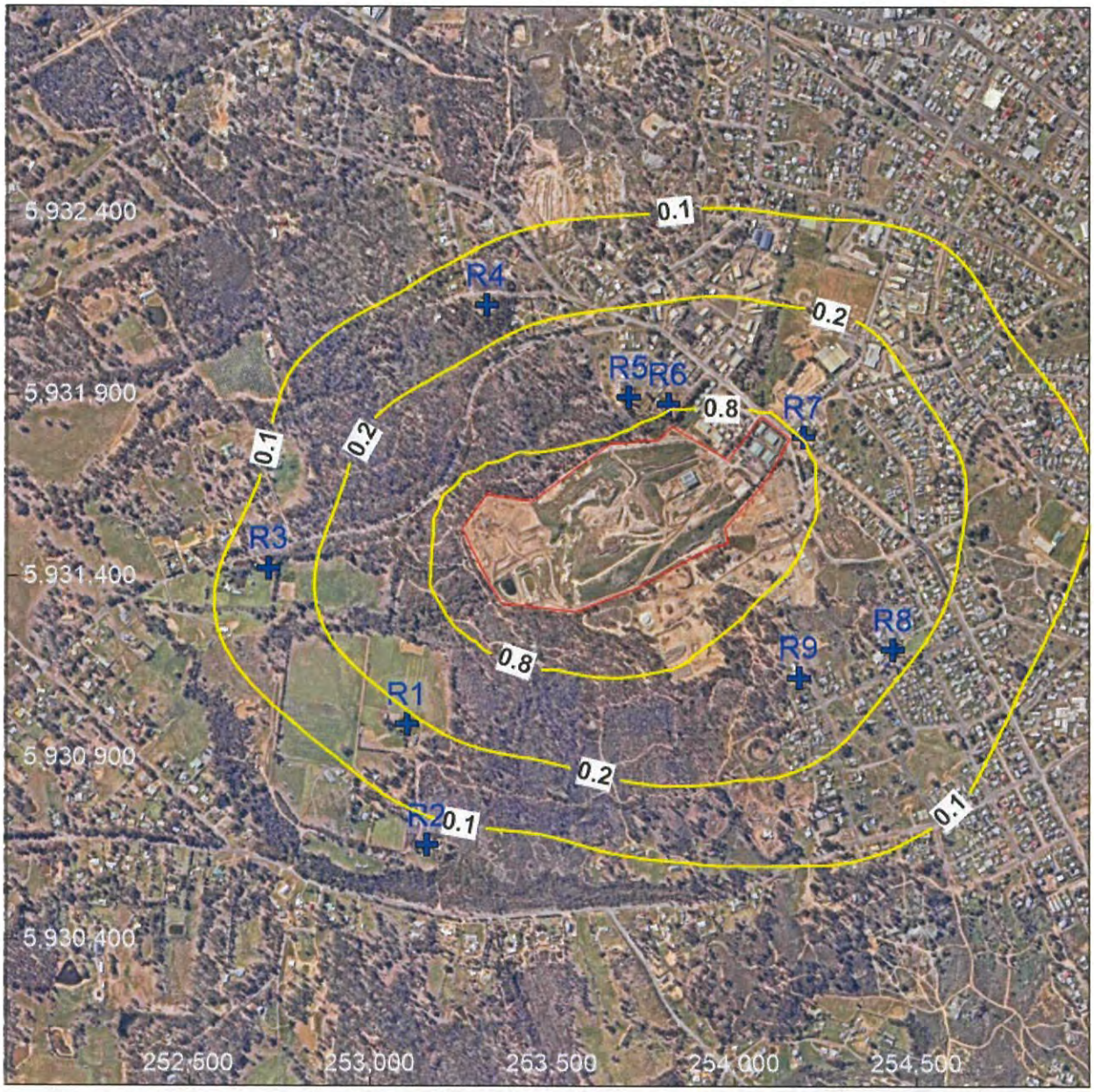
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B56 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Proposed Operations, Upset Conditions – 2013



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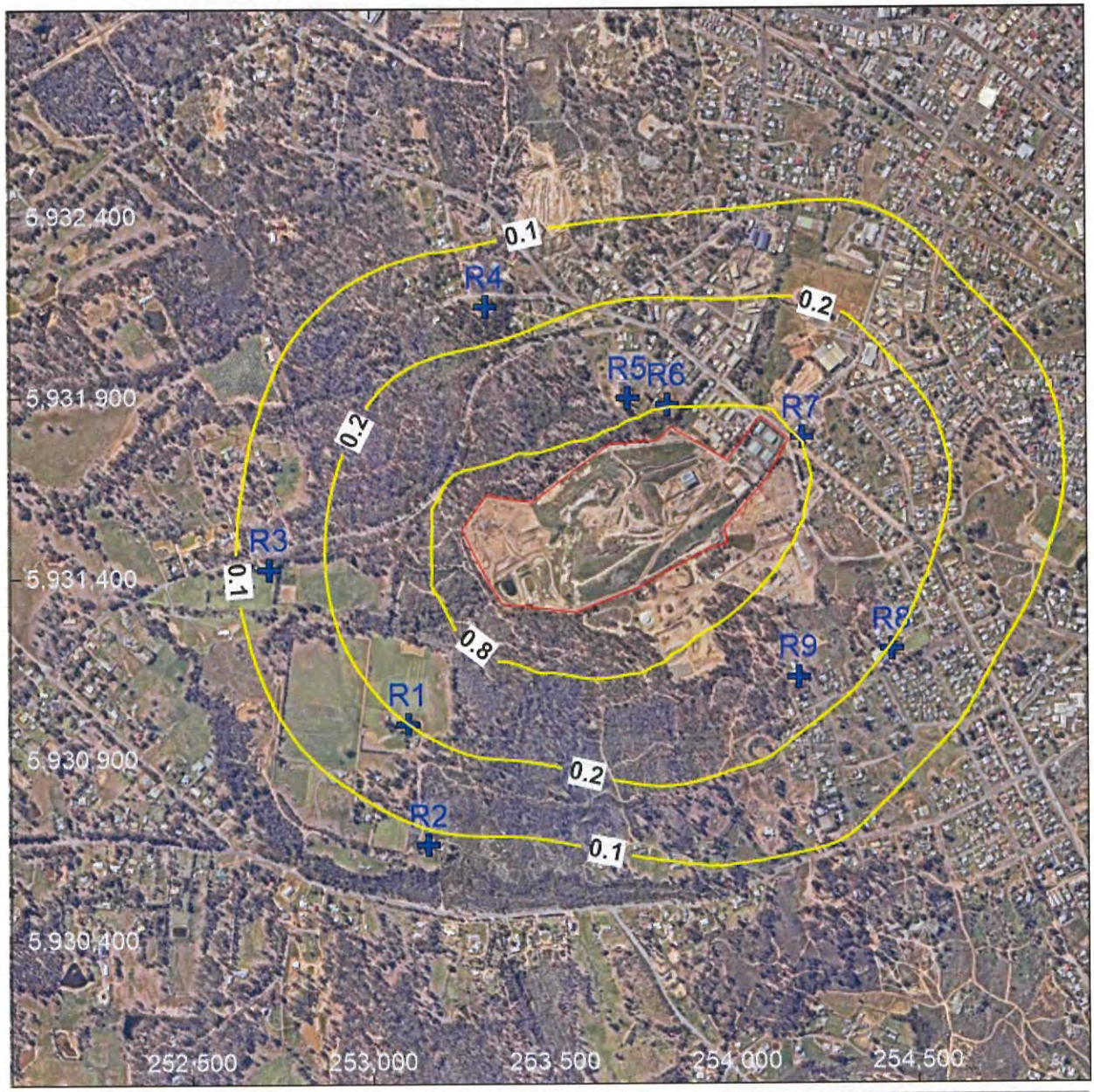
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B57 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Proposed Operations, Upset Conditions – 2014



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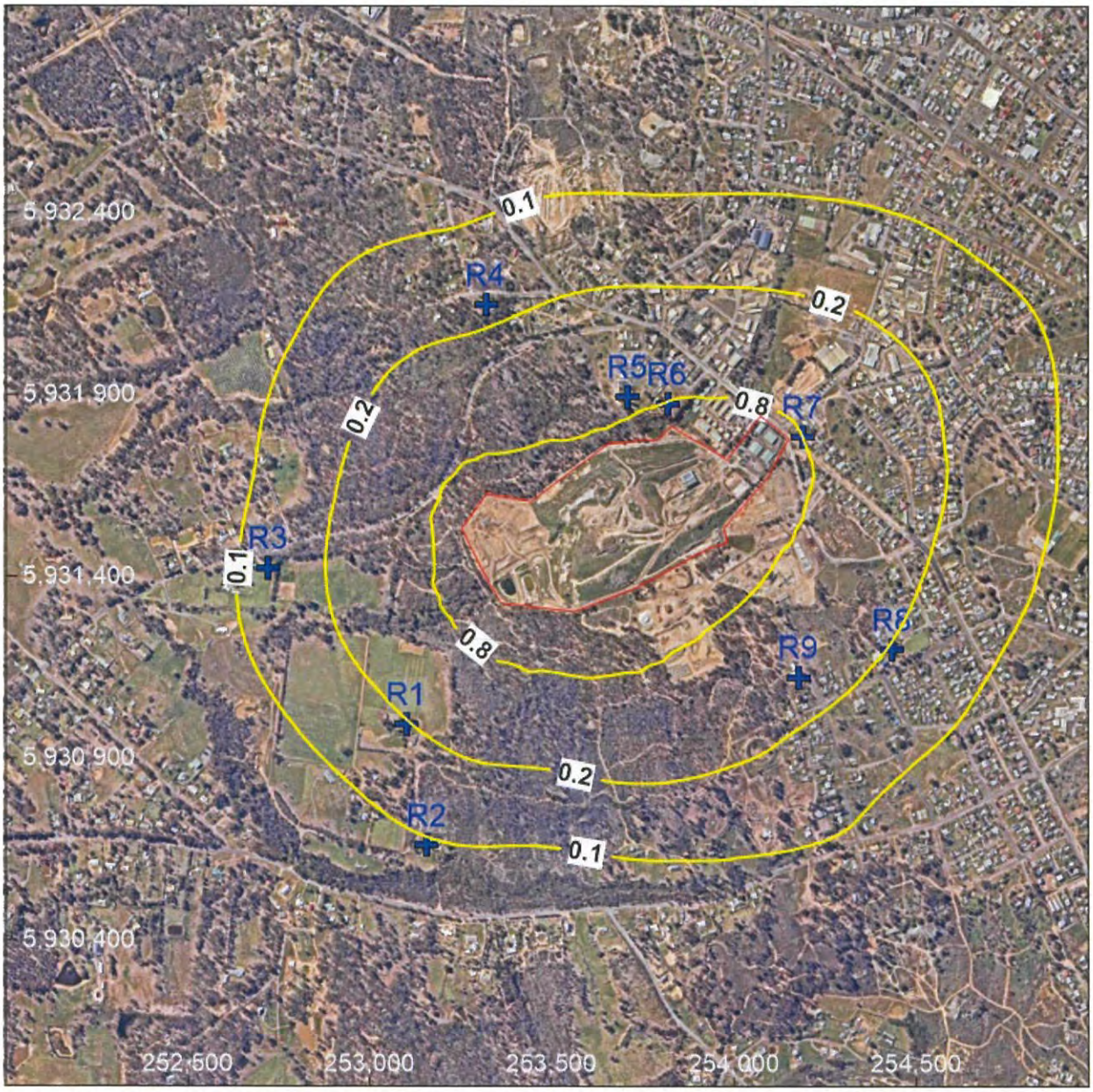
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Modelling Period:	2014
Projection:	GDA 1994 MGA Zone 55
Date:	18/01/2019

City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B58 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Proposed Operations, Upset Conditions – 2015



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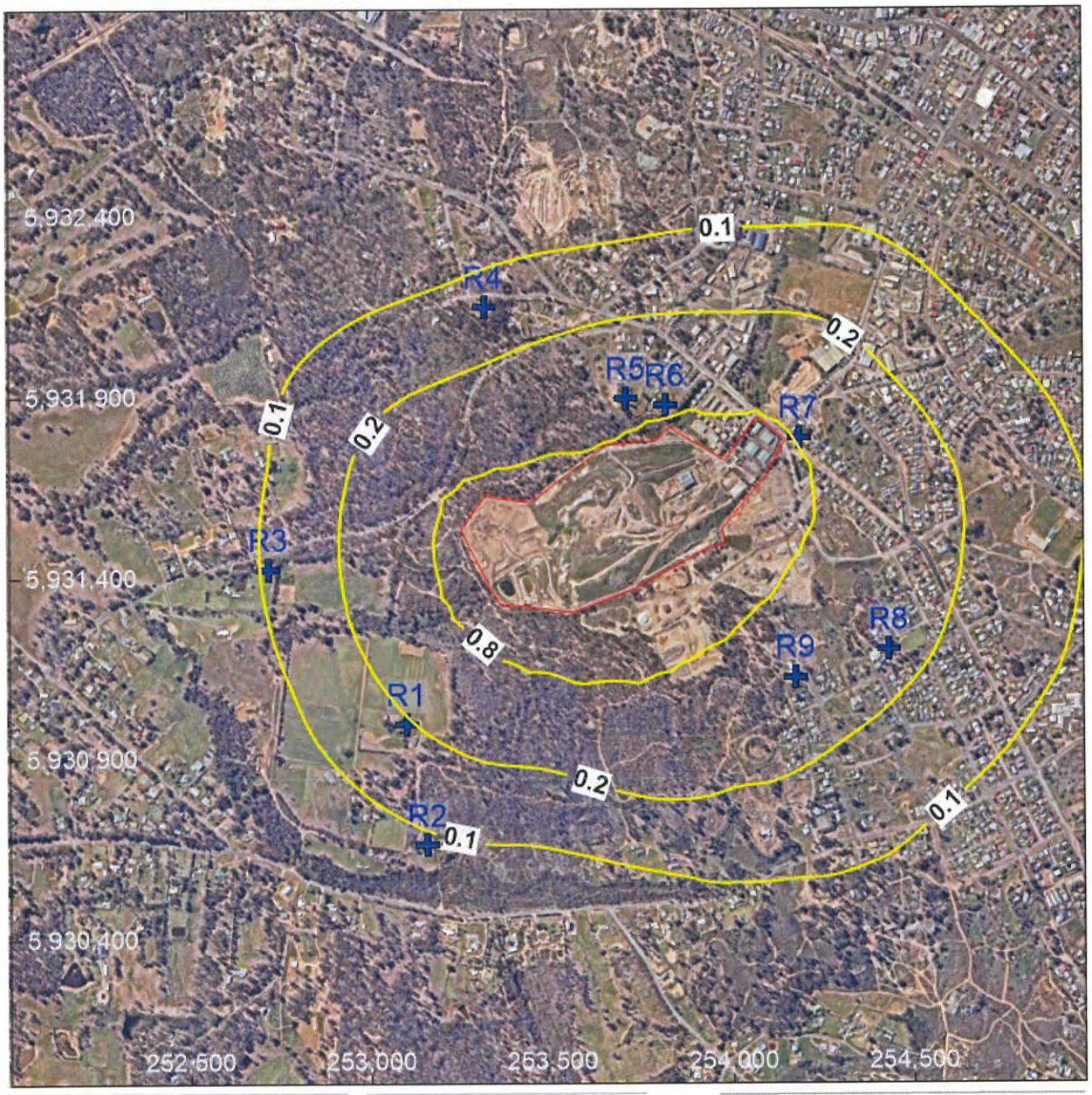
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B59 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Proposed Operations, Upset Conditions – 2016



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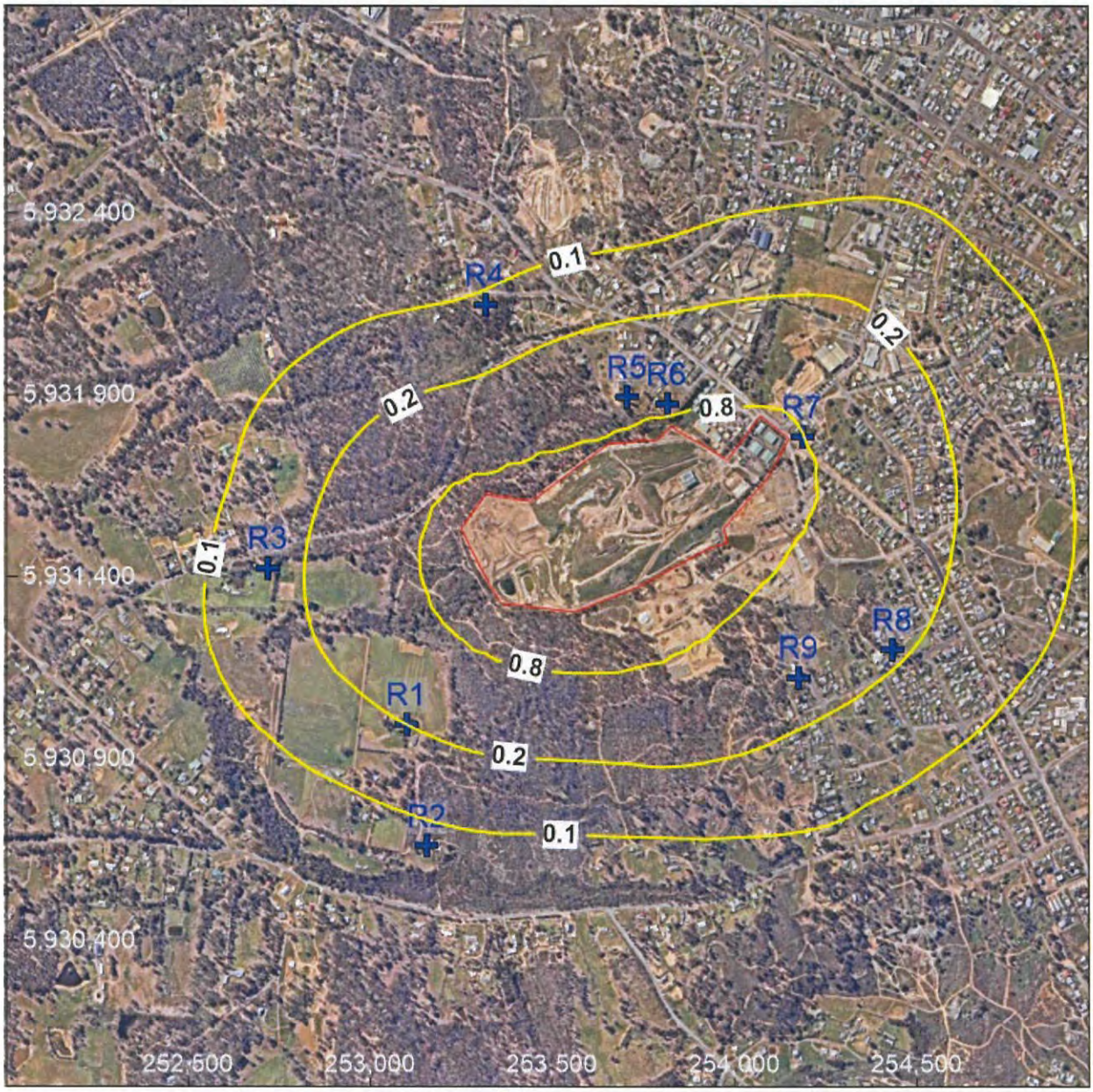
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Eaglehawk Landfill
Dust Impact Assessment

Incremental Impact - Proposed Upset Conditions

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B60 Predicted Incremental Annual Average Dust Deposition (g/m²/month) – Proposed Operations, Upset Conditions – 2017



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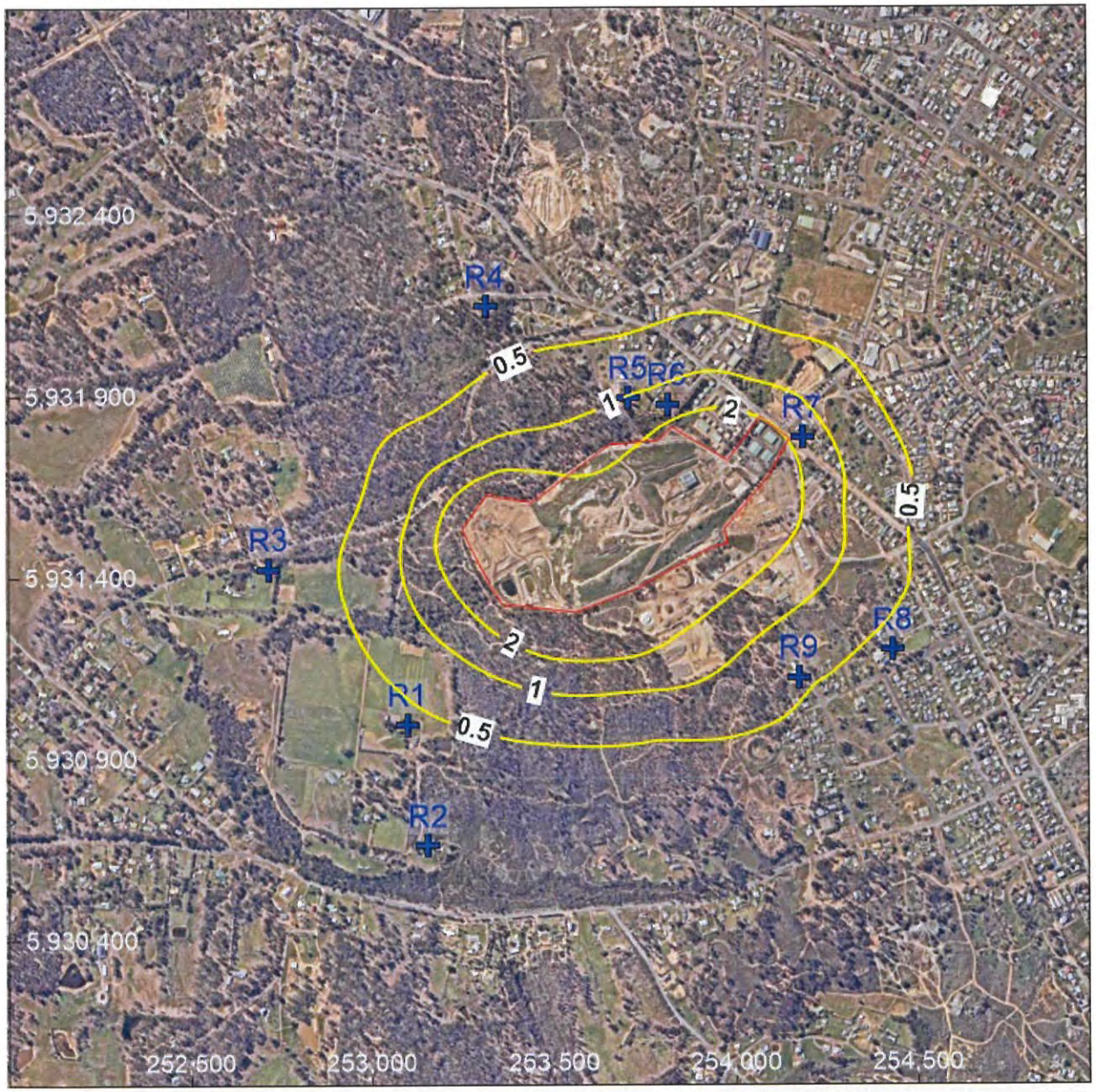
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	TSP	Averaging Period	Annual	Unit	g/m²/month

Figure B61 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2013



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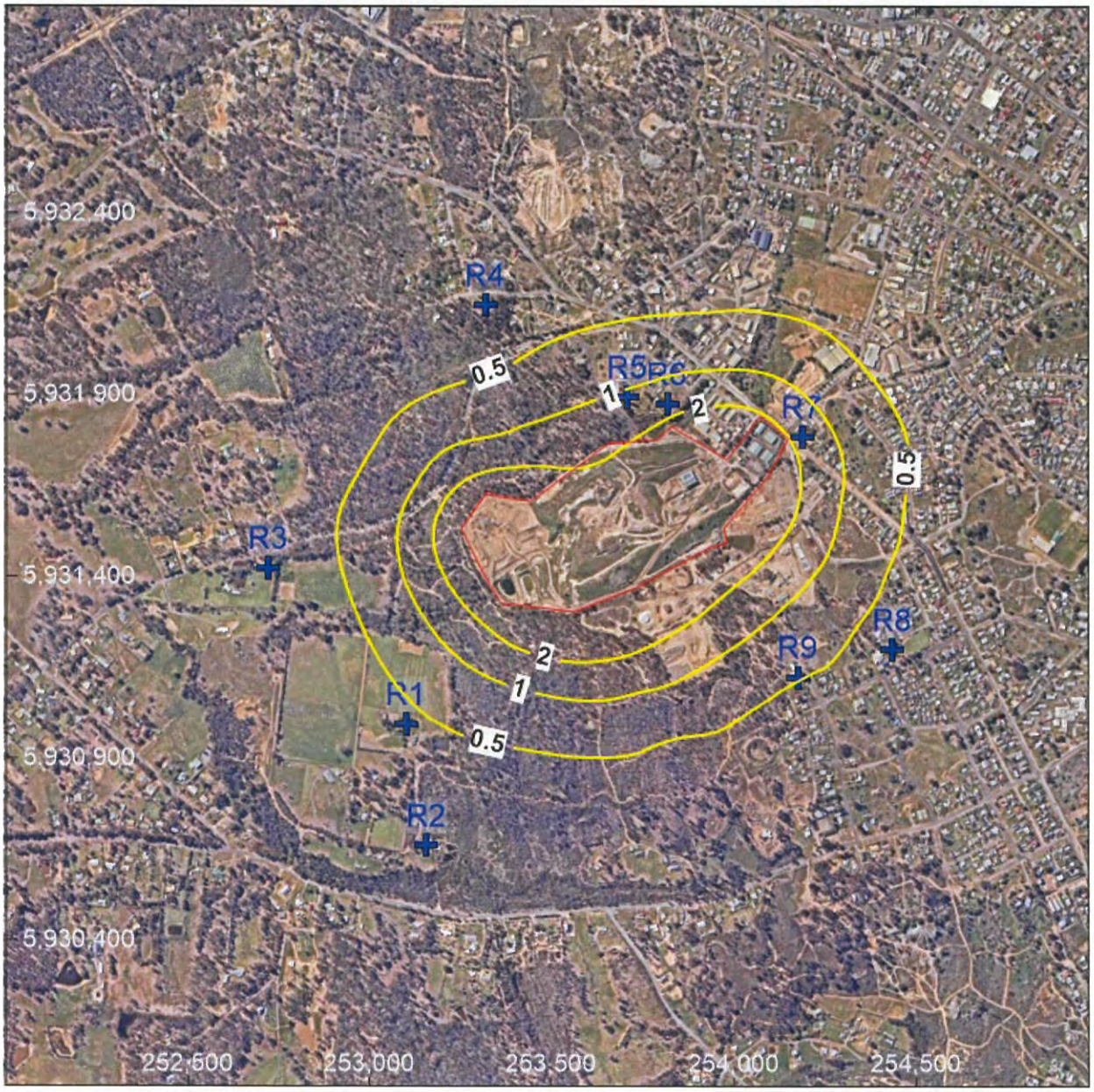
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B62 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2014



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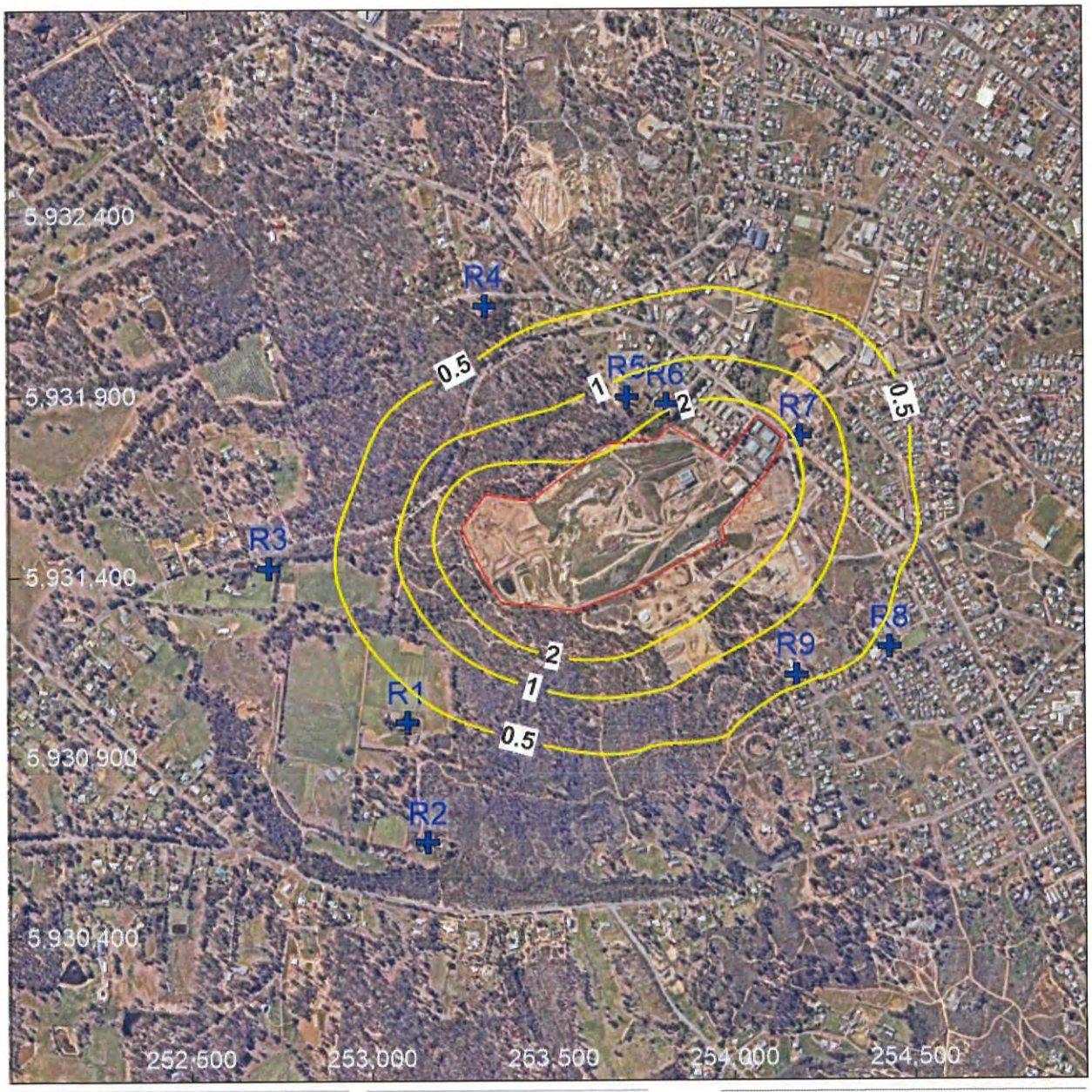
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B63 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2015



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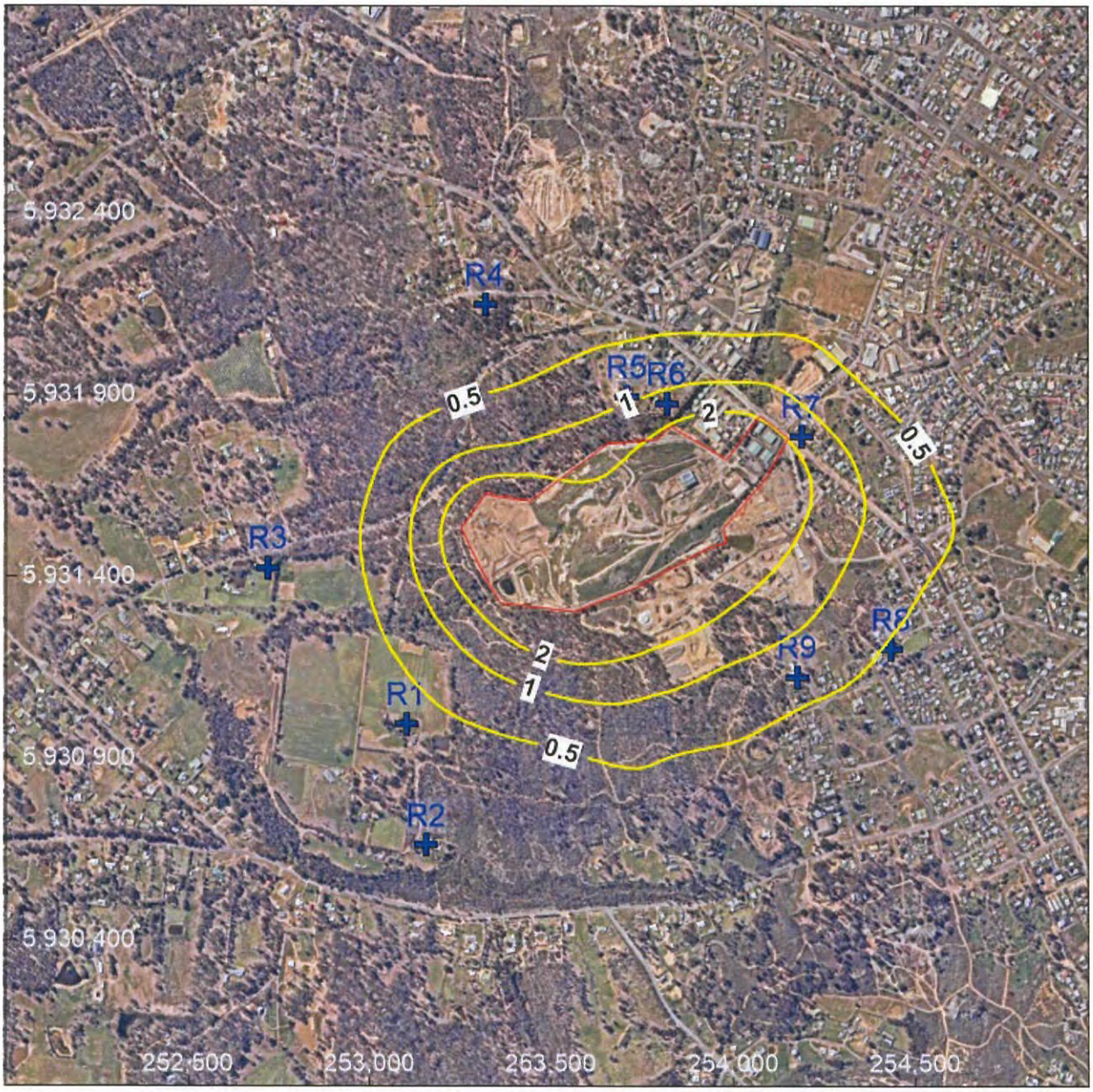
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B64 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2016



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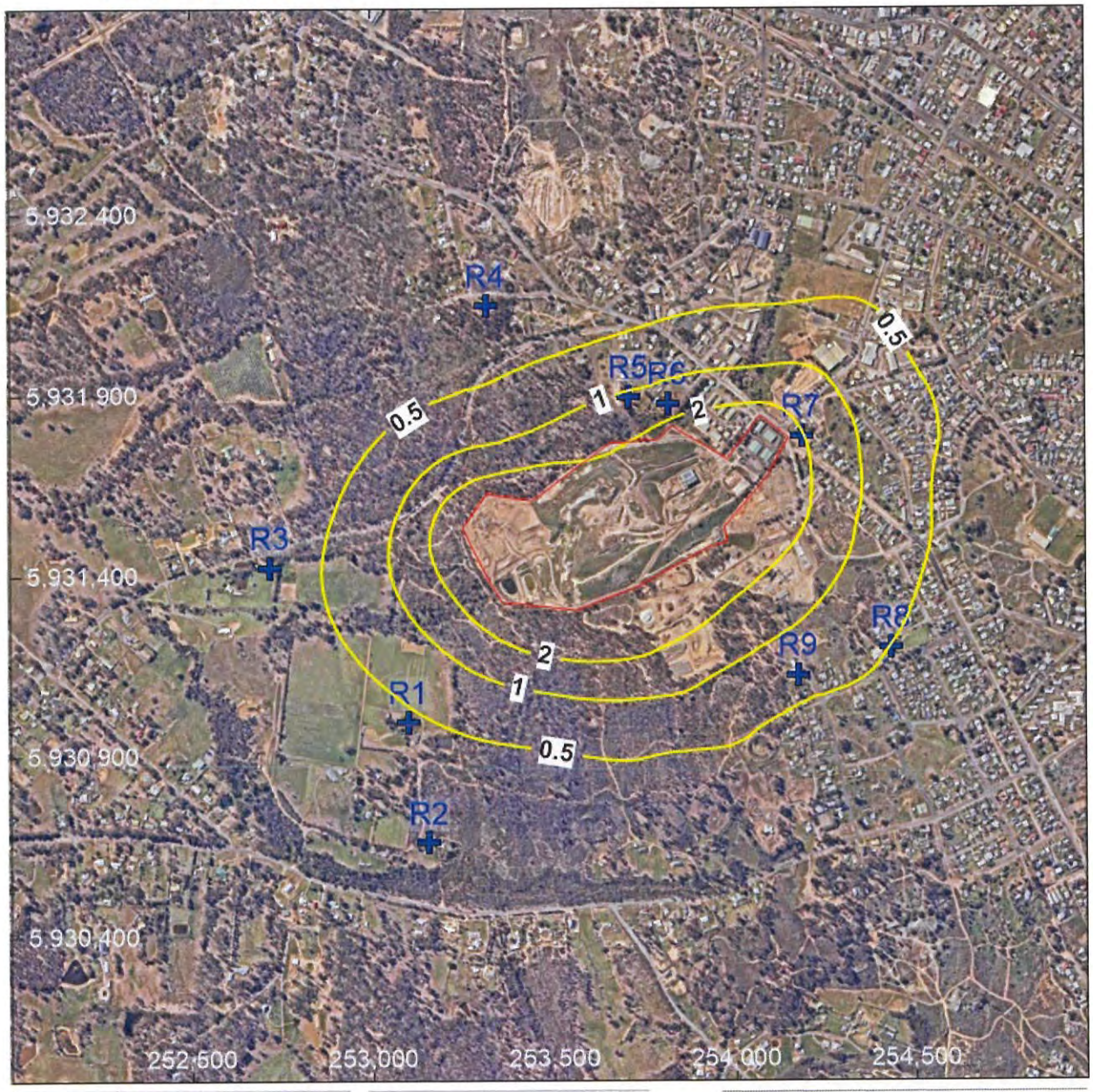
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B65 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2017



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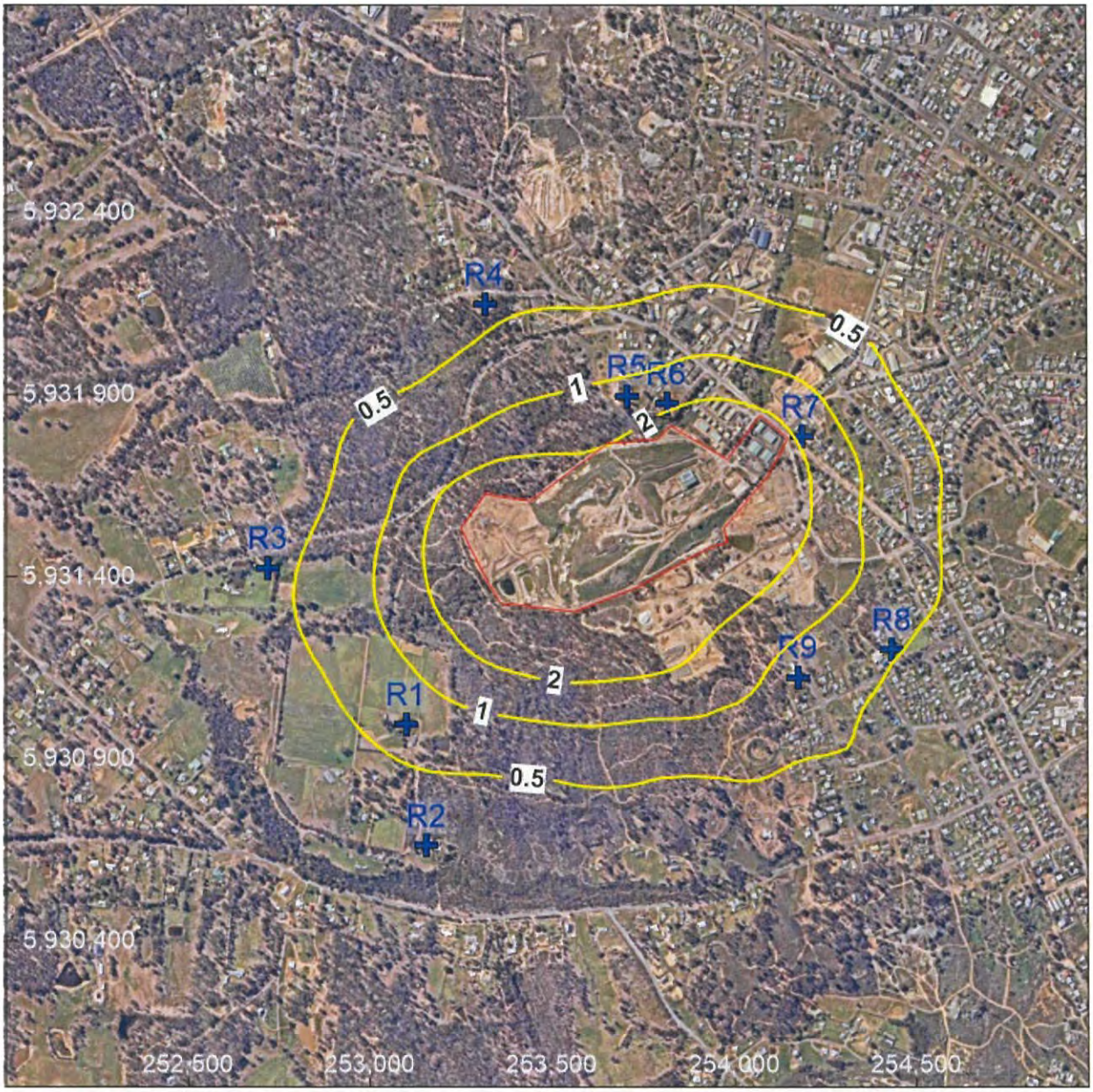
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B66 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2013



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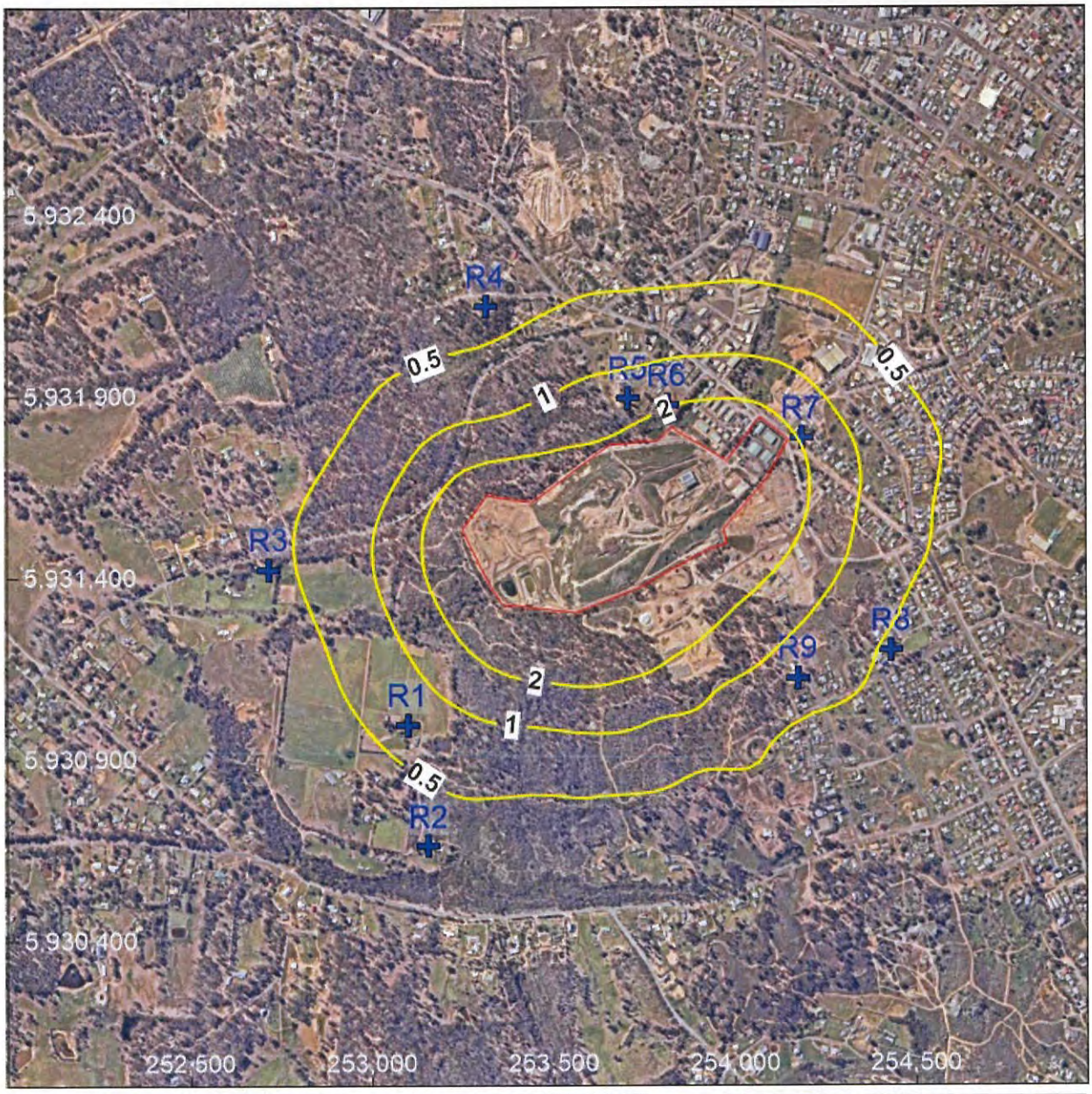
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Eaglehawk Landfill
Dust Impact Assessment

Incremental Impact - Proposed Upset Conditions

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B67 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2014



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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B68 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2015

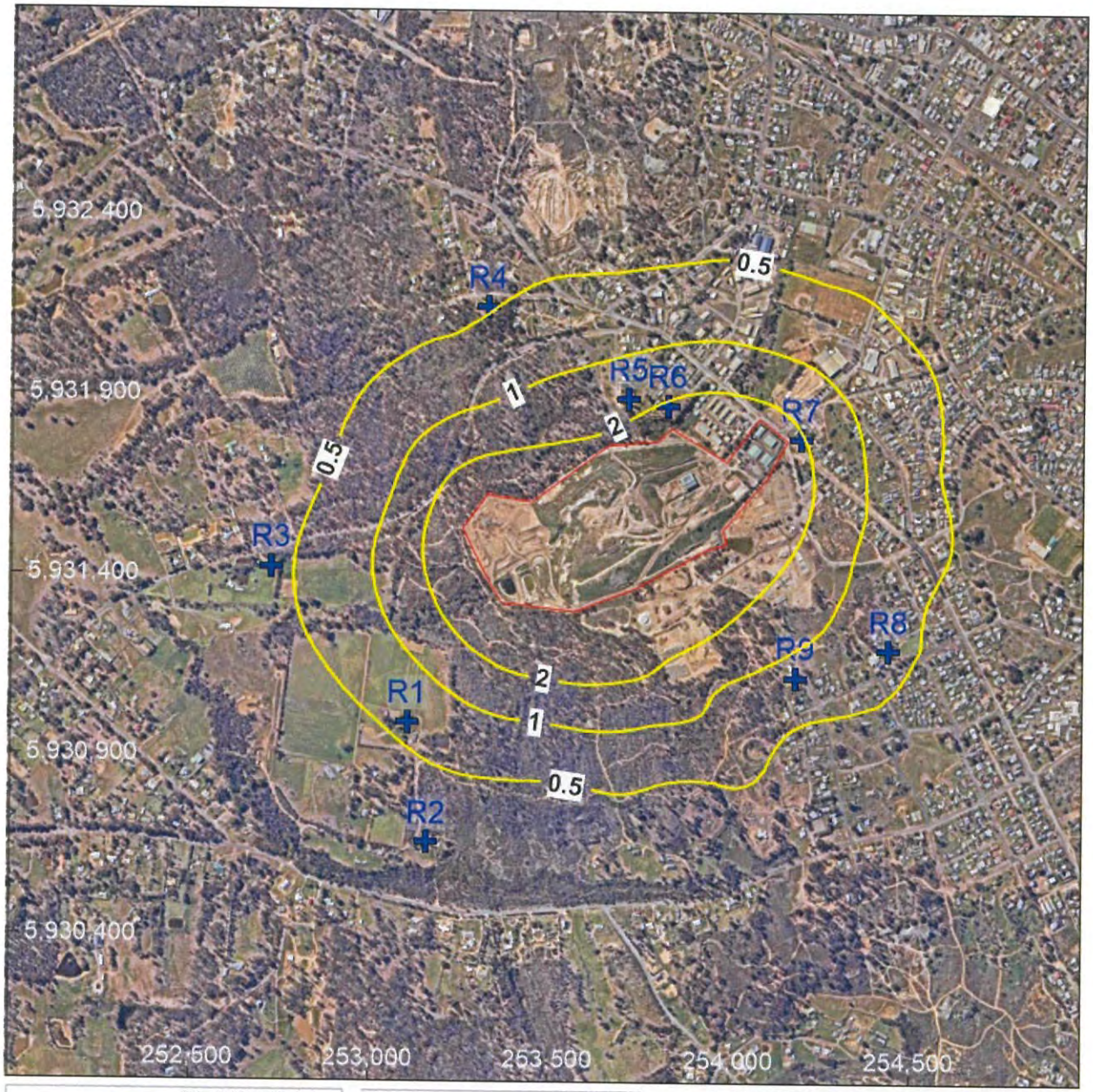
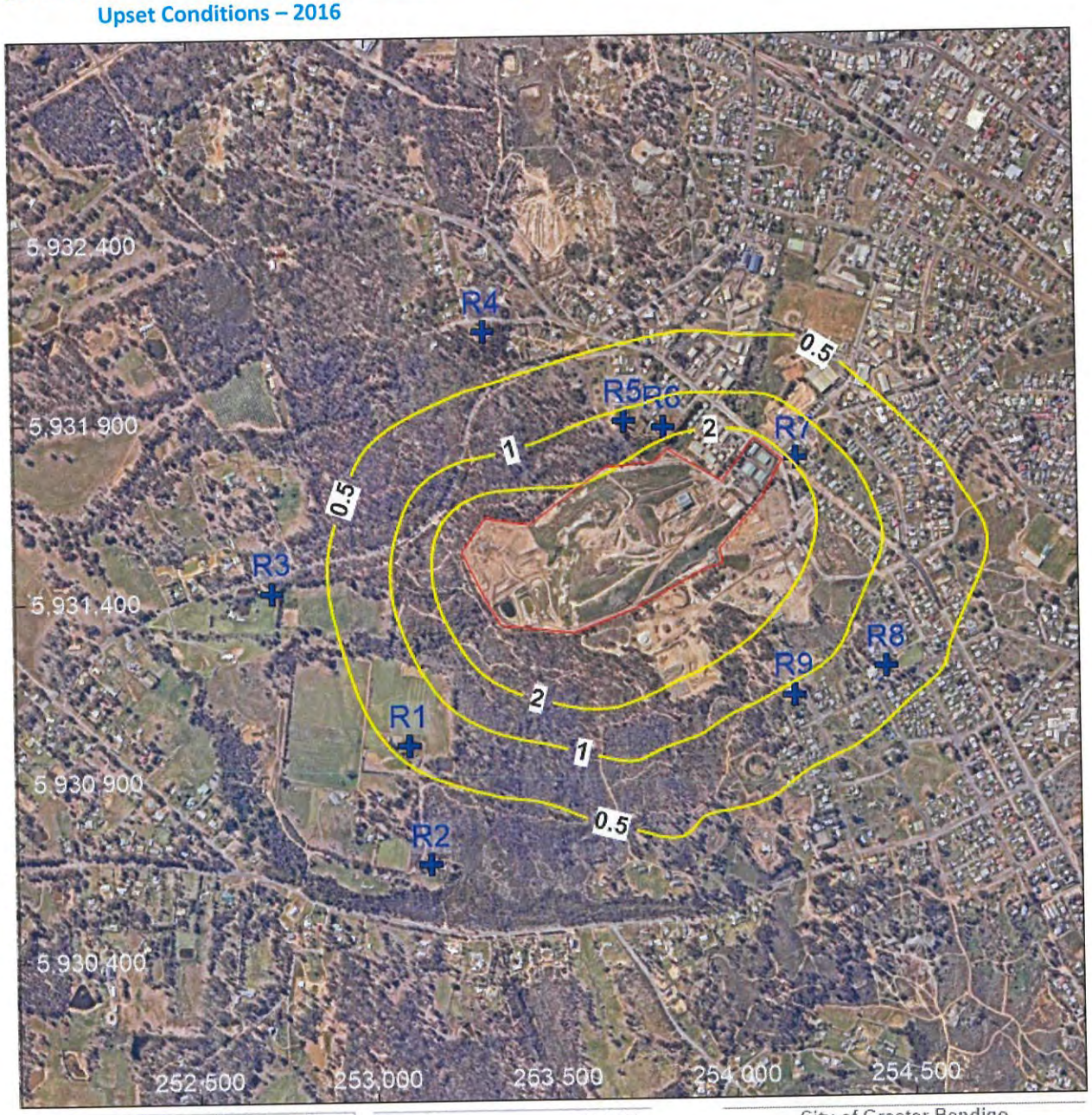


Figure B69 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2016



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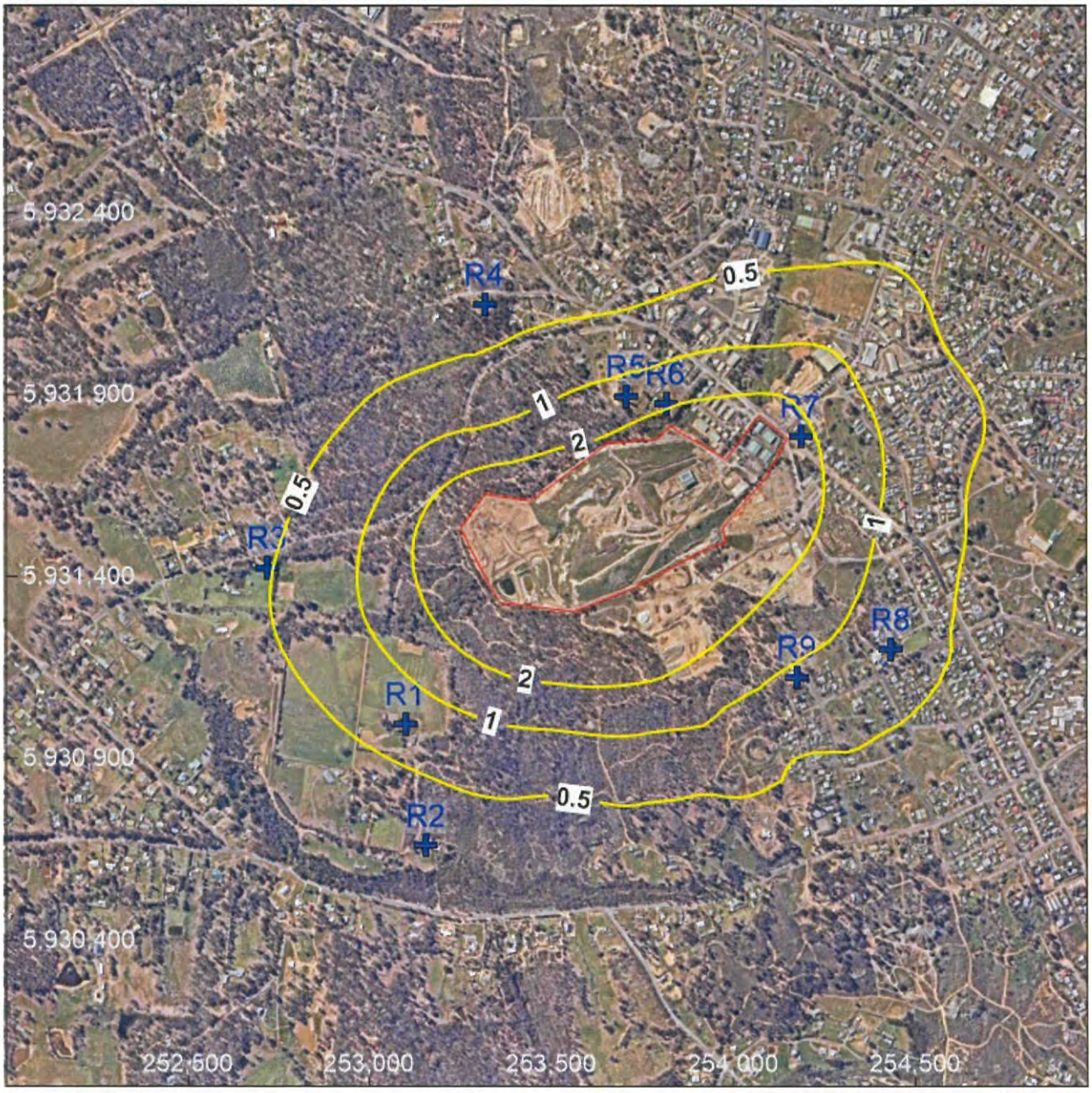
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B70 Predicted Incremental Annual Average PM_{10} Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2017



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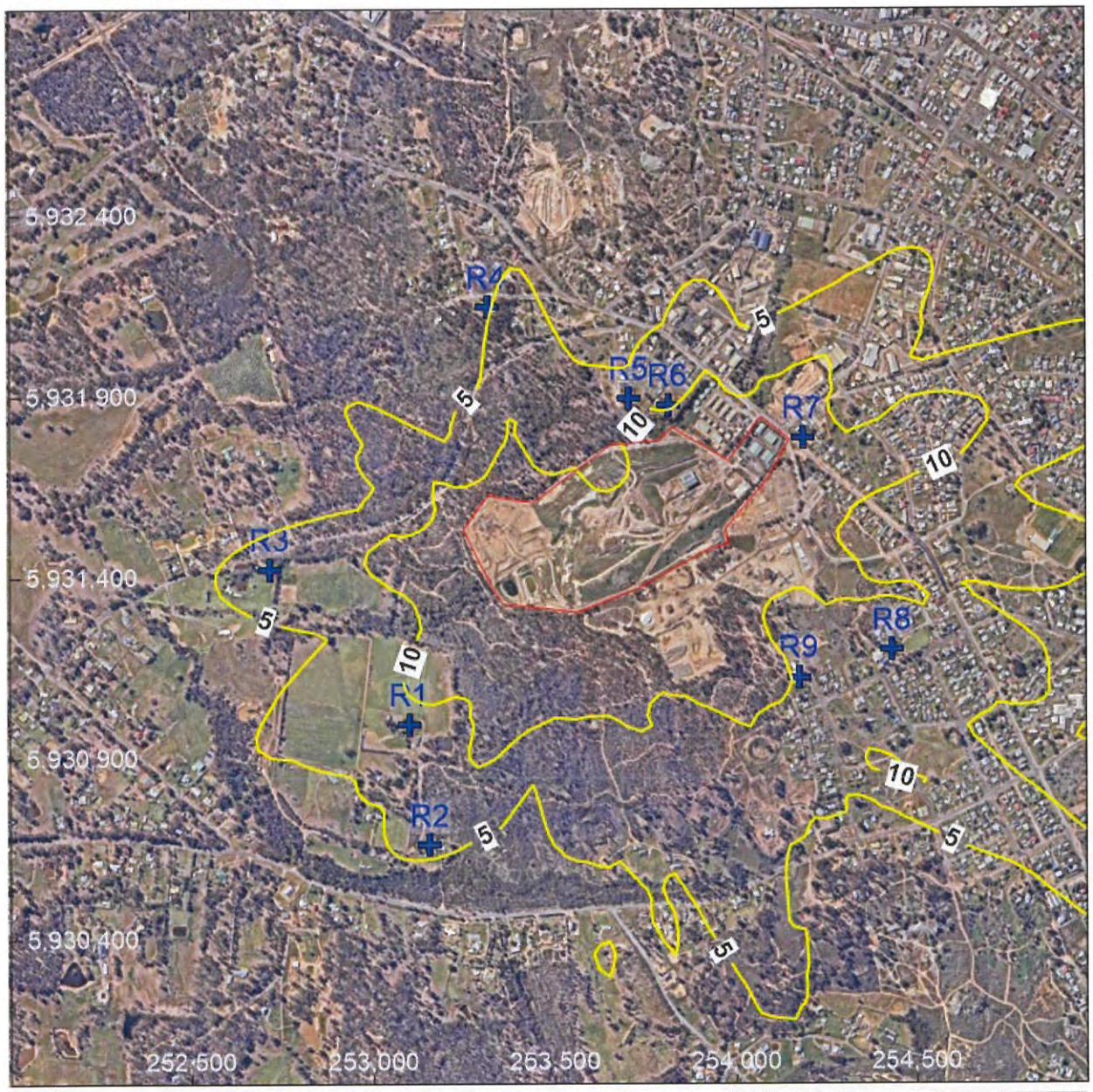
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure B71 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2013



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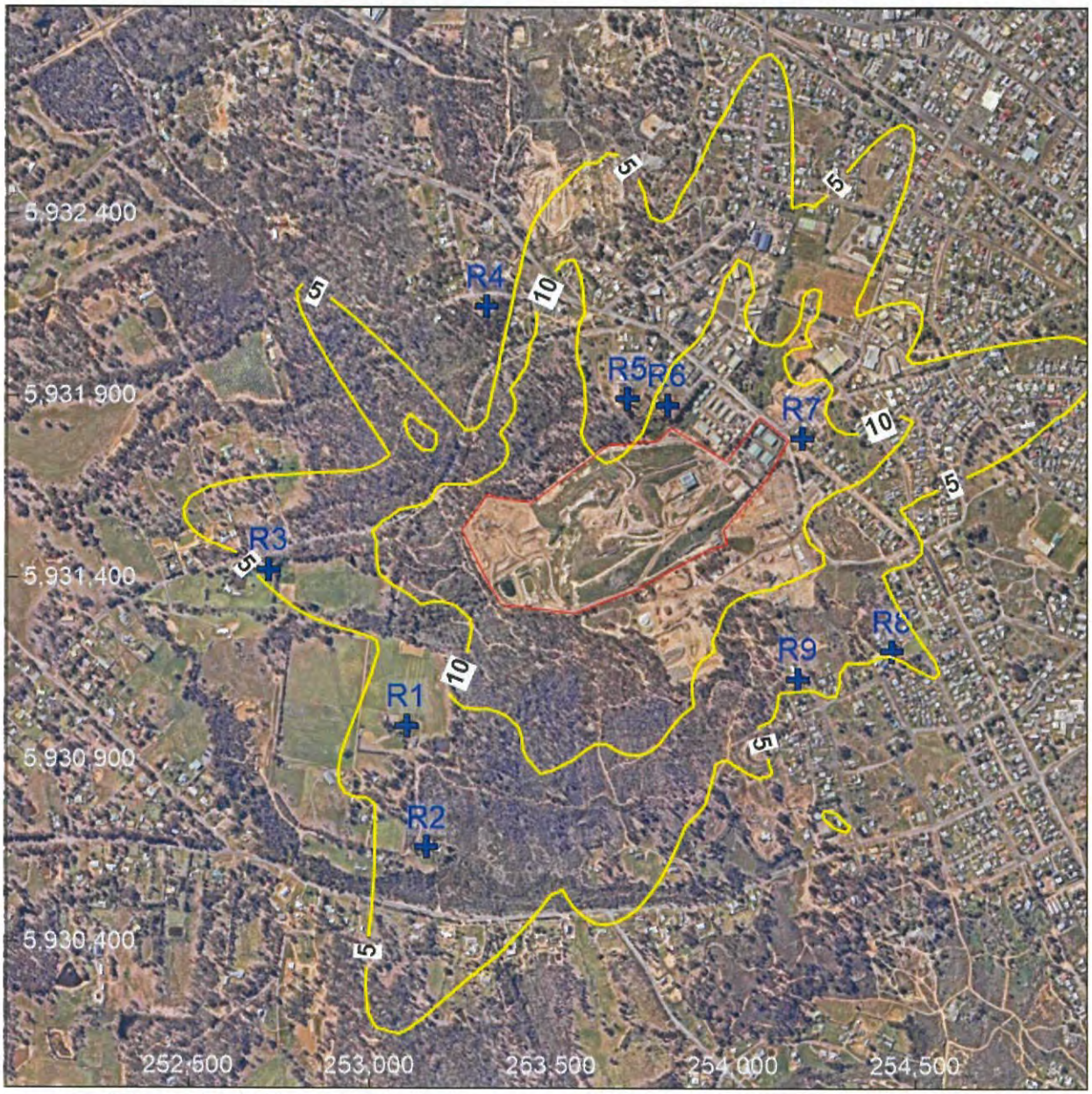
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B72 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2014



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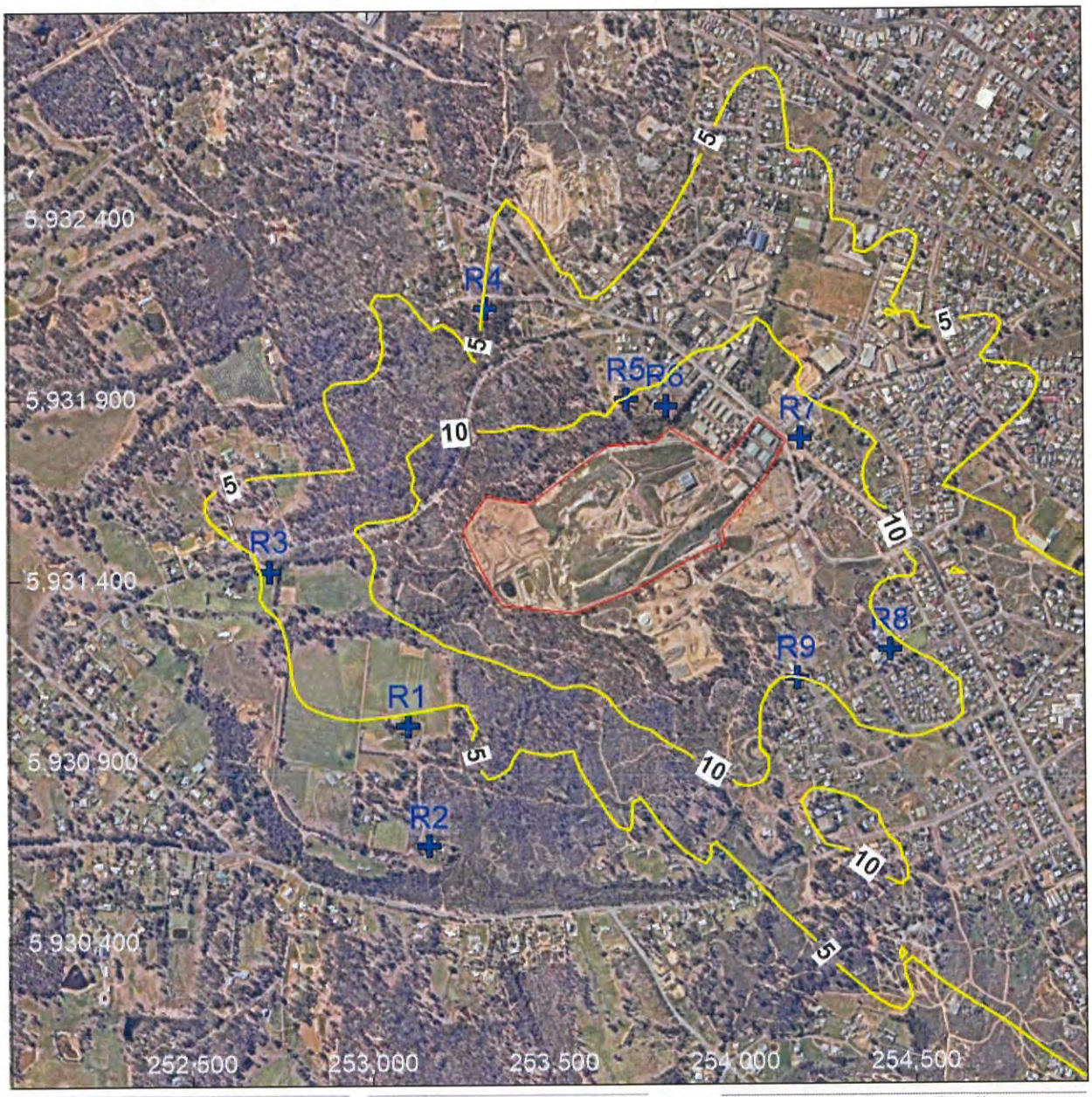
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B73 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2015



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City of Greater Bendigo
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Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B74 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2016



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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B75 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2017

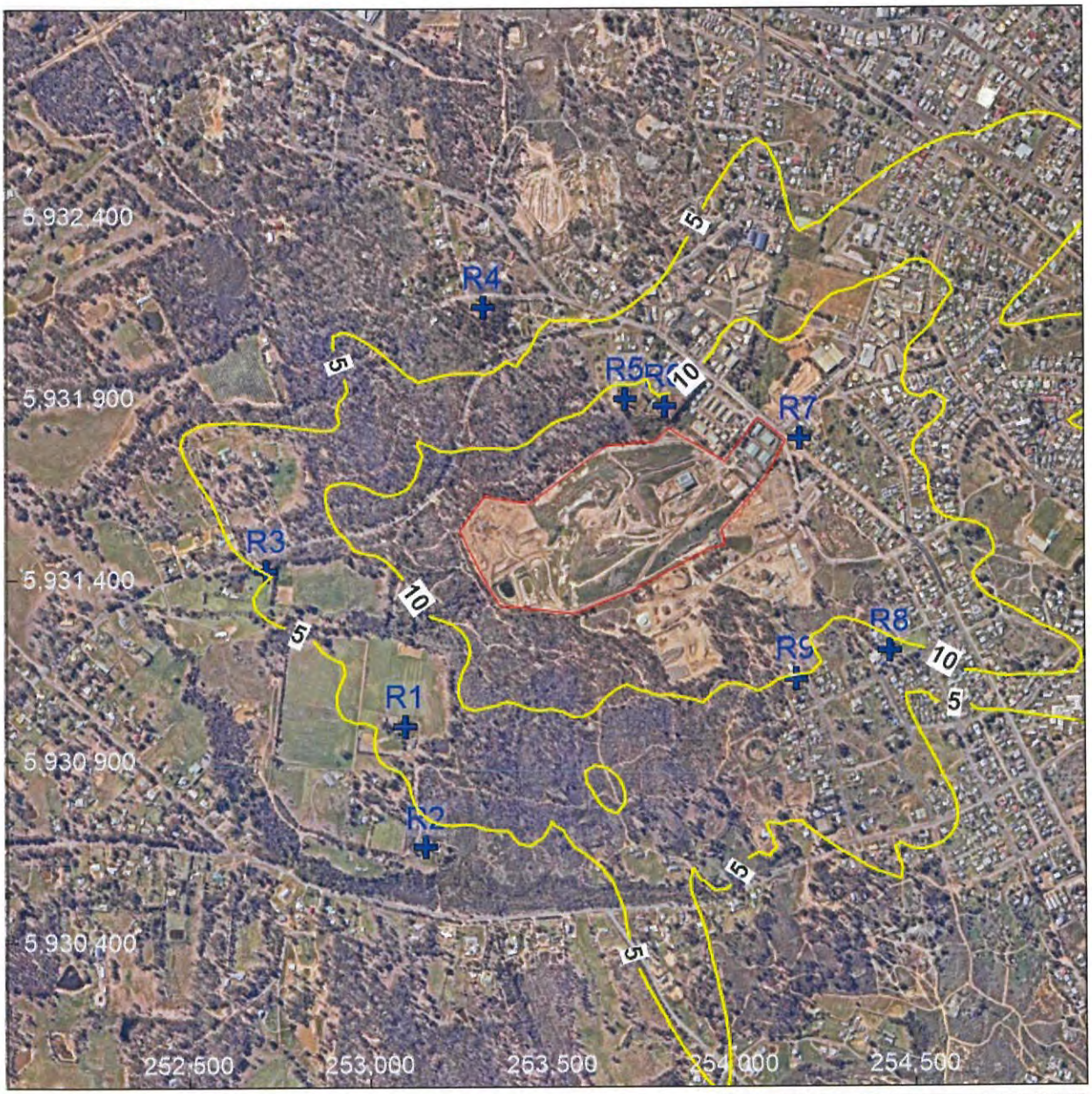
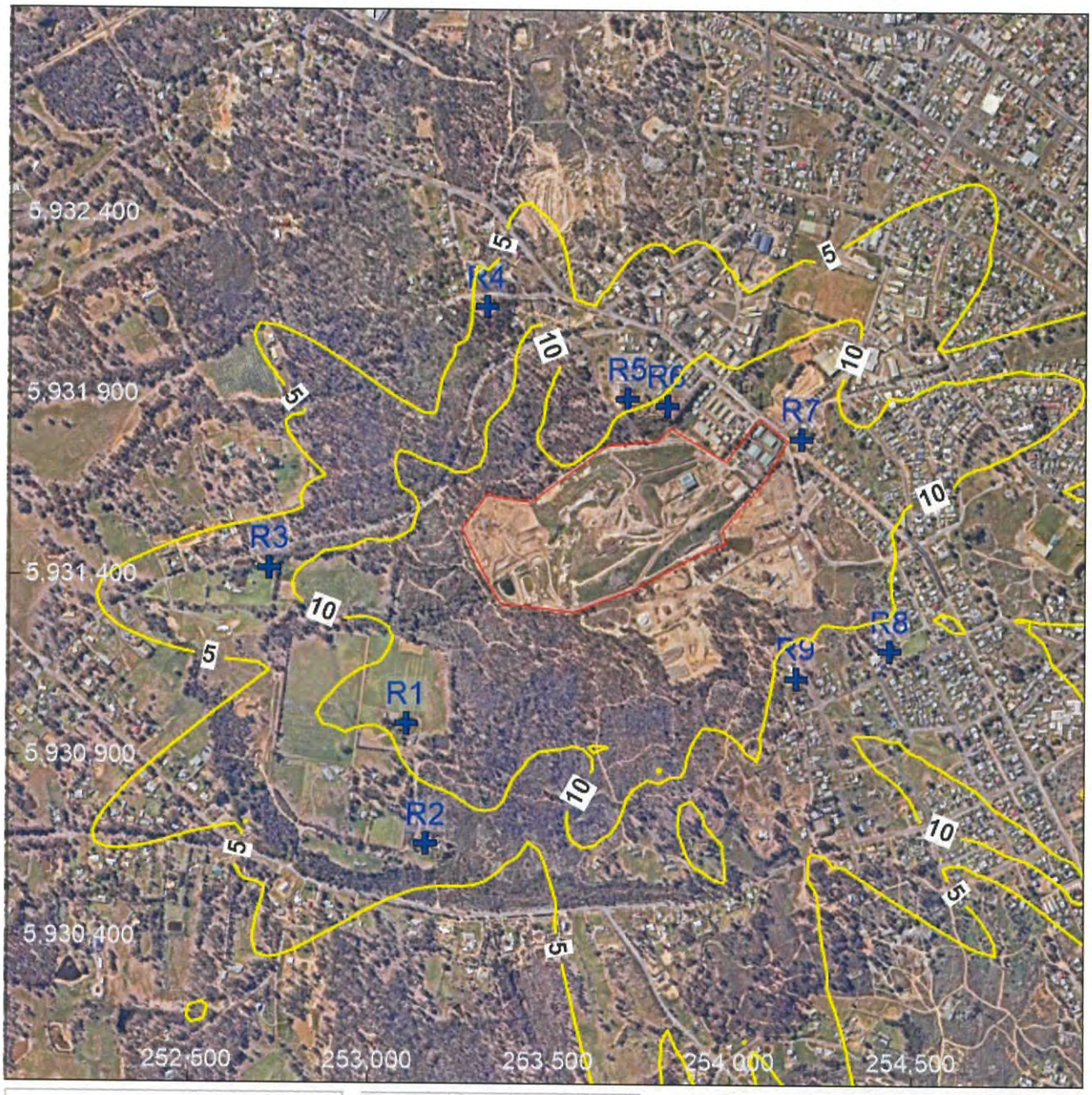


Figure B76 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2013



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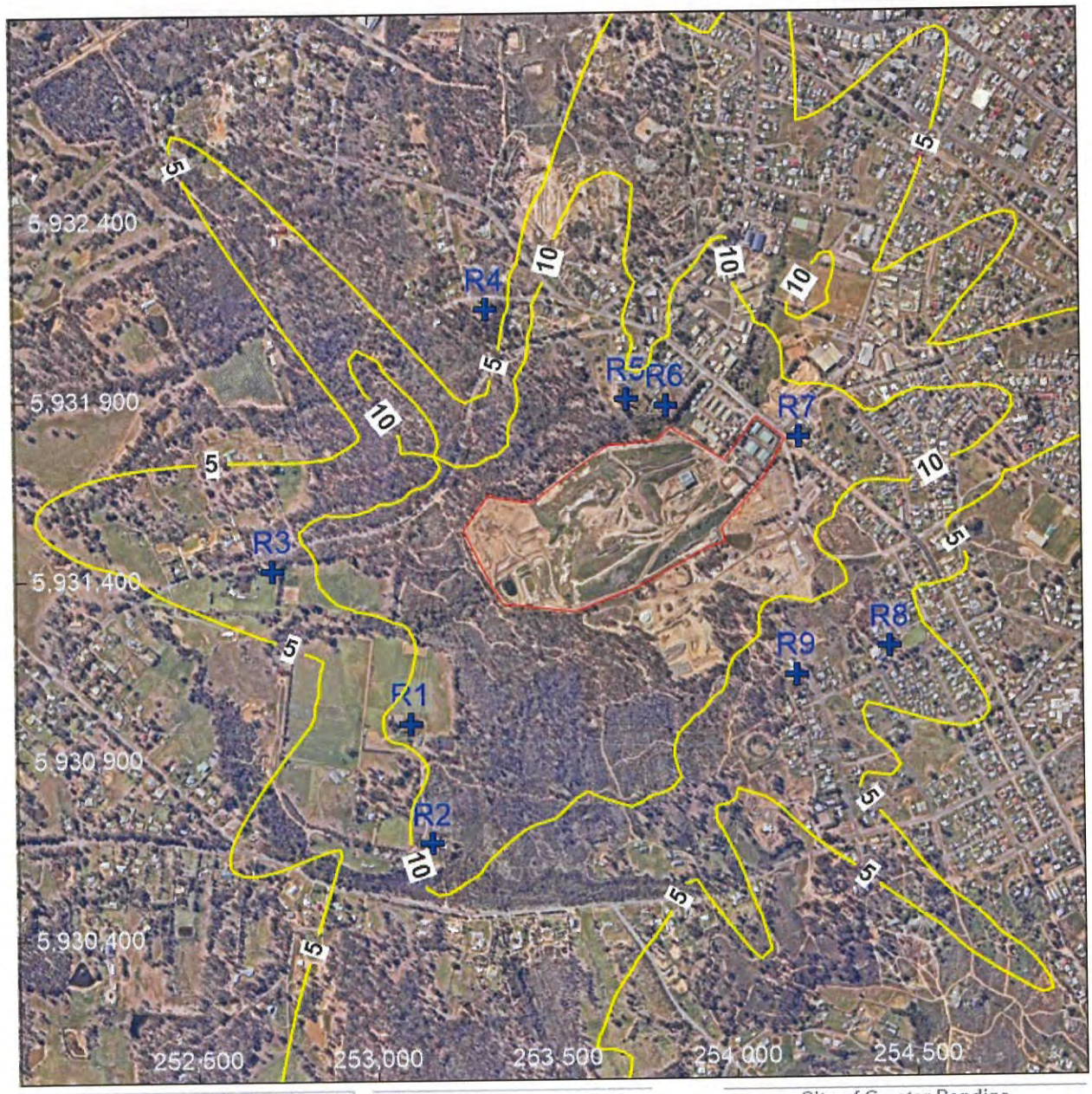
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B77 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2014



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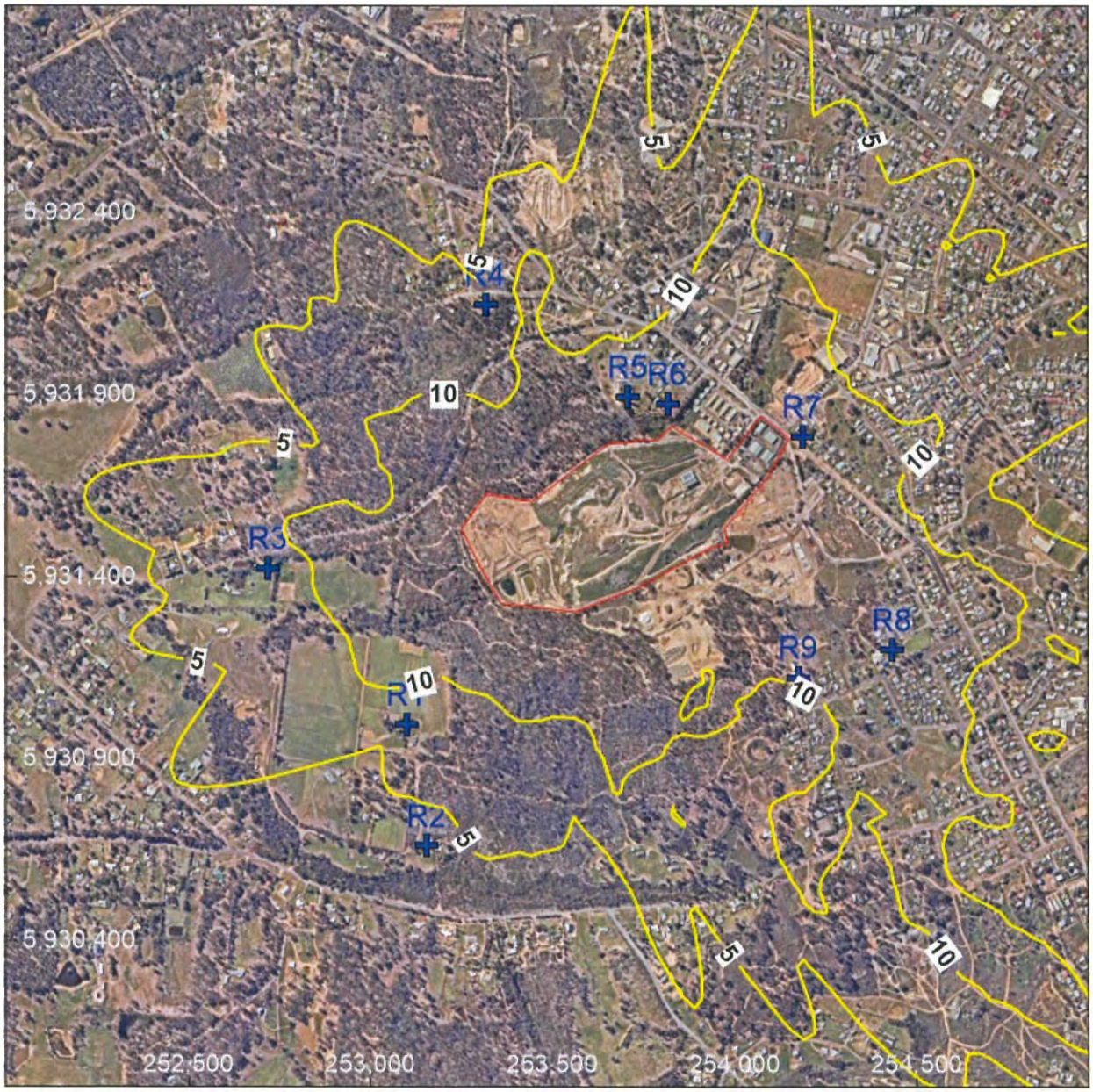
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	PM	Averaging Period	24-Hour	Unit	µg/m³

Figure B78 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2015



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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B79 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2016



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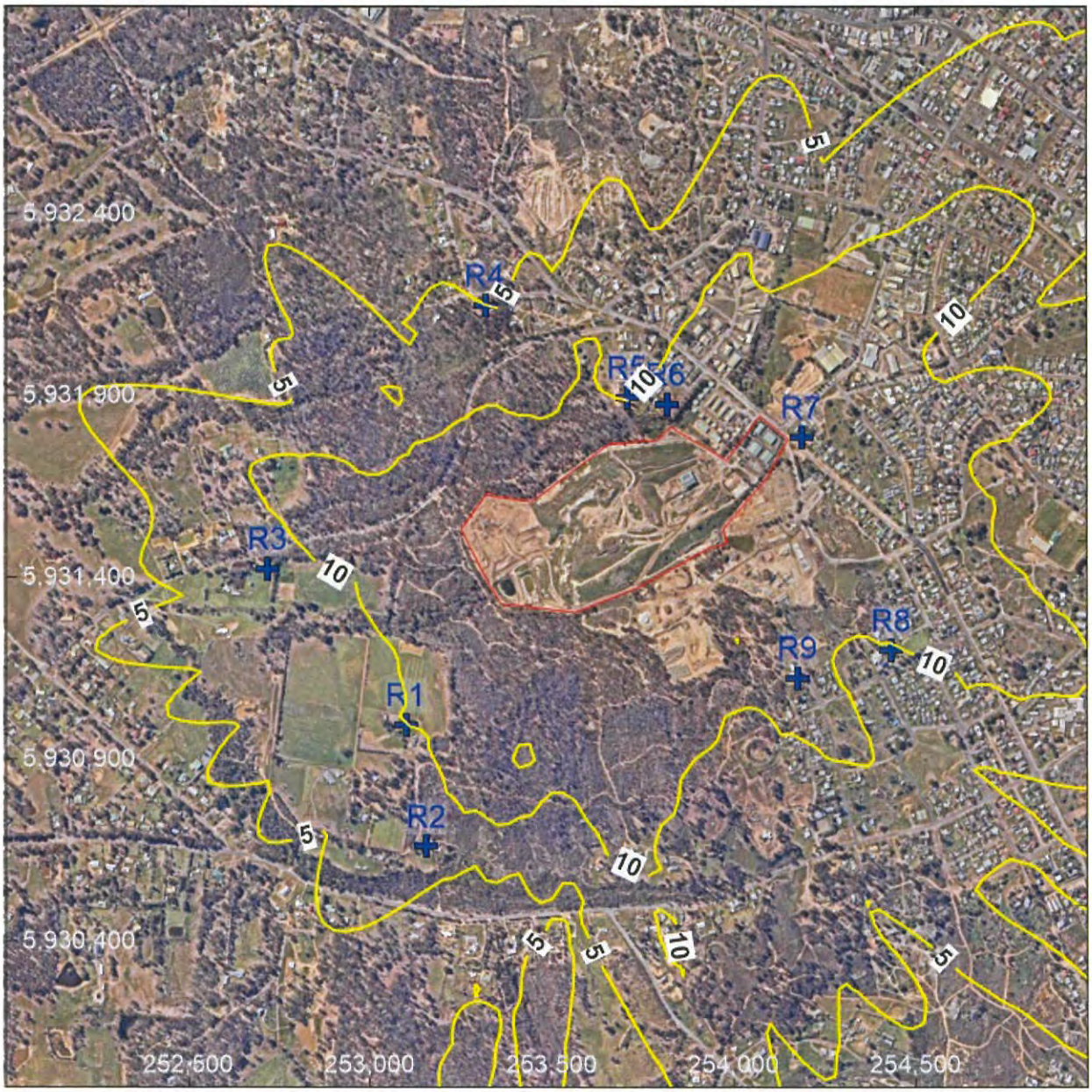
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City of Greater Bendigo
Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B80 Predicted Incremental 24-hour Average PM_{10} Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2017



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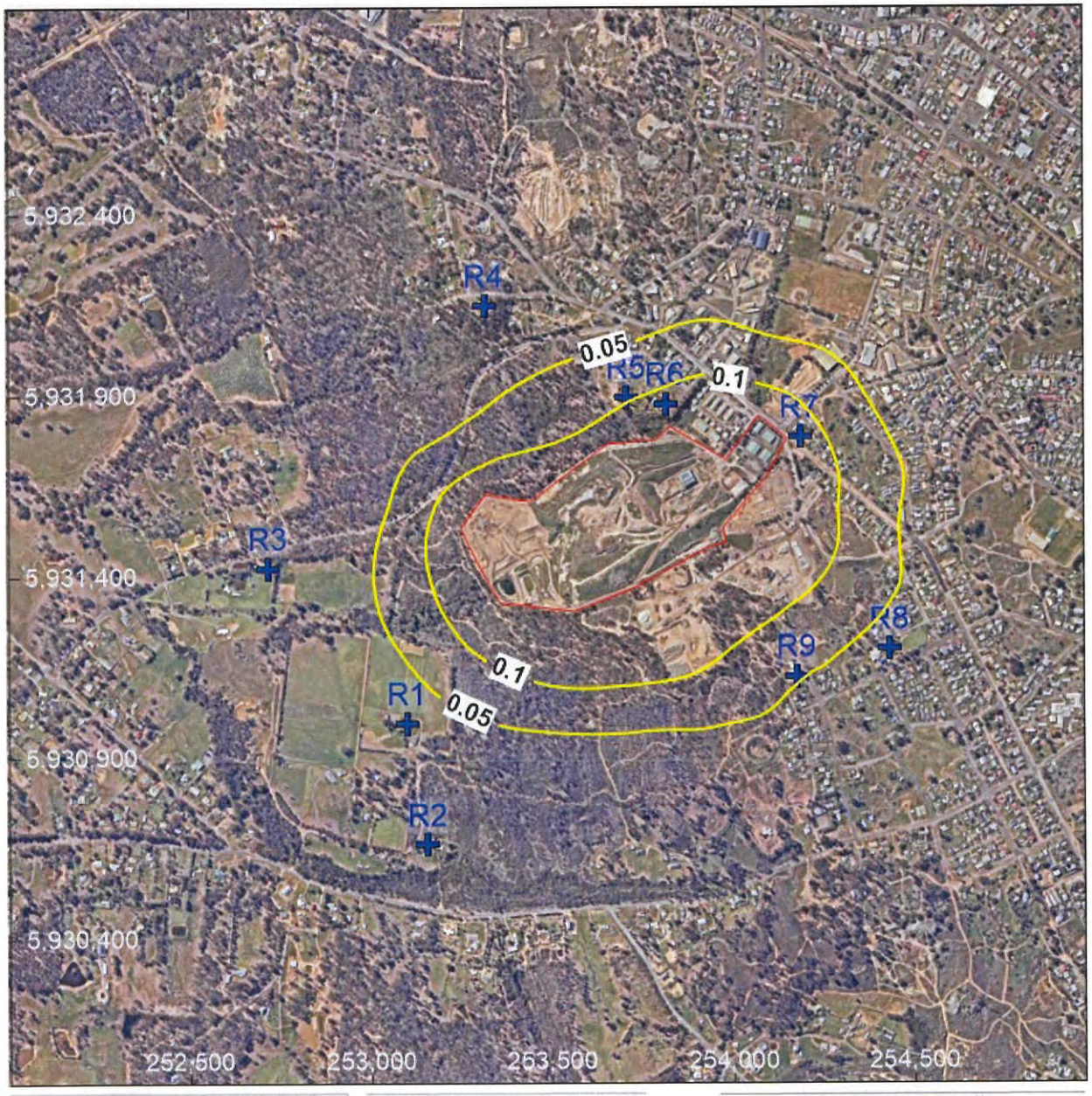
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Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure B81 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2013



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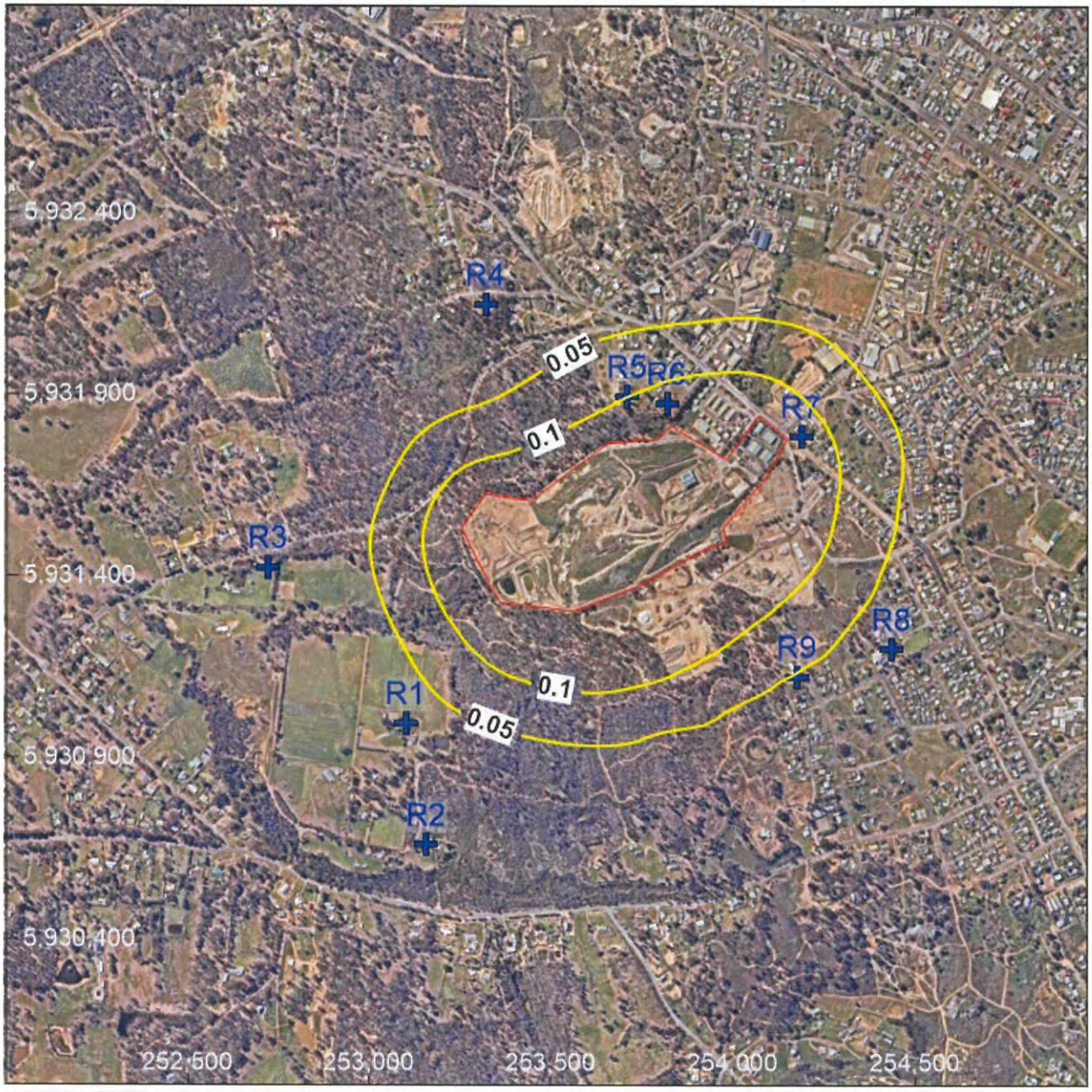
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Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B82 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2014



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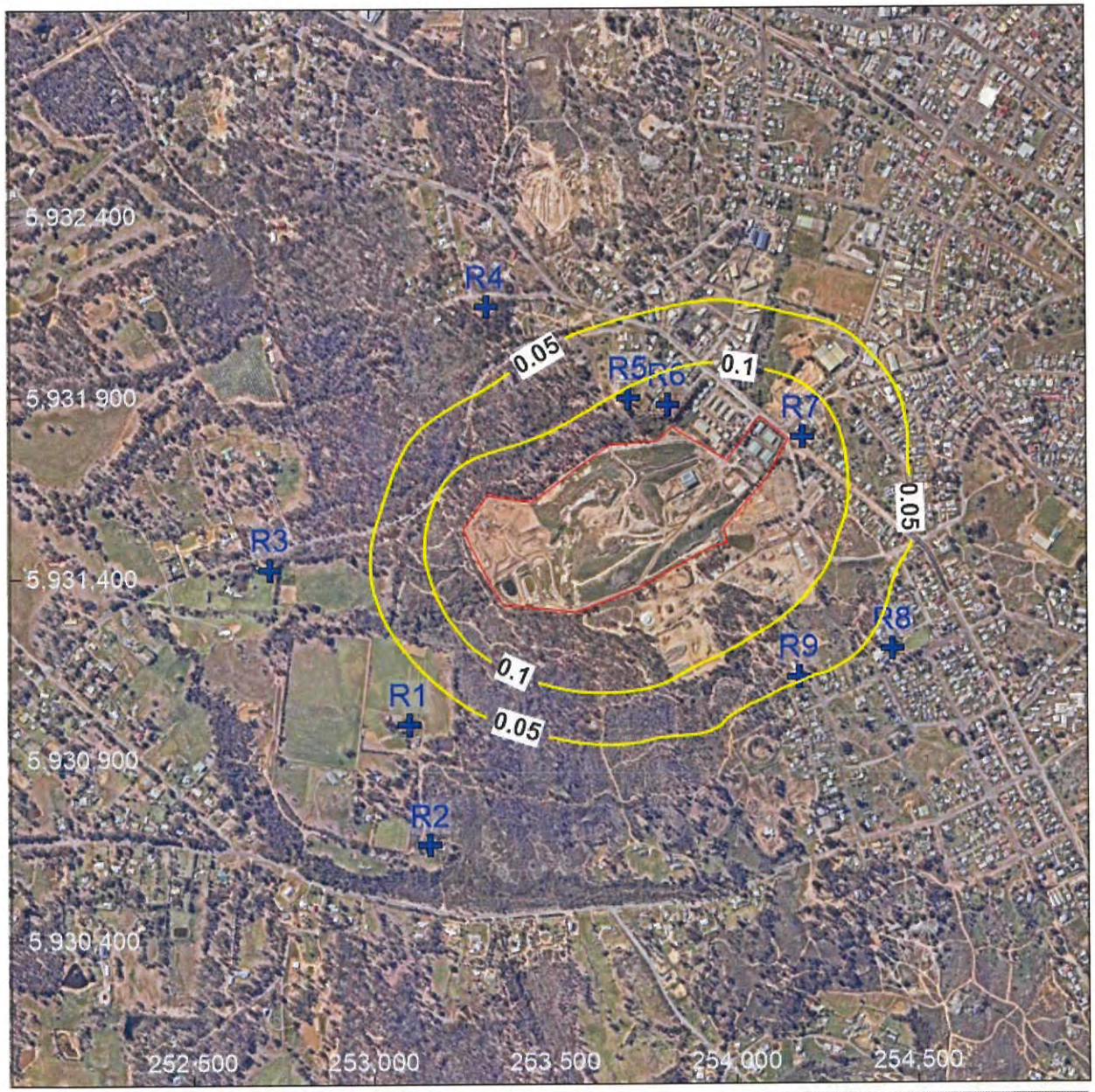
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Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B83 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2015



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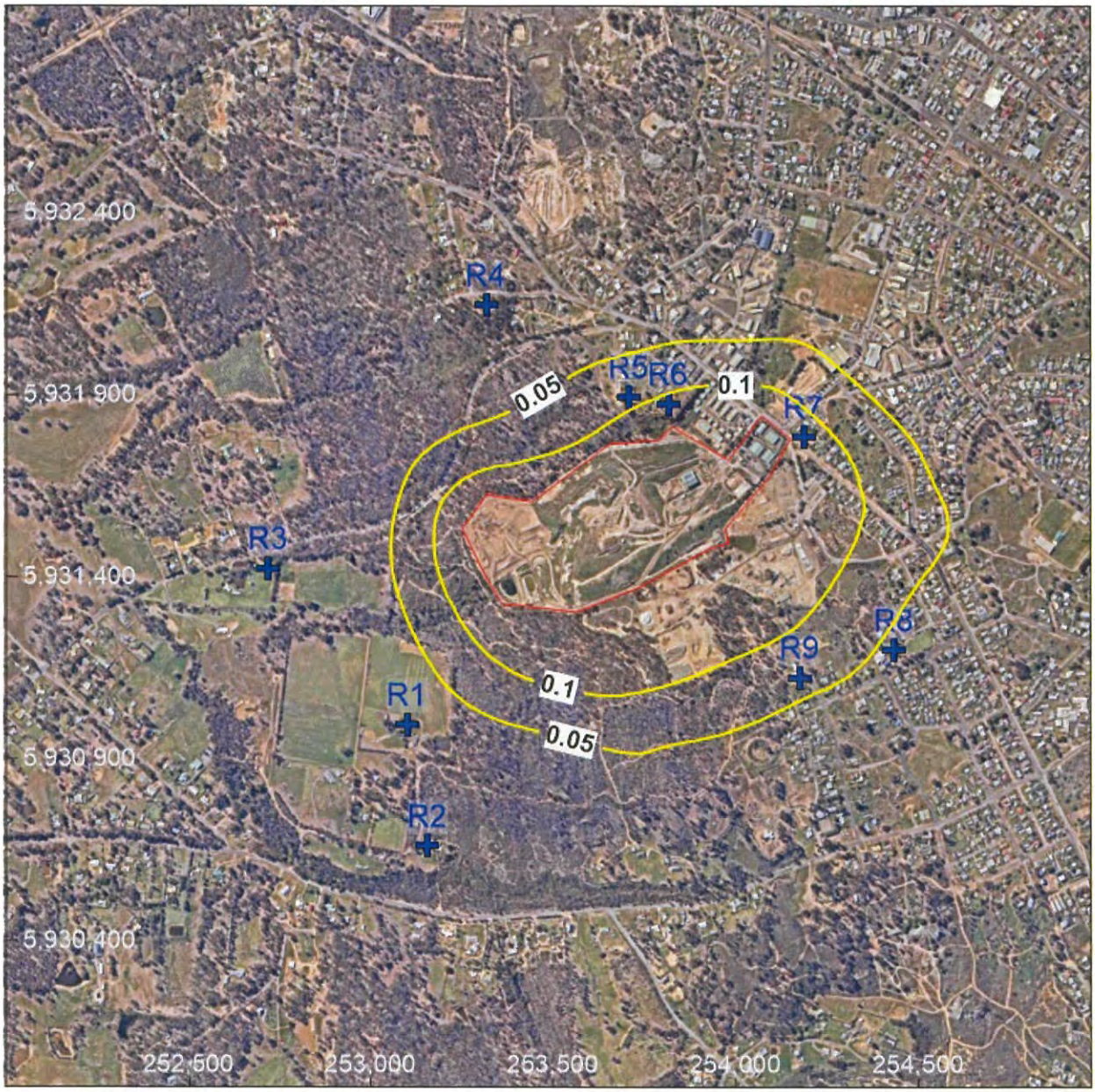
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Incremental Impact - Proposed Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B84 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2016



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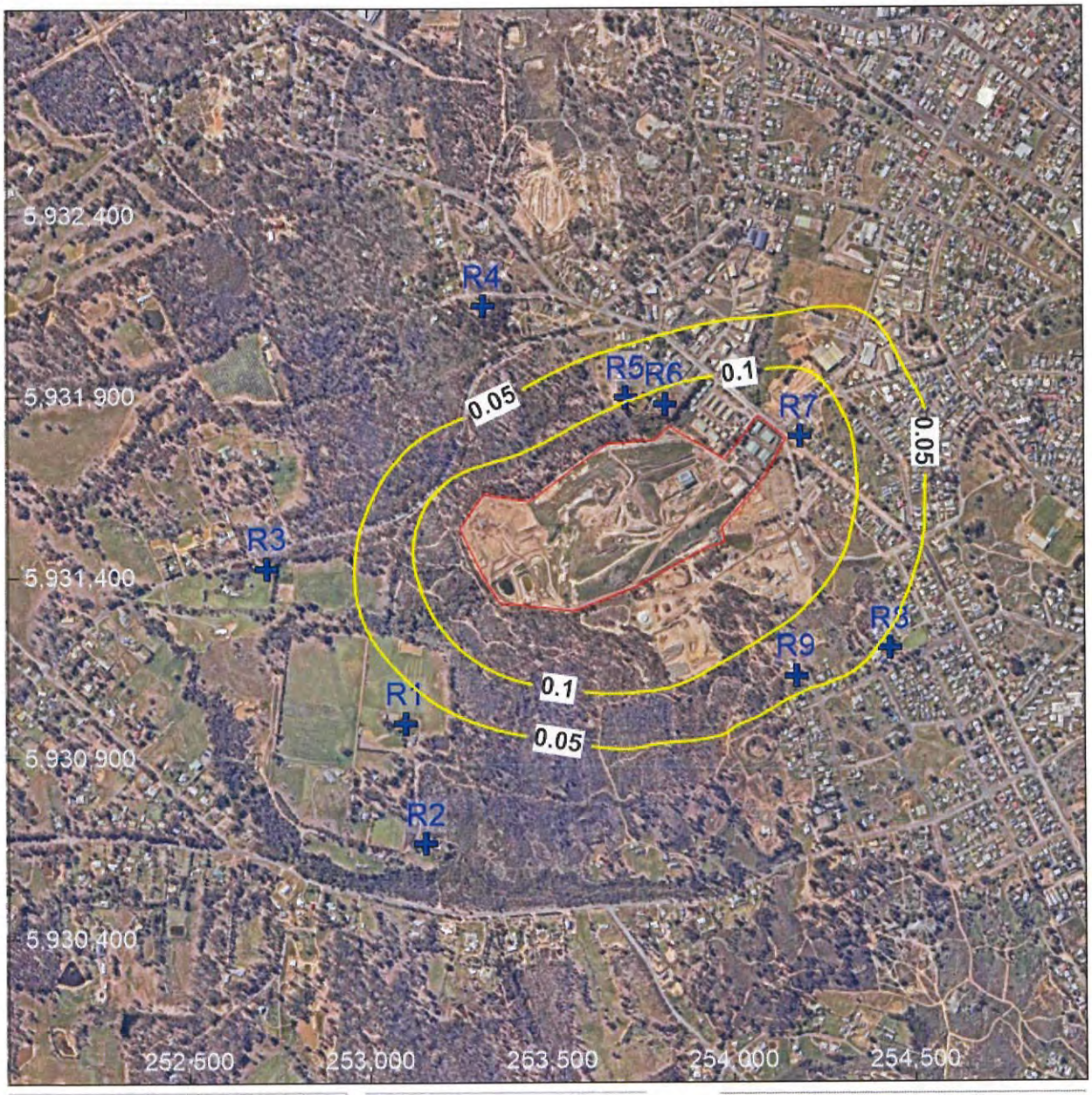
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Incremental Impact - Proposed Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B85 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2017



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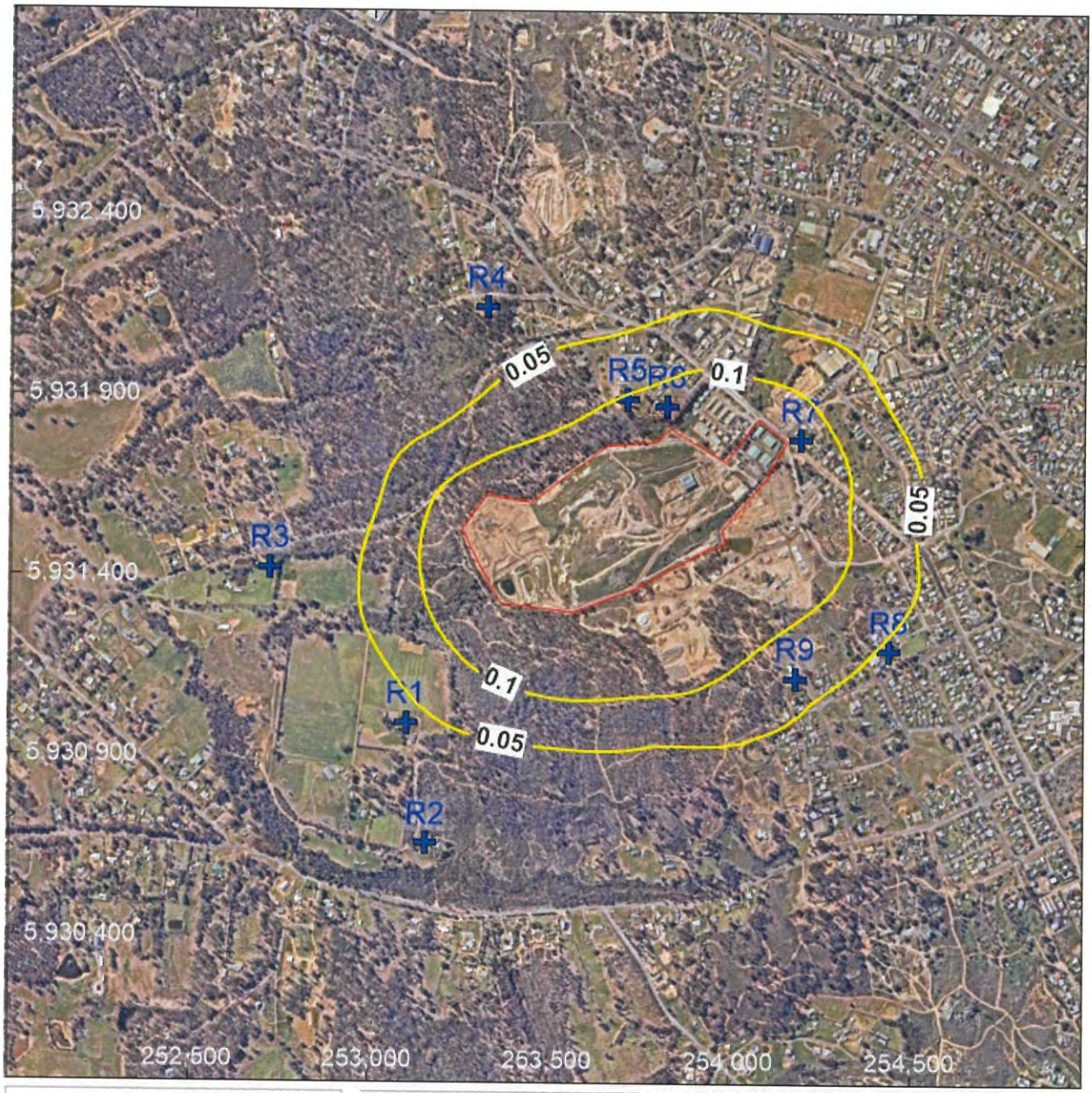
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Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B86 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2013



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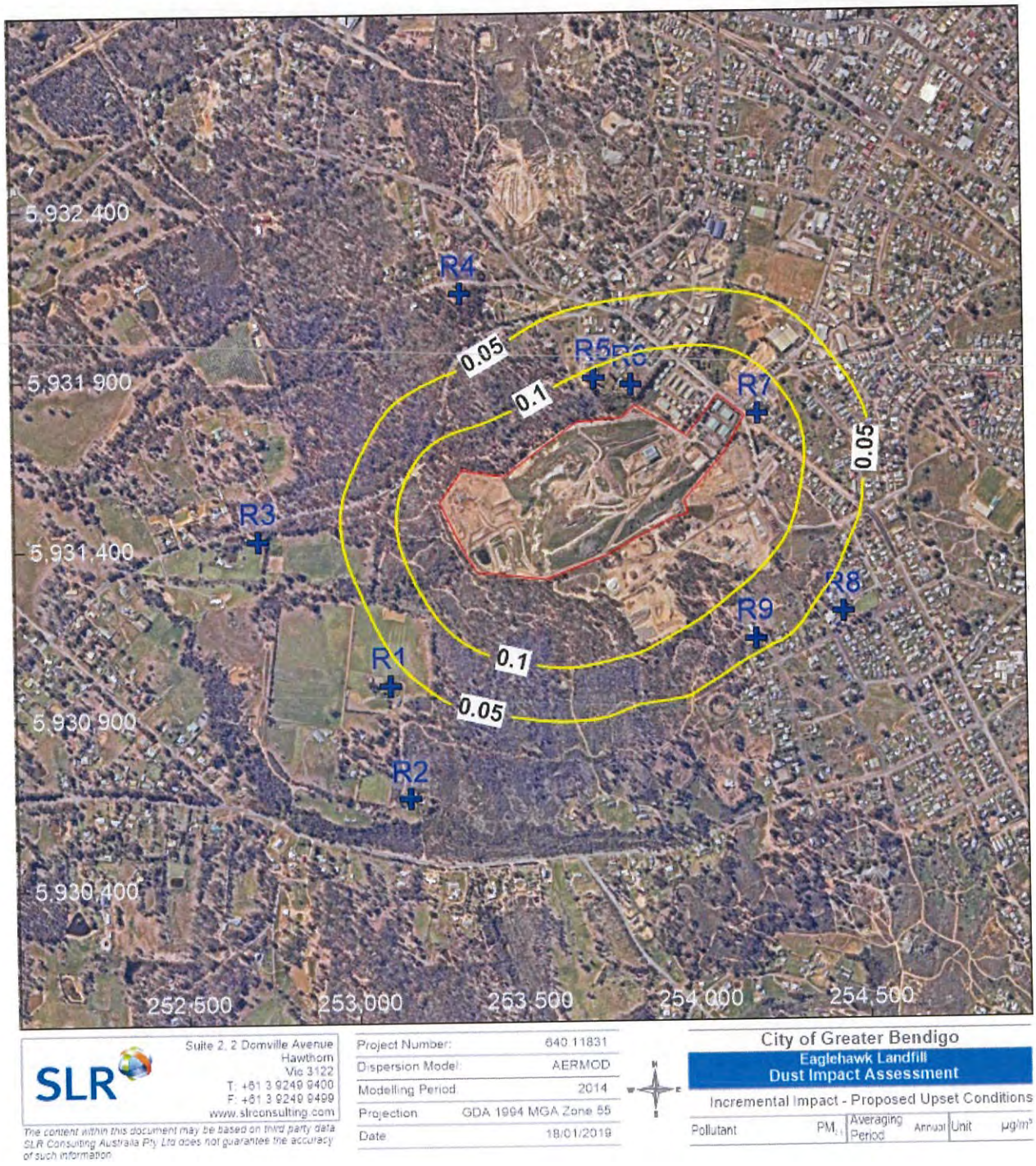
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Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B87 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2014



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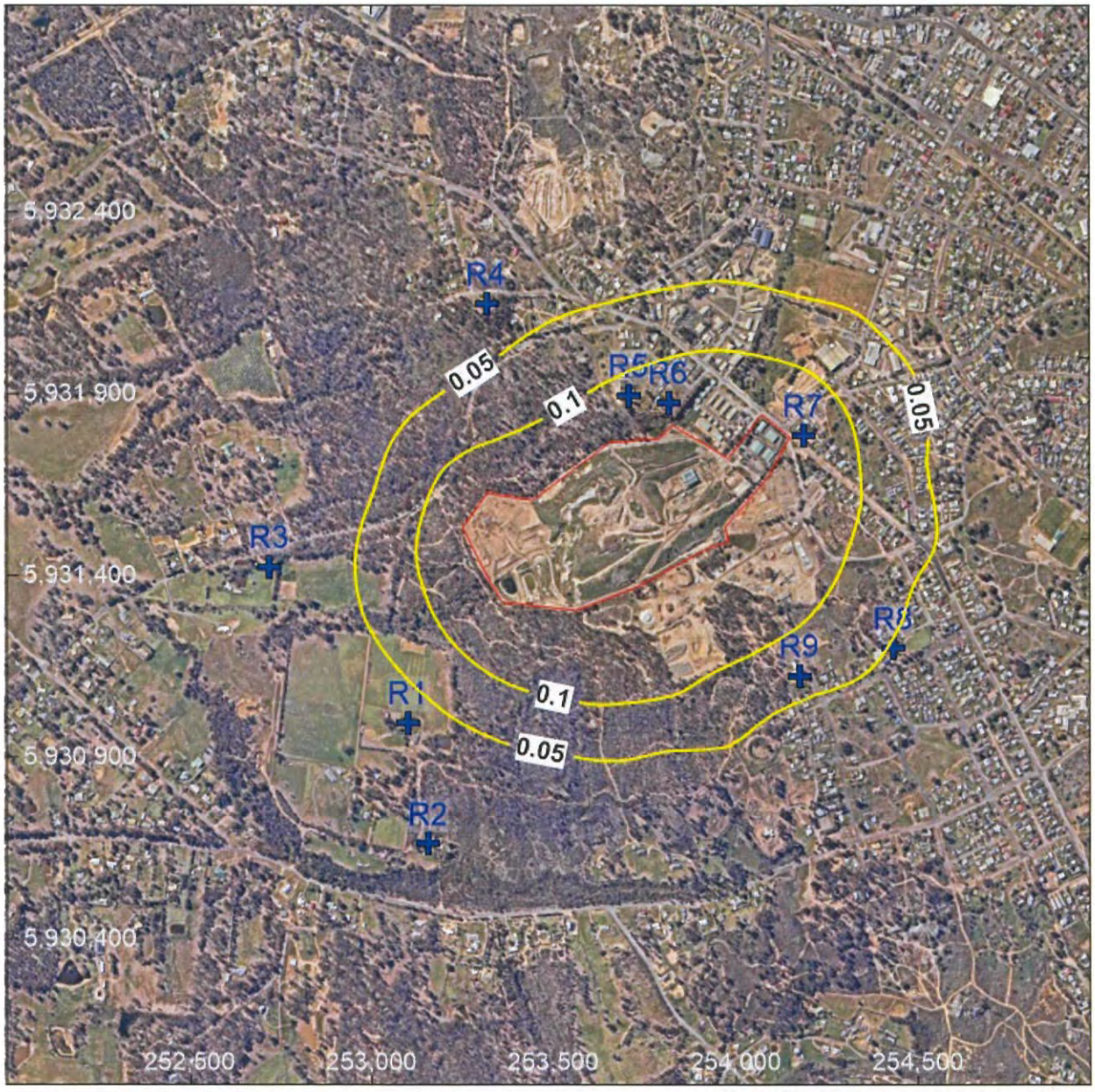
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Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B88 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2015



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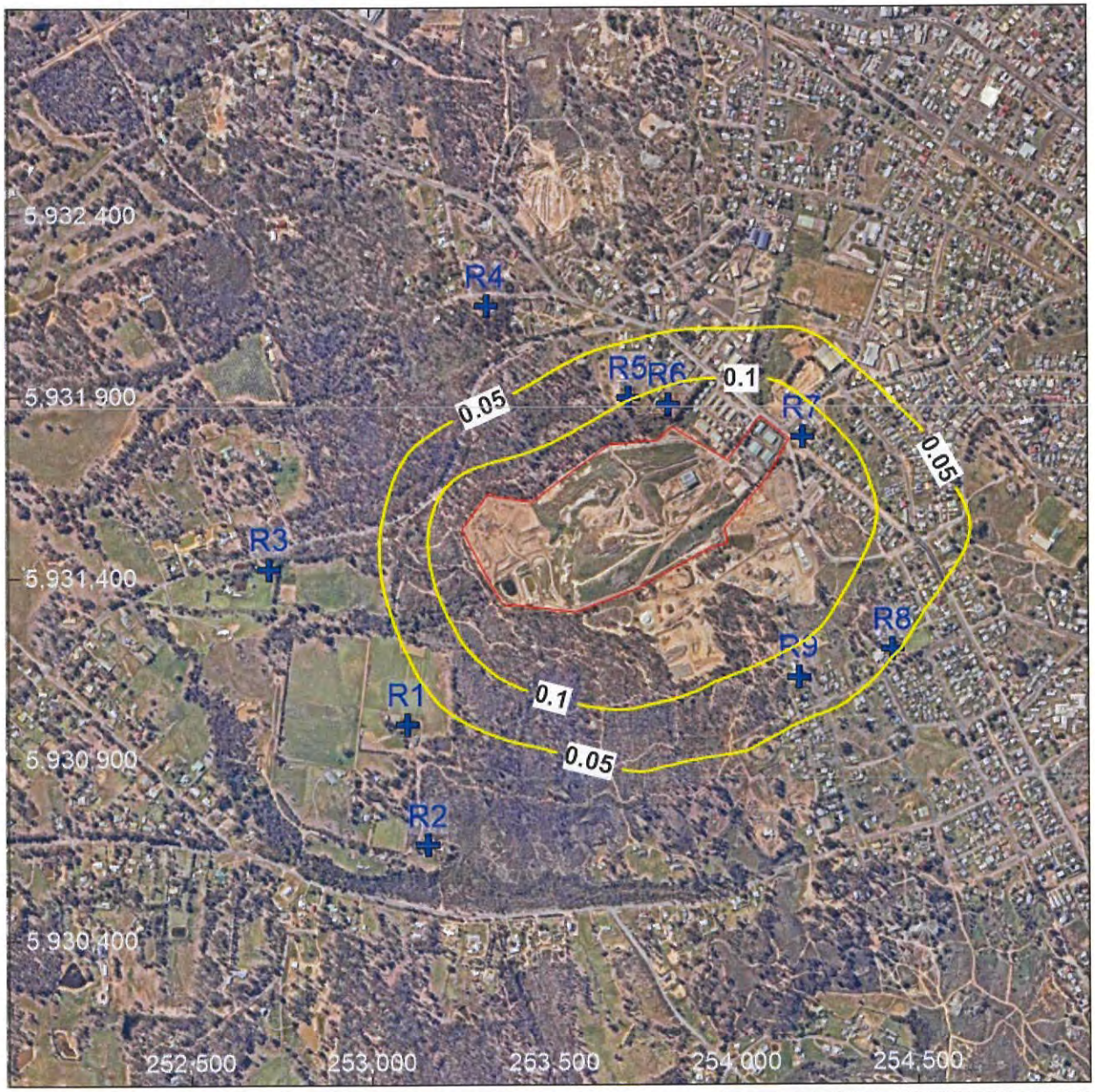
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Incremental Impact - Proposed Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B89 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2016



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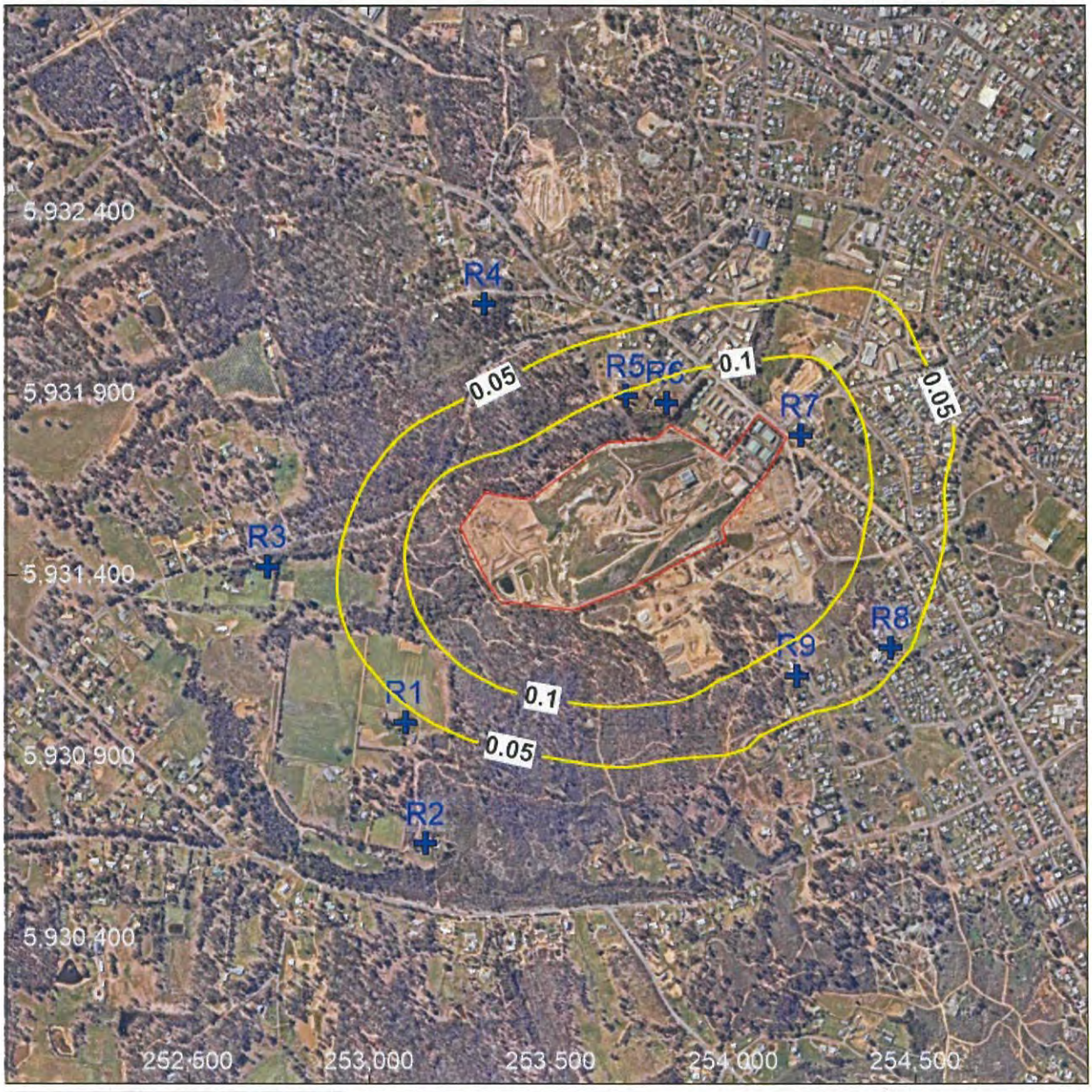
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Eaglehawk Landfill
Dust Impact Assessment
Incremental Impact - Proposed Upset Conditions

Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B90 Predicted Incremental Annual Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2017



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Dust Impact Assessment
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Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure B91 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2013



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City of Greater Bendigo

Eaglehawk Landfill
Dust Impact Assessment

Incremental Impact - Proposed Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B92 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2014

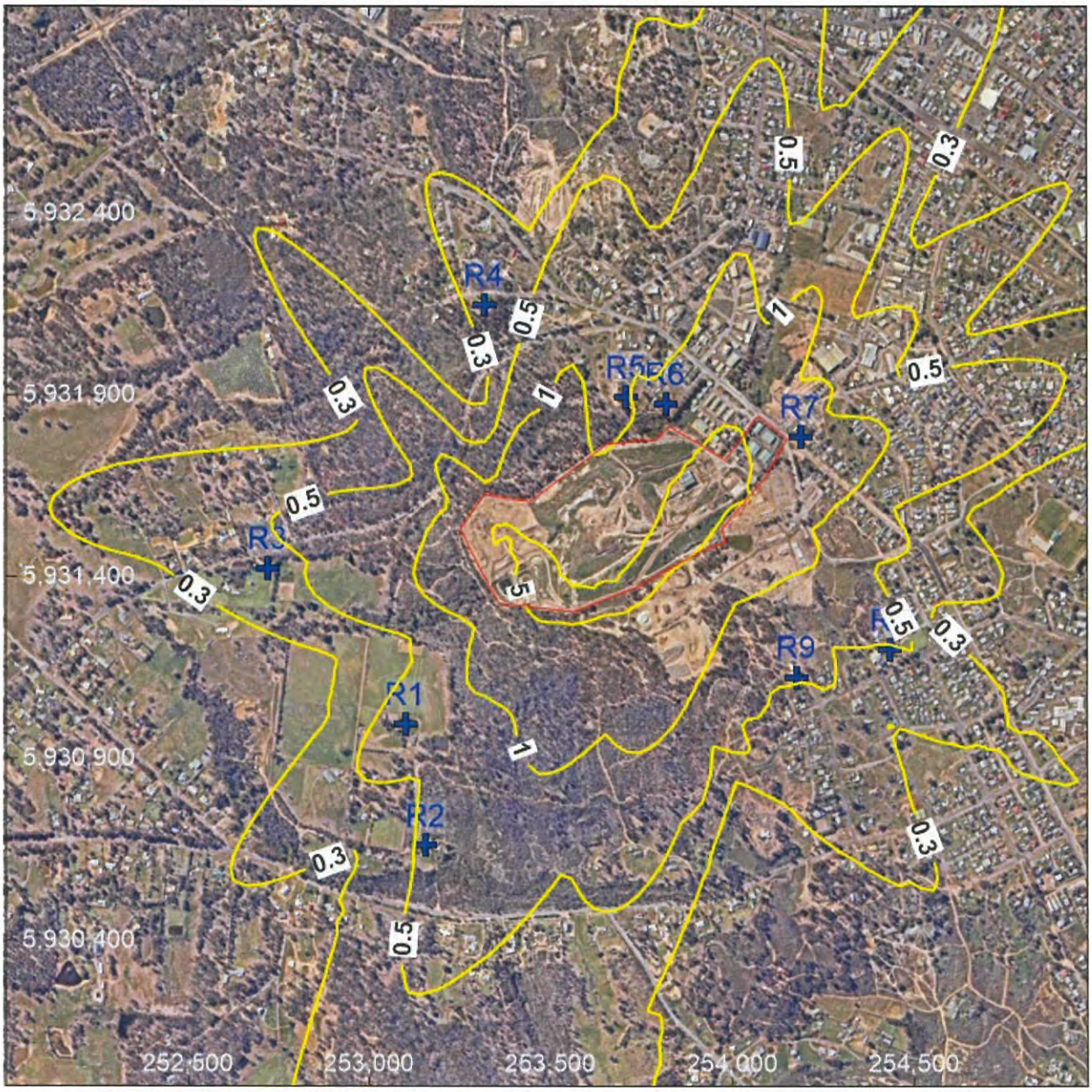


Figure B93 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2015

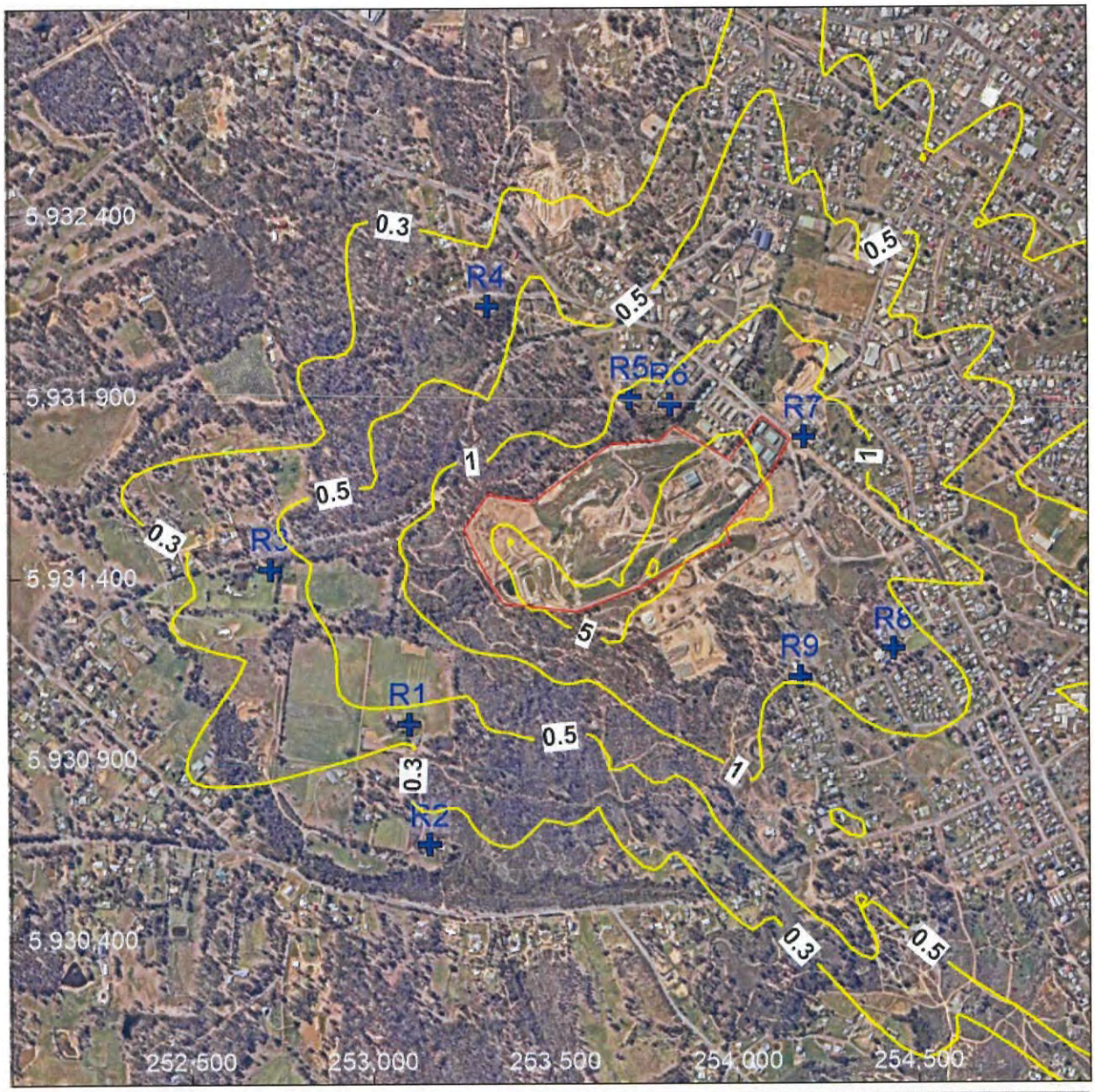
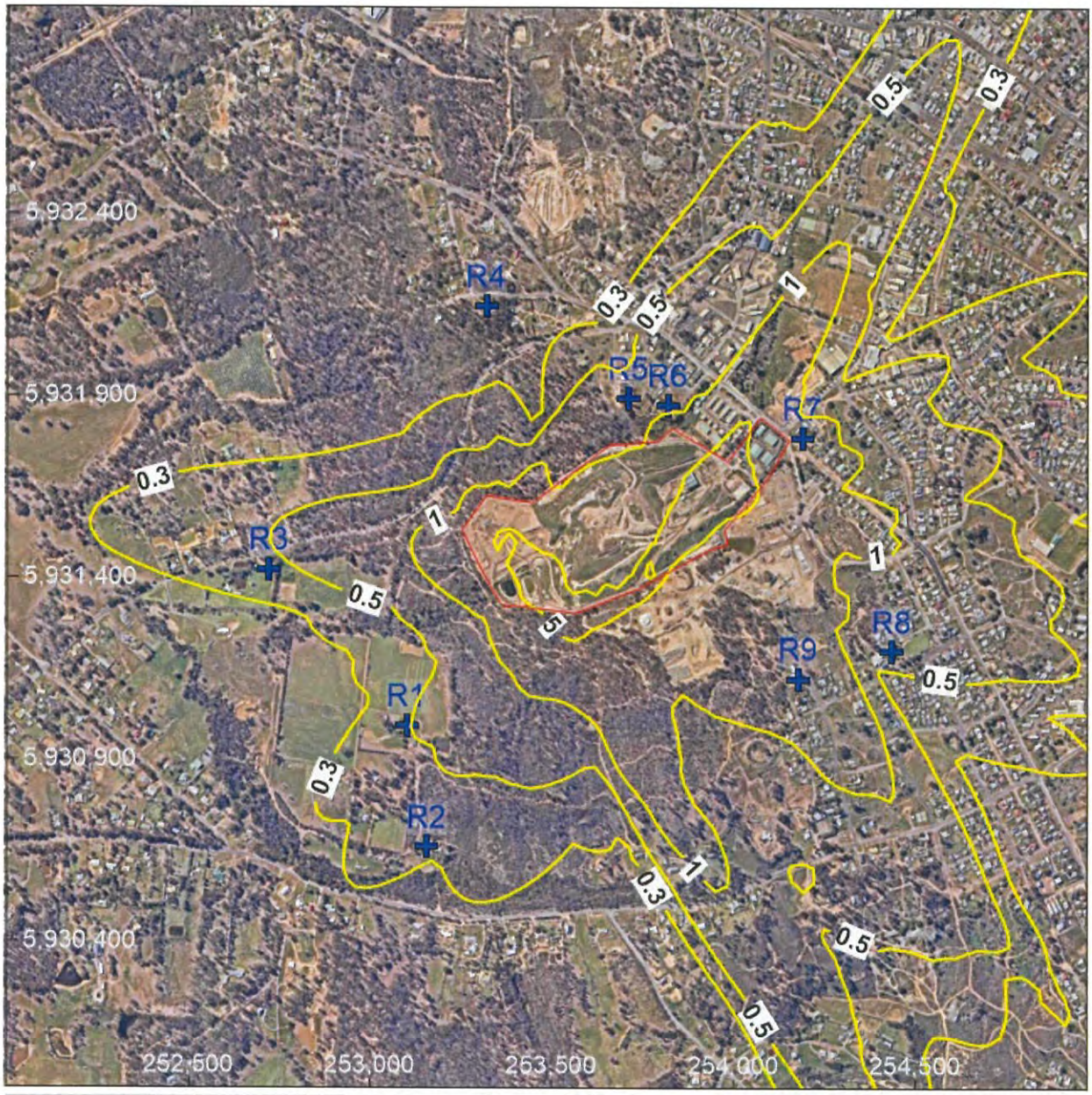


Figure B94 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2016



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Dust Impact Assessment
Incremental Impact - Proposed Normal Operations

Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B95 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Normal Conditions – 2017

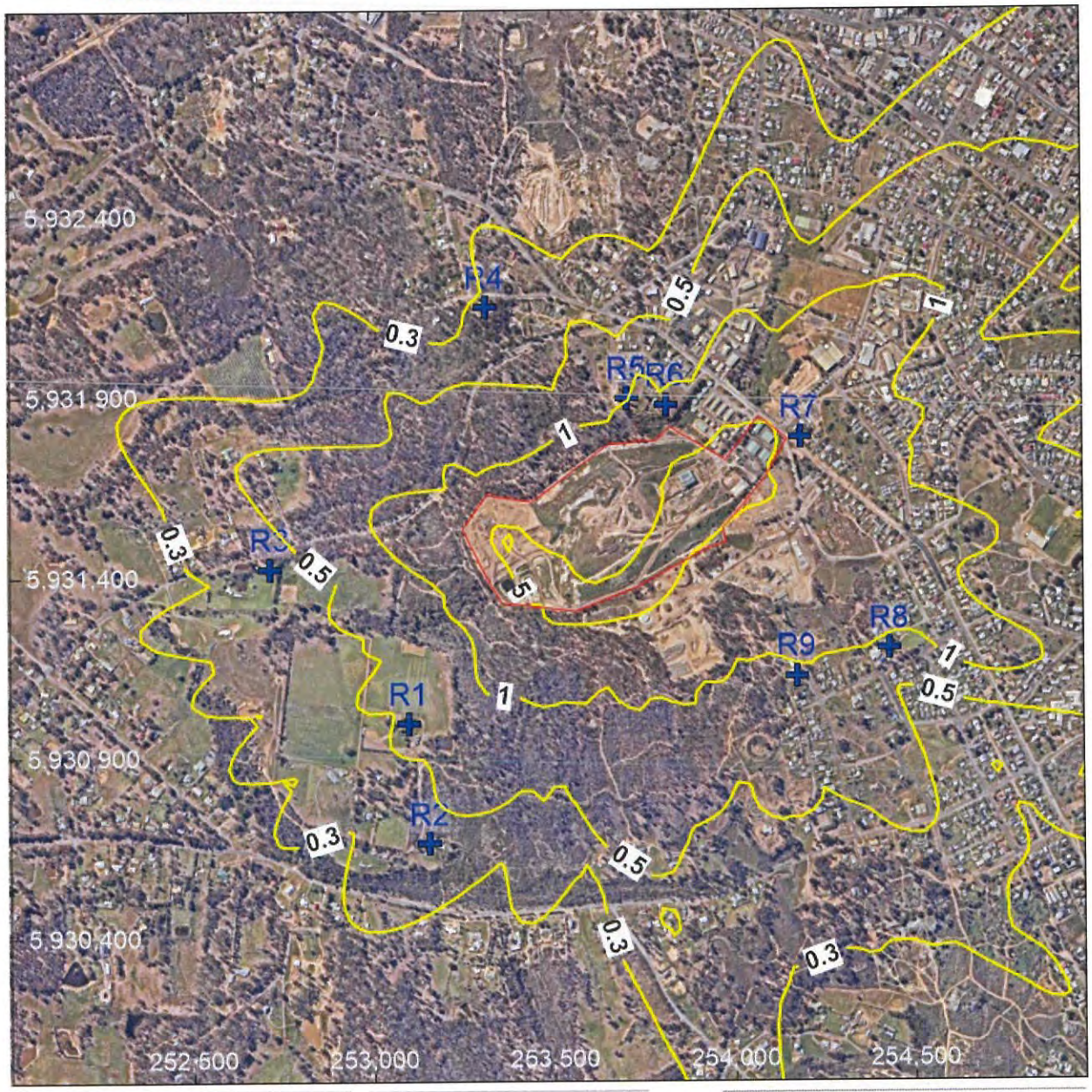
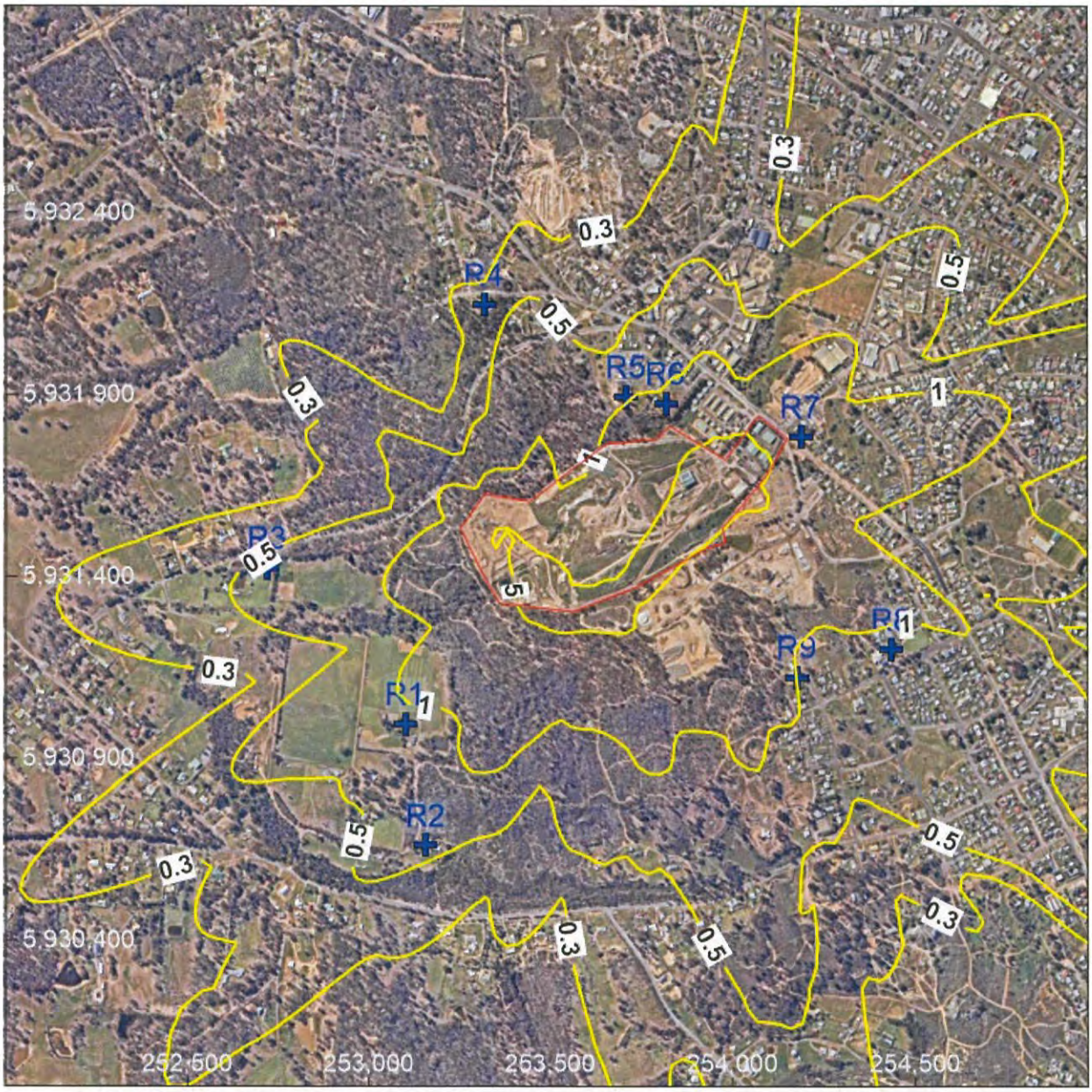


Figure B96 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2013



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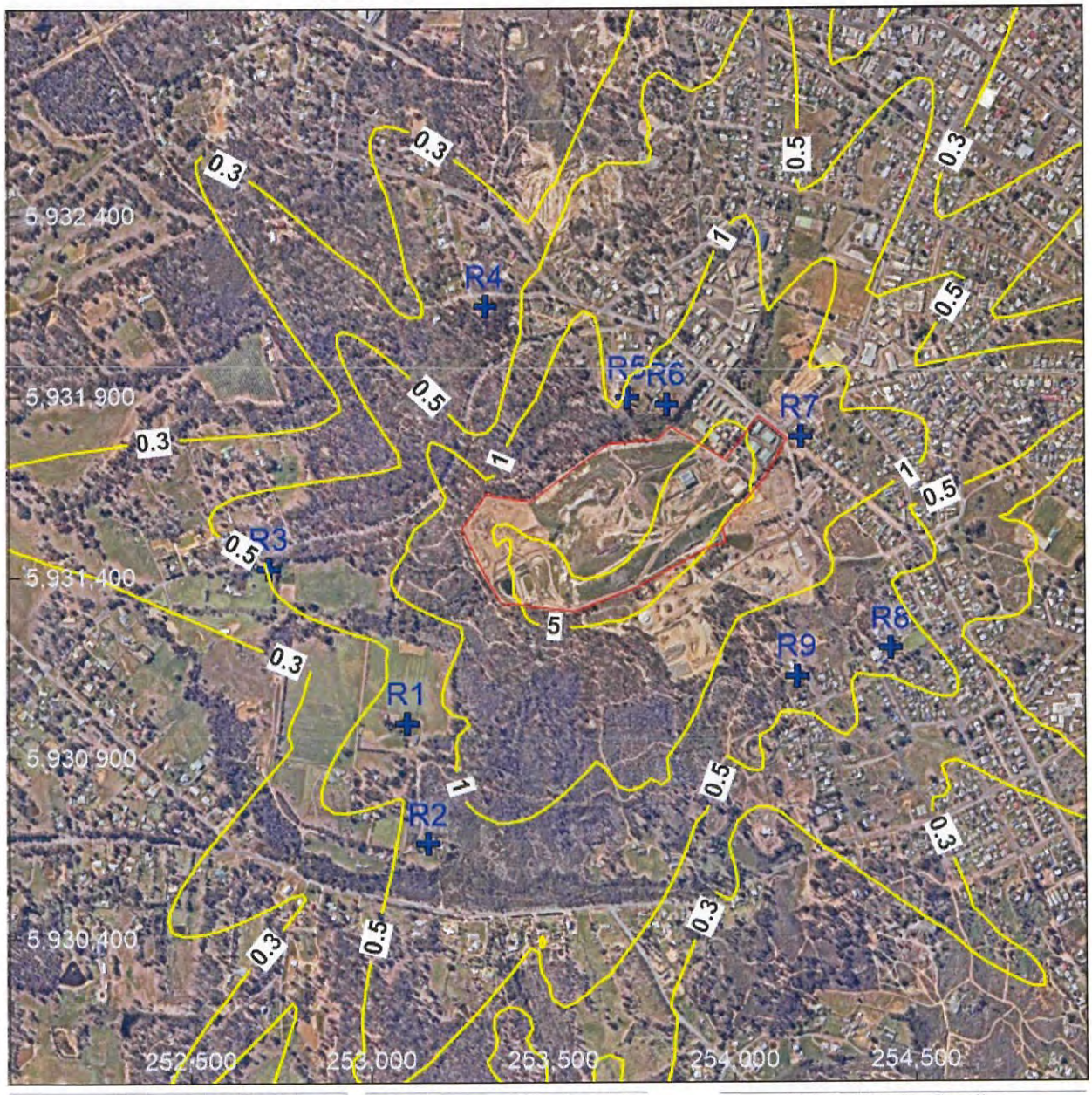
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Dust Impact Assessment
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Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B97 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2014



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Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B98 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2015



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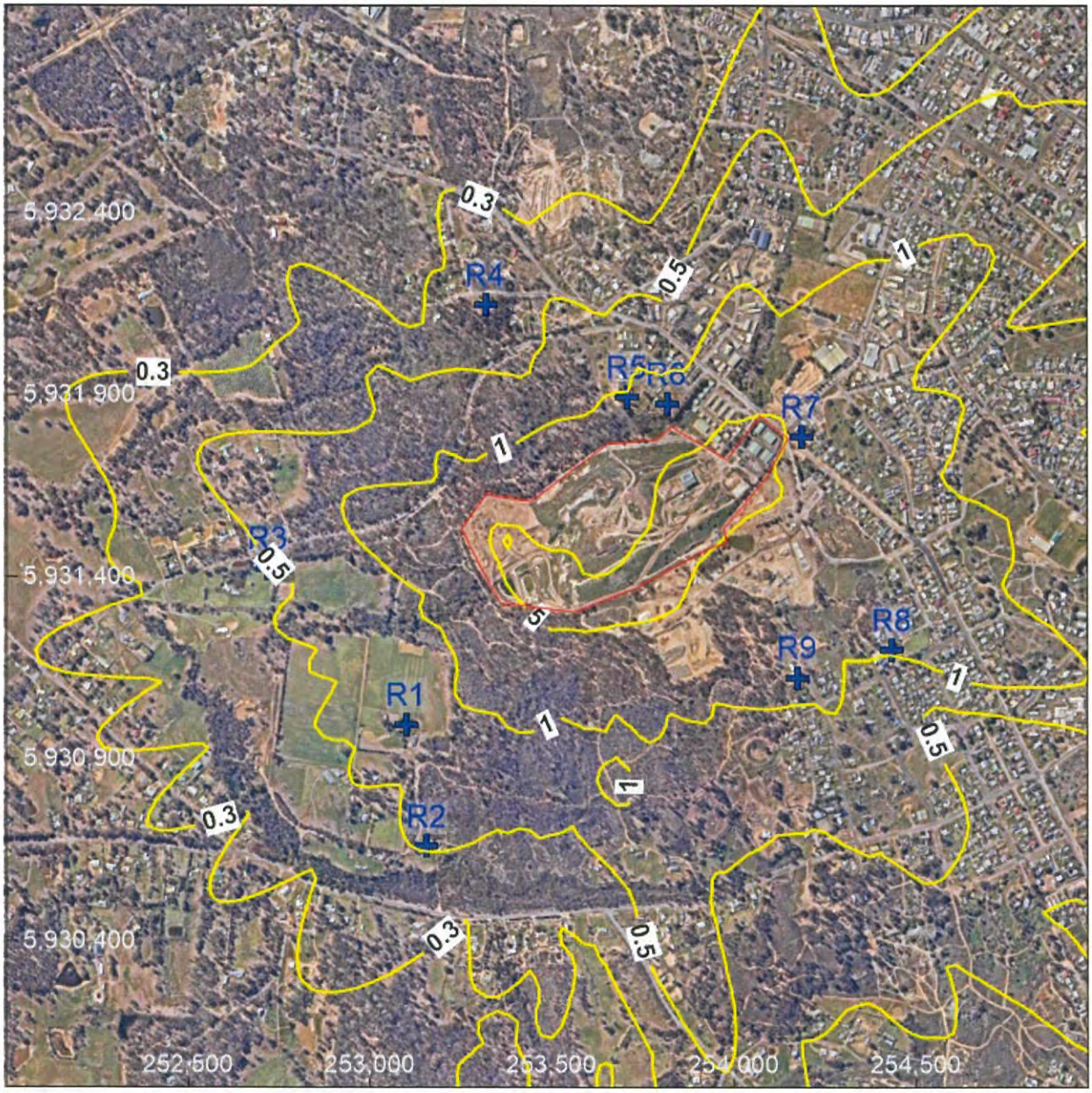
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Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure B99 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2016



Figure B100 Predicted Incremental 24-hour Average $PM_{2.5}$ Concentration (µg/m³) – Proposed Operations, Upset Conditions – 2017



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Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

ASIA PACIFIC OFFICES

BRISBANE
Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA
GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN
5 Foelsche Street
Darwin NT 0800
Australia
T: +61 8 8998 0100
F: +61 2 9427 8200

GOLD COAST
Ground Floor, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY
21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE
Suite 2, 2 Domville Avenue
Hawthorn VIC 3122
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE
10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH
Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

ROCKHAMPTON
rockhampton@slrconsulting.com
M: +61 407 810 417

SYDNEY
2 Lincoln Street
Lane Cove NSW 2066
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TAMWORTH
PO Box 11034
Tamworth NSW 2340
Australia
M: +61 408 474 248
F: +61 2 9427 8200

TOWNSVILLE
Level 1, 514 Sturt Street
Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

AUCKLAND
68 Beach Road
Auckland 1010
New Zealand
T: +64 27 441 7849

NELSON
5 Duncan Street
Port Nelson 7010
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Buffer Zone Landfill Gas Risk Assessment

Eaglehawk Landfill

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ABN: 74 149 638 164

Prepared by

AECOM Australia Pty Ltd
Level 10, Tower Two, 727 Collins Street, Melbourne VIC 3008, Australia
T +61 3 9653 1234 F +61 3 9654 7117 www.aecom.com
ABN 20 093 846 925

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Quality Information

Document Buffer Zone Landfill Gas Risk Assessment

Ref 60579200

Date 19-Sep-2019

Prepared by Vera Levina

Reviewed by David Ife

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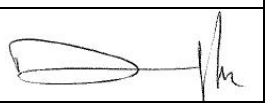
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			Name/Position	Signature
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Supplementary Folder

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) was engaged by Greater Bendigo City Council (Council) to undertake a landfill gas migration risk assessment to provide a basis for consideration of development proposals within the vicinity of Eaglehawk Landfill and to provide recommendations in relation to management of landfill gas risk in consideration of existing best practice guidance. The original scope of the assessment was based on the proposed scope requirements specified in the Request for Quotation (RFQ) received from Greater Bendigo City Council (Council) on 26 September 2017, and underpinned by our previous direct project experience related to the Eaglehawk landfill. The scope was extended following consultation with Council planning advisers and Auditor reviews.

EPA Publication 788.3 (2015) *Best Practice Environmental Management Siting, design, operation and rehabilitation of landfills* (Landfill BPEM), indicates that a municipal (putrescible) landfill should be sited at least 500m from buildings or structures (Landfill BPEM Table 5.2) to protect against gas migration, safety and amenity impacts. According to the BPEM, the recommended minimum buffer does not substitute appropriate management measures but "provides for contingencies that may arise with typical management practices".

Since the Eaglehawk landfill does not have a 500m buffer clear of any residential or industrial development, Council has engaged AECOM to identify the landfill gas risks in proximity to the landfill and to recommend appropriate buffer distances and management measures that will ensure the long-term protection of existing and potential receptors.

Due to the uncertain extent of the historical fill at the site, buffer distances were determined from the licence boundary as shown in Schedule 1B Premises Plan of the EPA licence 46490.

This report presents a landfill gas risk assessment for current and future landfill conditions and an approach to protect future developments based on the risk assessment. The landfill gas risk assessment is based on current landfill management practices and the assumption that management practices, in accordance with regulatory requirements, will continue till the end of landfill operations and during the aftercare period, until the landfill gas concentrations are reduced to levels that would pose no unacceptable risk.

2.0 Scope of Work

The scope of work completed by AECOM comprises the following components:

- Installation of soil gas monitoring bores;
- Undertaking three discrete monitoring events of the new and selected historical bores at the site and two methane emissions surveys of the subsurface services along the adjacent streets;
- Review of the conceptual site model, including LFG / soil gas conditions at the site;
- Assessment of risk of LFG migration to land and potential receptors in the vicinity of the landfill under anticipated future site LFG conditions;
- Review and selection of distances that would provide appropriate safeguards (buffers) to manage landfill gas risk;
- Development of an approach to defining control (management) areas on the basis of LFG risk; and,
- Propose building control measures within the adopted buffer.

3.0 Background

3.1 Site History

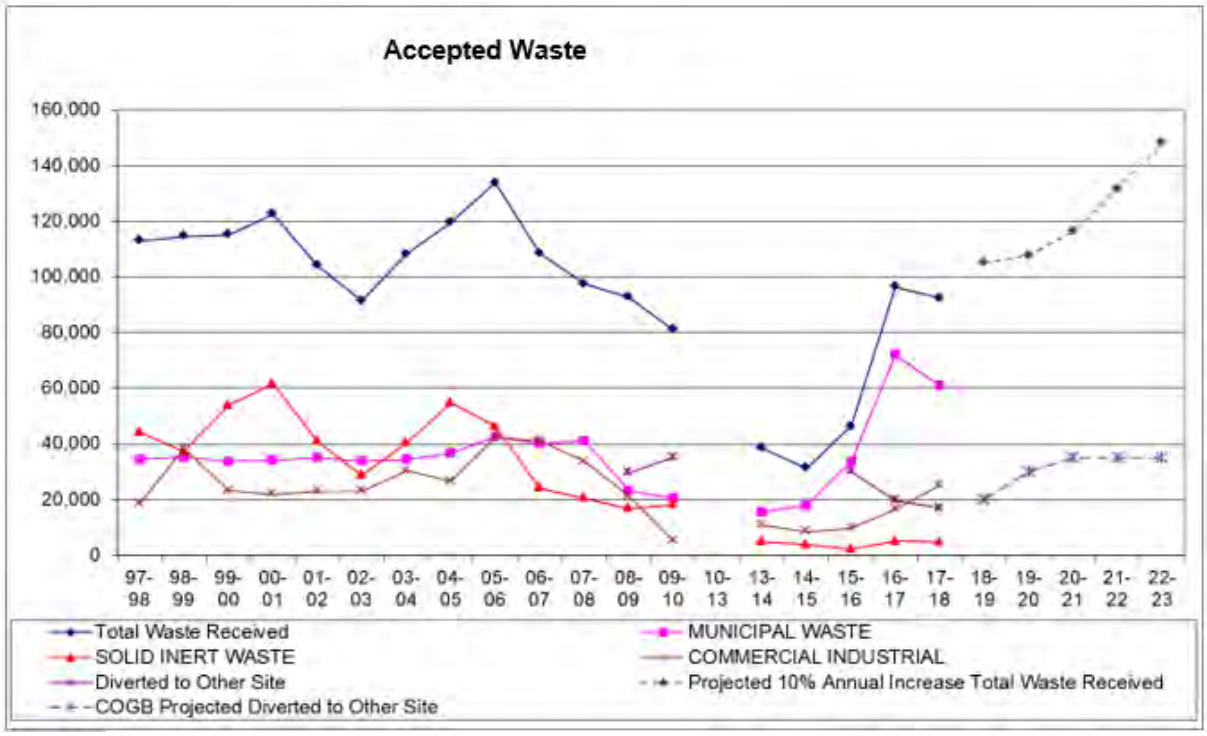
The Eaglehawk Landfill site includes the regional landfill and transfer station for the City of Greater Bendigo, located approximately 5.7 km northwest of the centre of Bendigo, in the suburb of Eaglehawk. The site covers an area of over 25 ha and is surrounded by various urban, industrial and recreational land uses.

The landfill is shown in Figure F1 in Appendix A and planning zones and overlays are illustrated in Figure F2. These figures also show the extent of two zones around the landfill, at 500m and 250m from the landfill (licence boundary, in figures simplified to outer licence boundary only). The 500m zone corresponds to the Landfill BPEM minimum buffer distance and the 250m zone incorporates buildings and structures closest to the landfill, such as existing and proposed residential dwellings and commercial / industrial properties.

The Eaglehawk Landfill has been developed as a valley-fill landfill in a gully that extended from the north-eastern side of Upper Californian Gully Road to the western boundary of the site although the precise extent of the original gully is unknown. The gully where filling took place extended to depths up to 15m below ground level currently observed at the sides of the landfill. Licensed landfill operations at the site commenced in 1975. Prior to licensed landfilling, areas of the current landfill site and in its immediate vicinity were used for the disposal of mine wastes (tailings) and by locals as a waste dump since the 1860's; the extent of off-site fill to the north-east of the current landfill is unknown. Based on Council's investigations in 2018 (study of historical aerial photography and intrusive investigations, as communicated to AECOM by Council), putrescible waste is confined entirely within landfill boundaries; illegal dumping is believed to be predominantly mine tailing sands.

The landfill is licensed to accept general (putrescible and solid inert waste, asbestos of domestic origin, shredded tyres) and prescribed waste (asbestos and Category C contaminated soil). The nature of the historical fill is uncertain. Nature and age of the fill across the site is expected to vary, resulting in variable LFG generation potential. Types and relative tonnages of different waste types accepted at Eaglehawk landfill during typical operational years is shown in Figure 1.

Figure 1 Waste Accepted at Eaglehawk Landfill



Historical tipping areas are known to extend further up the gully north and north east of the licensed landfill area at Eaglehawk landfill. The nature and amount of deposited waste is unknown, however it is anticipated that putrescible, organic (plant and animal) and potentially hazardous (agricultural and domestic origin) fill materials have been deposited. Historical tipping may potentially contribute to generation of LFG outside of the licensed premises boundary however it is expected to be negligible given the likely age of the waste.

The historical development of the landfill is summarised in Table 1.

Table 1 Cell Development

Cell	Year Open	Liner	Waste Type	Capping	LFG Management
1	1975	No engineered liner	Mostly municipal (putrescible) waste	Approved approximately 1.5m clay layer	Active; refer LMS plan in Appendix A
2	1998	Compacted clay liner (base)	Mostly municipal (putrescible) waste	Partially capped by approved approximately 1.5m clay layer; to be completed with engineered cap	
3A 3B	2008	Engineered composite base liner and side liner	Mostly municipal (putrescible) waste	Intermediate cover; to be completed with engineered cap	
5	2015	Engineered composite base and side liner	Municipal (putrescible) waste; C&I and organic waste diverted from municipal stream since 2015	Uncapped (daily cover); to be completed with engineered cap	Proposed (January 2019); refer LMS plan in Appendix A

Tipping will continue in Cell 5 for another 4-6 years, with about 100,000 tonnes accepted per year, with less than 20,000 t/a able to be diverted from the landfill. According to Council, there are no plans to extend the landfill life (Cell 4 will not progress).

Licensed landfill operations at Eaglehawk landfill commenced in 1975. Historically, areas of the current landfill site and in its immediate vicinity were used for the disposal of mine wastes (tailings) and by locals as a waste dump since 1860s.

Eaglehawk landfill is licensed to accept general (putrescible and solid inert) and prescribed waste. Municipal, solid inert and commercial industrial wastes have been accepted in relatively similar proportions over time. The nature of the historical fill is uncertain.

The nature and age of the fill across the site are expected to vary, resulting in variable LFG generation potential.

There remains about 4-6 years of airspace at the landfill.

3.2 Previous Related Investigations

A number of site investigations have been conducted on the site since landfilling began and these reports have informed the development of the conceptual site model of the facility.

- Eaglehawk Landfill Field Investigation Report 1993. AGC Woodward-Clyde, 1993.
- Eaglehawk Landfill – Preliminary Gas Management Investigation Study, URS, September 2000.
- Historical compliance monitoring (records 2001-2018).
- LFG Risk Assessment, URS, 2015.
- Eaglehawk Resource Recovery Facility Master Plan – Geotechnical Investigation Report. Infrastructure Solutions, April 2016.
- Albert Roy Reserve Eaglehawk, Preliminary Geotechnical Investigations, GTS, June 2016.
- Site investigation and classification at BMX facility, Eaglehawk, Shane Muir Consulting Engineers, August 2016.
- LFG Remediation Action Plan, Tonkin Consulting 2016.
- Risk assessment review as part of verified Eaglehawk Landfill Environmental Monitoring Program (AECOM, 2017) and Hydrogeological Assessment (AECOM, 2017).
- Allstone Quarries Borehole Environmental Logs SB01-SB30; location map; WSP, February 2018.

Previous assessment works of relevance to this LFGRA include:

- There are over 15 years of soil gas monitoring records (BH01-BH16 since 2001), with regular compliance monitoring at the site carried out at 6-monthly intervals (bore locations are illustrated in section 1.2.2). Continuous soil gas monitoring of bores BH18 and BH26 was carried out in winter 2017. In 2018, two compliance monitoring events (February and August) took place, with scope of the August event extended to include the additional soil gas monitoring bores and subsurface services locations.
- Eaglehawk landfill environmental site risk assessment was carried out in 2010-2011 as part of the EPA landfill licence reform. This included development of a comprehensive Conceptual Site Model (CSM).
- AECOM completed the LFGRA in 2015-2016 (AECOM, March 2016) following the recommendations of the s53v Audit for the site (ERM, 2015). The assessment covered risks to sensitive receptors existing at that time. Issues associated with any future sensitive development within the buffer zone were not considered separately as the plans were not available at the time. AECOM also provided recommendations in relation to LFG management and monitoring at the site, including extension of the monitoring network in the vicinity of BH18, west of Cell 5, south of Cell 2 and east of the site offices on the boundary with ASQ.
- A LFG Remediation Action Plan (LGRAP) was issued in March 2016 by Tonkin Consulting. The report contained carbon dioxide background assessment, which concluded that underlying geology (carbonate-rich sediments) was a viable alternative source of CO_2 and that bores BH20, BH21 and BH23 could be indicative of background CO_2 conditions based on their distance from the waste. The report delineated methane release points being associated with construction of Cells 3A and 3B, i.e., through fill (other than waste) between the cells 1, 3 and/or 5. The LGRAP recommended installation of four additional soil gas monitoring bores: three along the western site perimeter and one, nominated as background bore, further west near Bracewell Street.
- The risk assessment review indicated that waste at Eaglehawk landfill remains largely unsaturated, and that current LFG containment (capping, natural geology) and management (extraction) system have been generally effective in controlling LFG fugitive emissions.

The majority of LFG monitoring locations and collected data fall within 250m of the landfill (refer figures in Appendix A). Within this 250m zone, therefore, there is a higher degree of confidence in the assessment of the level of landfill gas exposure and risk than in the band between 250m and the BPEM buffer of 500m.

4.0 Site Investigation

4.1 Drilling Program

Twelve landfill gas monitoring bores (BH29 through to BH40) were drilled and installed within the landfill 500m buffer (mostly within 250m zone) to monitor off-site soil gas conditions. Locations were confirmed and cleared for potential underground services on the 12th June, 2018. Drilling works were completed 18th to 26th June 2018. Drilling works were completed by South Western Drilling Pty Ltd. All works were overseen by a qualified AECOM representative.

The locations of all LFG monitoring bores are shown in Figure F3 in Appendix A and LFG bore construction logs are presented in Appendix B.

Monitoring bore locations have been selected to confirm LFG migration away from the waste footprint, taking into account the following considerations:

- Council identified the possible buffer encroachment areas within 250m zone and 500m buffer.
- Soil gas monitoring results at the Eaglehawk landfill indicated that methane concentrations in monitoring bores BH18 and BH26 have exceeded action levels for subsurface geology recommended by EPA Landfill BPEM (Publication 788.3, 2015).
- Potential preferential pathways for offsite LFG transport through more permeable subsurface geology that have not been intercepted by the perimeter monitoring bores.
- There were apparent gaps in the perimeter monitoring bore network, either because bores were damaged or destroyed or not installed in anticipation of future site development.

The installed bores covered the following areas:

- Area within or just outside of 250m distance to the north-west of the landfill and aligned with fracturing in the vicinity of BH18 and BH26 where possible. The number and placement of bores in this area was confirmed with Council and Parks Victoria within the 500m buffer within the current GRZ and PUZ7 south and north of Bracewell Street, having regard to limitations associated with sensitive land use within the existing and potential future encroachment;
- Gap between existing bores BH21 and BH22, off-site along the southern perimeter of the landfill (existing Cell 2);
- Gap between BH23 and BH15 on the eastern side of the landfill;
- Gap between existing BH20 and BH21 along the western perimeter of the landfill.

Although the nominated locations required re-positioning due to Parks Victoria, seasonal rig access restrictions and adjustments during sub-surface clearance, overall it is considered that locations of the installed bores intercept areas representative of various LFG fate and transport conditions within the buffer.

Depths of the soil gas monitoring bores were based on the EPA guidelines (Pub.788.3 and 1684), i.e. to the water table or depth of the waste, whichever is shallower – the depths were confirmed once the locations were determined in agreement with Council). The bores were constructed in accordance with these guidelines.

LFG bores were drilled using a Boart Longyear DeltaBase 250 track mounted rig. Bores were drilled to a maximum depth of 15.2 m below ground surface. Solid Stem Augering was used to advance a 150 mm diameter borehole from surface. Upon auger refusal Down Hole Hammering was used to advance the borehole at a 125 mm diameter through the encountered competent (rock) geology to target depth. No drilling fluids were used to achieve target depth. Drill cuttings were used to determine the lithology.

Bores were constructed using Class 18 50 mm uPVC casing with a 5 mm slotted screen from the base of the bore. A 5-10 mm washed gravel pack was installed within the bore annulus around the screened section, extending 0.5 m above the top of the screen. A 1.0 m seal was then installed using a hydrated bentonite powder to create a bore seal above the screen/gravel zone. Bores were

completed with a 5% bentonite grout mixture at the surface and finished with a lockable steel standpipe monument.

Methane monitoring was conducted during drilling using an LEL meter and no methane was detected.

Construction details of all landfill gas boreholes drilled at Eaglehawk are contained in the Supplementary Folder at the end of this report.

4.2 Soil Gas Monitoring

The available guidelines (CIRIA, LFTGN03) suggest a 6 to12 months duration of monitoring for the sites with high LFG generation potential and moderate / high sensitivity of development (residential), and double that duration for site with variable concentrations. LFTGN03 suggests monthly frequency monitoring for operational phase, and 6-monthly for aftercare phase, and that collection of 12 sets of data is carried out over the 12 months period in order to determine the background soil gas levels during site preparation. Other publications (NHBC, report 4- 2007) suggest intervals of 2 weeks over a three month period. Continuous monitoring of the affected bores may provide better results than numerous discrete monitoring events, when performed over a period of a few weeks and capturing various atmospheric conditions.

At Eaglehawk landfill, there is an extensive historical record of soil gas concentrations at various depths along most of the landfill perimeter. It was considered therefore that a less demanding monitoring program was required to determine LFG fate and transport conditions further away from the waste footprint.

The data presented in this report is limited to October 2018 but since then two monitoring rounds have been undertaken. The results of these monitoring events are consistent with the previous monitoring history and support the conclusions contained herein. Additional monitoring results are provided in the Supplementary Folder at the end of this report.

Monitoring was undertaken in accordance with the methods provided in EPA Pub.1684 (EPA, 2018). A GA5000 Landfill gas analyser was used to measure concentrations of CH_4, CO_2, O_2, H_2S and CO, % balance, borehole flow rate and relative pressure. Depths to water were measured in each bore on at least one occasion (after gas sampling of the bore). The detection limits of the GA5000 were 0.1%v/v (1000 ppmv) for CH_4, CO_2, O_2 and 1 ppmv for H_2S and CO. Equipment was calibrated by the supplier prior to use.

Field monitoring records and calibration certificates are provided in **Appendix D**. Monitoring was conducted by qualified AECOM personnel.

To provide a baseline for monitoring of the new bores, we included gas monitoring of the existing gas monitoring bores at the site on at least monthly basis.

Monitoring of the new (BH29-BH40) and selected historical bores (BH18, BH19, BH21-BH23, BH26, BH27) was undertaken on the following occasions:

- During drilling program between 22, 26 and / or 27 June 2018 (BH29-BH40 bores, sampled on at least one of these dates; BH18, BH19, BH21- BH23, BH26, BH27 sampled three times)
- 18 July 2018 (BH18, BH19, BH21-BH23, BH26, BH27 and BH29-BH40);
- During compliance monitoring event 7 August 2018 (all bores were monitored); and
- 25 October 2018 (BH26 – BH40).

Offsite methane emissions surveys of the subsurface services were carried out preceding the drilling works and during August 2018 monitoring event.

Meteorological data was downloaded from the nearest Bureau of Meteorology (BOM) station (Bendigo Aerodrome). Atmospheric pressure fluctuations at the time of the monitoring events are illustrated in charts below, and the following is noted with respect to weather conditions influence on LFG emissions:

- During the events carried out throughout the drilling program (22, 26 and 27 June 2018) an overall rising pressure trend was apparent, which is not conducive to LFG release, however actual monitoring of the bores occurred during periods of falling pressure.
- 18 June 2018 monitoring event was preceded by at least four days of falling pressure, favourable for gas release, followed by rising pressure conditions on the day preceding the monitoring, with such short term rise potentially lagging response and therefore not prohibitive; monitoring took place during falling barometric pressure conditions.
- August 2018 monitoring event was conducted following days of fluctuating pressure, which was falling two days prior to the event, rising on the day preceding monitoring, and relatively stable on the day of the event; the atmospheric pressure conditions were considered generally not unfavourable for gas release.
- October 2018 bore monitoring event was carried out following a period of rising pressure however pressure was falling during the event. There was no rainfall reported.
- Overall, LFG emissions monitoring carried out as part of this investigation took place during weather conditions not prohibitive to LFG release.

Figure 2 Barometric Pressure & Rainfall Data - June 2018 Monitoring

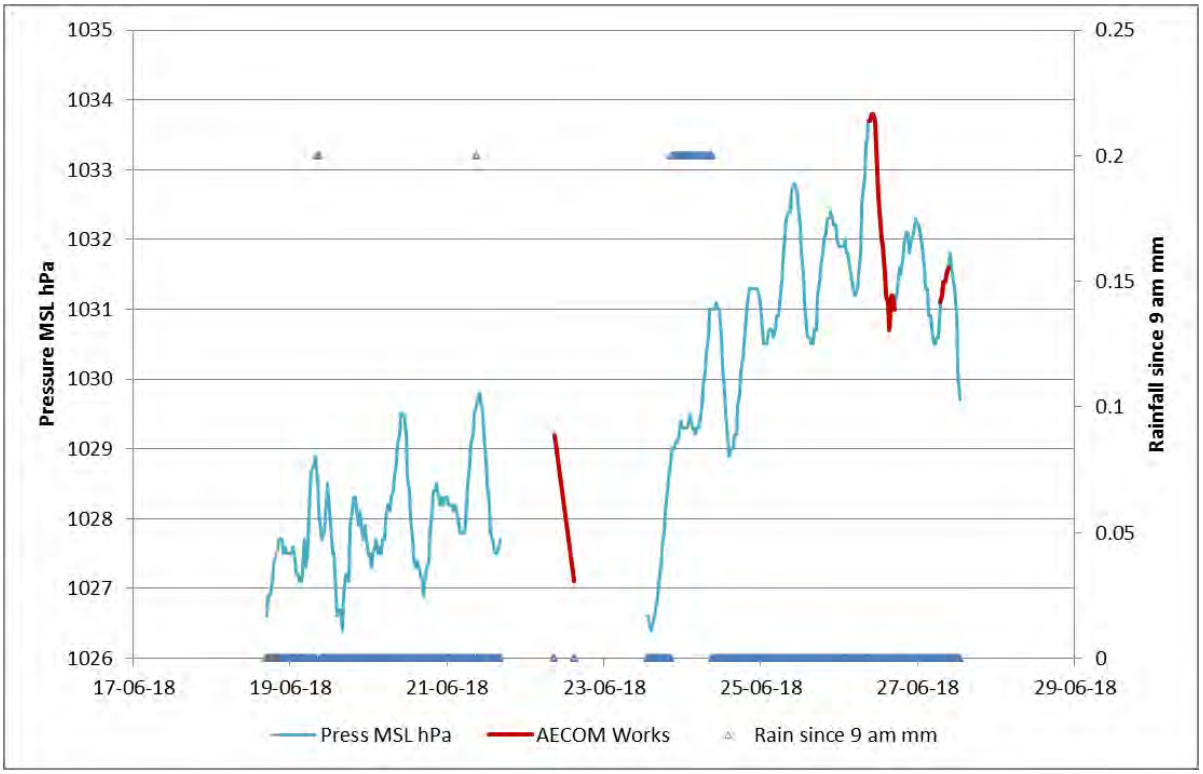


Figure 3 Barometric Pressure & Rainfall Data – July 2018 Monitoring

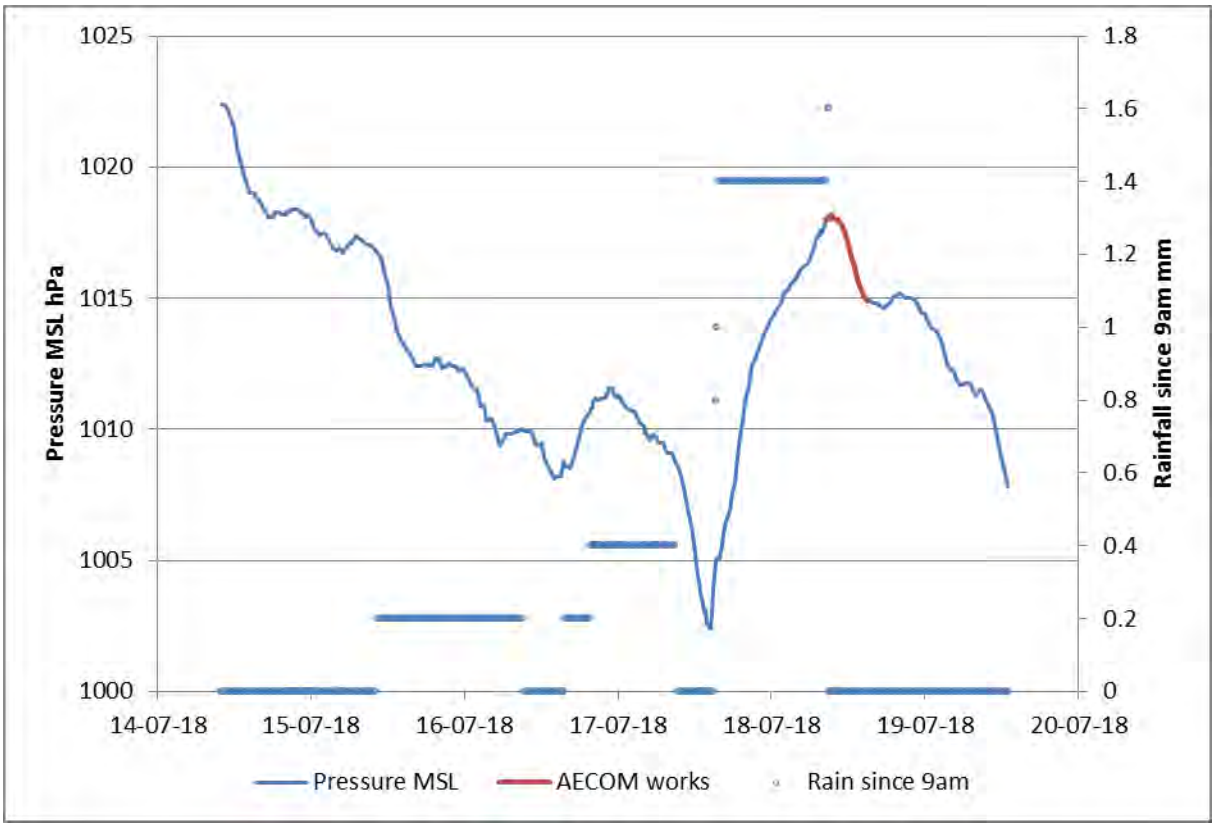


Figure 4 Barometric Pressure & Rainfall Data - August 2018 Monitoring

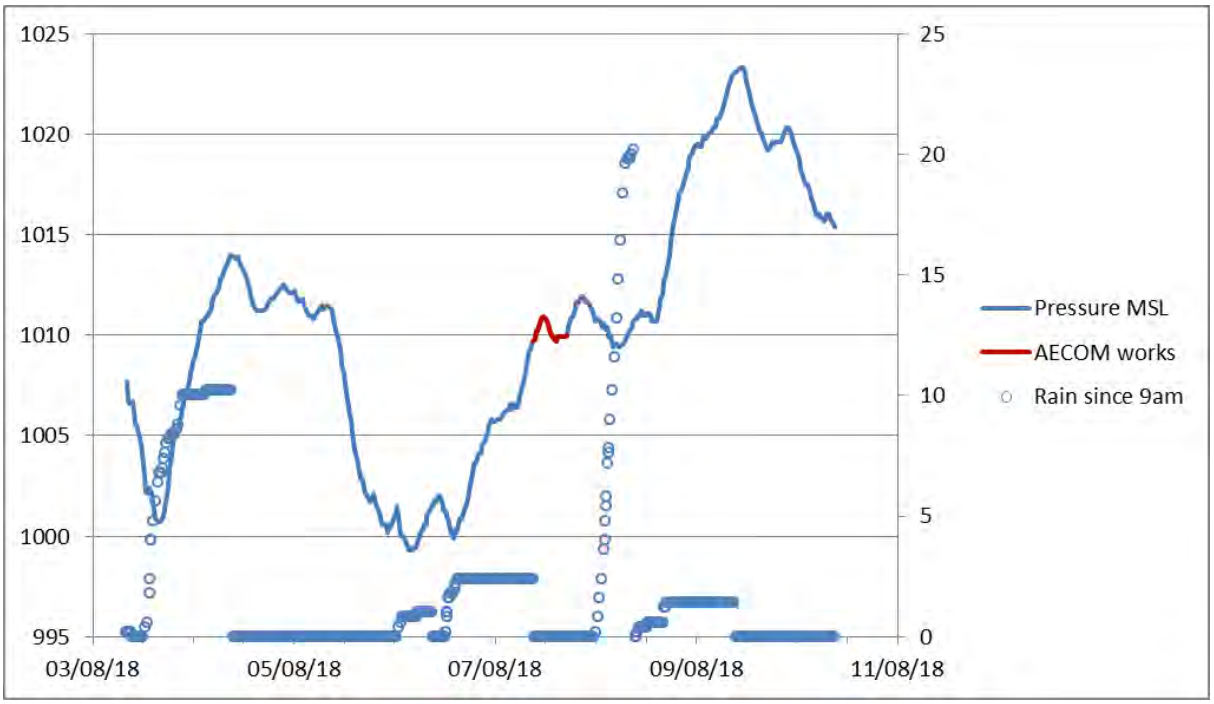
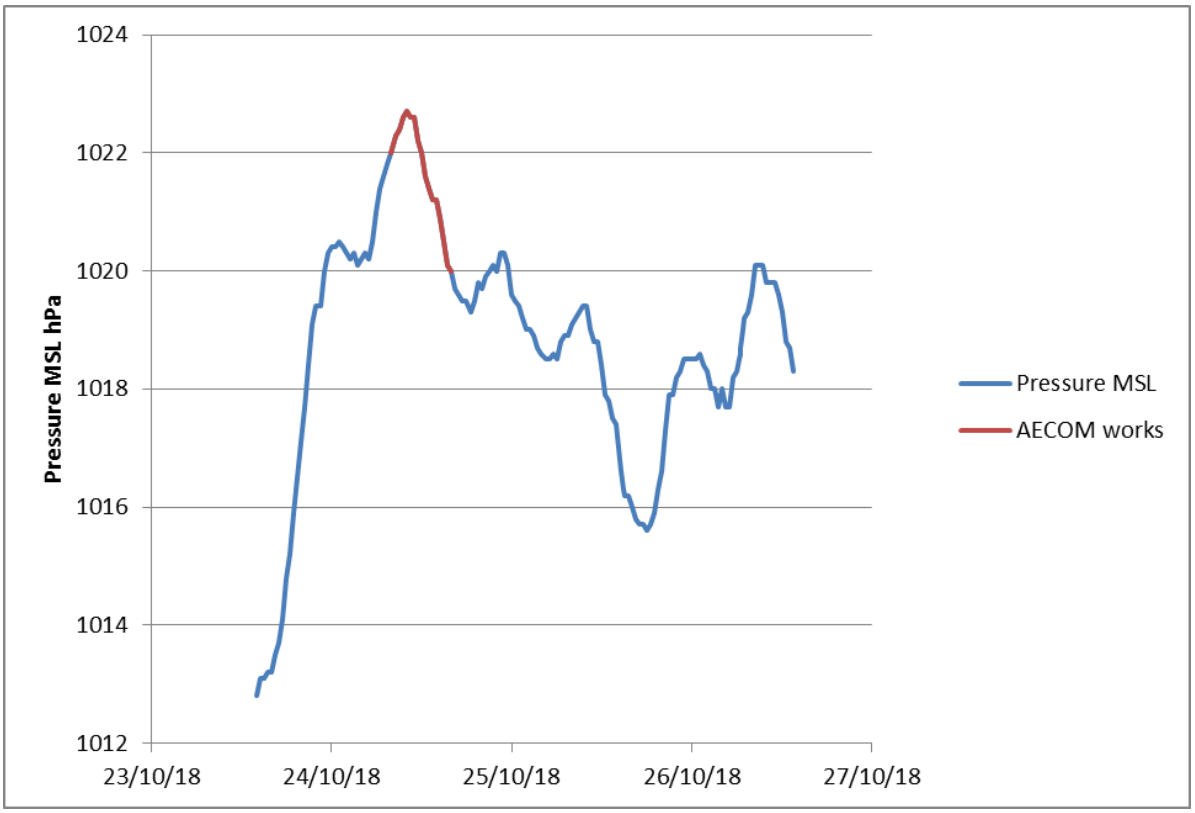


Figure 5 Barometric Pressure Data – October 2018 Monitoring



5.0 Investigation Results

5.1 Encountered Geology

The locations of all LFG monitoring bores are shown in Figure F3 Appendix A and LFG bore construction logs are presented in Appendix B.

Twelve landfill gas monitoring bores (BH29 through to BH40) were drilled and installed to a maximum depth of 15.2 m below ground surface. Solid Stem Augering was used to advance each borehole from the surface. Upon auger refusal Down Hole Hammering was used to advance the borehole through the encountered competent (rock) geology to target depth. Drill cuttings were used to determine the lithology.

Methane monitoring was carried out during drilling using an LEL meter and no methane was detected.

Subsurface geology encountered in the new bores was generally consistent with the previous drilling results and historical bore logs.

In the boreholes positioned to the north-east of the landfill (BH29, BH30 and BH31) a fill layer was observed above the natural geology. This was thickest (3.5 m) at BH29 and generally comprised sand and gravel materials which appeared to be re-worked natural rock.

At all other boreholes, weathered sedimentary bedrock was encountered from surface which was predominantly a fine grained, laminated siltstone with traces of fine to medium grained quartz sand within the silt matrix. Shale was observed from surface at location BH32 and occasional thin shale bands were apparent throughout the siltstone in many locations.

The small diameter (125 mm) hammer drilling methodology used effectively pulverised the weathered siltstone to fine chips (generally <10 mm) causing any observations of fracturing to be difficult. Larger diameter sample return at BH33 (<30 mm at 13.0 mbgl) may be indicative of fracturing. Visual observations of the hammer noise suggested a small fracture was encountered at BH30 (11.7 – 11.8 mbgl). Quartz veins were also observed within the siltstone at BH36.

Jointing / fracturing within the bedrock is likely to be at a higher frequency than observed, however it may be too small and not sufficiently well developed above the water table to observe with this method of drilling.

5.2 Gas Monitoring Results

Locations of all of the landfill gas monitoring bores are provided in Figure F3 Appendix A.

The June- October 2018 monitoring results and the historic monitoring data set for Eaglehawk landfill are tabulated in Appendix C. Field sheets showing monitoring results for 2018 are reproduced in Appendix D and a statistical assessment of background soil gas concentrations is included in Appendix E.

5.2.1 Soil Gas Monitoring Results June-October 2018

The subsurface landfill gas monitoring results collected by AECOM under the scope of this LFGRA are summarised in Appendix C.

- Methane continued to be detected in bore BH26 (0.4 – 8.5% v/v), located less than 20 m away from the waste footprint.
- 0.1%v/v of methane detected in BH22 and BH23 were considered unrepresentative, as the associated concentrations of CO_2 and O_2 were at ambient levels (0.3-0.4%v/v 20.3 – 20.4%v/v respectively.
- In the remainder of the bores the reported methane concentrations were below the instrument detection limit (0.1%v/v).
- Concentrations of CO_2 and O_2 reported for the historical bores remained generally consistent with the historical results for the respective bores.

- In most of the new bores, the reported concentrations of CO_2 and O_2 were relatively consistent with the background conditions in the vicinity of the site. The exception was BH29 which displayed CO_2 and O_2 concentrations suggesting LFG attenuation (methane oxidation) and bores BH31, BH32, BH34 and BH39 where the reported concentrations varied noticeably between the monitoring events. This variability has been attributed to un-stabilised conditions resulting from installation, or groundwater presence (BH32), however the observed increase in CO_2, and decrease in O_2 concentrations between the initial and the latest event potentially may be attributed to LFG transport and attenuation.
- Minor groundwater was detected at the bottom of boreholes BH32 and BH33. Based on limited monitoring results for these bores, the reported soil gas conditions in these bores (1.8 – 4.4%v/v of CO_2 and 19.3 – 19.8%v/v of O_2) were relatively consistent with conditions unaffected by presence of groundwater as reported for other bores.

5.2.2 Sub-Surface Services

Surveys of methane emissions from off-site utility pits, services and culverts were undertaken by AECOM in June and August 2018. Target areas included streets and accessible properties within the 500 m distance and adjacent to the landfill. Tabulated records are provided in Appendix C and monitoring results are mapped in Figures 4A and 4B in Appendix A.

The recorded methane concentrations were at ambient levels (<10 ppm) on both occasions. In comparison, at the selected locations with historical presence of methane, elevated concentrations continued to be detected (e.g. onsite Telstra Pit >1000 ppm).

5.3 Summary of Findings

- Soil gas monitoring network around Eaglehawk landfill has been extended to cover the gaps in the perimeter monitoring network, particularly south and west of the landfill, and to provide coverage of areas further away from the landfill site, mostly within 250 m of the landfill, with several bores located over 250 m away from the landfill.
- Subsurface geology encountered in the new bores was generally consistent with the previously observed conditions, with fill (reworked natural rock) of noticeable thickness reported in some bores to the north-east of the landfill. Methane (as %LEL) was not detected during drilling.
- LFG monitoring results for subsurface geology, collected between June and October 2018, including for the historical and new bores, continued to be indicative of methane oxidation conditions in the immediate vicinity of the landfill cells.
- CO_2 and O_2 concentrations in bores relatively remote from the landfill cells are consistent with background conditions, with no methane.
- Methane monitoring results for subsurface services in the streets in the vicinity of the landfill did not suggest methane migration.
- The collected monitoring results, including historical and new data, do not suggest that LFG transport through subsurface geology or services spreads beyond the immediate vicinity of the landfill cells, significantly less than the 250 m.

6.0 Landfill Gas Risk Assessment

6.1 Legislative Requirements and Guidance

With respect to landfill gas, management shall comply with relevant Australian and/or Victorian standards and requirements under existing laws and regulations. Relevant Australian and /or Victorian regulatory requirements include, but are not limited to, the following:

- Environment Protection Act 1970
- Environment Protection (Industrial Waste resource) Regulations 2009
- Environment Protection (Scheduled Premises and Exemptions) Regulations 2017
- Waste Management Policy (Siting, Design and Management of Landfills) (EPA Publication 968)
- Best Practice Environmental Management, Siting Design, Operation and Rehabilitation of Landfills' (EPA Publication 788.3) (generally referred to as the BPEM)
- Landfill Gas Fugitive Emissions Monitoring Guidelines (EPA Publication 1684)
- State Environmental Protection Policy – Air Quality Management
- Landfill Licensing Guidelines (EPA Publication 1323)
- Licence Assessment Guidelines (EPA Publication 1321)

In addition to the regulatory requirements, additional guidance in preparation of the risk assessment was provided by the following:

- Planning and Environment Act 1987;
- Assessing Planning Proposals near Landfills Guidelines (EPA Pub. 1642, 2017);
- Landfill Licensing Guidelines (EPA Pub. 1323.3, 2016 [Appendix 2 – Landfill Gas Risk Assessment]).
- Assessing Risks Posed by Hazardous ground Gases to Buildings (CIRIA C665, London 2007);
- Assessment and Management of Sites Impacted by Hazardous Ground Gases (NSW EPA, 2012);
- Guidance on the management of landfill gas (UK EA, LFTGN03 2004);
- Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (British Standard 8485:2015).

At the time of preparation of this assessment, landfill gas targets, or Action Levels that are expected to be achieved for the site have been prescribed by the BPEM Table 6.4; relevant targets are reproduced below.

Table 2 BPEM Action Levels

Location	Parameter(s)	Action Level (BPEM Table 6.4)
Subsurface geology at the landfill boundary	Methane and carbon dioxide	1% v/v methane and 1.5% v/v carbon dioxide above background*
Subsurface services on and adjacent to the site	Methane concentration	10,000 ppm
Buildings/structures on and adjacent to the site	Methane concentration in air	5,000 ppm

*Assessment of the background soil gas conditions (refer Appendix E) suggested that concentrations of carbon dioxide in the subsurface geology are close to 3%v/v (bores determined to be affected by LFG or located too close to the known landfill footprint were excluded).

6.2 Basis for LFG Risk Assessment

LFGRA methodology was based on EPA Publication 1642, which refers to two essentially the same approaches:

- Assessing risks posed by hazardous ground gases to buildings (Construction Industry Research and Information Association (CIRIA), Publication 665, 2007); and
- Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (British Standard 8485:2015).

The tiered risk assessment approach recommended by EPA Victoria is based on LFGTN03 (2004), and follows Hazard identification and risk screening - Simple quantitative RA - Complex RA.

The qualitative approach suggested in CIRIA C665 Section 8 and Appendix A was used to estimate levels of risk related to hazardous gases. The conceptual site model (CSM) followed the Source-Pathway-Receptor model, where risk is eliminated if one of the elements is unrealised, which is also consistent with LFGTN03 (2004) Tier 2 (simple) risk assessment approach, using both site-specific data and projections of site performance.

Given that sensitive receptors have been pre-determined (any buildings or structures encroaching the buffer), consequences associated with LFG hazards (i.e. explosion, asphyxiation) have not changed since the previous LFGRA. This risk assessment addressed likelihood of the events that may cause the above consequences, based on potential for LFG migration within the default 500m buffer under various future LFG management scenarios.

The assessment approach was as following:

- Update the components of the CSM:
    - Source characteristics were reviewed using recent cell construction and rehabilitation data, LFG active management data (LFG extraction system performance over the recent years), and available in-waste LFG conditions data. Consideration was given to potential future source conditions (LFG production / management options) that may affect LFG migration within the buffer.
    - LFG migration pathways within the 500m buffer were reviewed taking into account current and future migration controls, preferential pathways (transmissive zones), background soil gas conditions, groundwater level fluctuations, and potential correlation between the available data. Potential LFG fate and transport processes within the buffer under possible future LFG management scenarios were considered.
    - Potential sensitive receptors were reviewed based on existing planning zones and taking into account potential future source / pathways scenarios.
- Assess the viability of connections between the various risk elements of source – pathway – receptor.
- Assess the risk of LFG migration to the potential sensitive receptors under several possible viable LFG management scenarios and associated potential LFG fate & transport conditions.
- Evaluate the risks for various scenarios (buffer zones / distance increments).

Soil gas monitoring results informed assessment of the current LFG conditions in the vicinity of the landfill, taking into consideration presence of groundwater in the bores and consistency with the historical data for the respective bores, and assessment of future potential LFG migration, including assessment of background carbon dioxide concentrations and LFG transport and attenuation in subsurface geology.

Background carbon dioxide concentrations were assessed following the approach indicated in EPA guidelines (Publication 1684, February 2018). Details of the assessment are presented in Appendix E, and the following steps were applied:

- Review bore monitoring data for completeness;
- Visual replay of monitoring data to identify gaps and outliers;

- Assess seasonality impact and trends;
- Verify if the data follows normal distribution;
- Eliminate outliers and dirty bores and repeat process;
- Calculate 95% confidence interval average and provide recommendations.

Methane to carbon dioxide and oxygen to %Balance ratios were used to assess LFG attenuation and borehole flows were used to calculate Gas Screening Values (GSV) (in accordance with the method recommended in CIRIA Publication C665, 2007). GSVs are used for the purposes of LFG risk assessment to classify sites for development, and were calculated as:

GSV = gas concentration * flow/ 100

Table 3 Risk Classification Based on GSV (after CIRIA 665)

Risk Classification	GSV (CH_4 or CO_2) (L/hr) Threshold
Very low risk	<0.07
Low risk	<0.7
Moderate risk	<3.5
Moderate to high risk	<15
High risk	<70
Very high risk	>70

The BS8485 method defines a borehole hazardous gas flow rate (Qhg) which is an identical calculation to the CIRIA 665 (2007) GSV, but applies the worst case based on historical maxima of flow rate or concentration. The tabulation of historical monitoring data (Appendix C) shows the calculated Qhg for historical and worst case conditions for CH_4 and CO_2. It should be noted that BS8485 indicates that GSV is based on measured data but ultimately derives from professional judgement.

The risk assessment was subject to the following assumptions and limitations (as referred to in CIRIA C665 Section 8 & Appendix A):

- Data reliability – known anomalous results due to equipment malfunction were excluded, presence of groundwater was taken into consideration.
- Monitoring period – historical monitoring data appears to have sufficient duration and frequency and covers variable atmospheric conditions and stages of landfill development and LFG management at the site. Limited monitoring data is available for the newly installed monitoring bores. LFG extraction from Cell 3 has commenced prior to installation of the new bores and final capping over Cell 3 has not been installed.
- The collected results appear relatively consistent.
- Landfill at the site is assumed to be a single source of LFG in the area although source characteristics are likely to vary between cells/ portions of the landfill due to variable liner, capping and/or LFG extraction conditions.
- LFG management scenarios include active extraction of LFG prior to and upon full site rehabilitation (final capping of all cells), and a scenario where no active extraction is occurring during the aftercare period (i.e. until the LFG concentrations are reduced to levels that would have a minimal impact on the environment). Alternative post-closure LFG management scenarios (e.g. passive venting) have not been considered.

6.3 LFG Conditions Assessment

Eaglehawk landfill as a source has been characterised historically as part of landfill licence and LFG risk assessments. During this review recent LFG recovery data and anticipated future landfill conditions have been considered in order to account for changes of source strength over time.

Potential for LFG migration from Eaglehawk landfill has also been assessed previously, taking into consideration factors controlling LFG migration such as landfill cell design elements, surrounding geology, the presence of man-made conduits and natural attenuation processes. This assessment considers the influence of background soil gas conditions, variability of local geology and associated fate and transport processes, groundwater elevations, and reported incidents / monitoring results signifying the likelihood of exposure.

Particular migration pathways to the existing/ future sensitive receptors within the Landfill BPEM buffer (500m) have not been specifically addressed, as it is assumed that confirmation of any underground shafts, building designs requiring gas control systems and implementation of LFG Risk Management plans will be imposed by future planning permit application procedures.

Impacts on the potential receptors have not been considered, based on the assumptions stated above.

Historical monitoring and risk assessment reports for the site, the results of recent intrusive and LFG monitoring investigations and available local geology data have informed this assessment, but it is noted that some historical bores may have deteriorated over time, as apparent in reduction of the total bore depths. It is uncertain if bore conditions rendered the monitoring results unrepresentative, as the discrete monitoring results have remained relatively consistent for the respective bores.

As indicated in Section 4.0, the field investigations component of the risk assessment included installation of 12 soil gas monitoring bores at locations targeting areas of the possible buffer encroachment, taking into consideration gaps in the perimeter monitoring network and potential preferential pathways through subsurface geology, and 3 discrete monitoring events.

The LFGRA has been carried out in consultation with Council and Environmental Auditor in order to address requirements stipulated by EPA in their Publication 1642 *Assessing planning proposals within the buffer of a landfill* (October 2017).

Based on the assessment approach provided by the above publication, Eaglehawk landfill score currently amounts to **13** based on the sum of these factors:

1. landfill score = landfill size score **3** (500,001 – 2,000,000 m^3)
2. Landfill type score **5** (putrescible)
3. Landfill age score **5** (operating landfill).

Therefore, regardless of the planning proposal score (1-3), a LFGRA is required to inform the planning permit application approval process.

EPA Publication 1642 (October 2017) provides guidance on the assessment of risk posed by LFG to the nearby receptors. The assessment is based on Source-Pathway-Receptor concept; these aspects have been considered during the Conceptual Site Model review.

6.4 Basis for Buffer Distance Determination

The BPEM indicates that “Appropriate buffer distance must be maintained between the landfill and sensitive land uses (receptors) to protect those receptors from any impacts resulting from a failure of landfill design or management or abnormal weather conditions. These failures might constitute discharge from the site of potentially explosive landfill gas.” Note methane is explosive within 5-15%v/v range.

The development of a technically robust approach to defining a landfill gas buffer for the Eaglehawk Landfill therefore requires preparation of a conceptual model for the facility that includes these elements:

- Site-specific identification of sources of LFG;
- Identification of potential pathways for migration; and,
- Mapping of receptors.

The Eaglehawk landfill has been receiving waste for over 40 years, employing varying standards of engineering and operational practices. These factors all influence the conceptual model and hence the risk posed by landfill gas migration.

Understanding of the LFG condition and the development of a conceptual site model provides the basis for the assessment of potential risks and potential subsequent identification of the most appropriate risk mitigation option(s) to achieve the site objectives.

Figure F3, Appendix A shows that most monitoring bores are located within 250m of the landfill and other LFG monitoring has been conducted predominantly within that distance. Therefore, there is a higher degree of confidence in the assessment of level of landfill gas risk within 250m of the landfill, than in the band between 250m and the BPEM buffer of 500m.

In developing this understanding, the following were assessed, which are detailed herein:

- Landfill gas sources;
- Landfill gas generation;
- Landfill gas composition;
- Landfill gas transport mechanism(s); and
- Landfill gas attenuation mechanisms.

The 500m BPEM standard buffer distance has been adopted as the default, but since development has occurred within that distance, development controls should be mapped on the basis of risk rather than proximity.

Based on the available monitoring data, there is a higher degree of confidence in the assessment of level of landfill gas risk within 250m of the landfill, than in the band between 250m and the BPEM buffer of 500m.

Therefore, the assessment and mitigation measures are discussed for development within 0-250m of the landfill and 250-500m of the landfill.

6.5 LFG Sources

Eaglehawk landfill is considered a main source of LFG subject to this assessment. It is uncertain whether subsurface mines underlying the investigations area contribute to the detected soil gas concentrations at and in the vicinity of the landfill.

6.5.1 Primary Sources

- The primary source of landfill gas to potential receptors is considered to be the decomposition of waste within the landfills.
- Typically, LFG generated from municipal landfills comprises 60% methane and 40% carbon dioxide however multiple factors will influence the composition.

History of landfill operations and waste composition in the cells is summarised in Section 3.1.

Historical paired bores BH11 through to BH16 (all destroyed except BH15) were positioned at locations based on Council's knowledge of extent of waste material, and while none of these bores had reported methane above occasional 0.1-0.2%v/v, relatively elevated concentrations of CO_2 and relatively depleted concentrations of O_2 in the deep bores (bores BH11, BH13 and BH15) suggested methane oxidation.

This assumption is further supported by data reported for the new bore BH29 and historical bores BH11-BH16, all located in the north-eastern area of the site away from the licensed Cell 1. No waste fill was described in the logs of these bores and the log of groundwater bore MB10, at the north-eastern perimeter of the site. However new bore BH29 installed in the vicinity of MB10 reported elevated concentrations of CO_2 (9.7 – 11.8%v/v) and depleted concentrations of O_2 (6.8-7.8%v/v) indicative of methane oxidation, which is consistent with the proximity of the historical fill along the eastern site perimeter.

6.5.2 Secondary Sources

- LFG has the potential to dissolve into and volatilise from groundwater/ leachate. The concentration of constituents in the dissolved phase and the vapour phase immediately above the water must be in equilibrium.
- Thus, as the groundwater/ leachate migrates from the primary source, it has the potential to act as a secondary source of LFG. The LFG constituents volatilise when the impacted water migrates from areas of high gas concentrations (e.g. waste) to low gas concentrations (i.e. outside waste footprint). The transport of LFG via the groundwater is limited by the rate of groundwater dispersion, which is a relatively slow process, so this process is not likely to be a significant source.

Groundwater monitoring results for Eaglehawk landfill do not indicate a leachate plume in groundwater, but in the absence of a liner in the largest and oldest landfill Cell 1, migration of leachate to groundwater cannot be precluded.

The Master Plan (April 2016) indicated the following relevant information in relation to secondary sources of LFG:

- The historical fill, including that impacted by municipal waste (plastic, inert waste) and old mine tailings (mullock), was underlain by weathered siltstone, without any dedicated or effective impervious layer beneath the waste.
- The landfill site is underlined by low-permeability bedrock sediments. Old mining waste (1-3.5m of wet sandy materials) was encountered under 10-15m of fill in the eastern portion of the site in bores LB01 and LB02, located within 200m north-east (up-valley) of bore MB04.
- In bores LB01 – LB04, materials immediately underlying the waste were described as moist and/or wet, underlain by unsaturated siltstone.
- Potential source of water in this area may have been associated with abandoned historically leaking water conduits, discovered and disconnected by Council in November 2018.

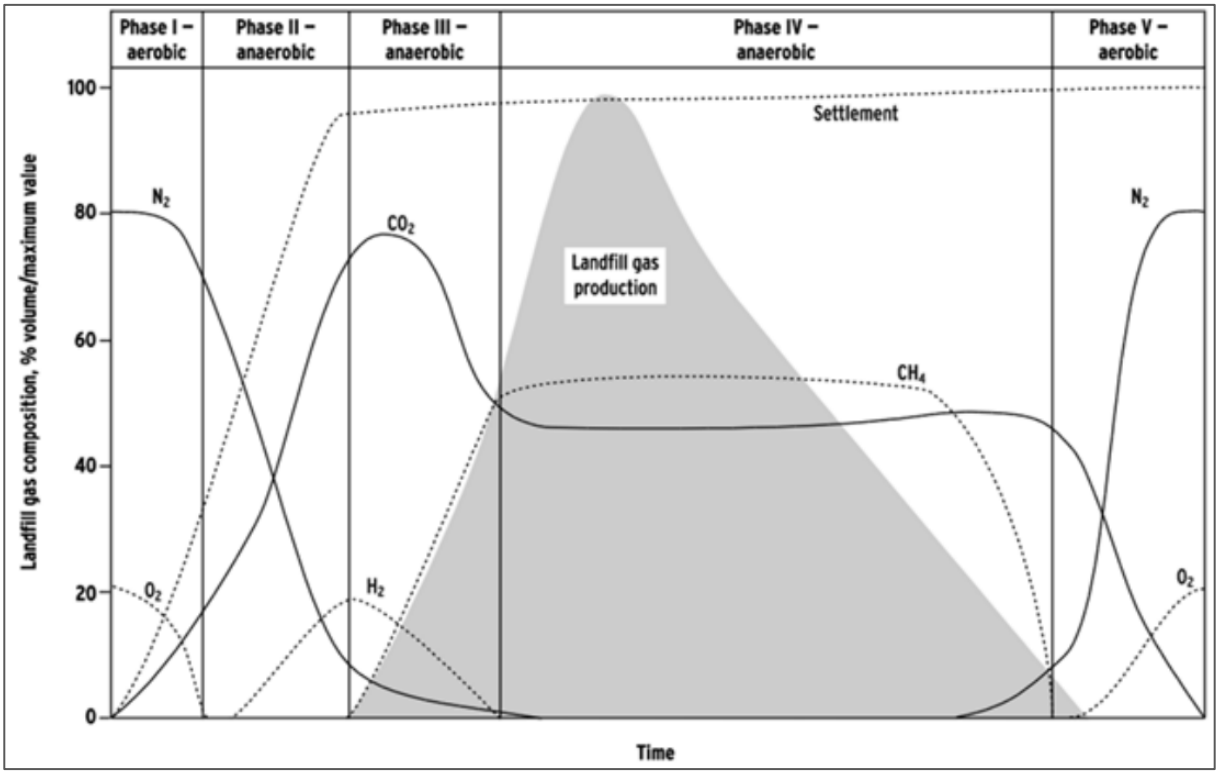
However, as the inferred groundwater flow is directed towards south-west, migration of the potential leachate plume towards the identified receptors within the buffer area is unlikely.

Groundwater monitoring results for Eaglehawk landfill do not suggest a leachate plume in groundwater. Since the largest and oldest landfill Cell 1 is unlined, migration of leachate to groundwater cannot be precluded. However, as the inferred groundwater flow is directed towards the south-west, migration of the potential leachate plume towards the identified receptors within the buffer is unlikely.

6.6 LFG Generation

LFG is produced through bacterial decomposition of waste and chemical reactions. In a landfill, LFG is produced by the breakdown of organic wastes (putrescible and green waste) by microbes which occur naturally in the soil. The biodegradable component is broken down in a series of stages to produce LFG – a mixture of gases composed very largely of methane (CH_4) and carbon dioxide (CO_2). Trace gases, such as carbon monoxide, hydrogen sulphide and volatile organic compounds can also be present. Different organic materials are degraded at different rates under oxic and anoxic conditions; with the result that LFG generation can continue in a landfill for a significant period – at least 30 years post closure – even under optimum conditions. As such, it is generally considered that there are five (5) main phases in the life of a landfill and its generation of LFG. These phases are represented in a general plot published by Farquar and Rovers in 1973, and shown in Figure 6 (reproduced from EPA Pub.788.3, 2015).

Figure 6 LFG Generation (after Farquar and Rovers, 1973)



Moisture is one of the most important factors controlling the rate of biodegradation, but not the only one. Methanogens, like all organisms, rely on the presence of various nutrients and other chemical species at suitable and appropriate concentrations, if they are to function efficiently and effectively. It is also important that materials that might be toxic to them are absent or at least relatively inaccessible. It is, therefore, a combination of many complex factors that vary rapidly and spatially throughout the body of waste that controls the rate of yield and detailed composition of the LFG, and, thus the final shape of the gas yield curve, including its length in time.

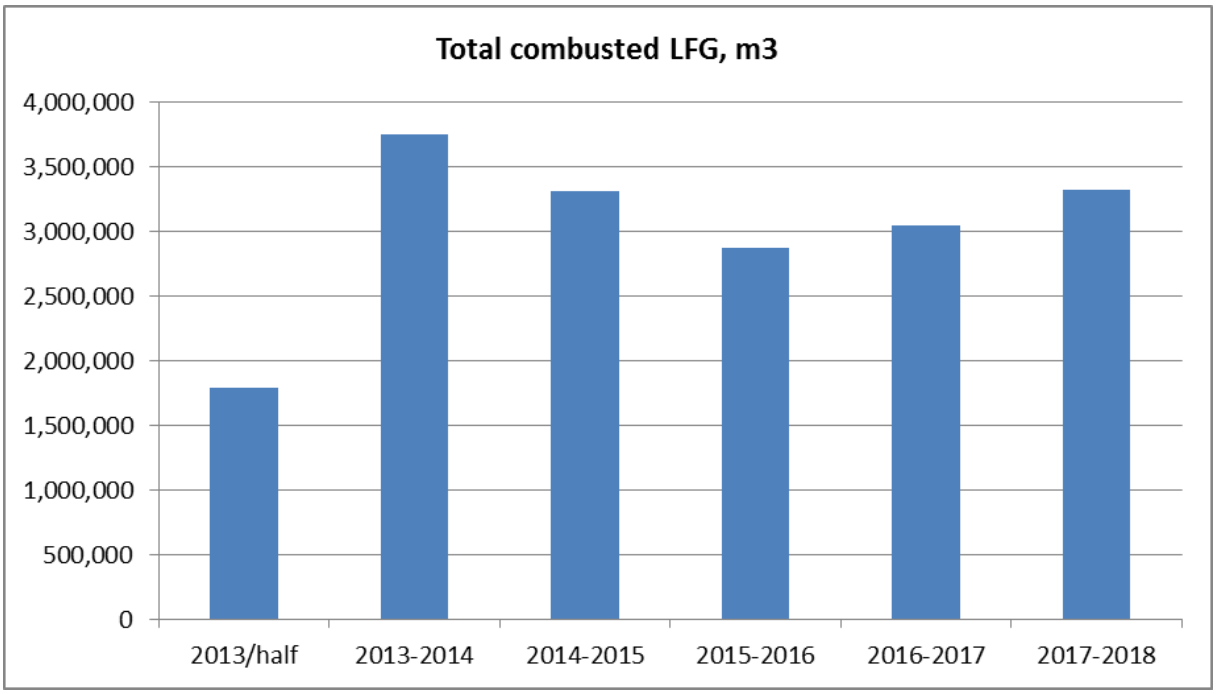
Climate in the Bendigo region is typically dry, with most rainfall occurring during winter months, and overall annual average evaporation exceeding precipitation. Leachate levels historically reported for the landfill indicate that leachate generation is very low. Leachate sump and monitoring bores LB01-LB04 have not exhibited elevated levels of leachate. Therefore, since Eaglehawk is a dry landfill, methane generation is expected to be inhibited to a certain degree by low moisture content, but the potential for LFG generation will remain.

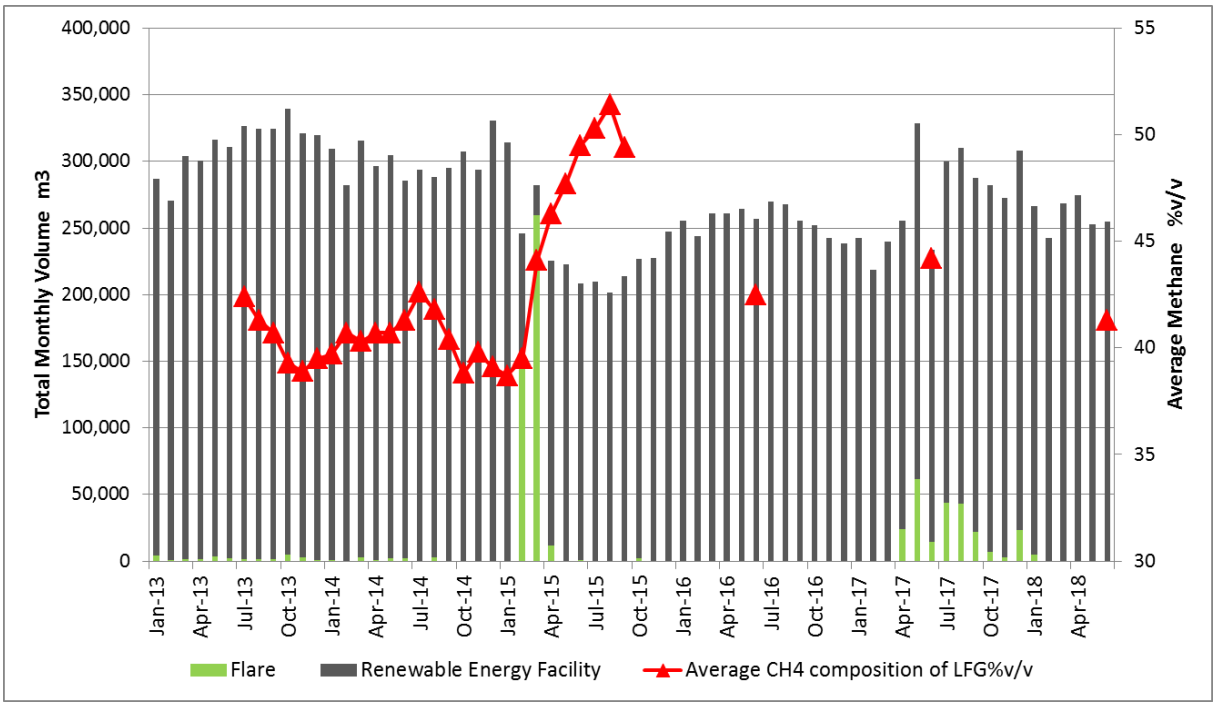
Based on LMS reports for the latest 5 years (2013-2018), refer Figure 7, most of the collected gas has been utilised for power generation as opposed to flaring. The bulk of gas is thought to have been collected from the historical cells, as cells 3a and 3b (intermediate-capped) were connected to the system only recently (in 2018). Once cells 3a and 3b are fully rehabilitated, LFG generation is likely to increase as anaerobic conditions prevail.

Filling of Cell 5 is likely to continue for another 4-6 years and will contribute to LFG production at the site. Prior to capping, it is expected that LFG generation (and recovery) from this cell will be limited. It is likely that LFG generation will increase once this cell is rehabilitated and anaerobic degradation becomes dominant.

Full site rehabilitation is estimated to happen within the next 10 years and waste degradation and LFG generation will continue for at least 30 years post closure.

Figure 7 LMS Gas Collection (2013-2018)





LFG generation was simulated using empirical modelling (the LandGEM model from the US EPA) in order to compare empirical LFG generation and extraction data. The results of the assessment are presented in **Appendix F**.

Detailed waste acceptance data is limited to 1997 onwards. A range of scenarios have been simulated to account for potential historical acceptance rates and default methane generation parameters were used. The predicted peak methane generation rates vary between 5 and 7 Mm^3 per year. These appear to be overestimating, and correspond to extraction efficiency of approximately 50-80%, based on the reported extraction data (Figure 7).

In August 2014, EPA monitored individual extraction system collections points, and were relatively satisfied with the LFG composition. Since the change of generators and reduction of extraction rates in early 2015, it appears that methane recovery has improved (an increase in average methane concentrations reported since February 2015) which is likely due to the reduction of air ingress into the system.

Site specific data in relation to LFG composition in the waste is limited. Available average monthly methane concentrations in the collection system varied around 40%v/v (limited data available from LMS). In absence of dedicated gas monitoring bores installed in-waste, leachate bore LB03 was sampled in February 2016. The bore reported elevated concentrations of methane and carbon dioxide (75.3% and 20.5% v/v respectively) consistent with LFG and relatively low borehole flow (0.5 L/hr). LB03 is not equipped with a gas tight cap so borehole flow was probably underestimated.

Monitoring in 2018 indicates that cells 1, 2, 3a and 3b continue to generate LFG. Conditions in the lower lifts in Cell 5 are expected to become methanogenic as filling continues.

LMS data for the past 5 years does not suggest a decline in viable LFG recovery, with the bulk of LFG being collected from Cell 1 which contains waste over 40 years old.

With completion and closure of Cell 5 and rehabilitation of cells 3a, 3b and 5, LFG generation is expected to increase as anaerobic conditions in the cell increase.

It is anticipated LFG generation will continue for at least thirty years after rehabilitation of Cell 5.

6.7 Pathways

Main ground gas migration mechanisms include pressure-driven advection and concentration-driven diffusion of a gas phase and dissolved phase migration in groundwater.

Pressure-driven gas transport occurs in response to a (gas) pressure differential. As gas is constantly produced in the waste, pressure will build up unless the pressure is relieved. Pressure can be relieved by the migration of gas vertically to the atmosphere or initially laterally where preferential pathways exist. In addition to advection due to pressure build-up within the waste, hydrostatic advective flow may occur. As groundwater acts as a barrier to LFG movement, in the event of water level rises, less pore space is available for gas, which effectively creates pressure driven flow.

Diffusion is the transport via concentration gradients. Diffusional mass transport will occur along with advective mass transport, but diffusional mass transport of gas is typically orders of magnitude less than advective mass transport. Diffusional transport is sufficiently slow that it is generally not adequate to result in landfill gas risk in structures. However, pressure-driven gas transport can represent a significant risk.

For a risk to eventuate, landfill gas must be transported from the waste to the potential receptor(s). LFG transport can occur by either advective (pressure-driven) gas transport where flow of gas actually displaces soil gas to replace it; or diffusion where gas constituents migrate slowly due to concentration differentials with no flow.

In the assessment of risk, proximity to the landfill is an important consideration. The likelihood of a landfill gas event is assessed as being greater within the 250m zone around the landfill than in the 250 – 500m zone. This assumption is applicable to each of the pathways described in the following sections.

Key pathways and barriers that influence the vertical or lateral migration of LFG are discussed below.

6.7.1 Natural Geology

Where fugitive emissions of LFG are able to exit the waste through the side, the presence of impermeable/ semi-impermeable sediments and fractured permeability nature of bedrock may restrict vertical migration to the surface and result in increased lateral migration under pressurised flow.

Information on regional Eaglehawk geology was derived from the following sources:

- 1:10,000 Bendigo Gold Field – Eaglehawk geological map (reproduced in
- Geological Report for Bendigo Goldfield
- 1:50,000 geological map Bendigo sheet
- 1:100,000 geological map Bendigo sheet
- Regolith–landform map of the Bendigo 1:100,000 sheet area
- Geology data provided under the Water Management Information System (WMIS)

Local information was based on bore logs data available for Eaglehawk landfill site and the nearby sites.

Migration through the geological profile is controlled by the dominant lithology of the geological medium and the structural discontinuities – joints, faults and other fracture systems.

The geological map of the site is provided in Appendix A, Figure F3 and geological cross sections are presented in Appendix A, Figures F5A, F5B and 5C.

The geology is dominated by a series of anticlinal structures trending NNW – SSE. The Lancashire Fault passes beneath the western margin of the landfill and exhibits the same linear trend as the anticlinal structures.

6.7.1.1 Lithological Influences

Tertiary and Quaternary Sediments

- Tertiary sediments, which are likely to be more permeable than the underlying Palaeozoic basement, are not present across the study area.
- The 1:50,000 geological map shows the presence of Quaternary Age, unconsolidated Shepparton Formation sediments on the southern boundary of the site however Willman and Wilkinson (1992) noted these were removed in the search for gold prior to landfilling.

Ordovician Bedrock

The site is underlain by a Lower Ordovician turbidite sequence comprising three distinct lithologies:

- Chewtonian Zones 1 and 2 metasediments – shale rich sequence comprising interbedded slate and fine to coarse grained sandstones.
- Bendigonian Zone 4 sandstones

The 1:10,000 geological map shows coarse and medium to fine sandstone beds around the landfill although drilling of the monitoring bores indicated multiple interceptions of coarse grained sediments of various thickness within the mudstone-siltstone sequence, with multiple instances of gravel/ coarse sand within a fine grained matrix encountered during drilling of the monitoring bores.

6.7.1.2 Structural Influences

The Lower Ordovician sedimentary sequence is folded into a set of NNW-SSE trending tight (chevron) folds with extensive local reverse faulting (refer Appendix A, Figure F3**)**. The folds are regular (150-200 m average half-wavelengths) and persistent (for up to 25 km along strike, and some traced 1.4 km deep), with straight limbs dipping on average 65-75º. The rocks are affected by a strongly developed axial plane cleavage. The 1:10,000 Bendigo Gold Field – Eaglehawk geological map shows several anticlinal structures underlying the site (5 folds) and extending through the 500m buffer; there are also folds intercepting the buffer zone outside of the landfill footprint (refer Appendix A**,** Figure F5A).

Folds are truncated by numerous faults. There are no major (regional) faults in the vicinity of the landfill; the Lancashire Fault inferred throughout the 500m buffer and bordering the south-western portion of the landfill appears to be a break fault between Lancashire and Napoleon-Maiden Gully anticlinal structures. Mineralisation varies between the types of faults described for the Bendigo Goldfield area, including mineralised bedding-plane faults, strike or break faults and associated mineralised fault zones; and un-mineralised oblique faults cutting across the regional structural trend,

truncating fold axes and mineralised structures. It is not unlikely that various types of faults exist in the vicinity of the landfill, given the extensive network of mine shafts in the area.

Fracturing is most common along the fold axes. Jointing occurs in predominantly sub-vertical transverse sets (strike parallel, normal to fold axes) with a weaker sub-horizontal sets (dip parallel). 1:10,000 Geological Report described individual joints as relatively discontinuous (on scale of metres), with occasional thin carbonate or thicker quartz filling. WMIS driller logs available for bores within 1-3 km area surrounding the landfill describe deep structures such as faults and/or fractured zones at depths over 20-80m below ground. In the site specific bores, fractures / fracture zones identification has been limited; fractures were noted in the bore logs MB01 (based on quartz fragments, at 8.75mbgl between the mine shaft voids, and at 16.5 mbgl), MB04 and MB05 (at 13-14mbgl).

6.7.1.3 Weathering Influences

Regolith study of the Bendigo 1:100,000 sheet area indicated that in the vicinity of the Eaglehawk landfill highly and moderately weathered metasediments predominate, representative of the in situ regolith consisting predominantly of deep saprolite overlying fresh bedrock units[1]. A weathered zone of 20m of oxidised and leached material was described in Douglas et al, 1976.

Bore logs refer to highly variable thickness and degree of weathering of bedrock underneath and in the vicinity of the site. WMIS driller logs available for bores within 1-3 km area surrounding the landfill describe variable weathered sediments encountered to depths of 4 – 20m below ground, including fine grained sediments (described as clay), coarser grained materials (sand, clayey / silty sand and surficial sediments (described as river gravel, gravel, sand/gravel). Geotechnical investigations carried out in preparation of Eaglehawk Resource Recovery Facility Master Plan (Infrastructure Solutions, April 2016), indicated that highly weathered siltstone up to 7m to the north of the landfill, along the tip entrance road, half-way towards Upper California Gully Rd (location 1 SPT, log BH1); while less weathered siltstone appeared closer to and underlying the landfill. Of the site specific bore logs, MB10 refers to 2m residual clay overlying more than 10m of highly weathered siltstone underlain by moderately weathered siltstone (to 46mbgl), BH25-BH28 refer to the top 0.5-1mbgl as extremely weathered and underlying sequence as moderately weathered sediments, BH29-BH40 refer to the top 10-15mbgl as weathered sediments, and the remainder of the logs indicates up to 2m of residual clay overlying metasediments of unspecified degree of weathering.

Bedrock sediments are characterised by low permeability, probably best developed in the upper 20 m of oxidised and leached material (Douglas et al, 1976) but likely to extend to up to 200 m below ground surface

6.7.1.4 Geological Pathways

As with groundwater, it is considered that gas migration would more readily occur within the zones of higher permeability, likely to be associated with sandstones, and with secondary (fracture) porosity, associated with bedding planes, fracture zones associated with NNW-SSE oriented fold hinges and faults. Thick beds of pelitic sediments may limit the potential for vertical migration and natural attenuation of the lateral fugitive LFG emissions.

It has also been reported in previous groundwater investigations (AGC, 1986) that the transmissivity, in the region could vary, from up to 74 m^2/d along strike to 5m^2/day across it. The results of hydraulic analysis at the selected groundwater bores carried out in 2013 showed that across the site, the transmissivity of the bedrock aquifer is very low (estimated 0.12 - 2.26 m^2/d).

Of the existing monitoring bores, several bore cluster in the areas potentially characterised by higher permeability of the hosting rocks:

- BH01-BH06, BH17, BH23, BH27, BH31, BH39, BH40 – along anticlinal hinges and within sandier portions of the sedimentary sequence transecting the central part of the landfill;
- BH11-BH16, BH24, BH29, BH30 – along New Chum anticline;

[1] (A. Kotsonis & B. Joyce. Regolith mapping at Bendigo, and its relationship to gold in central Victoria, Australia. Pub. In Advances in Regolith, 2003) http://crcleme.org.au/Pubs/Advancesinregolith/Kotsonis_Joyce.pdf)

- BH18-BH22, BH25, BH26, BH28, BH32, BH33, BH35-BH38 – along the Lancashire Fault and anticlinal hinges transecting the western portion of the site.

Based on the monitoring results (average CO_2 and O_2 concentrations), there is no clear spatial correlation between the potentially more permeable geology and elevated soil gas concentrations that may be associated with LFG. Both in areas of likely transport through fractures (anticline hinges, faults, sandstone packages) and less structurally deformed / less sandy sediments, there are bores exhibiting soil gas concentrations indicative of LFG migration and/or attenuation and bores not showing any effects of LFG. Potential for gas confinement by less permeable sedimentary sequence cannot be excluded.

More permeable sediments, where present close to the natural surface, are expected to allow for air ingress and natural attenuation.

Based on the monitoring results reported for the bores listed above, there is no conclusive evidence of LFG migration along the potentially higher permeable zones, including:

- between areas in the immediate vicinity of the landfill boundary where methane has been detected (bores BH18 and BH26), and offsite monitoring locations along the potential higher permeability pathway (offsite bore BH38 and further offsite bores BH36 and BH37, located outside of 250m band, where no methane has been detected and carbon dioxide concentrations have varied between 0.1-4.7%v/v); or
- between bores where elevated concentrations of carbon dioxide (>5%v/v) have been detected on several occasions over time and bores located within the respective potential geological pathways where concentrations of carbon dioxide were close to adopted background (about 3%), such as bores BH15 and BH24, BH17, BH27 and BH39, BH40, BH29 and BH30, BH31 and BH23, with bores with relatively elevated concentrations of carbon dioxide located predominantly in the immediate vicinity of the landfill cells.

At Eaglehawk landfill, the majority of the underlying sedimentary profile, while providing a low permeability barrier for potential lateral fugitive emissions, may also restrict potential for vertical gas migration to the surface and prolong travel distance subsurface through the zones of potentially higher permeability within the Ordovician sediments.

There is no conclusive evidence of LFG migration along the potentially higher permeable zones around the landfill, including from areas in the immediate vicinity of the landfill boundary towards offsite bores within and outside of 250m band.

6.7.2 Mine Tailings

Prior to landfilling, the valley had been partially filled with mine tailings, of various substantial thicknesses. Mine tailings heap (batter “sand”) shown on the 1:10,000 Bendigo Gold Field – Eaglehawk map appears to underlie portions of the landfill. These deposits have been apparent during various onsite investigations. Soil gas monitoring bore BH22 installed in 2012 west of MB04 on the southern landfill perimeter intercepted 4m of sand over wet clay which was interpreted as mine tailings.

In the case of Cell 1 and Cell 2, waste sits directly on top of tailings, as shown in **Plate 1** (facing south-east towards Cell 1). This photograph, taken in 2002 when Cells 3a and 3b were being prepared for construction, indicates there is more than 2m of tailings beneath the waste.

During the geotechnical investigations in 2015 (Infrastructure Solutions, April 2016), mine tailings of variable thickness were described in several boreholes to the north of the landfill and underneath the eastern portion of the landfill:

- To the north of the landfill, along the tip entrance road, mullock was dry and appeared to thin out from about 7m at the landfill perimeter (location 2 SPT, log BH2) to about 3m half-way towards Upper California Gully Rd (location 1 SPT, log BH1).
- Underlying the eastern portion of the landfill, mullock was described as moist to wet and 3.5-5m thick (location LB3, log BH3 (current bore LB01); locations 5-7 SPT, logs BH5-BH7).

To the north of Cell 1, the extent of tailings appears to be constrained by topography, indicating the mullock was spread within the gully. The preferential pathway for landfill gas migration is therefore constrained along this margin; however there are significant gas readings in bores on the border indicating the tailings are extensive enough to provide a pathway for release beyond the edge of the landfill cell.

Drilling undertaken at the Allstone Quarry (ASQ) (WSP, 2018) provided an indication of the extent and nature of mine tailings to the south and east of the landfill, within the 200m buffer. The bore locations are shown in Figure 8 and Figure F3 (Appendix A) and described in Table 4.

Geotechnical investigations conducted at the BMX track about 250m north-east of the landfill Cell 1 (Shane Muir Consulting Engineers, 2016) described the subsurface profile encountered in the three hand-augered boreholes as containing various dry rock fill of about 0.5 -2m thickness, with no waste, overlying weathered mudstone or siltstone.

It is considered that due to the generally continuous nature of these relatively permeable deposits, tailings are likely to represent a continuous LFG migration pathway within the 500m buffer. This pathway will only become significant when the landfill is capped and preferential vertical migration is constrained, and when the tailings are unsaturated and sufficiently permeable.

Saturated mine tailings underlying the unlined landfill and associated leachate migration may contribute to LFG migration. Based on groundwater monitoring data available at the time of this assessment, there is no leachate plume in groundwater that may contribute to LFG transport offsite. However, the possibility of leachate migration from the unlined landfill cells should not be excluded. The anticipated direction of the leachate plume will be consistent with groundwater flow, currently inferred towards south-west of the landfill, where there are no receptors within the buffer zones.

Plate 1 Waste on Top of Tailings



Figure 8 Location of Geotechnical Investigation Bores – Allstone Quarry (after WSP, 2018)

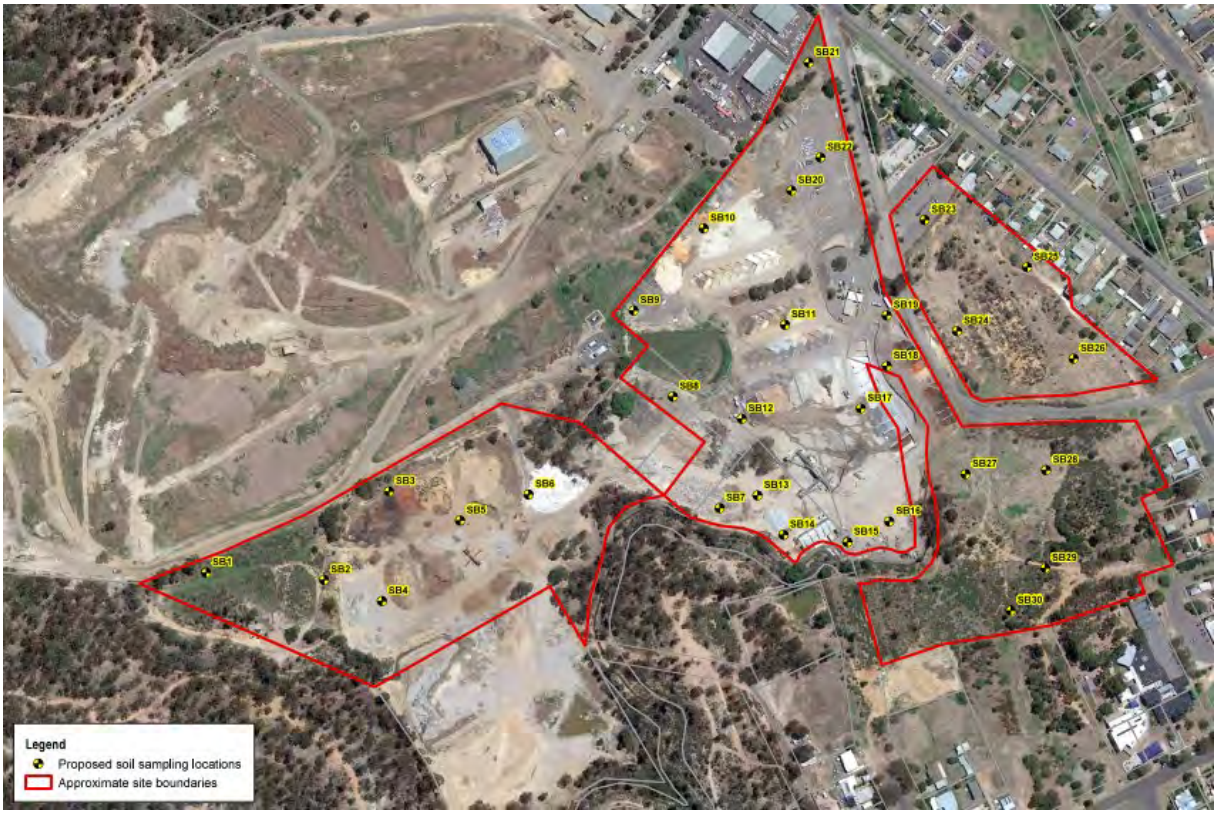


Table 4 Description of Tailings - Allstone Quarry

Bores	Thickness	Lithological Description
SB1, SB3	1.5 – 2m	Silts and clays
SB9, SB10	>2m	Coarser grained fill
SB21	0.5m	Sandy gravel
SB2, SB4-SB6	1.5 – 2m	Silty and clayey fill
SB7, SB8, SB11, SB16, SB27, SB28	Up to 2m	Coarser grained fill and reworked siltstone
SB12-15, SB17-20, SB22, SB26, SB30	0.5 – 1.0m	Coarser grained fill
SB23-25 and SB29	0m	Outcropping bedrock

Unsaturated permeable mine tailings may provide a preferential gas migration pathway south-east and north-east of the site, particularly where the landfill is capped and the tailings are permeable.

Saturated mine tailings may facilitate leachate migration and potentially contribute to LFG migration (LFG partitioning).

Depth to Groundwater and Fluctuations in Groundwater Elevation

The depth to groundwater influences the cross sectional area available for lateral gas migration. A shallow water table restricts LFG displacement in the unsaturated zone and results in the gas being closer to the ground surface, where pressurised flow can be dissipated to the atmosphere.

A rise in groundwater levels may result in pressurisation of the gas in the unsaturated zone, resulting in pressurised flow and increased lateral migration. A fall in groundwater levels potentially depressurises landfill gas in the unsaturated zone which is likely to decrease the potential for lateral migration away from the waste mass into the surrounding geologic media.

Groundwater occurs within Ordovician bedrock sediments which are characterised by low permeability. Groundwater levels across the site have varied by 7 - 10m since monitoring commenced in 1993, with a long-term decreasing trend reflecting the regional drought, and general recovery (by about 5m) in response to the break of drought in 2010-2011. Over the last 10 years, the reported depths to groundwater varied from about 5 -10m (MB03, MB04, located west and south of the landfill) to about 20m (MB06, MB07, MB08) along the boundary with the closest potential receptors to the north of the landfill.

There is at least 30 m of unsaturated profile available for gas transport within the 250m zone to the east of the landfill (bore MB10).

It is unlikely that water levels will rise by tens of meters and increase the potential for lateral migration.

For the closest receptors to the north of the landfill, the unsaturated profile varies in thickness, with at least 5m available for gas transport during periods of high water table and more than 10-15m available at other times. To the east of the landfill, there is at least 30m of unsaturated profile available for gas transport within the 250m zone.

It is unlikely that water levels will rise by tens of metres and increase the potential for lateral migration.

6.7.4 Underground Services and Mine Workings

Manmade potential pathways in the vicinity of the landfill and within the buffer zone include sub-ground services and historical (abandoned) mine shafts.

6.7.4.1 Sub-ground Services

There are limited underground services / structures in the vicinity of the landfill that may provide preferential pathways for off-site landfill gas migration. A summary of referrals (dated June 2018) is presented in Table 5.

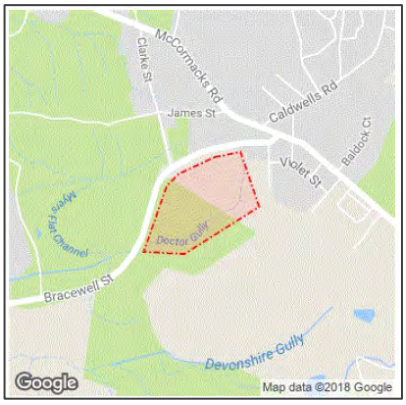
Of the reported existing underground utilities, Telstra telecommunications along Bracewell Road do not intersect licenced or historical landfill. Telstra service pits observed onsite did not appear on the Dial-Before-You-Dig (DBYD) referrals. Methane was detected at one onsite Telstra pit however none was detected at other Telstra pits in the vicinity of the site.

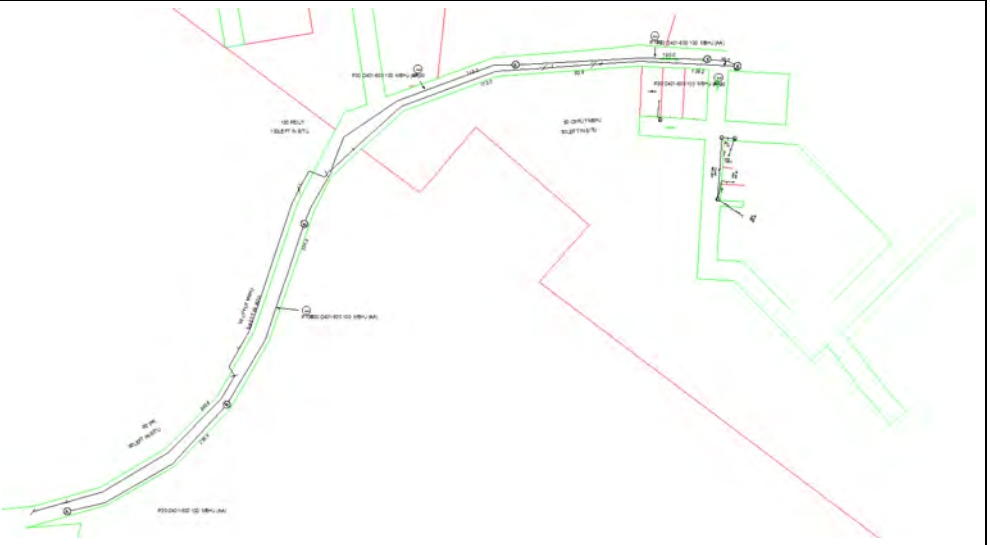
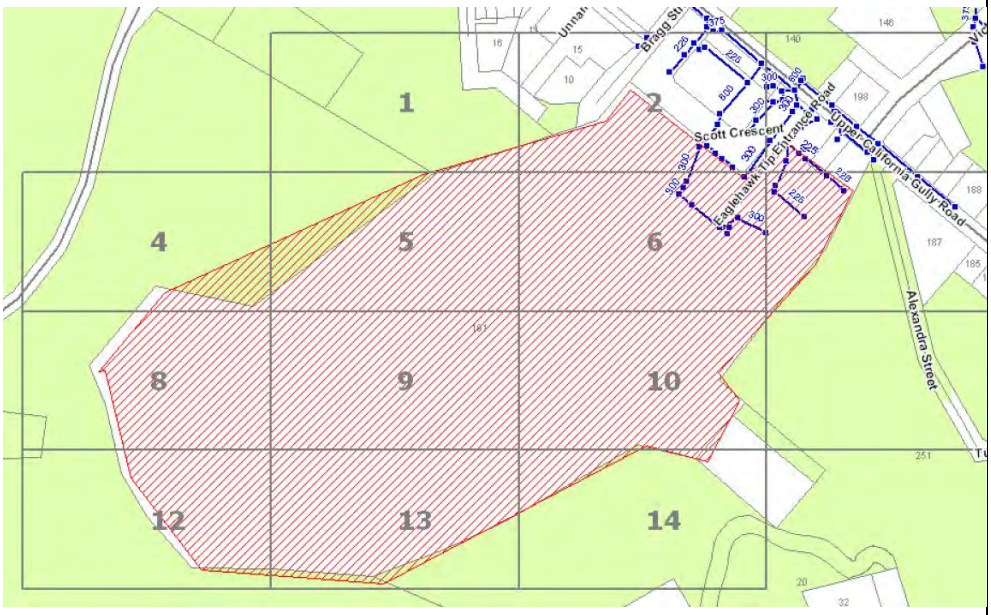
The existing stormwater drainage services do not extend towards the potential receptors in residential/commercial buildings but rather to the collector main along Upper California Gully Rd.

Historically, methane was occasionally detected at the Fire Plug 03 and in the stormwater drainage pit at the entrance to the Ecocentre. Methane was also detected in the Telstra pit near the site offices (refer illustration in Table 5 below). All of these locations are situated outside of the licensed landfill footprint.

Methane was not detected during the offsite sub-surface services surveys carried out in June and August 2018 (refer Figures F4A and F4B, Appendix A for walkover maps and Appendix C for monitoring results). This suggests that even though methane has been detected at several onsite underground services in the area of the historical fill, there is no offsite methane migration through subsurface services in the vicinity of the landfill.

Table 5 Summary of Underground Services in the Vicinity of Eaglehawk Landfill

Service	Locations
Telstra VICTAS	Referral returned services only along Bracewell Rd with connections to the existing dwellings on Upper California Gully Rd: 

Service	Locations
	
NBN Co, VicTas	No assets
Electricity (Powercor)	No assets
Gas (AusNet)	No assets
Mains Water Stormwater Sewer (Greater Bendigo City Council)	Water utilities immediately adjacent/ intersecting historical fill are concentrated at the tip entrance area 
Various onsite (not on DBYD referrals)	• Se 6 (Telstra pit near the site office/garages) • Se 7 (Fireplug 03) • Se 22 (Telstra pit east of weighbridge / liquids recycle centre) • Se 18 (stormwater drainage pit Ecocentre)

Service	Locations
	 

No evidence of methane in underground services at the streets adjacent to the landfill site has been reported during two walkovers conducted by AECOM in June and August 2018.

Manmade potential pathways are limited to the immediate vicinity of the landfill, and 2018 monitoring of sub-ground services remote from the landfill perimeter indicated negligible methane concentrations.

Although methane has been detected at several onsite underground services in the area of the historical fill, there is no apparent offsite methane migration through subsurface services in the vicinity of the landfill.

Conservatively, current planning zones GRZ, PUZ2, INZ1, INZ3 and PUZ1 and all roads within and adjacent to these, were assumed to represent this potential pathway.

6.7.5 Abandoned Mine Workings

There are multiple disused mine workings (comprising shafts, drives and galleries) in this area which have been buried or covered and are likely to extend throughout the 500m buffer (refer Figure F3 in Appendix A).

There are also multiple shafts mapped along the fold running in the middle of the site, with northern shafts at the north-western perimeter of cells 1 and 3a, and further west along the western landfill boundary (Cell 5). Depths and spatial extent of the shafts and associated workings are uncertain.

Geological maps and Victorian Heritage Database indicate that main shafts could be hundreds of metres deep and have multiple lateral branches at various depths. Potential risks of gas migration, accumulation and release are likely to be associated with multiple shallow shafts that are largely unmapped.

There are multiple unused mineshafts clustered along three anticlinal structures underlying the site, extending throughout the 500m buffer, and potentially beyond that in the subsurface (the geometry of the shafts is uncertain). The Bendigonian unit bordering the north-east of the landfill has been most heavily mined. Shaft voids have been encountered during drilling of MB01 at depths (235-240mAHD and 215-220mAHD) correlating with the base of the landfill (220-245 mAHD), therefore there is a potential for LFG migrating from the landfill to be intercepted by the mine shafts. At the site, the latest mine shaft collapse was reported in 2011 at the transfer station area.

It is recognised that the concentration of methane will diminish as distance increases, regardless of the pathway. In the case of mine workings although the permeability is significantly higher and the pathway is better defined, so too is the availability of air which would have a significant mitigating influence through oxidation and dilution.

The landfill is located in an area that is likely to be underlain by extensive mine workings of uncertain depth and connectivity, which are generally aligned with the gold bearing geological structures and may provide preferential LFG migration pathways.

Although the mine workings provide a potential pathway, the concentration of methane is expected to diminish as a result of oxidation and dilution processes within these voids and the concentration will therefore be less between 250 and 500m from the landfill than within the 250m zone.

6.7.6 LFG Transport Barriers

6.7.6.1 Landfill Intermediate Cover and Final Cap

A final landfill cap will preclude / limit the potential for gas to exit the top of the landfill to the atmosphere potentially resulting in increases of in-waste pressures. In the absence of a cap, pressure is more readily released vertically, directly to the atmosphere, limiting the potential for lateral LFG migration.

Installation of a low permeability cover may produce a change in landfill gas generation (i.e. enforce anaerobic conditions) and migration processes (other than emissions to atmosphere).

Completed cells at the site are covered with an intermediate cap. The approved capping system over Cell 1 and partially Cell 2, now comprises approximately 1.5 m thick layer of clay which controls fugitive landfill gas emissions into the atmosphere and provides a low permeability barrier and/ or oxidation media. Cells 3A and 3B are covered with an intermediate cap. The filling of Cell 5 is ongoing. The final cap will be fully engineered and will provide a better containment for vertical LFG

emissions however it may facilitate lateral LFG migration and emissions. However, it will also improve the efficiency of LFG extraction which is controlling pressure build up.

Until the remainder of the site is fully rehabilitated (an engineered cap installed), there is the potential for LFG to be emitted from the top of the uncapped landfill or for air ingress which may affect LFG recovery efficiency. It is also likely that in-waste pressures will dissipate. The nature of capping over Cell 1, which is the most extensive at the site, is likely to promote similar environmental performance in the future, i.e. providing sufficient control to vertical emissions without exacerbating pressure build up in the landfill.

Surface emissions monitoring of cells 1-3 implemented regularly since 2010 demonstrated that under current LFG management conditions, existing landfill cover provides an efficient barrier system and controls harmful emissions (i.e. above the adopted action levels) to the atmosphere. Perimeter soil gas monitoring bores do not exhibit borehole flows indicative of pressure-driven LFG migration, and with exception of two bores BH18 and BH26, there have been no reported methane concentrations of concern.

Final cell rehabilitation is anticipated to occur within the next 10 years.

Capping over Cells 1 and 2 was accepted by EPA and comprises over 1m of clay and doesn't include plastic membrane.

Cells 3a and 3b have intermediate cover in place. Cell 5 will be closed in about 4-6 years. Final capping of these cells is likely to include clay and geomembrane.

Under current capping conditions (in combination with active LFG management), lateral LFG migration under pressure appears unlikely.

Upon full site rehabilitation, LFG pressure in the landfill is likely to increase and promote lateral pressure-driven emissions through subsurface geology. LFG management controls will be applied during the aftercare period as appropriate.

6.7.6.2 Landfill Side Liner

The presence of a landfill side liner will generally limit the potential for lateral migration of LFG outside the waste (physical barrier). Unlined stages of the landfill have no engineered controls to prevent fugitive emissions to subsurface.

There is no engineered liner system in Cell 1 at the site. In the absence of cell construction information, cell boundary was defined based on Council's advice, EPA licence schedule of premises and supported by subsurface profile (reworked natural or natural sediments) in Cell 1 perimeter monitoring bores. Engineered liners were constructed in the cells operating since 2000. In the absence of suitable engineered side liners, the potential for lateral LFG migration from these landfill cells cannot be excluded. Appropriately engineered liners have been installed at Cell 5 and it is anticipated that their presence will significantly limit the potential for lateral gas migration. Deterioration of the liners with time will provide a release point for LFG emissions into the surrounding environment; however it is recognised that LFG generation will also reduce over time.

Perimeter soil gas monitoring around the landfill during the aftercare period will allow for early detection of potential emissions in case of liner failure, and application of timely LFG mitigation measures if required.

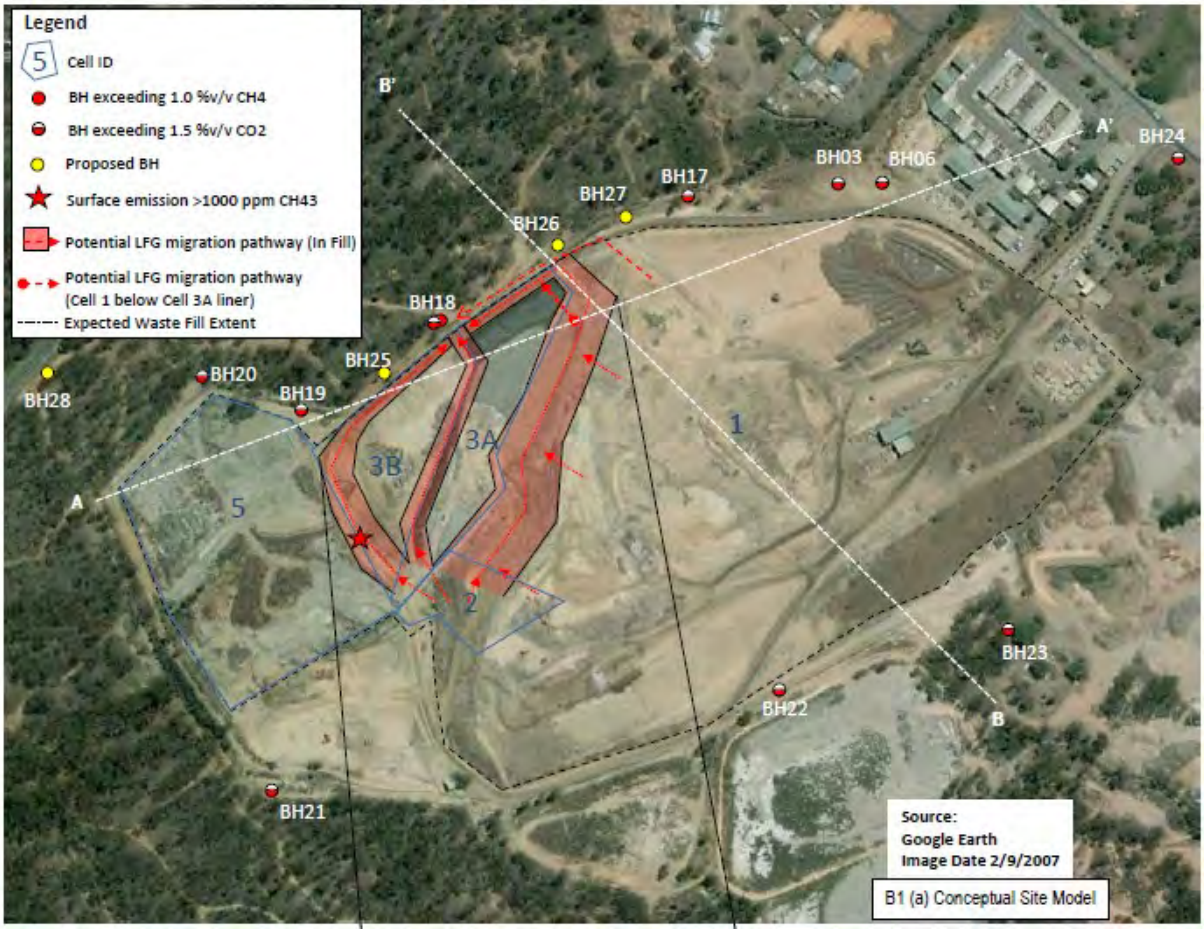
Landfill cell layout is such that fugitive emissions to subsurface geology from Cell 1 and 2, and subsequent transport to the east and north of the landfill are not precluded.

Methane detected in soil gas monitoring bores BH18 and BH26 in the immediate vicinity of Cells 3a and 3b has been attributed to release points associated with the side separation system between the cells.

The illustration in the LGRAP (Tonkin Consulting, 2016), reproduced below, suggest that basal lifts in Cells 3a and 3b were separated from historical Cell1 and between Cells 3a and 3b by fill overlain by engineered liner. It is uncertain whether fill material was of low permeability. These separation zones border the waste perimeter opposite bores BH18 and BH26, where relatively elevated concentrations of methane have been detected since installation. It was suggested (as illustrated in reproduced

figures below) that separation of cells provided preferential pathways for gas migration towards release points (into subsurface geology, as apparent from monitoring data for BH18 and BH26 at the north-western landfill perimeter.

Figure 9 Conceptual Site Model, reproduced from Tonkin Consulting 2016.



The absence of side liners in cells 1 and 2 means that fugitive emissions to subsurface geology east and north of the landfill are not controlled.

Intended performance of the side liner system in Cells 3a and 3b appears compromised and it provides a preferential in-waste migration pathway and release point for fugitive emissions to subsurface geology at the north-western perimeter.

The intact side liner in Cell 5 is expected to control fugitive emissions to subsurface geology along the north-western and south-western perimeter of the cell.

Liner deterioration will provide release points for fugitive emissions to subsurface geology at north-western and south-western perimeter (Cells 3a, 3b and 5).

Perimeter soil gas monitoring around the landfill during the aftercare period will allow for early detection of potential emissions in case of liner failure, and application of timely LFG mitigation measures if required.

6.7.6.3 Landfill Gas Recovery Systems

The implementation of LFG recovery systems from within the waste reduces the potential for pressure build-up within the landfill cell. The reduction of in-waste gas pressure will minimise the potential for LFG migration from the waste either vertically or laterally.

The collected LFG is currently utilised for the generation of electricity. According to the site EIP (Meinhardt, June 2004) the LFG management contractor would operate LFG collection and reuse

system until the quantity of extracted LFG is no longer viable to use. It is estimated that this will continue until approximately 2030 and this will be followed by LFG flaring until the LFG concentrations are reduced to levels that would have a minimal impact on the environment. The anticipated aftercare period will be approximately thirty years.

LGRAP (Tonkin Consulting 2016) suggested installation of an interception trench along the north-western toe of Cells 3a and 3b to enable management of fugitive LFG emissions attributed to cell separation liner system.

Over time, active LFG extraction is expected to cease at the site. This may result in relative pressure build up, particularly in the capped Cells 3a, 3b and 5. The nature of capping there is anticipated to limit vertical gas release and pressure dissipation and induce lateral advective transport. Aftercare monitoring is required to enable detection of the fugitive emissions.

Current active LFG extraction is expected to provide sufficient control over pressure-driven migration of LFG to and through subsurface geology.

It is anticipated that control will continue until the end of viable LFG recovery (power generation, until 2030s) and further into the future (flaring, until 2040s).

It is anticipated that LFG management will continue at the site until LFG concentrations are reduced to levels that would pose no risk of offsite migration at harmful levels (until 2050s).

6.7.6.4 LFG Weathering

LFG can undergo changes in composition during transport. The main mechanisms of change include:

- Dilution: whereby LFG mixes with the background soil gas already present;
- Methane oxidation: whereby methane is consumed by microbes in the presence of oxygen to produce carbon dioxide; and
- Water-washing: whereby as LFG encounters water, carbon dioxide is preferentially stripped given its greater degree of solubility (approximately 60 times).

6.7.6.4.1 Indicators of LFG Attenuation

Landfill gas typically comprises 60% methane and 40% carbon dioxide, whereas background soil gas is typically equivalent to air and comprises 21% oxygen and 79% balance gas (predominantly nitrogen).

There is no information available to AECOM for in-waste bores in order to assess source LFG conditions (borehole pressure/ flow and/or cell specific LFG composition) in the cells of various ages.

Outside the waste, methane has been observed in two bores (BH18 and BH26) located less than 20 m away from waste footprint of Cells 1 and 3a. Methane has not been observed or observed in negligible concentrations in the other monitoring bores.

In addition to assessing the LFG transport mechanisms, variations to the typical gas compositions can be used to determine the attenuation mechanism(s) that may be taking place.

6.7.6.4.2 Background Soil Gas

Based on historical monitoring results for Eaglehawk landfill perimeter bores, methane has not been detected in any bores except BH18 and BH26, both known to be affected by LFG. Therefore, methane is not a background gas. There is no known natural gas supply infrastructure at the site, and the nearest connected users are thought to be Scott Crescent commercial precinct and residents at Bragg Street, Violet Street and Walker Crescent, north of Cell 1.

Assessment of the background soil gas conditions (refer Appendix E) suggested that concentrations of carbon dioxide in the subsurface geology are close to 3%v/v (bores determined to be affected by LFG or located too close to the known landfill footprint were excluded). Alternative source of background carbon dioxide in the subsurface geology may be attributed to carbonaceous sedimentary beds and mineralisation zones within Ordovician bedrock in Bendigo area. This has been documented in the LGRAP (Tonkin, 2016).

Potential correlation between carbon dioxide concentrations with lithology and/or structural geology around the landfill was also considered using time series of grouped bores (refer Appendix E). The available data indicates that no such correlation appears to exist.

Statistical analysis of the carbon dioxide concentrations suggested no correlation between elevated concentrations and zones assumed to have higher permeability. This conclusion is subject to limited long-term offsite data for the new bores remote from the landfill.

Methane is not a background gas in the vicinity of the landfill.

Background concentrations of carbon dioxide are relatively elevated in the vicinity of the landfill, potentially attributed to carbonaceous content of the underlying sediments.

It is assumed that concentrations in excess of 3%v/v are indicative of oxidation processes in the subsurface geology in the vicinity of the site.

6.7.6.4.3 Dilution

If dilution of LFG is occurring in the absence of other attenuation mechanisms, the ratio of methane to carbon dioxide will remain at approximately 1.5 (or 3% methane for each 2% carbon dioxide). Oxygen and balance gas will be present.

Based on the available monitoring data for two perimeter bores that reported methane, the ratios were 0 to 0.95 in BH18 and 0.4 to 1.23 in BH26 (1.23 the closet indicative of dilution, with oxygen reported at 0.1% at the time).

Monitoring results indicate LFG dilution is not the primary attenuation mechanism under current LFG conditions at Eaglehawk landfill.

6.7.6.4.4 Methane Oxidation

Microbes can use methane as a source of energy in the presence of oxygen by the simplified chemical reaction as follows:

Aerobic Respiration: $CH_{4(gas)} + 2O_{2(gas)} = CO_{2(gas)} + 2H_2O_{(liquid)}$

As can be seen in the above simplified chemical reaction, the occurrence of aerobic respiration will result in a decrease in methane and oxygen concentrations and an increase in carbon dioxide concentration and these changes are used as indicators of its occurrence. Ratio of CH_4:CO_2 is typically depressed (i.e. <1.5).

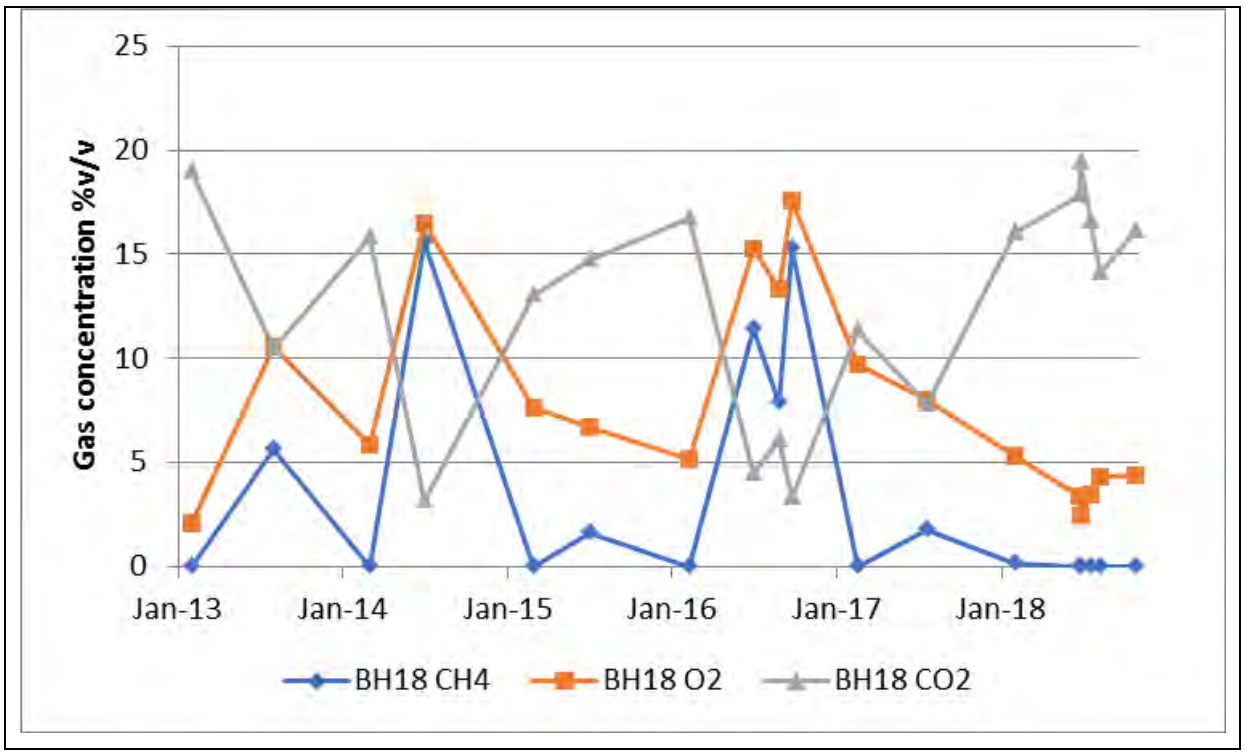
The maximum CH_4:CO_2 ratios for the entire monitoring dataset are provided in Table 6. Apart from BH01, BH02 and BH26, all of the values are significantly below 1, indicating elevated concentrations of CO_2 relative to CH_4 which attests to methane oxidation process over most of the site.

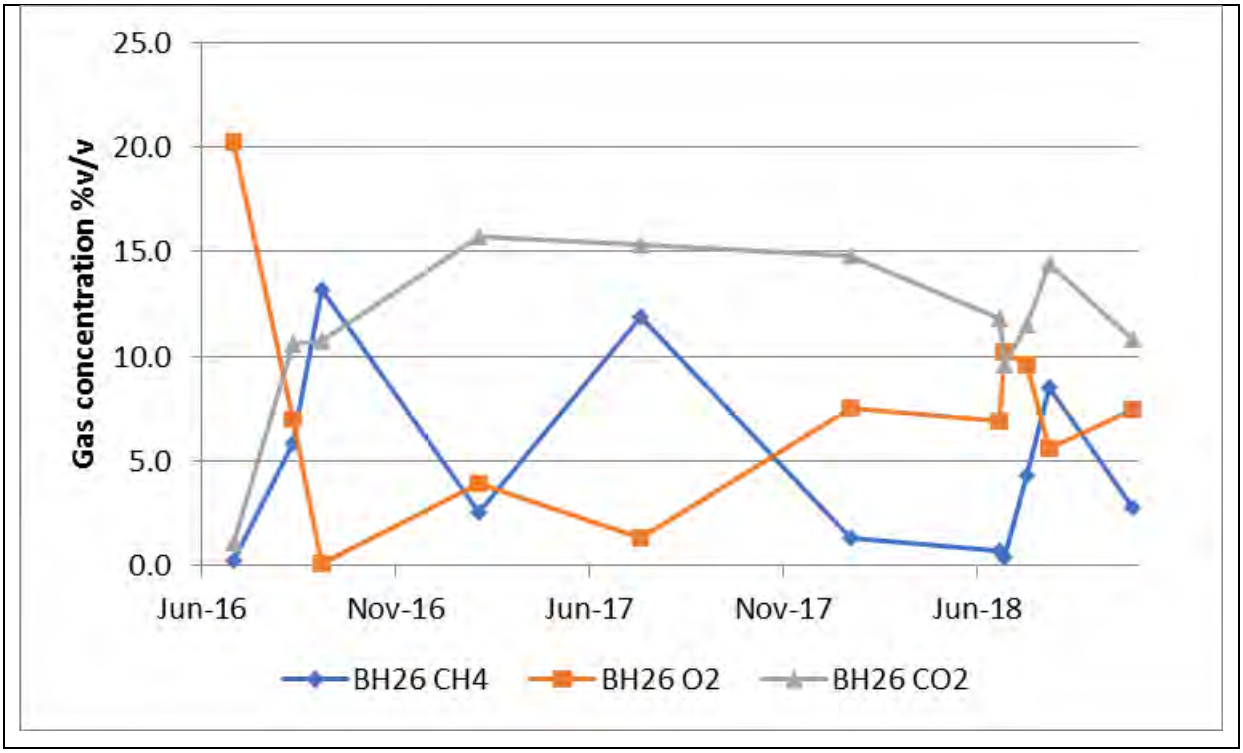
Table 6 Maximum CH4:CO2 ratios

Bore	CH_4/ CO_2	Bore	CH_4/ CO_2	Bore	CH_4/ CO_2	Bore	CH_4/ CO_2
BH01	1.00	**BH11**	0.03	**BH21**	0.00	**BH31**	0.00
BH02	2.40	**BH12**	0.08	**BH22**	0.33	**BH32**	0.00
BH03	0.05	**BH13**	0.06	**BH23**	0.25	**BH33**	0.00
BH04	0.06	**BH14**	0.06	**BH24**	0.00	**BH34**	0.00
BH05	0.08	**BH15**	0.08	**BH25**	0.00	**BH35**	0.00
BH06	0.06	**BH16**	0.02	**BH26**	1.23	**BH36**	0.00
BH07	0.18	**BH17**	0.00	**BH27**	0.00	**BH37**	0.00
BH08	0.05	**BH18**	0.95	**BH28**	0.03	**BH38**	0.00

Bore	CH_4/ CO_2	Bore	CH_4/ CO_2	Bore	CH_4/ CO_2	Bore	CH_4/ CO_2
BH09	0.03	**BH19**	0.00	**BH29**	0.00	**BH39**	0.00
BH10	0.07	**BH20**	0.00	**BH30**	0.00	**BH40**	0.00

Monitoring results reported for bores BH18 and BH26 known to be affected by LFG due to liner system of Cells 3a and 3b (refer Section 6.7.6.2), also demonstrate the above relationship and support that methane oxidation is occurring in the subsurface (refer charts below). Ratios of CH_4:CO_2 in BH18 (when methane was detected) have varied between 0.2 and 0.9, and in BH26 – between 0.1 and 1.2.





In the remainder of the bores, negligible concentrations of methane have been occasionally reported in some of the bores:

- BH01-BH16 (2001 – current, except destroyed BH10-BH14 and BH16) reported occasional negligible (0.1-0.5%v/v) methane concentrations. Differences in soil gas concentrations between the pairs of the bores and within the pairs (3m and 10m deep bores) may be attributed to variable pathways and/ or air ingress. The concentrations of carbon dioxide and oxygen in these bores have changed over time and remained indicative of oxidising processes in the subsurface. In most of the bores, carbon dioxide decreased and oxygen increased in comparison with pre-extraction stage of landfilling. Soil gas concentrations in BH06 have been changing (decreasing oxygen, increasing carbon dioxide) since 2009. All results suggest that natural attenuation is occurring at rates notably exceeding that of migration.
- In bores BH17-BH24 (2013 – current) and BH25-BH28 (since 2016), methane concentrations above 0.1%v/v were reported mainly for bores BH18 and BH26, with 0.1%v/v reported for BH22 and BH23 in July 2018 and BH28 in February 2018. All results suggest that natural attenuation is occurring, at rates exceeding the migration in the vicinity of most bores.
- Limited data available for the new bores BH29-BH40 at the time of preparation of this assessment suggest that methane encountered in the perimeter bores BH18 and BH26 effectively oxidises in the subsurface and soil gas concentrations similar to background occur in the areas of the proposed development north and west of the site.

Aerobic respiration of each methane molecule results in a net loss of two (2) gas molecules. Therefore, if aerobic respiration is occurring at a sufficient rate, the loss in gas molecules may result in the observed increase in the concentration of the balance gas (%Balance) to above background concentrations (>79%). This relationship can also be assessed using the ratio of %Balance to oxygen, where ratios over 3.8 (typical for air) are found in soils with oxidation processes, as oxygen is consumed.

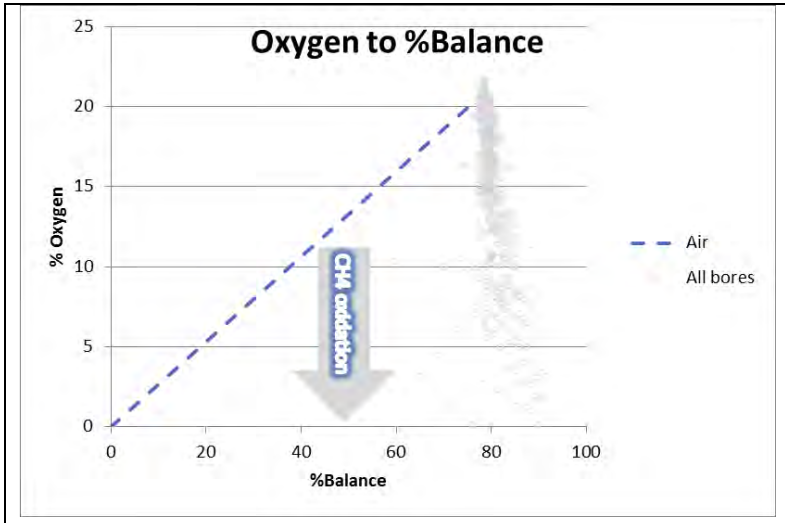
In bores BH18 and BH26, % Balance data suggested that at times oxygen has been consumed and there was a potential for further methane migration in the vicinity of these bores. Of the remainder of the bores, balance gas over 80% (on average) has been reported in bores with elevated concentrations of carbon dioxide and depleted concentrations of oxygen.

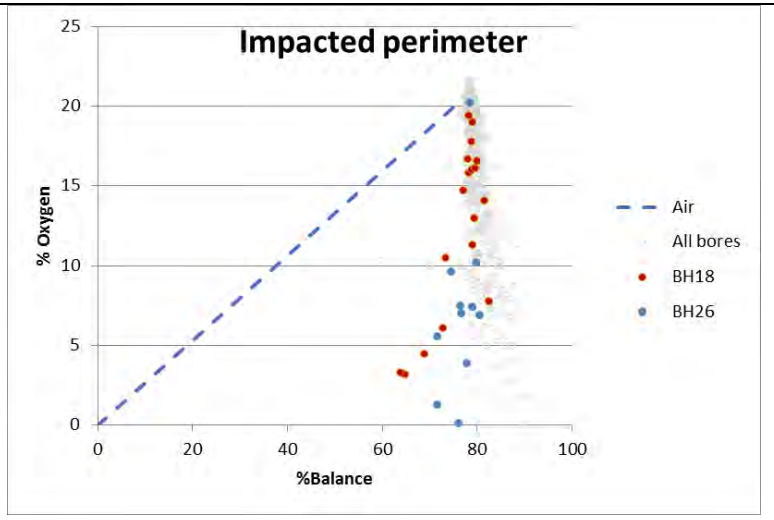
At Eaglehawk landfill, the concentrations of balance gases (%Balance) have varied between the bores and over time. For the majority of bores, the %Balance / O_2 ratios were above 3.8, indicative of oxidation processes in the subsurface profile. This is illustrated in charts below, with bores grouped to show conditions within the different buffer zones.

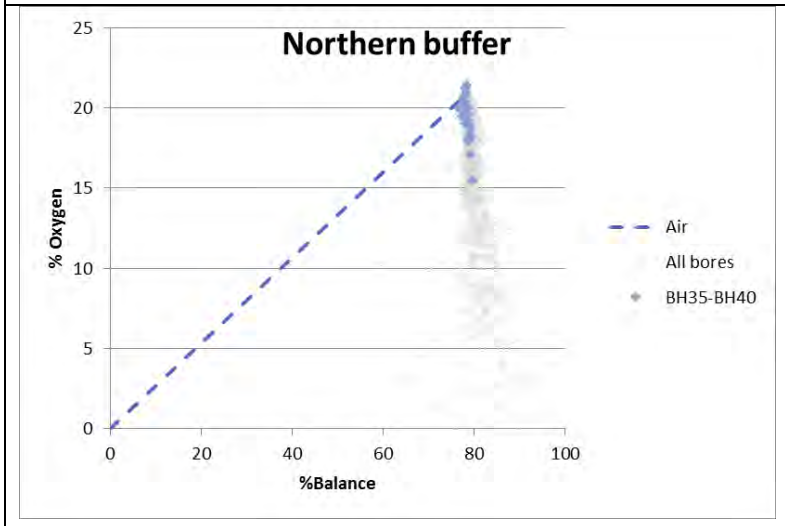
Soil gas monitoring data for Eaglehawk landfill indicate that methane oxidation is occurring around the landfill, generally at rates exceeding that of migration.

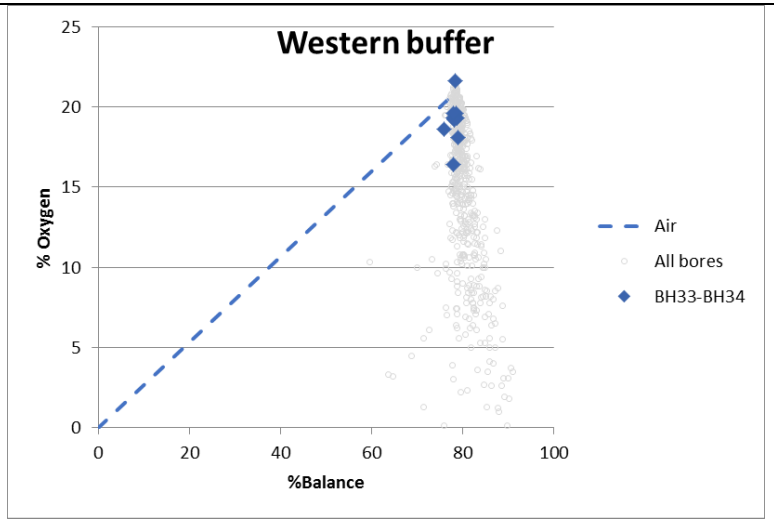
The observed concentrations of oxygen indicate there is significant capacity for further methane oxidation to occur.

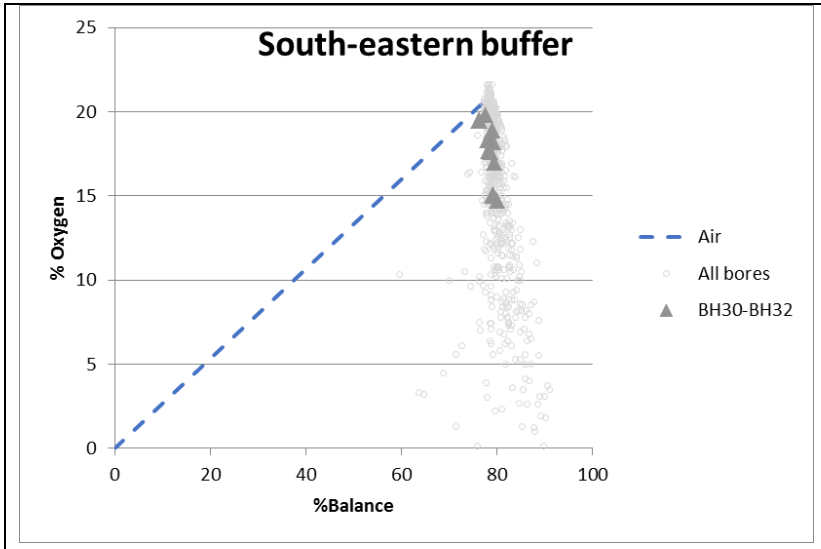
This is expected to continue in the future, at rates dependent on pressure-driven transport under the potential landfill aftercare management scenarios.

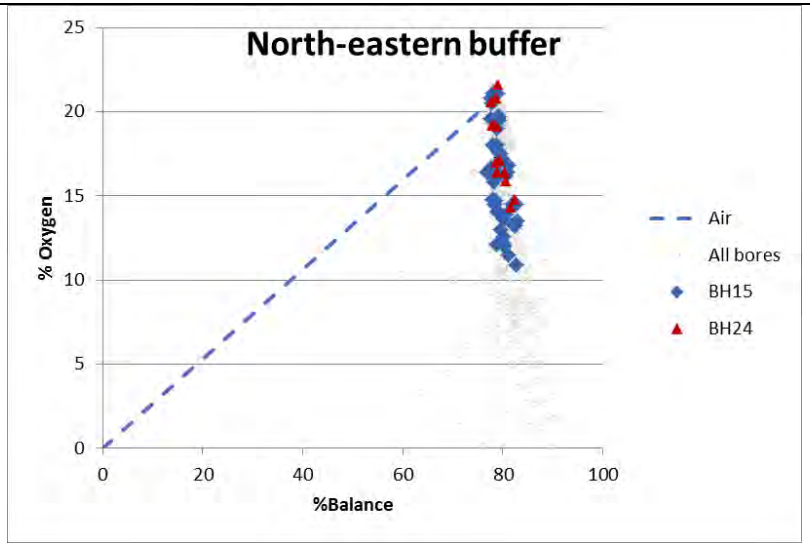

Oxygen to %Balance
% Oxygen
%Balance
CH4 oxidation
Air
All bores


Impacted perimeter
% Oxygen
%Balance
Air
All bores
BH18
BH26


Northern buffer
% Oxygen
%Balance
Air
All bores
BH35-BH40


Western buffer
% Oxygen
%Balance
Air
All bores
BH33-BH34


South-eastern buffer
% Oxygen
%Balance
0
5
10
15
20
25
0
20
40
60
80
100
Air
All bores
BH30-BH32


North-eastern buffer
% Oxygen
%Balance
0
5
10
15
20
25
0
20
40
60
80
100
Air
All bores
BH15
BH24

6.7.6.4.5 Water Washing

Given the relatively higher degree of solubility of carbon dioxide compared to methane, in areas of high water saturations, carbon dioxide can be preferentially stripped. Thus, the proportion of methane to carbon dioxide would increase if water washing occurs and would typically be greater than 1.5. The historical and current soil gas concentrations in the vicinity of the Eaglehawk landfill do not suggest water washing. As noted previously, ratios of CH_4:CO_2 in BH18 and BH26 (when methane was detected) are lower, in the range 0.2-1.2.

Depths of the soil gas monitoring bores vary around the site. Groundwater was not encountered during drilling of the soil gas bores, and based on the recent gauging results, gas monitoring bores were effectively dry. Groundwater influence on LFG monitoring does not appear to be an issue at the site.

Water is present in several gas monitoring bores at the site - one monitoring bore (in Cell 1) with leachate and at least two monitoring bores with groundwater present. Therefore, although the waste is largely dry and water washing doesn't currently manifest itself, it cannot be excluded. Otherwise no effect is anticipated to future LFG generation or migration potential based on existing leachate or groundwater levels, assuming the landfill remains dry and underlain by over 20 m of unsaturated profile.

Current soil gas conditions in the vicinity of the Eaglehawk landfill do not suggest water washing. Given the local climate and deep groundwater, this is expected to continue into the future.

In addition, apart from "concentrating" the methane in LFG, the occurrence of water washing also provides an indication of the degree of LFG migration. As the carbon dioxide has a limited saturation potential and water infiltration is typically sporadic, the process typically occurs at a relatively slow timeframe. Thus, if water washing is noted, migration of LFG can be inferred to be occurring at a relatively slow rate.

6.7.7 Potential for LFG Transport

6.7.7.1 Vertical emissions

The uncapped landfill does not preclude direct emissions of landfill gases into atmosphere, but once it is capped with a vertical migration barrier and an oxidation zone, pressure-driven emissions to the atmosphere will be reduced to negligible levels.

Capping conditions vary across the landfill, but monitoring of cap emissions indicate that the intermediate capping over the majority of the historical landfill is effectively controlling vertical methane emissions to atmosphere.

Future low permeability capping over Cells 3a, 3b and 5 will be designed to contain LFG. Surface monitoring indicates that intermediate capping over Cells 3a and 3b is already effective in controlling vertical methane emissions.

It is considered that capping conditions during the remaining operational and future fully rehabilitated states of the landfill will provide an effective vertical LFG migration barrier.

6.7.7.2 Lateral emissions

Capping is anticipated to cause lateral pressure-driven migration. Potential lateral migration through subsurface geology is targeted by the perimeter gas monitoring bores, particularly in the direction of the closest receptors such as residential and commercial properties to the north and north-east of the landfill.

Data collected between 2001 and 2004 is thought representative of soil gas conditions in the vicinity of relatively young (12-15 years old) waste in the absence of a liner, capping or active LFG management. Differences in concentrations between pairs of bores and within the pairs (3m and 10m deep bores) may be attributed to variable pathways and/ or air ingress. Occasional negligible (0.1-0.5%v/v) methane concentrations have been reported for all bores.

Since commencement of active LFG extraction, methane concentrations have generally remained below the instrument detection limit (0.1%) in all bores except BH18 and BH26, where detected

methane has been attributed to preferential emissions pathways. At the time of preparation of this assessment, methane was not detected in any of the new bores (BH29-BH40), including those (BH36, BH37 and BH38) located along the potentially more permeable zone aligned with BH18 / BH26.

The reported concentrations of methane, carbon dioxide, oxygen and %Balance in BH18 and BH26 and the remainder of the monitoring bores indicate that the degree of lateral LFG migration is very limited. In 2017, continuous monitoring of BH18 and BH26 was undertaken (refer Figure 10). This indicated a relatively low and stable range of concentrations of methane and carbon dioxide (0.1-4%v/v and 8-11%v/v, respectively) in BH18, with methane not exceeding 10%v/v after the maximum recorded drop in barometric pressure, accompanied by oxygen consumption and slight increase in carbon dioxide. In the absence of a capping barrier and extraction system in Cells 3a and 3b at the time, and based on the assumption that methane emissions occur via uncontrolled preferential pathways, these soil concentrations are thought representative of typical long term conditions in the absence of active extraction.

In BH26, higher LFG concentrations fluctuated over a greater range, with full oxygen depletion during the atmospheric pressure troughs. Oxygen became available during the periods of atmospheric pressure highs, and soil gas conditions in this bore have been considered representative of the worst case condition in the absence of active extraction and an intermediate cap. The future worst case is anticipated when the site is rehabilitated with low permeability capping, and air ingress through the exposed cell batter (facing Cell 5 at the time) is no more available.

Maximum concentrations of methane and carbon dioxide recorded in soil gas monitoring bores over time are provided in Table 7 below. It is important to refer to the full data set (Appendix C) to ensure the recorded maximum concentrations are not taken out of context, e.g. concentrations of major and balance gases. The data indicates that there has been generally no methane detected beyond the licence boundary and that concentrations of carbon dioxide reduce with overall distance from the landfill.

Table 7 Maximum Concentrations Recorded in Soil Gas Monitoring Bores

Bore ID	Distance to licence boundary	Date	Max CH4	Date	Max CO2
Bores on the licence boundary					
BH01	On the boundary	Apr-12	0.4	Aug-18	2.6
BH02	On the boundary	Dec-01	2.4	Mar-11	5.6
BH03	On the boundary	Feb-07, Apr-12	0.3	Sep-03	17
BH04	On the boundary	Feb-07, Apr-12	0.4	Apr-02 Mar-11	30 (anomalous balance) 19
BH05	On the boundary	Nov-03, Sep-05, Mar-11, Apr-12	0.1	Feb-17	6
BH06	On the boundary	Mar-10, Mar-11, Apr-12	0.1	Feb-16	6.5
BH07	On the boundary	Jun-11	0.3	Feb-17	11
BH08	On the boundary	Aug-01	0.4	Feb-02	10.1
BH09	On the boundary	Oct-01, Nov-03, Sep-05, Mar-10, Apr-12	0.1	May-02	20

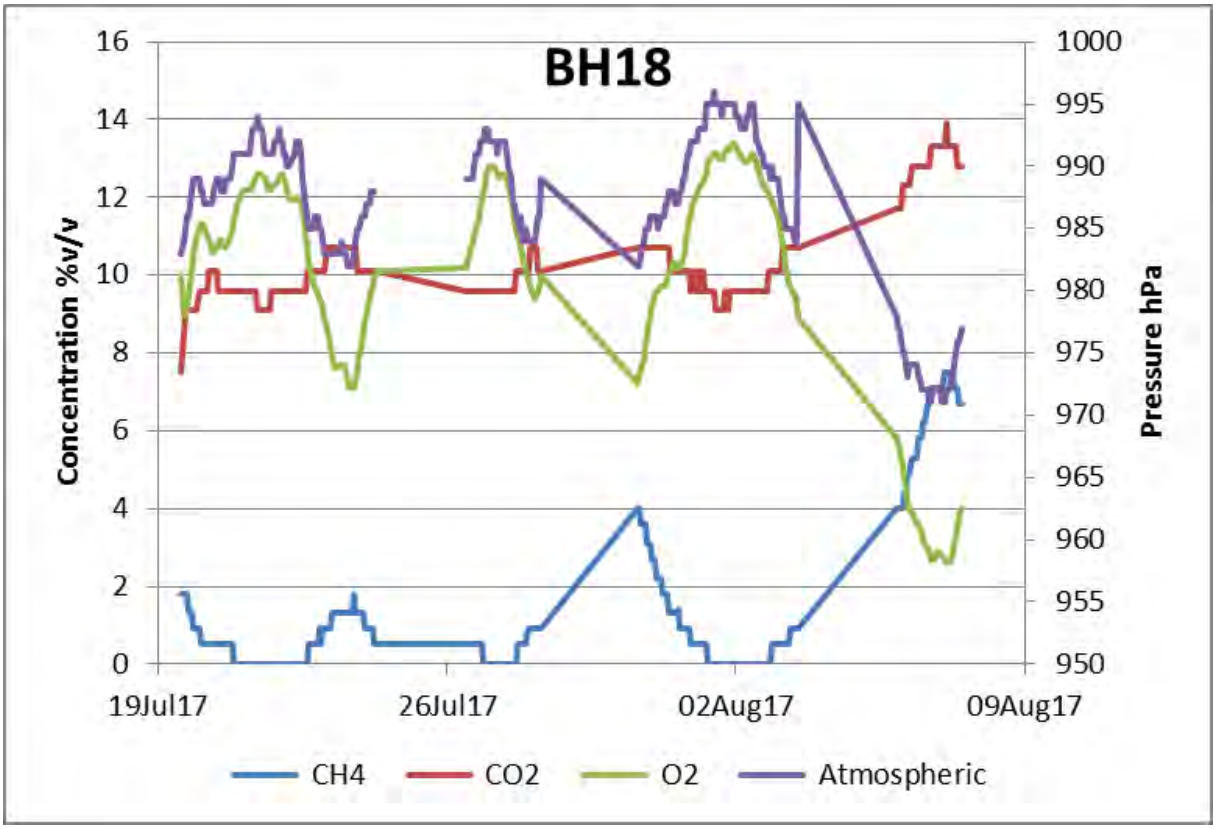
Bore ID	Distance to licence boundary	Date	Max CH4	Date	Max CO2
BH10	On the boundary	Aug-01	0.5	Feb-02	12
BH17	On the boundary		0	Feb-17	7.9
BH18	On the boundary	Jul-14	16	Sep-16	18
BH19	On the boundary		0	Sep-16	13
BH20	On the boundary		0	Jul-14	5.8
BH21	On the boundary		0	Mar-14	13
BH22	On the boundary	Jul-18	0.1	Mar-15	15
BH23	On the boundary	Jul-18	0.1	Feb-17	4.2
BH25	On the boundary		0	Jul-16	9.5
BH26	On the boundary	Sep-16	13.2	Feb-17	15.7
BH27	On the boundary		0	Feb-17	7.1
BH29	On the boundary		0	Oct-18	11.8
Bores within 250 m of the licence boundary					
BH39	About 50m		0	Aug-18	4.7
BH38	About 55m		0	Aug-18	2.9
BH32	About 60m		0	Aug-18	4.4
BH33	About 80m		0	Oct-18	2.9
BH11	About 100m	Nov-03	0.2	Mar-02	7.5
BH12	About 100m	Nov-03, Sep-05	0.1	May-02	4.6
BH13	About 100m	Nov-03	0.2	Oct-01	11
BH14	About 100m	Nov-03	0.2	Nov-0.3	3.4
BH24	About 100m		0	Feb-17	4.8
BH28	About 100m	Feb-18	0.1	Jul-16	5.4
BH31	About 100m		0	Aug-18	6.0
BH15	About 110m	Nov-03, Jun-04, Mar-10, Mar-11, Apr-12	0.1	Feb-02	9.1
BH16	About 110m	Nov-03	0.1	Mar-02	11
BH34	About 170m		0	Oct-18	5.5
BH40	About 240m		0	Aug-18	2.6

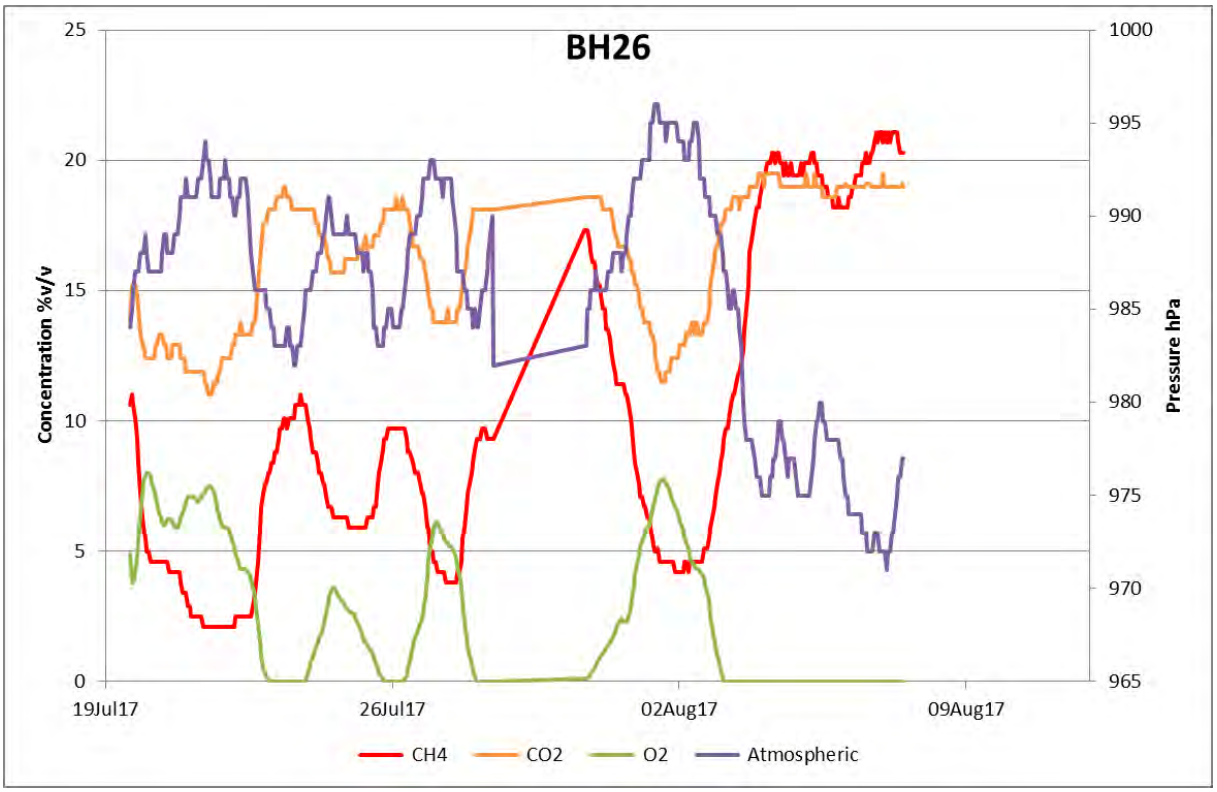
Bore ID	Distance to licence boundary	Date	Max CH4	Date	Max CO2
Bores over 250 m from the licence boundary					
BH30	About 280m		0	Aug-18	3.9
BH35	About 360m		0	Oct-18	3.5
BH36	About 325m		0	Oct-18	2.7
BH37	About 310m		0	Oct-18	2.3

Gas flows in the monitoring bores were recorded in the range 0-0.1 L/hr over the monitoring period. CIRIA 665 indicates the risk level to be very low for both methane and carbon dioxide since the GSV is less than 0.07 L/hr (refer Table 3 and monitoring results in Appendix C).

Qhg for methane and carbon dioxide based on historical maxima up to October 2018 are illustrated in Figure F6 (Appendix A).

Figure 10 LFG Monitoring Results – BH18 and BH26





Based on the reported concentrations of carbon dioxide, oxygen and balance gases, LFG attenuation (methane oxidation) at rates exceeding the migration is supported by long term soil gas monitoring data in the bores around the landfill.

It is considered that lateral LFG migration through the subsurface geology may occur both during the remaining operational and future rehabilitated landfill stages.

The rate of lateral LFG migration is expected to be higher in zones of higher permeability. The travel distance depends on pressurised flow and natural attenuation. The available monitoring data suggests very low risk based on GSV (<0.07L/hr for CH_4 and CO_2).

Pre-extraction monitoring data (2001-2004) north of uncapped Cell 1 and more recent data for other bores around the landfill perimeter indicated occasional minor concentrations of methane.

The concentrations of methane in bores BH18 and BH26 prior to and during LFG extraction from Cells 3A and 3B, and the concentrations of methane, carbon dioxide, oxygen and %Balance in these and the remainder of the bores indicate that under current landfill conditions the degree of lateral LFG migration is very limited.

6.8 Receptors

For the purposes of this risk assessment, and based on existing zoning in the proximity of the landfill at the time of preparation of this report, the potential receptors were grouped into the following categories:

- Residential / school – Existing residential developments and undeveloped areas within GRZ and school within PUZ2;
- Industrial – Industrial and commercial uses according with industrial zoning;
- Limited development potential:
  - Undeveloped areas within PUZ7, PPRZ, PCRZ;

- Farming land: land with potential for a broad range of uses at low densities, including agriculture, farm dwellings, sheds, industry and warehouse.

Road zone RDZ2 and zone PUZ1 (services) were grouped with the adjacent residential/school or industrial receptors, to account for potential risk to construction / maintenance workers.

A summary of the current planning zones and adopted receptor categories in the vicinity of the landfill, including within the default landfill buffer, is presented in Table 8 below. Planning zones and overlays are illustrated in Figure F2 in Appendix A.

The categories are grouped on the basis of distance within the 500m landfill buffer from a MSW landfill as defined in BPEM. The density of data within the 250m band indicates a higher degree of confidence in the assessed level of landfill gas exposure and risk than in the band between 250m and the BPEM buffer of 500m, hence two bands are shown.

Table 8 Receptor Categories

Planning Zone	Receptors	Adopted Grouping	Within 250m	250m - 500m
General Residential GRZ	• Humans and assets • Humans and assets (subsurface infrastructure) in the vicinity of the site. • Other temporal sensitive receptors during construction/ excavation works.	Residential / school	Violet Street, Bragg Street, Evely Street and Walker Crescent within 200m north of Cell 1; Upper California Gully Road	Upper California Gully Road, Brown Street, Vinton Street, Butler Street, Batten Street, Hosken Street, Caldwells Road, Pearson Street, Robbins Street, McCormacks Street, James Street, Clarke Street
Industrial 1, 3 IN1Z, IN3Z	• Humans and assets (buildings, structures, property & materials); • Humans and assets (subsurface infrastructure) in the vicinity of the site. • Other temporal sensitive receptors during construction/ excavation works.	Industrial	Adjacent Scott Crescent and Baldock Court commercial precincts, Alexandra Street, Turner Street, ASQ	Turner Street, ASQ
Public Use 2 (Education) PUZ2	• Humans and assets (subsurface infrastructure) in the vicinity of the site. • Other temporal sensitive receptors during construction/ excavation works.	Residential / school		California Gully Primary School

Planning Zone	Receptors	Adopted Grouping	Within 250m	250m - 500m
Public Use 7 (Other public use) PUZ7	• Municipal buildings and structures associated with non-sensitive uses or activities • Assets (subsurface infrastructure) in the vicinity of the site. • Other temporal sensitive receptors during construction/ excavation works.	Limited development potential	Vegetation Protection Overlay towards Bracewell Street	Vegetation Protection Overlay towards Bracewell Street; area adjacent to PUZ2
Public Park and Recreation PPRZ	• Municipal buildings and structures associated with non-sensitive uses or activities	Limited development potential	Albert Roy Reserve	Albert Roy Reserve Small reserve on corner of Bracewell Street and Walker Crescent
Public Conservation and Resource PCRZ	Environment	Limited development potential	Bendigo Regional Park	Bendigo Regional Park
Farming FZ	• Humans and assets at the neighbouring residential properties • Humans and assets (subsurface infrastructure) in the vicinity of the site. • Other temporal sensitive receptors during construction/ excavation works.	Limited development potential	Bracewell Street	Bracewell Street, Bonazza Road, unnamed track
Environmental Significance Overlay	Environment	Limited development potential	Devonshire Gully	Devonshire Gully; Dead Horse Gully
Vegetation Protection Overlay	Environment	Residential	Towards Bracewell Street	Bracewell Street to James street

6.9 Contingencies

Gas monitoring, data assessment and risk review will be carried out in accordance with the requirements of the EMP. It is expected that monitoring results will provide an early warning in the event that the LFG risk profile increases.

An elevated risk profile may occur as a result of a number of factors including, but not limited to, placement of final capping, compromised LFG extraction or exposure through earthworks. These may occur either onsite i.e. within the landfill itself, or offsite in adjacent properties and may be manifested by the following observations:

- Increased and sustained pressure-driven LFG migration.
- Increased and sustained concentration of CH_4 or CO_2 above adopted BPEM trigger levels.

An elevated risk profile will trigger contingency actions to be undertaken by relevant Council departments. Such actions may be implemented at or in the vicinity of the landfill and may include:

- Modification or extension of LFG extraction system to target areas of elevated gas generation;
- Construction of targeted gas interception trenches to mitigate LFG migration and facilitate passive venting and oxidation of methane;
- Installation of gas venting bores across the gas migration pathway and equipped with Baroballs© or equivalent to facilitate Passive Soil Vapour Extraction (PSVE).

In the event that such measures do not sufficiently mitigate the risk, Council may require that more rigorous building controls and monitoring protocols be adopted for developments in the area at risk.

6.10 Conceptual Site Model Summary

Key points and additional relevant information for the development of the conceptual site model are summarised below.

- Mine tailings and historical fill of uncertain nature have been deposited since 1860s.
- The age of putrescible and solid inert wastes landfilled since 1975 varies between the cells:
  - Cell 1 – over 40 years
  - Cell 2 – between 5-30 years
  - Cells 3a and 3b – over 10 years
  - Cell 5 – less than 5 years
- There remains about 4-6 years of airspace at the landfill. It is anticipated that until Cell 5 completion, the waste receival rates will not exceed historic volumes.
- Degradation of putrescible waste in the landfill is a primary source of LFG at the site. Monitoring indicates that cells 1, 2, 3a and 3b continue to generate LFG. LFG recovery data suggests that the landfill is a strong source of landfill gas. Methane concentrations in waste appear consistent with municipal waste (based on LFG extraction system reports). LFG generation is expected to increase with development of anaerobic conditions in Cell 5. It is anticipated LFG generation will continue for at least thirty years after rehabilitation of Cell 5.
- A leachate plume may represent a secondary source of LFG however given the inferred groundwater flow direction towards the south-west, migration towards the identified sensitive receptors located in the buffer in the north, northeast and east is unlikely. Currently there has been no evidence of a leachate plume in groundwater however since the largest and oldest landfill Cell 1 is unlined, migration of leachate to groundwater cannot be precluded. Saturated mine tailings may facilitate leachate migration and hence contribute to LFG migration but currently there is no evidence of this occurring.
- The landfill buffer area is likely to be underlain by extensive mine workings of uncertain depth and connectivity, which are generally aligned with the gold bearing geological structures. These

represent a potential pathway for LFG migration, provided the conduits are shallow and connectivity with the source exists (refer Figure F7A in Appendix A).

- The geology surrounding the waste footprint is generally considered to be a low permeability fractured weathered siltstone and sandstone. Preferential flow paths may exist along the zones of higher permeability thought associated with fold hinges and faults (refer Figure F7B in Appendix A).
- Local surficial permeable mine tailings appear to persist within the buffer zone to the east and potentially north east of the landfill (refer Figure F7B in Appendix A).
- For the closest receptors to the north of the landfill, the unsaturated profile varies in thickness, with at least 5m available for gas transport during periods of high water table and more than 10-15m available at other times. To the east of the landfill, there is at least 30m of unsaturated profile available for gas transport within the 250m zone. Currently reported and the historic elevated potentiometric surface may not be representative of the water table.
- The landfill buffer area is likely to be underlain by extensive mine workings of uncertain depth and connectivity, which are generally aligned with the gold bearing geological structures. These alignments intersect the landfilled area at several locations. Mine workings represent a potential pathway for LFG migration, provided the conduits are shallow and connectivity with the source exists. At the same time they will facilitate LFG dissipation / dissolution in presence of air.
- Manmade subsurface conduits such as utility services are limited to the immediate vicinity of the landfill (refer Figure F7C in Appendix A). Although methane has been detected at several onsite service pits in the area of the historical fill, there is no apparent offsite methane migration through subsurface services in the vicinity of the landfill.
- Approved intermediate capping over Cells 1 and 2 comprises over 1m of clay and doesn't include plastic membrane. Cells 3a and 3b have intermediate cover in place; Cell 5 will be closed in about 4-6 years and final capping of these cells will include clay and plastic membrane.
- Fugitive emissions to subsurface geology east and north of the landfill are not controlled in absence of side liners in Cells 1 and 2. Intended performance of the side liner system in Cells 3a and 3b appears compromised (refer Section 6.7.6.2) and it provides a preferential in-waste migration pathway and release point for fugitive emissions to subsurface geology at the north-western perimeter. The intact side liner in Cell 5 is expected to control fugitive emissions to subsurface geology along the north-western and south-western perimeter of the cell.
- Longer term liner deterioration may provide release points for fugitive emissions to subsurface geology north-western and south-western perimeter (Cells 3a, 3b and 5).
- There is no evidence of lateral LFG migration under pressure under current capping conditions (in combination with active LFG management). Results of cap emissions monitoring and sub-surface LFG monitoring suggest that pressure-driven advection is limited and potential fugitive emissions are controlled by methane oxidation. The available monitoring data suggests very low risk based on GSV (<0.07L/hr for methane and carbon dioxide).
- It is considered that capping conditions during the remaining operational and future fully rehabilitated states of the landfill will provide an effective vertical LFG migration barrier.
- Upon full site rehabilitation, LFG build up in the landfill is likely to increase and promote lateral pressure-driven emissions through subsurface geology. It is anticipated that active LFG extraction at the site which will continue until the end of viable LFG recovery and be followed by further flaring, will provide sufficient control over pressure-driven lateral migration of LFG.
- LFG extraction shutdown during the period of high LFG generation may cause various outcomes in the vicinity of the landfill cells at the site, such as summarised below:
    - Lateral LFG migration from Cell 1 in absence of low permeability liner. However given capping conditions and demonstrated natural attenuation of LFG in the vicinity of Cell 1, pressure driven migration is expected to be controlled by attenuation processes.

  - Since Cell 2 is bound by other cells, lateral LFG migration from this cell is not expected to occur to any significant extent.
  - Pressure build up in cells 3A/3B and 5 where low permeability liners are present and composite capping will be constructed. In cells 3A/ 3B lateral LFG migration through the side liner is known. In Cell 5 the composite low permeability liner is designed to contain built up LFG.

- It is anticipated that LFG management will continue at the site until LFG concentrations are reduced to levels that would pose no risk of offsite migration at harmful levels. Future LFG management at the landfill will continue in accordance with the rehabilitation and aftercare management plan, which will specify the length of aftercare period and associated LFG management measures including extraction system configuration, responsible parties, timeframes and contingency measures. These measures should also include contingencies in the event of premature LFG extraction failure. Such measures may include:
  - Implement LFG contingency plan as per contractor procedure and site rehabilitation plan;
  - Cells 3A and 3B – consider implementation of additional measures such as passive vent / trench;
  - Cell 5 – consider implementation of additional measures such as passive vent / trench.
- Methane is not a background gas in the vicinity of the landfill. Background concentrations of carbon dioxide are relatively elevated ($\geq$3%) in the vicinity of the landfill, potentially attributed to natural processes in the underlying geology.
- LFG related soil gas concentrations reported for the available perimeter monitoring bores indicates that lateral methane migration has been very limited (suggested by methane detected in BH26 and periodically in BH18, and historic occasional minor concentrations in several other perimeter bores). Results of LFG monitoring suggest that pressure-driven potential fugitive LFG emissions are controlled by natural attenuation processes.
- Methane oxidation is occurring around the Eaglehawk landfill, generally at rates exceeding that of migration. The observed concentrations of oxygen indicate there is significant capacity for further methane oxidation to occur. This is expected to continue in the future, at rates dependent on pressure-driven transport under the potential landfill aftercare management measures, i.e., capping, LFG extraction, possible passive management.
- Very low or insignificant gas flow rates at the bores closer to the landfill and low concentrations of CO_2 indicate that risk will not be any higher further away from the landfill, i.e., the worst case Qhg is a single value (0.08) corresponding to low risk (0.07-0.7) – refer Table 3 and Appendix C.

The LFGRA indicates that there are potential sources of CO_2 other than the landfill.

Qhg values shown in Figure F6 (Appendix A) indicate that the risks associated with methane and carbon dioxide are very low within most of the 250m band around the landfill. The density of data within the 250m band indicates a higher degree of confidence in the assessed level of landfill gas exposure and risk than in the band between 250m and the BPEM buffer of 500m. As distance from the landfill increases, attenuation will further reduce the concentration and flow rate of LFG, thus reducing the likelihood.

Monitoring of LFG flow rates will continue in the existing bore network and more bores are proposed to be installed in the 250 – 500m zone to provide an ongoing indication of landfill gas risk to sensitive receptors (refer Section 8.0).

To mitigate any increased gas flows arising from the capping and rehabilitation of the landfill, LFG extraction will continue post-closure until monitoring indicates the level of risk is acceptable.

7.0 Buffer Assessment

7.1 Buffer Definition

A buffer area is an area of prescribed width between adjoining land uses or developments that is created for the purpose of mitigating the impacts of one or more land uses and in which the carrying out of certain developments is restricted. In the case of the Eaglehawk landfill, where landfill gas represents a risk to buildings and structures and to human health, the default BPEM buffer distance is 500m.

The 500m buffer has been encroached by residential and industrial developments and there are planning provisions that would permit further development within this zone. A risk-based assessment of landfill gas risk is therefore required to ensure that these risks are appropriately managed and taken into account in consideration of future developments. The previous section presented the basis for the landfill gas risk assessment, including the identification of sources, pathways and receptors. This process informs the mapping of areas of potential LFG risk where more rigorous monitoring requirements and building standards may be required for developments such as dwellings and industrial facilities.

As shown in Figure F6 Appendix A Qhg values indicate that the risks associated with methane and carbon dioxide are very low within most of the 250m band around the landfill. The density of data within the 250m band indicates a higher degree of confidence in the assessed level of landfill gas exposure and risk than in the band between 250m and the BPEM buffer of 500m.

Within the 500m buffer a risk-based assessment assisted in designation of control areas where landfill gas risk can be defined on the basis of severity and likelihood and recognising that likelihood will reduce as distance from the landfill increases.

The Eaglehawk Landfill does not have clear buffers that conform to BPEM requirements. Residential and industrial land uses exist within the default BPEM buffer. Currently there are planning provisions that would permit further development within the buffer.

The 500m BPEM standard buffer distance has been adopted as the default, but since development has occurred within that distance, development controls are mapped on the basis of risk rather than proximity.

7.2 Assessment of Risk

The semi-quantitative risk assessment approach proposed in CIRIA 665 and BS8485 has been used for assessment of risk where adequate data was available i.e. from 0 - 250m of the landfill and as described in Section 6.2.

In the 250 – 500m zone, where data is sparse and mainly inferred, a qualitative risk assessment approach has been adopted based on the guidance documents referenced in Section 6.1, which included the following steps:

- Development of a conceptual model of the landfill and its surroundings, including information on the landfill as a source of hazards, landfill environmental setting, including the receptors, pathways to receptors and existing and future controls.
- Hazard identification and risk screening, including such elements as:
  - Source of risk;
  - Type and location of the receptors;
  - Pathways to the receptors; and
  - Prioritisation of receptors.

To evaluate the risks of migration, an assessment of likelihood was performed based on *Guidance on the Management of Landfill Gas* (UK EA, 2004). It is noted that this varies in detail from the assessment matrix presented in EPA Publication 1321 however the general approach is the same.

The tables below present the adopted ranges of **likelihood** (Table 9) and **severity** (Table 10) of events for use in the risk assessment based on AS/NZS ISO 31000:2009 and other relevant Australian and UK guidance.

Table 9 Categories of Likelihood

#	Category	Description / Frequency
1	Extremely Unlikely	No recorded or known incidents Might occur in situation and time frame / Incident occurs less than once in a million years
2	Very Unlikely	No recorded incidents Might occur under atypical conditions / Incident occurs between once per million and once every 10,000 years
3	Unlikely	Few recorded incidents Might occur but not expected to / Incident occurs between once per 10,000 years and once every 100 years
4	Somewhat unlikely	Some recorded incidents Might occur occasionally / Incident occurs between once per 100 years and once every 10 years
5	Fairly probable	Several recorded incidents Expected to occur / Incident occurs between once per 10 years and once per year
6	Probable	Multiple recorded incidents Almost certain to occur / Incident occurs at least once per year

Due to uncertainty in relation to subsurface conditions within the majority of the 500m buffer, it was conservatively assumed that pathways around the landfill will persist to the full extent of the 500m buffer, but the level of risk, as defined by the likelihood of a landfill gas event, will change with distance.

Table 10 Categories of Severity

Level	Category	Potential Impact		
		Human Health	Environment	Assets & Community
1	Minor	No injury or illness.	Nuisance on-site only.	No outside complaints; negligible financial loss
2	Noticeable	First aid required.	Noticeable off-site emissions. Maximum acceptable level of emission; no environmental harm.	Singular complaints; small financial loss.

Level	Category	Potential Impact		
		Human Health	Environment	Assets & Community
3	Significant	Temporary impairment, able to resume normal duties immediately.	Material and sustained off-site emissions. Breach of permissible limits but no environmental harm.	Community complaints. Potential penalty infringement notice; written direction from regulatory agency. Small financial loss.
4	Severe	Temporary impairment / hospital treatment required; unable to resume normal duties immediately.	Off-site emissions warrant public warning & off-site emergency plan invocation. Significant compliance parameter breach.	Minor public outcry / community meetings or local media coverage. Penalty infringement notice. Major financial loss.
5	Major	Extensive human injuries/ illness. Permanent impairment and/or disability as a result of injury or illness.	Widespread but not persistent damage to land. Serious toxic effect on beneficial or protected species.	Short term public outcry / state media coverage. Evacuation of local populace. Major financial loss.
6	Catastrophic	Fatality (s) as a result of injury or illness.	Serious irreversible off-site impact.	Serious ongoing public outcry / national media coverage. Site shutdown; immense financial loss.

Consequences associated with LFG hazards (i.e. explosion, asphyxiation, vegetation die back, infrastructure deterioration) have not changed since the previous LFGRA (LFG Risk Assessment, URS 2015).

The **risk score** is evaluated as the product of likelihood and consequence, as shown in Table 11. The risk score is a quantitative rating of the level of risk, showing a gradation from 1 to 36. For the purpose of this assessment, the ratings are grouped into three, as shown in Table 12, along with the proposed mitigation measures for each grouping.

Table 11 Evaluation of Risk Score (Severity – Likelihood Matrix)

			Severity of Consequence					
			1	2	3	4	5	6
			Minor	Noticeable	Significant	Severe	Major	Catastrophic
Likelihood of Occurrence	1	Extremely Unlikely	1	2	3	4	5	6
	2	Very Unlikely	2	4	6	8	10	12
	3	Unlikely	3	6	9	12	15	18
	4	Somewhat Unlikely	4	8	12	16	20	24
	5	Fairly Probable	5	10	15	20	25	30
	6	Probable	6	12	18	24	30	36

Table 12 Risk Categorisation and Management

Risk Score	Risk Evaluation	Management Actions (from EPA Pub. 1321)	Recommended Measures	
			Landfill Management	Planning Department
6 or less	Acceptable without review	None required; continue routine management / monitoring practices.	Continue LFG management and monitoring as per landfill licence and aftercare management plan.	
>6 to 15	Acceptable with review	Review existing management practices and control measures for effectiveness; update if required and continue to implement as part of routine management and monitoring practices.	• Review LFG management. • If the ongoing monitoring as per EMP indicates elevated site risk profile, inform planning department to trigger planning controls.	Require specific LFG monitoring for construction, road / service maintenance works*.
16 or more	Tolerable with further action measures and review	Develop and implement additional measures to confirm and/or mitigate identified risks, such as additional monitoring or control measures.	• Implement additional on-site LFG management and monitoring as per landfill licence and aftercare management plan. • Inform planning department to trigger implementation of planning controls.	Planning proposal should require case specific LFGRA as per EPA Publication 1642 (2017).

* Note - The gas protection scores may change over time and should therefore be reviewed on the basis of LFG monitoring. Approval of any new development should be subject to Council assessment of monitoring results at the time of the application

In the context of this assessment, the above actions should be applied to implementation of planning controls.

7.3 Designation of Risk

The risk assessment in relation to the adopted receptor groups, which have been mapped according to land uses (residential/school, industrial and land with limited development potential), is illustrated in Table 13.

As discussed in Section 6.4, 250m distance from landfill contains the majority of the LFG monitoring bores. The assessment of Qhg values of these bores, shown in Figure F6, Appendix A, confirms that the level of risk for both methane and carbon dioxide is very low for most locations within this zone. Recognising that the likelihood of a landfill gas event increases as distance to the landfill decreases, the risk is higher within 250m, than within the 250 – 500m distance of the landfill.

Within the 500m buffer, the level of risk is determined on the basis of the coincidence of severity (receptors) with pathways (mine workings, tailings, underground services, lithology and geological structure).

Where the maximum risk score is above 6, the cell in Table 13 is highlighted in **bold**. Similarly, areas of overlapping pathways and receptors identified above are shown in Figures F7A- F7C in Appendix A, which form the basis for mapping of control areas around the landfill.

The risk assessment indicated that, if best practice landfill management is implemented at the site until closure and during rehabilitation and aftercare periods, the conditions at Eaglehawk landfill will generally control lateral fugitive LFG emissions and that natural attenuation processes will further mitigate fugitive emissions. The identified risks all rated as acceptable. Higher risk rates associated with more severe potential consequences will require review / action.

Table 13 Risk Assessment

Source			Existing Controls	Future Controls	Pathways	Receptor Group	Zones	Severity	Max Severity Score	250m			500m		
Cell	Year Open	Liner System								Likelihood & Score		Risk	Likelihood & Score		Risk
1	1975	No liner system	• Natural attenuation • Capping • LFG extraction • Structural discontinuities are tight and no methane emissions have been recorded • Low permeability and no methane emissions have been recorded	• LFG extraction • Aftercare management / monitoring • Natural attenuation • Capping and rehabilitation • Survey for mine workings prior to development • Ensure implementation of LFG Risk Management Plan	Mine workings Figure 7A	Residential / School	GRZ, PUZ2	Severe / major	5	Unlikely	3	**15**	Very unlikely	2	**10**
						Industrial	IN1Z, IN3Z	Minor / Significant	3	Unlikely	3	**9**	Very unlikely	2	6
						Limited development potential	PCRZ, PPRZ, PUZ7	Minor	1	Unlikely	3	3	Very unlikely	2	2
					Tailings Figure 7B	Industrial	IN1Z, IN3Z	Minor / Significant	3	Somewhat unlikely	4	**12**	Extremely unlikely	1	3
						Limited development potential	PPRZ	Minor	1	Somewhat unlikely	4	4	Extremely unlikely	1	1
					Underground services Figure 7C	Residential / School	GRZ	Severe / major	5	Unlikely	3	**15**	Very unlikely	2	**10**
						Industrial	IN1Z, IN3Z	Minor / Significant	3	Unlikely	3	**9**	Very unlikely	2	6
					Lithology / Geological structure Figure 7B	Residential / School	GRZ, PUZ2	Severe / major	5	Unlikely	3	**15**	Extremely unlikely	1	5
						Industrial	IN1Z, IN3Z	Minor / Significant	3	Unlikely	3	**9**	Extremely unlikely	1	3
						Limited development potential	PPRZ, PUZ7	Minor	1	Unlikely	3	3	Extremely unlikely	1	1
2	1998	Compacted clay liner (base)	• Clay basal liner • Natural attenuation												
3A and 3B	2008	Engineered composite base liner and side liner	• Engineered basal liner and side liner • Natural attenuation • LFG extraction • Structural discontinuities are tight and no methane emissions have been recorded • Low permeability and no methane emissions have been recorded	• LFG extraction • Aftercare management / monitoring • Natural attenuation • Capping and rehabilitation • Survey for mine workings prior to development • Ensure implementation of LFG management plan.	Mine workings Figure 7A	Residential / School	GRZ	Severe / major	5	No receptor within 250m			Extremely unlikely	1	5
						Limited development potential	PCRZ, PUZ7	Minor	1	Unlikely	3	3	Very unlikely	2	2
					Underground services Figure 7C	Residential / School	GRZ	Severe / major	5	No receptor within 250m			Very unlikely	2	**10**
						Industrial	IN1Z, IN3Z	Minor / Significant	3	No receptor within 250m			Very unlikely	2	6
					Lithology / Geological structure Figure 7B	Residential / School	GRZ	Severe / major	5	No receptor within 250m			Extremely unlikely	1	5
						Industrial	IN1Z, IN3Z	Minor / Significant	3	No receptor within 250m			Extremely unlikely	1	3
						Limited development potential	PCRZ, PUZ7	Minor	1	Unlikely	3	3	Extremely unlikely	1	1

Source			Existing Controls	Future Controls	Pathways	Receptor Group	Zones	Severity	Max Severity Score	250m			500m		
Cell	Year Open	Liner System								Likelihood & Score		Risk	Likelihood & Score		Risk
5	2013	Engineered composite base and side liner	• Composite basal and side liner • Natural attenuation	• LFG extraction • Aftercare management / monitoring • Natural attenuation • Capping and rehabilitation	Liner failure (no pathway unless liner system fails)	Limited development potential	PCRZ	Minor	1	Extremely unlikely	1	1	Extremely unlikely	1	1
							FZ*	Severe / major	5	Extremely unlikely	1	5	Extremely unlikely	1	5

* There is no apparent pathway connecting Cell 5 and FZ.

7.4 Gas Protection Scores and Building Control Measures

BS8485 provides an approach to defining scores which are the basis for gas protection measures. The Characteristic Gas Situation (CS) is calculated on the basis of the GSV, as shown in Table 14.

Table 14 CS by site characteristic GSV (after BS8485)

CS	Hazard Potential	Site Characteristic GSV (L/hr)	Additional Factors
1	Very low	<0.07	Typical <1% methane concentration and <5% carbon dioxide concentration (otherwise consider an increase to CS2)
2	Low	0.07 - <0.7	Typical measured flow rate <70 L/h (otherwise consider an increase to CS3)
3	Moderate	0.7 - <3.5	-
4	Moderate to high	3.5 - <15	-
5	High	15 - <70	-
6	Very high	>70	-

As indicated in the monitoring data (Appendix C) gas flow rates are in the range 0-0.1 L/hr and methane and carbon dioxide concentrations are generally low, indicating GSV values are in the range CS1 – CS2. The record also indicates that this situation has not changed over time and is therefore reflective of the general landfill management status, which is unlikely to deteriorate in the future.

With the higher rating (CS2), BS8485 defines minimum gas protection scores as follows:

Type A Building – Conventional residential house at grade Score 3.5

Type B Building – School and apartments or hospital, at grade Score 3.5

Type C Building – Office building with basement Score 2.5

Type D Building – Large floor plant retail/commercial at grade Score 1.5

BS8485 proposes a number of gas protection measures that could be employed to mitigate landfill gas risk, according to the gas protection scores. In many cases these measures may not be required, however a site specific assessment of gas flows and concentrations would need to be conducted to assess whether the CS for the site rates as 1 or 2. Table 15 below summarises the building control measures that are proposed for building at a site classified as CS2. If the site classifies as CS1, then no specific landfill gas control measures would be required.

Note that, according to BS8485, the gas protection system should consist of at least two of the elements shown in Table 15.

Monitoring of all bores indicated GSV values were generally very low (<0.07 L/hr), so it is assumed that in the 250 – 500m band, flow rates and hence GSVs could not be higher and the CS values would be 1.

Table 15 Building Control Measures

Type of building	Minimum Gas protection score	Floor construction	Ventilation	Gas membrane
Residential house (Building Type A)	3.5	Suspended floor	Ventilated underfloor void	Gas resistant membrane
Apartment (Building Type B)	3.5	Slab base construction	Low fines gravel blanket draining to	Gas resistant membrane

Type of building	Minimum Gas protection score	Floor construction	Ventilation	Gas membrane
			gravel trench around building	
Office building with basement car park (Building Type C)	2.5	Slab base construction	Well ventilated basement car park	Gas resistant membrane
Large floor plant retail/commercial (Building Type D)	1.5	Slab base construction	Dispersal layer beneath slab	Gas resistant membrane

7.5 Mapping of Control Areas

Control areas have been designated where the risk scores are greater than 6, based on overlapping of pathway and receptor areas, as illustrated in figures F7A through to F7C. They have been mapped on the basis of cadastral plans (parcel boundaries) and existing planning zones, indicating where individual properties are at potential risk with respect to landfill gas migration. It is noted that in several areas planning zones and cadastral boundaries don't match.

Based on assumptions in relation to likelihood of pathway realisation, risk scores are generally higher within the 250m band. Maximum risk scores of 15 and 10 have been calculated for Residential receptor group lying within the 250m band and the 250-500m band, respectively. Maximum risk scores of 9 and 12 have been calculated for Industrial receptor group lying within the 250m band.

The control areas have been grouped based on elevated risk scores ($\geq$6) and accordingly to the CS status, i.e. adopted CS of 2 within 250m band and 1 within 250-500m band.

The results of the risk assessment, including designated controls and the areas where controls should be implemented for new planning proposals, are presented in Table 16 and mapped in Figures F8A and F8B (Appendix A).

The control areas provide the basis for planning controls. Implementation of the proposed control measures should be commensurate with LFG risk suggested by monitoring, which is anticipated to continue in accordance with Eaglehawk landfill rehabilitation and aftercare management requirements until the landfill poses no unacceptable risk of offsite LFG emissions.

Control measures, where required, need to be implemented, such as relevant protective measures in new buildings based on international building standards such as British Standard 8485:2015.

In the absence of specific soil gas data for the potential future developments in areas of potential LFG-related risks, site-specific LFG risks should be confirmed through monitoring of LFG concentrations.

The characteristic gas situation (CS) and hence gas protection scores may change over time and therefore they should be reviewed on the basis of LFG monitoring. Approval of any new development should be subject to Council assessment of monitoring results, based on the EMP, at the time of the application.

Table 16 BS8485 Gas Protection Scores

Description	Control Area (Figure F8A-F8B)	Planning Zone	Qualitative Risk Score	CS[1]	Building Type[2]	Minimum Gas Protection Score for new buildings[3]
Areas zoned residential	1	GRZ	15	2	A, B	3.5
Area zoned residential / school mainly between 250m and 500m from the landfill	2	GRZ	10	1	A, B	0 (i.e. no building protection measures).
Areas zoned industrial generally within 250m of landfill	3	IN1Z	9-12	2	C, D	1.5 – 2.5

[1] Refer BS 8485 Table 2 – CS2 corresponds to a GSV value between 0.07 and <0.7 L/hr

[2] Refer BS 8485 Table 3 – Type A, B corresponds to private or commercial/public buildings, Type C, D corresponds to commercial/public and commercial/industrial buildings

[3] Refer BS 8485 Table 4

8.0 Monitoring Recommendation

Assessment of landfill gas risk is based on an appropriate monitoring program and while the 250m zone is adequately served by the existing network, the risk assessment has identified two areas of residential land between 250m and 500m where the coverage is not commensurate with the identified risk. To address this issue, it is proposed to install bores in this area at approximate locations shown in Figure F9 (Appendix A).

It is recommended that these bores be drilled and that monitoring of gas concentration and flow rate be incorporated into the current monitoring program, which should continue in accordance with the EMP. In addition, monitoring of underground service pits in the residential areas should be incorporated into the monitoring plan.

Data assessment and risk review should be undertaken in accordance with the responsibility matrix within the EMP.

9.0 Outcomes of Assessment

Migration of landfill gas from landfills can present a human health and environmental risk for receptors on adjacent land. Although the BPEM recommends that a 500m buffer should be maintained between a landfill and sensitive land uses (receptors), there is no designated buffer around the Eaglehawk landfill and existing residential, commercial and industrial developments encroach to within 500m of the facility.

The majority of LFG monitoring locations and collected data fall within 250m of the landfill and the available monitoring data suggests very low risk in this band based on GSV (<0.07L/hr for CH_4 and CO_2). It is assumed that in the 250 – 500m band, GSVs could not be higher because attenuation will further reduce the concentration and flow rate of LFG as distance increases.

The density of data within the 250m band indicates a higher degree of confidence in the assessed level of landfill gas exposure and risk than in the band between 250m and the BPEM buffer of 500m.

The landfill gas risk assessment of sources, pathways and receptors in the land surrounding the landfill indicates that there are areas where residential and industrial developments may be underlain by pathways created by mine workings, tailings, underground services and / or lithology (refer Figures F7A-7C, Appendix A). In such areas the assessment indicates risk scores ranging from >6 to 15 (Figures F8A-8B, Appendix A), therefore requiring planning controls.

However, it is not concluded in the assessment that the buffer be reduced. As discussed in Section 6.4, the 500m BPEM standard buffer distance has been adopted as the default, but since development has occurred within that distance, development controls should be mapped on the basis of risk rather than proximity. Therefore the assessment and mitigation measures are discussed for development within 0-250 m of the landfill and 250-500 m of the landfill. Landfill management, including but not limited to monitoring, will inform the need to implement planning controls put in place based on this assessment. Mitigation should be proportionate to risk.

If the ongoing monitoring as per EMP indicates an elevated site risk profile, LFG management measures should be reviewed and modified and planning department should be informed to trigger planning controls (such as building control measures).

Landfill management documentation is in place for both the operation and aftercare phase which sets out the monitoring and assessment program and triggers and actions. This document is expected to be periodically revised and updated as necessary. Future developments must be implemented in accordance with appropriate risk mitigation measures commensurate with suggested planning controls, including OHS and building standards. Such measures may include:

- Within 500m of the landfill – any sensitive use with a risk score of 6 or less wouldn't require management actions apart from routine LFG management and monitoring (as per landfill licence);
- Uses with a risk score between 6 and 15 would require review of effectiveness of existing OHS management practices and control measures and implementation of protection measures based on international building standards such as British Standard 8485:2015;
- If future LFG conditions result in risk scores over 15, future residential or industrial developments will require assessments on a case by case basis as per EPA Publication 1642 (2017).

A summary of the main assessment outcomes, including the proposed planning actions in relation to identified risks to the receptors is presented in Table 17 below.

Table 17 Summary of Assessment Outcomes and Proposed Mitigation

Element	Assessment	Mitigation
LFG Sources		
Primary – decomposition of waste	LFG from MSW landfills typically comprises 60% CH_4 and 40% CO_2 at the most active period of biodegradation. Current estimates indicate methane generation at around 3 - 4 million m^3 a year.	Landfill rehabilitation and aftercare management, including leachate and LFG management, will continue to control potential fugitive LFG emissions.
Secondary – volatilisation from leachate impacted groundwater	A leachate plume in groundwater has not been identified, but in absence of liner in the largest and oldest landfill Cell 1, migration of leachate to groundwater cannot be precluded.	
Subsurface Pathways		
Natural geology	Through fractures in the basement rocks, weathered zones and porous sediments and rocks	Aftercare management measures, including LFG monitoring, will provide early indication of potential fugitive emissions. Expand monitoring in the 250 – 500m zone of the landfill and continue monitoring in accordance with the EMP.
Mine tailings	Unsaturated permeable mining residues beneath the waste make up a significant pathway for gas migration	
Mine workings	The landfill is located in an area underlain by extensive mine workings of uncertain depth and connectivity, which are generally aligned with the gold bearing geological structures and may provide preferential LFG migration pathways.	Recommend Council implement a process whereby if any new mine shafts are identified within 500m of the landfill, the planning department be notified and such notification should inform any future planning permit approvals in accordance with applicable mitigation measures as per Table 11 and Table 15 in this document.
Underground services	Service conduits to industrial and urban areas provide a potential pathway for gas migration.	Aftercare management measures, including LFG monitoring, will provide early indication of potential fugitive emissions. Ensure sub-surface services do not intersect the landfill.
Barriers to migration and attenuation processes	• Low permeability of natural geology • Engineered liners • LFG extraction systems • Methane oxidation • Building standards	• Landfill rehabilitation and aftercare management measures, as above. • If required, compliance with international building standards to ensure foundation / side gas emission barriers and appropriate management measures.

Element		Assessment	Mitigation
Receptors	**Zones**	**Risk Rating**	**Potential Mitigation Measures**
Residential / School	• GRZ; • PUZ2	• Maximum 15, generally within 250m of landfill - acceptable with review; • Maximum 10, mainly between 250m and 500m from the landfill - acceptable with review.	Development within area shown as Control Area 1 in **Figure F8A-8B** Appendix A should require gas protection measures according to Gas Protection Score 3.5 (BS8485 Table 4). Development within area shown as Control Area 2 in Figure F8A-8B does not require gas protection measures (BS8485 Table 4). Control Areas 1 and 2 - Require Landfill gas monitoring for construction, road / sub-surface utility maintenance works.
Industrial	• IN1Z • IN3Z	Maximum 9-12, acceptable with review	Development within area shown as Control Area 3 in **Figure F8A-8B** Appendix A should require gas protection measures according to Gas Protection Score 1.5-2.5 (BS8485 Table 4). Control Area 3 - Require landfill gas monitoring for construction, road / sub-surface utility maintenance works.
Limited development potential	• PUZ7 • PPRZ • PCRZ • FZ	All < 6, acceptable without review.	No action based on existing zoning within default 500m buffer area.
Road zone RDZ2 and zone PUZ1 (services) were grouped with the adjacent residential/school or industrial receptors, to account for potential risk to construction / maintenance workers. Control Areas 1 and 2- Require landfill gas monitoring for construction, road / sub-surface utility maintenance works.			

10.0 References

BS 8485:2015, 2015. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (British Standard 8485:2015).

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11.0 Standard Limitation

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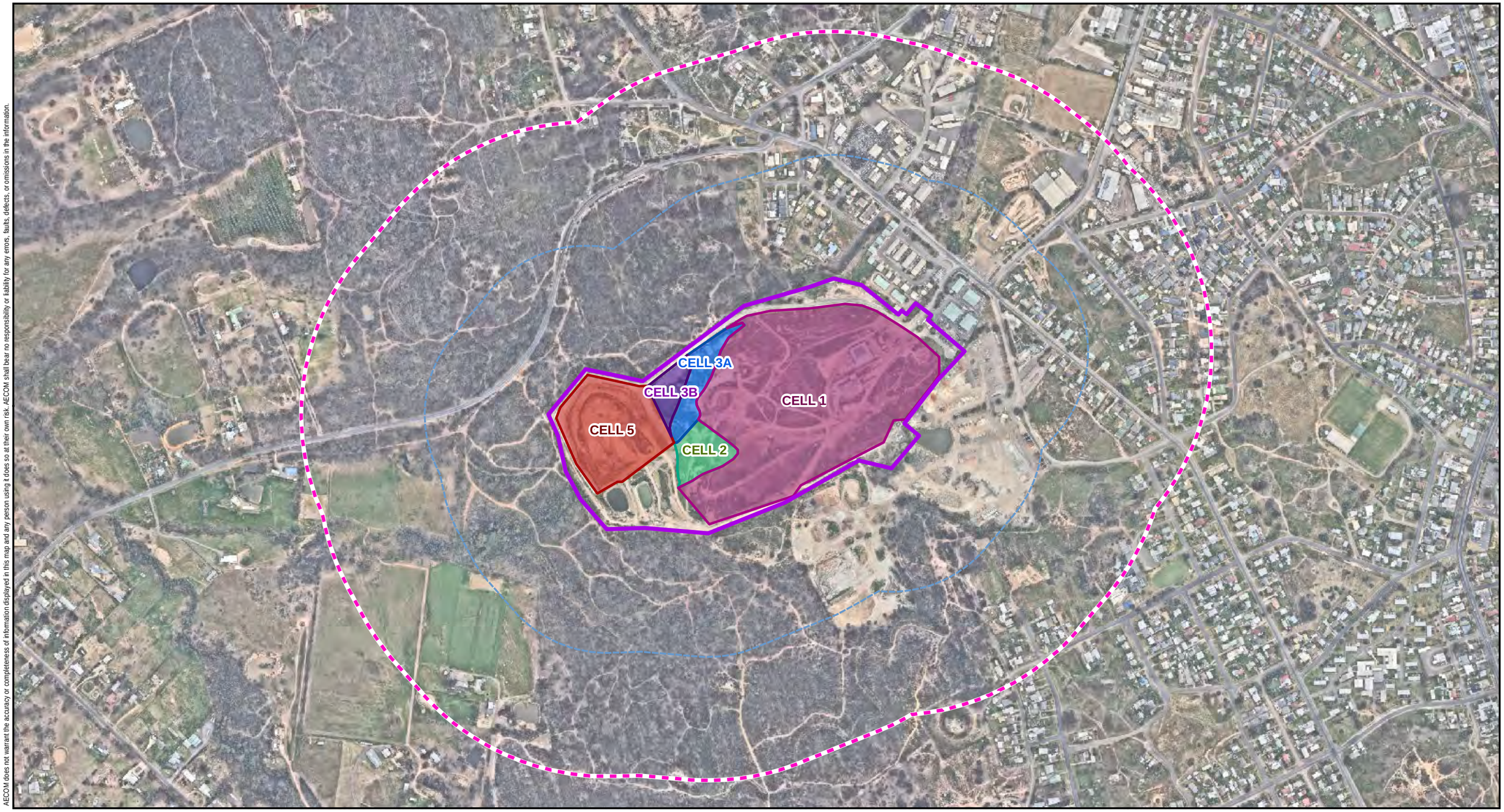
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Appendix A

Figures

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DATUM GDA 1994, PROJECTION MGA ZONE 55

0 80 160 240 320
metres

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Legend

- 250m zone
- 500m buffer
- Landfill Boundary
- Cell 1 – no liner system
- Cell 2 – base clay liner
- Cell 5 – engineered base and side liner
- Cells 3A – engineered base liner
- Cells 3B – engineered base liner

Data sources:
Base Data: Vicmap (c) 2017 (Imagery: Nearmap)



BUFFER ASSESSMENT STUDY AREA

City of Greater Bendigo

Eaglehawk Landfill

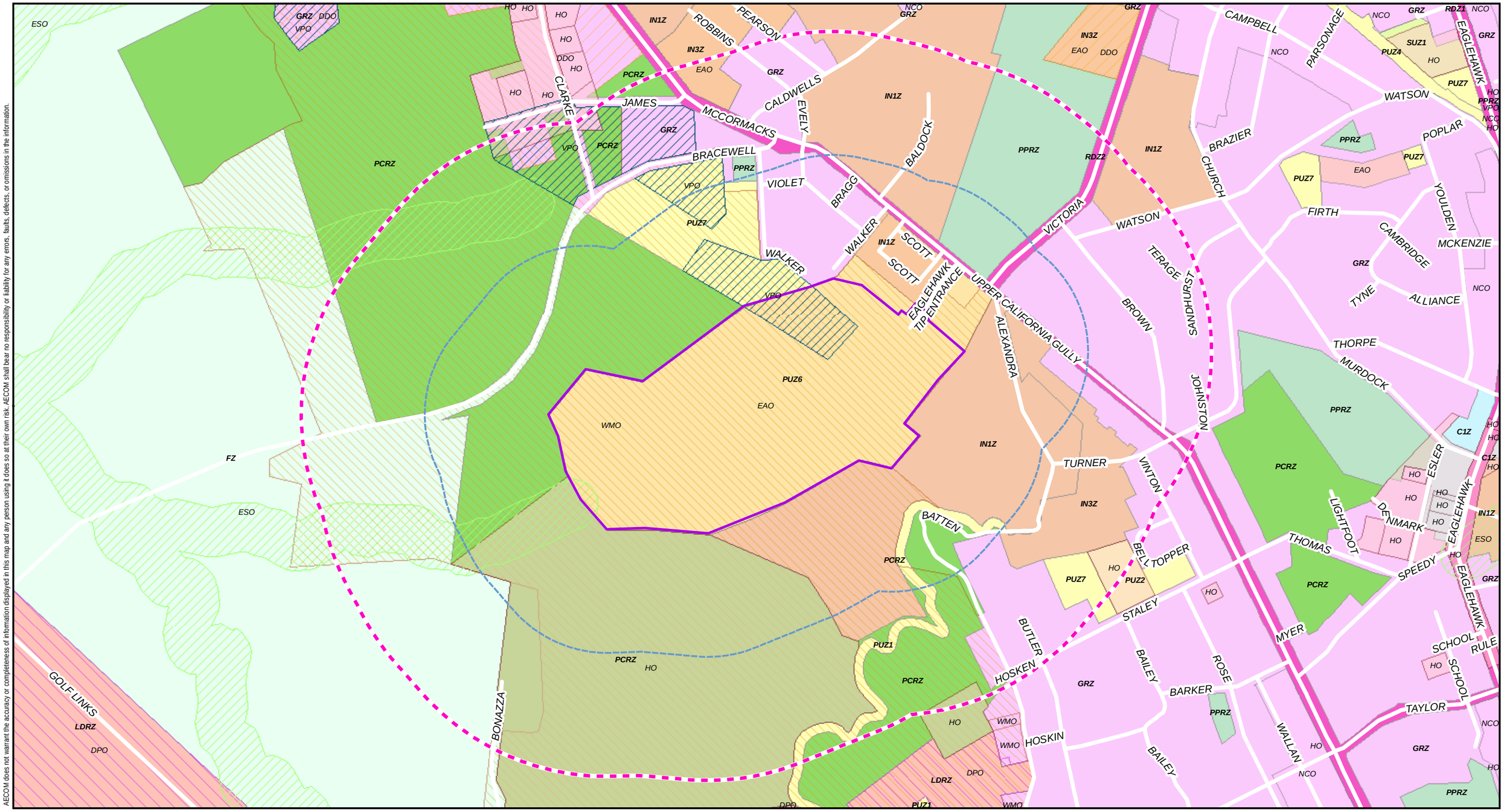
Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure
F1

Map Document: (P:\605X\60579200\4. Tech Work Area\4.99 GIS\MXDS\2019\06\Report\F1_Study Area.mxd)

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Legend

- 250m zone
- 500m buffer
- Licence boundary

Planning Zones

- Commercial Zone
- Farming Zone
- General Residential Zone
- Industrial Zone
- Low Density Residential Zone
- Public Conservation and Resource Zone
- Public Park and Recreation Zone
- Public Use Zone
- Road Zone
- Special Use Zone

Planning Overlays - Heritage

- Design Development Overlay
- Development Plan Overlay
- Heritage Overlay
- Neighbourhood Character Overlay

Planning Overlays - Environment

- Environmental Significance Overlay
- Vegetation Protection

Planning Overlays - Other

- Environmental Audit Overlay
- Wildfire Management Overlay

Data sources:
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BUFFER ASSESSMENT STUDY AREA ZONE OVERLAYS

City of Greater Bendigo

Eaglehawk Landfill

Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure
F2

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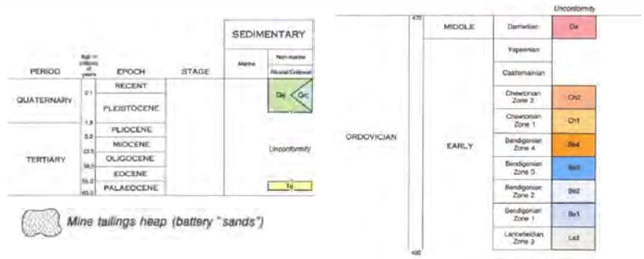
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Legend

- LFG Bore - Active
- LFG Bore - Destroyed
- GW Bore - Active
- GW Bore - Decommissioned
- Leachate bore
- ASQ Bores
- Geological Cross Sections
- 250m zone
- 500m buffer
- Cadastre
- Licence boundary
- Cell 1 – no liner system
- Cell 2 – base clay liner
- Cell 5 – engineered base and side liner
- Cells 3A – engineered base liner
- Cells 3B – engineered base liner

Data sources:
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BUFFER ASSESSMENT - GEOLOGY AND BORE HOLE LOCATIONS

City of Greater Bendigo

Eaglehawk Landfill

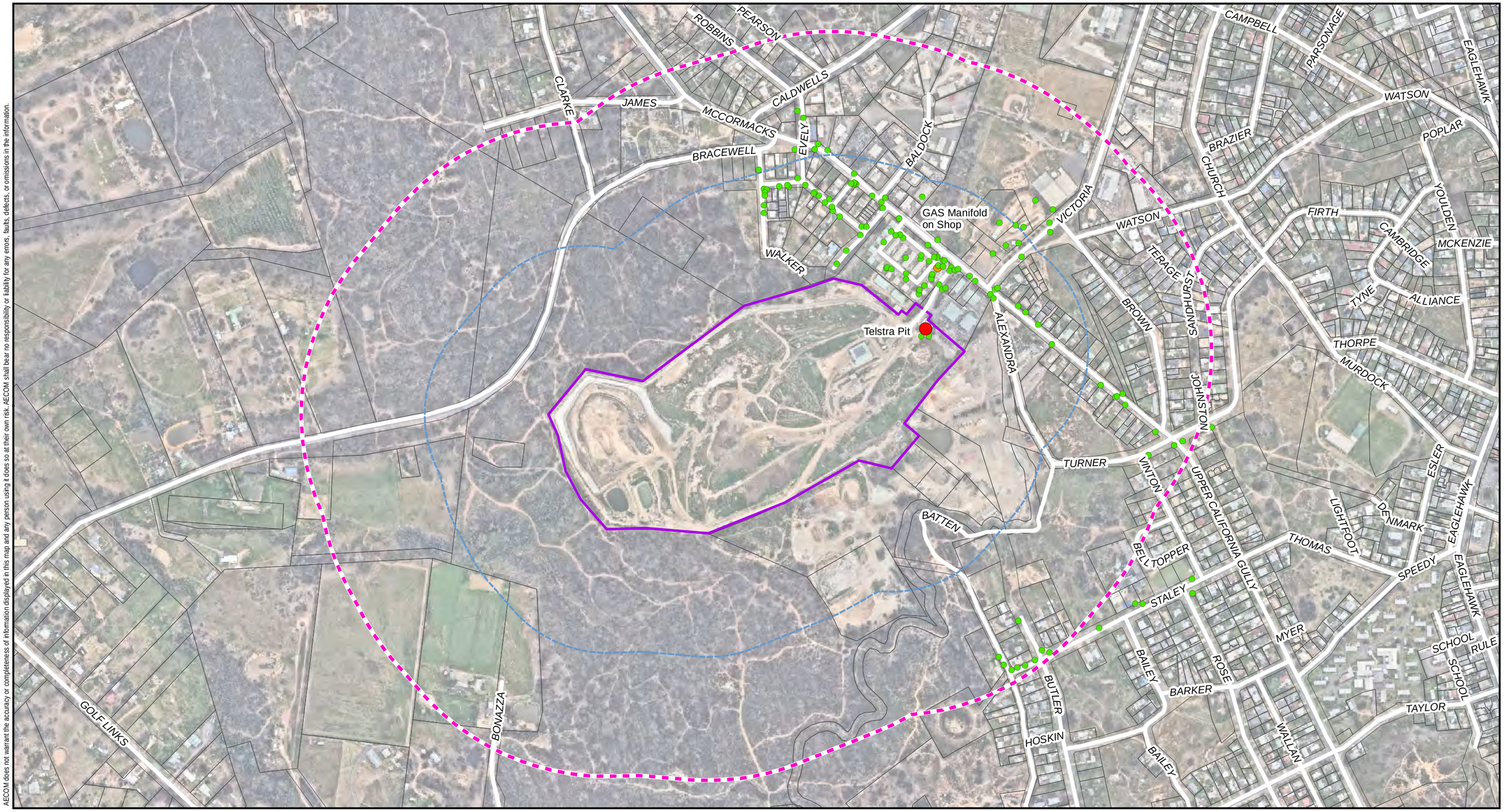
Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure
F3

Map Document: (P:\605X\60579200\4. Tech Work Area\4.99 GIS\MXDS\2019\06\Report\F3_Geology_Bore_location.mxd)

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LEGEND

- Licence boundary
- 250m zone
- 500m buffer
- Cadastre

CH4 (ppmv)

- <10
- 10 - 100
- 101 - 1000
- >1000

Data sources:
Base Data: Vicmap (c) 2017 (Imagery: Nearmap)

JUNE 2018 OFF SITE SERVICES AND PITS WALKOVER RESULTS (METHANE)

City of Greater Bendigo

Eaglehawk Landfill Buffer Assessment

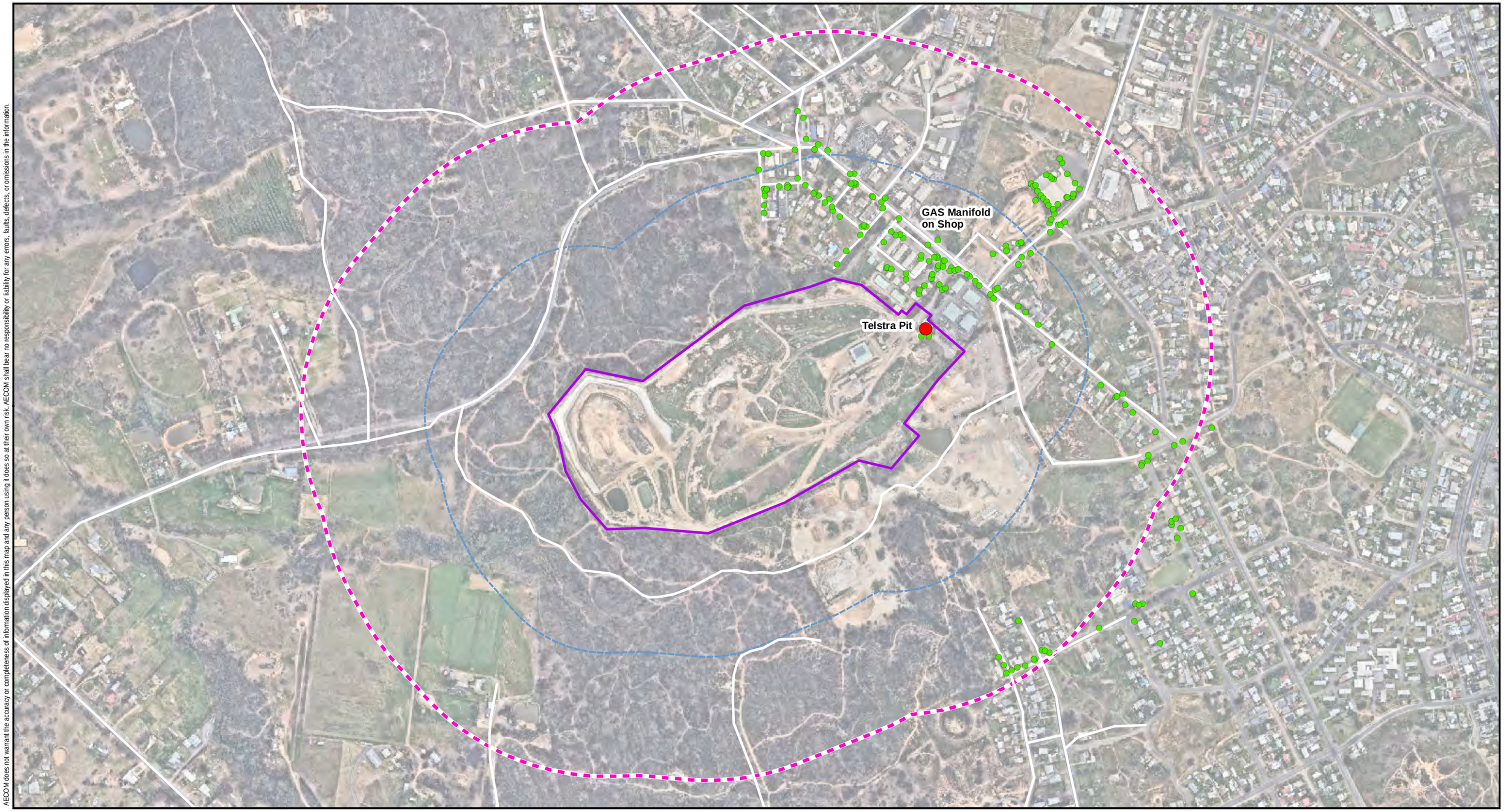
Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure
F4A

Map Document: (P:\605X\60579200\4. Tech Work Area\4.99 GIS\MXDS\2019\06\Report\F4a_June_Services_walkover.mxd)

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LEGEND

- Licence boundary
- 250m zone
- 500m buffer

CH4 (ppmv)

- <10
- 10-100
- 101-1000
- >1000

Data sources:
Base Data: Vicmap (c) 2017 (Imagery: Nearmap)

AUGUST 2018 OFF SITE SERVICES AND PITS WALKOVER RESULTS (METHANE)

City of Greater Bendigo

Eaglehawk Landfill Buffer Assessment

Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

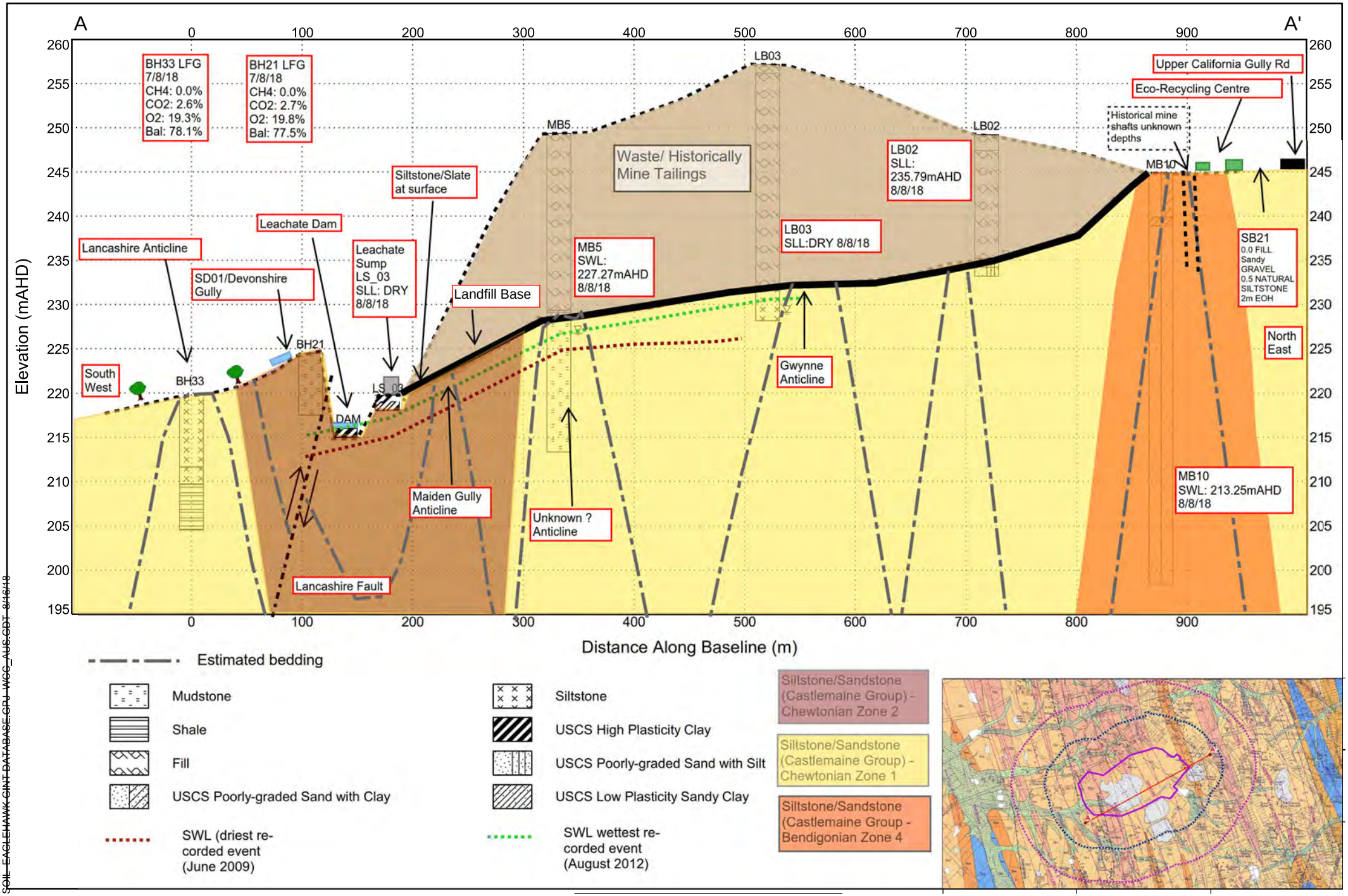
Figure
F4B

Map Document: (P:\605X\60579200\4. Tech Work Area\4.99 GIS\MXDS\2019\06\Report\F4b_June_Services_Walkover.mxd)

A4 size

FIGURE - F5A

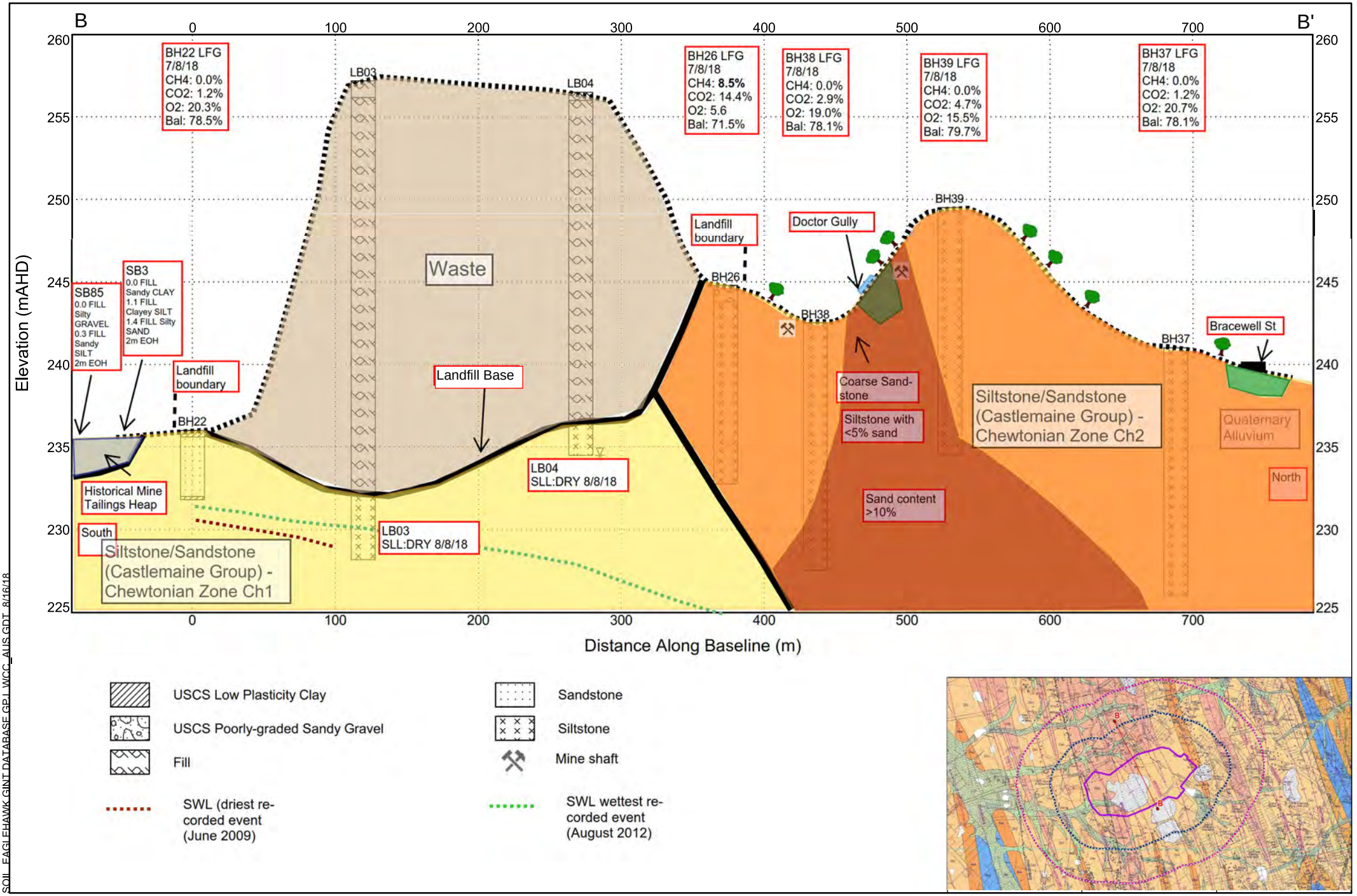
SECTION A - A'



SOIL_EAGLEHAWK_GINT_DATABASE.GPJ_WGC_AUS.GDT_8/16/18

FIGURE - F5B

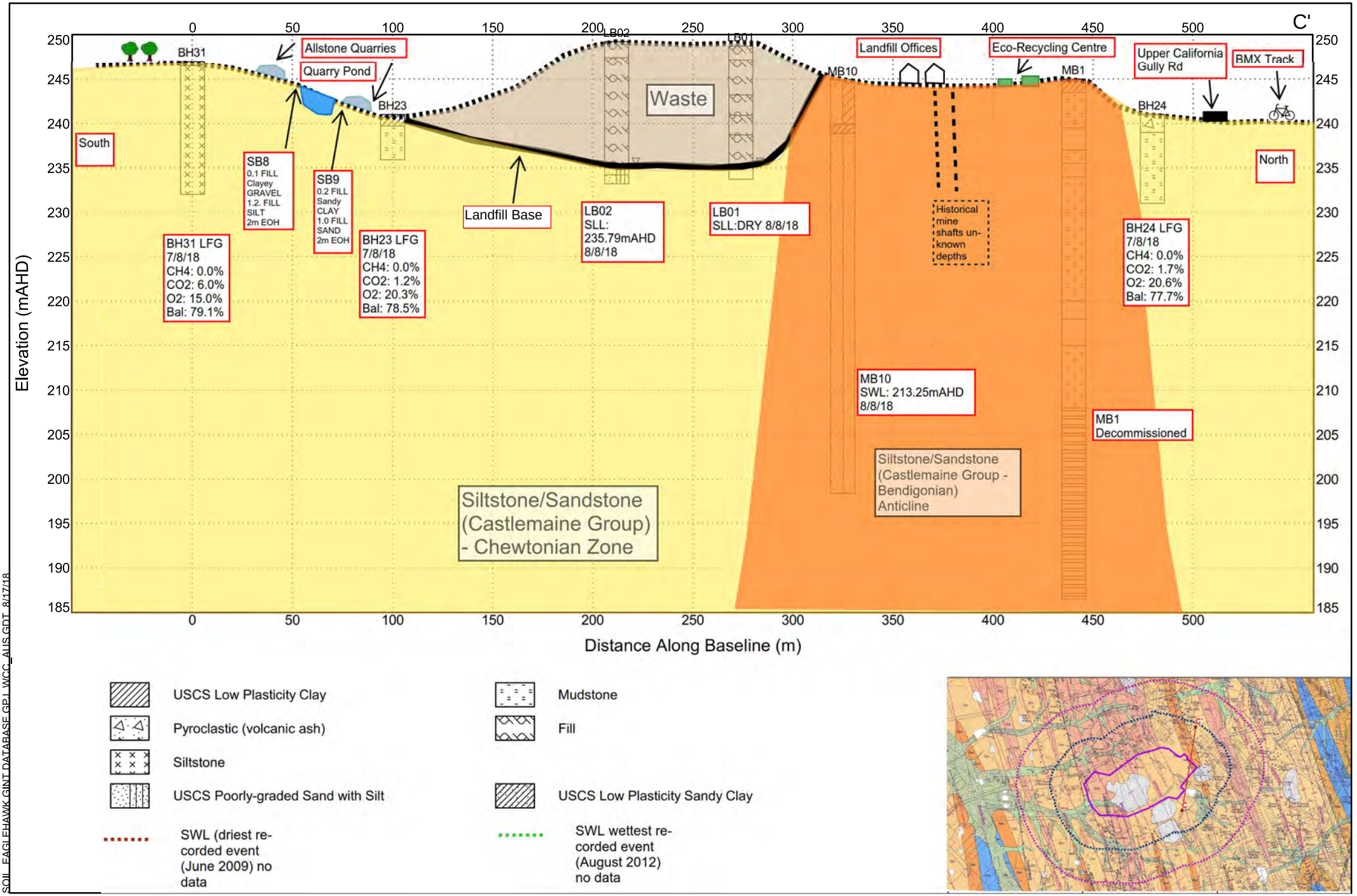
SECTION B-B'



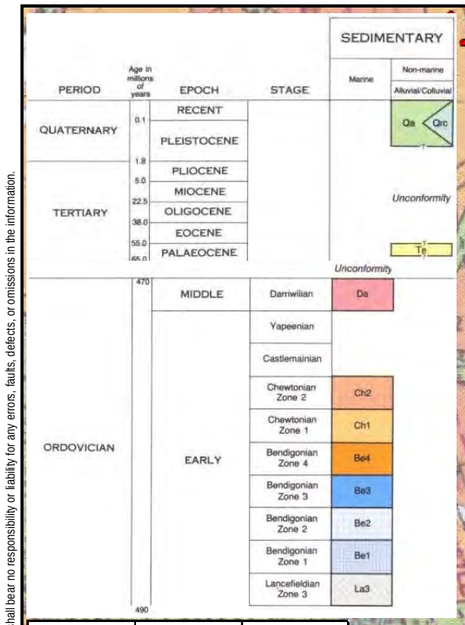
SOIL_FAGLEHAWK GINT DATABASE.GPJ WCC_AUS.GDT 8/16/18

FIGURE - F5C

SECTION C-C'



SOIL_FAGLEHAWK GINT DATABASE.GPJ WCC_AUS.GDT 8/17/18



Bore	Qhg (CH4)	Qhg (CO2)
BH01	0.0004	0.0026
BH02	0.0024	0.0056
BH03	0.0003	0.0166
BH04	0.0004	0.03
BH05	0.0001	0.006
BH06	0.0002	0.013
BH07	0.0003	0.0105
BH08	0.0004	0.0101
BH09	0.0001	0.02
BH10	NA	NA
BH11	NA	NA
BH12	NA	NA
BH13	NA	NA
BH14	NA	NA
BH15	0.0001	0.0091
BH16	NA	NA
BH17	0	0.0079
BH18	0.0624	0.0704
BH19	0	0.075
BH20	0.003	0.0058
BH21	0	0.0665
BH22	0.0006	0.0912
BH23	0.0006	0.0252
BH24	0	0
BH25	0	0.0475
BH26	0.066	0.0785
BH27	0	0.0426
BH28	0.0001	0.0054
BH29	0	0.0826
BH30	0	0.0039
BH31	0	0
BH32	0	0.022
BH33	0	0.0145
BH34	0	0.0165
BH35	0	0.0245
BH36	0	0.0216
BH37	0	0.0276
BH38	0	0.0029
BH39	0	0.0047
BH40	0	0.0026

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

PROJECT ID 60579200
CREATED BY TS
LAST MODIFIED vera.levina 02 JUL 2019

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 80 160 240 320
metres

1:7,500 when printed at A4

Legend

- Mineshafts
- 250m zone
- 500m buffer
- Licence boundary
- Cell 1 – no liner system
- Cell 2 – base clay liner
- Cell 5 – engineered base and side liner
- Cells 3A – engineered base liner
- Cells 3B – engineered base liner

Borehole hazardous gases flow rate

CH4 | CO2
< 0.07 - very low risk
> 0.07 & < 0.7 - low risk

Mine tailings heap (battery "sands")

Data sources:
Base Data: Vicmap (c) 2017

Existing urban	Existing residential developments within GRZ and education facilities within PUZ2
Potential urban	Undeveloped areas within GRZ
Industrial	Industrial and commercial uses according with industrial zoning
Open land	Undeveloped areas within FZ, PUZ7, PPRZ, PCRZ
GRZ	General Residential
PUZ	Public Use
FZ	Farming
PCRZ	Public Conservation and Resources
PPRZ	Public Park and Recreation
IN	Industrial
RD	Road

BOREHOLE HAZARDOUS GASES FLOW RATES QHG FOR CH4 AND CO2

BASED ON HISTORICAL MAXIMUM CONCENTRATIONS & FLOW RATES

City of Greater Bendigo

Eaglehawk Landfill

Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure
F6

A4 size

AECOM

Legend

- 250m zone
- 500m buffer
- Areas with risk score >6

Landfill cells

- Cell 1 – no liner system
- Cell 2 – base clay liner
- Cell 5 – engineered base and side liner
- Cells 3A – engineered base liner
- Cells 3B – engineered base liner

Severity Score

- 1 Limited Development Potential
- 3 Industrial Receptors
- 5 Residential / Road, School/ Farming
- Cadastral boundaries

Mine Workings

Likelihood Score

- 2
- 3

CELL 1
CELL 2
CELL 3A
CELL 3B
CELL 5

Industrial Receptors
Residential
GRZ
Limited Development Potential
IN3Z
IN1Z
PCRZ
PPRZ
PUZ7
PUZ1
RDZ2
Residential / Road
School PUZ2
Farming
FZ

0 100 200 300 400 500 metres

City of Greater Bendigo

Eaglehawk Landfill

Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure 7A: Mine Workings

AECOM

Legend

- 250m zone
- 500m buffer
- Areas with risk score >6

Landfill cells

- Cell 1 – no liner system
- Cell 2 – base clay liner
- Cell 5 – engineered base & side liner
- Cells 3A – engineered base liner
- Cells 3B – engineered base liner

Severity Score

- 1 Limited Development Potential
- 3 Industrial Receptors
- 5 Residential / Road, School /Farming
- **Cadastral Boundaries**

Permeable Geology

Likelihood Score

- 1
- 3
- Anticlines (Likelihood Score 3)
- Synclines (Likelihood Score 3)
- Faults (Likelihood Score 3)

Tailings

Likelihood Score

- 1
- 4

Industrial Receptors
Residential
GRZ
IN3Z
Limited Development Potential
PCRZ
PUZ7
IN1Z
PPRZ
RDZ2
Residential / Road
School PUZ2
PUZ1
Farming
FZ
CELL 1
CELL 2
CELL 3A
CELL 3B
CELL 5

0 100 200 300 400 500 metres

City of Greater Bendigo

Eaglehawk Landfill

Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure 7B: Geology & Tailings

AECOM

Legend

- 250m zone
- 500m buffer
- Areas with risk score >6

Severity Score

- 1 Limited Development Potential
- 3 Industrial Receptors
- 5 Residential / Road, School/ Farming
- Cadastre

Underground Services

Likelihood Score

- 0
- 2
- 3

Industrial Receptors
Residential
GRZ
IN3Z
Limited Development Potential
Industrial Receptors
IN1Z
Limited Development Potential
PPRZ
IN1Z
Industrial Receptors
GRZ
Residential
Limited Development Potential
PCRZ
PUZ7
Limited Development Potential
RDZ2
Industrial Receptors
IN1Z
Limited Development Potential
PCRZ
Residential
GRZ
Residential / Road
CELL 3A
CELL 3B
CELL 1
CELL 5
CELL 2
GRZ
IN1Z
Industrial Receptors
IN3Z
Residential
Industrial Receptors
Limited Development Potential
Limited Development Potential
PUZ7
School
PUZ2
Limited Development Potential
GRZ
Residential
Farming
FZ
Limited Development Potential
PCRZ
PCRZ
Limited Development Potential
PUZ1

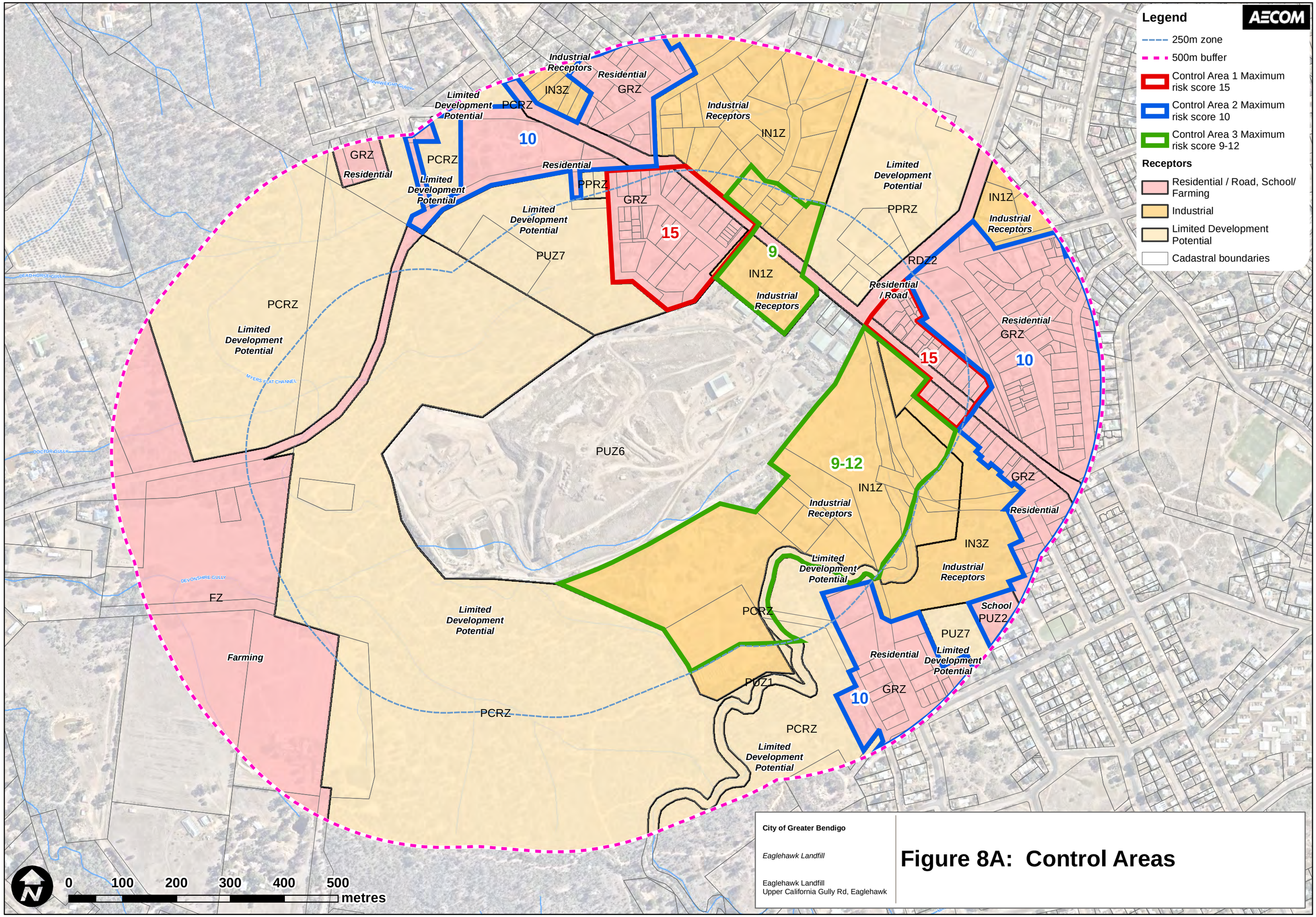
0 100 200 300 400 500 metres

City of Greater Bendigo

Eaglehawk Landfill

Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure 7C: Underground Services

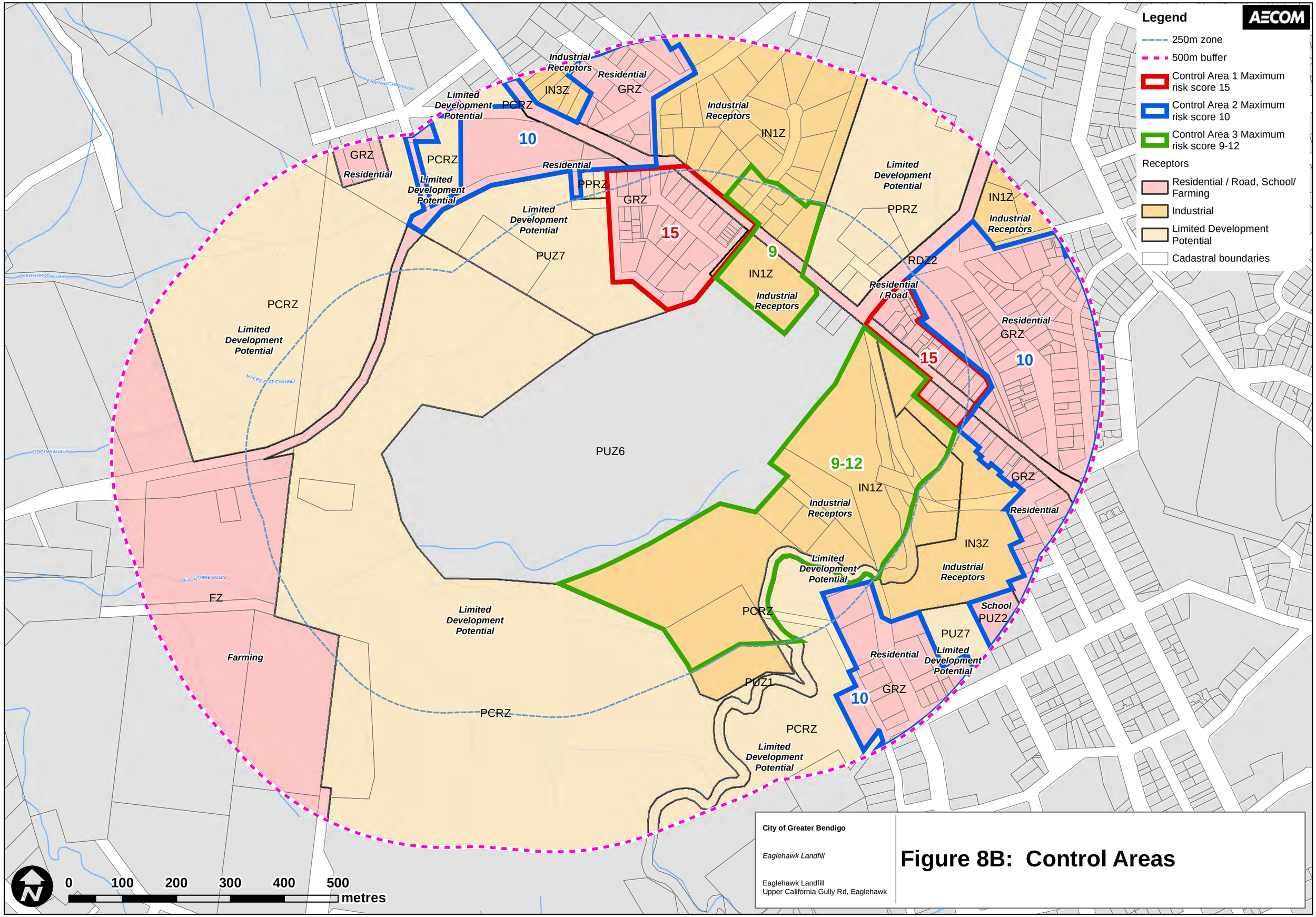


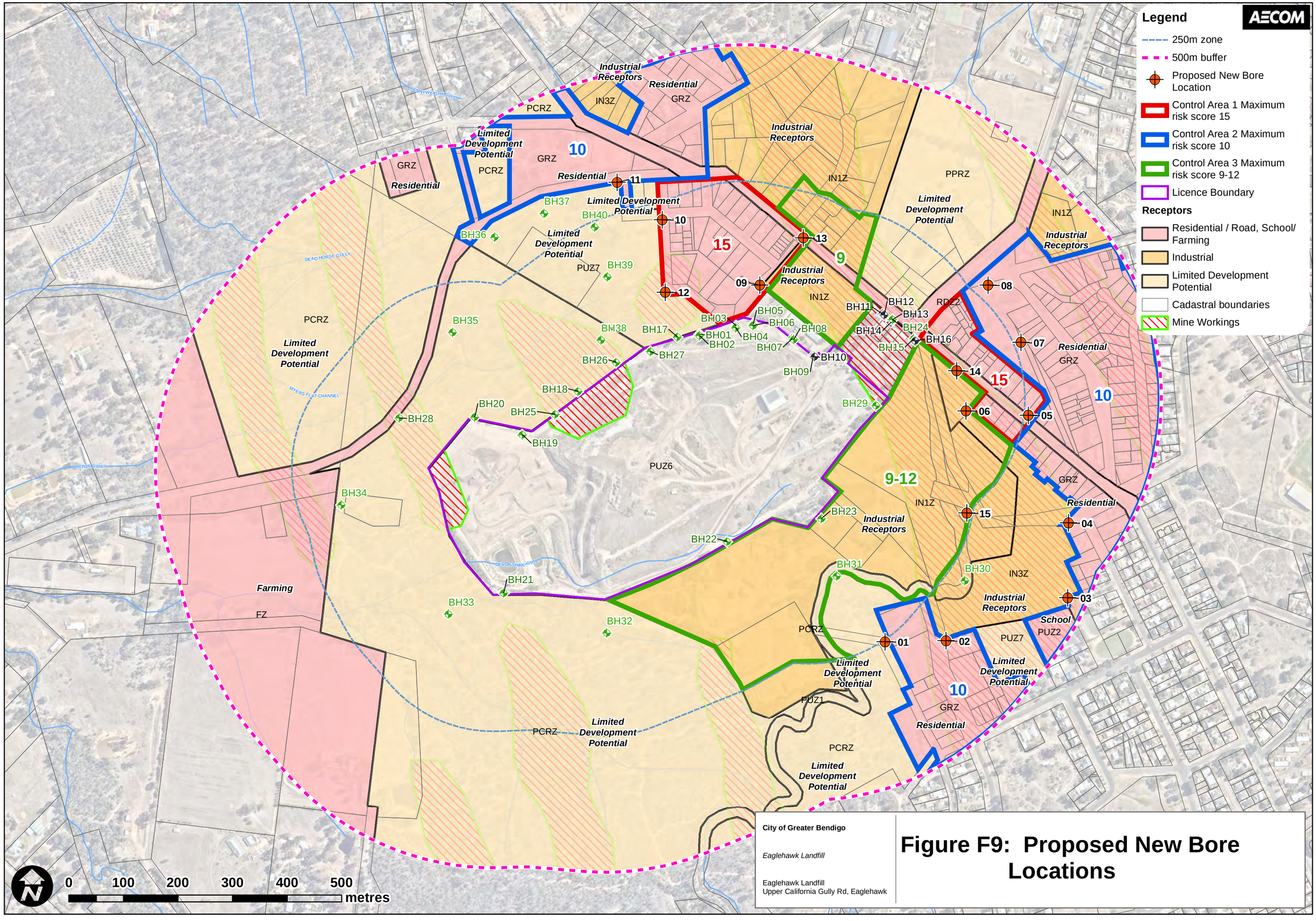
City of Greater Bendigo

Eaglehawk Landfill

Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure 8A: Control Areas


Legend
AECOM
250m zone
500m buffer
Control Area 1 Maximum risk score 15
Control Area 2 Maximum risk score 10
Control Area 3 Maximum risk score 9-12
Receptors
Residential / Road, School/ Farming
Industrial
Limited Development Potential
Cadastral boundaries
PENNYWEIGHT GULLY
DEAD HORSE GULLY
MYERS FLAT CHANNEL
DOCTOR GULLY
DEVONSHIRE GULLY
Industrial Receptors
Residential
IN3Z
GRZ
Limited Development Potential
PCRZ
10
IN1Z
PPRZ
15
9
PUZ7
RDZ2
Residential / Road
PUZ6
9-12
School
PUZ2
FZ
Farming
PUZ1
0
100
200
300
400
500
metres
City of Greater Bendigo
Eaglehawk Landfill
Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk
Figure 8B: Control Areas


Legend
AECOM
250m zone
500m buffer
Proposed New Bore Location
Control Area 1 Maximum risk score 15
Control Area 2 Maximum risk score 10
Control Area 3 Maximum risk score 9-12
Licence Boundary
Receptors
Residential / Road, School/ Farming
Industrial
Limited Development Potential
Cadastral boundaries
Mine Workings
Industrial Receptors
Residential
Limited Development Potential
PCRZ
GRZ
IN3Z
IN1Z
PPRZ
PUZ7
PUZ6
PUZ2
PUZ1
FZ
Farming
School
RD22
10
15
9
9-12
01
02
03
04
05
06
07
08
09
10
11
12
13
14
15
BH01
BH02
BH03
BH04
BH05
BH06
BH07
BH08
BH09
BH10
BH11
BH12
BH13
BH14
BH15
BH16
BH17
BH18
BH19
BH20
BH21
BH22
BH23
BH24
BH25
BH26
BH27
BH28
BH29
BH30
BH31
BH32
BH33
BH34
BH35
BH36
BH37
BH38
BH39
BH40
DEAD HORSE GULLY
MYERS FLAT CHANNEL
DOCTOR GULLY
DEVONSHIRE GULLY
0
100
200
300
400
500
metres
City of Greater Bendigo
Eaglehawk Landfill
Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk
Figure F9: Proposed New Bore Locations

LEGEND			
⊗	LANDFILL GAS WELL	———	90mm WELL FLOWLINE
⊙	WELL RISER	—·—·—	125mm LATERAL FLOWLINE
■	WELLHEAD STATION	- - - - -	160mm MAIN HEADER
⊕	CKV / J-TRAP	—··—··—	200mm MAIN HEADER
⊠	LANDFILL GAS MONITORING BORE	—·—·—	225mm MAIN HEADER
⋈	GAS VALVE	——·—·—	280mm MAIN HEADER
⊣	RISER / END CAP	●	REDRILLS
⋈	FLARE	●	NEW WELLS

20 10 0 20 40 60 80

SCALE 1:1000 FOR A1 SIZE
SCALE 1:2000 FOR A3 SIZE
GDA 94 / MGA ZONE 55

N

NEARMAP PTY LTD AERIAL DATED 2 MAR 2019

BUILDING RUBBLE & RESIDENTIAL TIP AREA
MULCH STORAGE AREA
WEIGHBRIDGE N 5931700
TRUCK WASH
LIQUID WASTE TREATMENT PLANT
WORK STAFF
FLARE
CKV
POWER STATION
CELL 1
CELL 2
CELL 3A
CELL 3B
CELL 5
LEACHATE DAM
BH02 BH06 BH07 BH08 BH09 BH17 BH18 BH19 BH20 BH21 BH22 BH23
TW1 TW2 TW3
JT1 JT2 JT3 JT4
NOTE1 NOTE2
225mm 280mm 200mm 160mm 125 LAT
E 253500 E 253600 E 253700 E 253800 E 253900 E 254000
N 5931600 N 5931500 N 5931400 N 5931300

NOTES:

1. POSITIONS OF WELLS 36 & 37 CONNECTED TO STATION E TO BE INVESTIGATED.
2. WELLS AND FLOWLINES INDICATED ARE UNSURVEYED AND IN APPROXIMATE LOCATIONS.

AS BUILT

No	DATE	DRN	DESN	CHKD	APP	DESCRIPTION
5	25/07/17	OS	DD	DD	GF	17 WELLS REDRILLED. NEW TW1-3 & I STN. H STN RELOCATED.
4	18/04/16	OS	–	–	GF	WELLS 52-56 REMOVED AND OTHER LAYOUT UPDATES.
3	02/04/13	AAH	–	–	–	RENUMBERED FROM 2040-CA-003.
2	29/03/10	AAH	SF	DD	SF	WELLS 57-64 AND STATIONS G & H ADDED. WELL 12 REDRILLED
1	05/06/09	AAH	–	–	–	WELL STATION F AND WELLS 41-56 ADDED.
0	21/09/05	AAH	DKW	DKW	JF	AB – ORIGINAL ISSUE

REVISIONS

No	DATE	DRN	DESN	CHKD	APP	DESCRIPTION
6	11/04/19	JF	DD	RB	DD	5 WELLS REDRILLED. WELLS 65-67, 71, 73-74, 76-77 & STN J ADDED. 160MM MAIN ADDED.

REVISIONS

DRAWING NUMBER	DESCRIPTION

REFERENCE DRAWINGS

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LMS ENERGY

DRAWN:	AAH
DATE:	02/12/04
DESIGN:	DKW
DATE:	02/12/04
APPRVD:	DKW
DATE:	04/10/05
A.B.N.	39 059 428 474

EAGLEHAWK (BENDIGO) RENEWABLE ENERGY FACILITY

GAS FIELD LAYOUT

SCALE	DRAWING NUMBER	PAGE	SIZE	REV
1:1000	30007-CA-003	1 OF 2	A1	6

LAST PLOTTED TIME: PLOTTED DATE: LAST MODIFIED TIME: MODIFIED DATE:

COORDINATES				
DESCRIPTION	LOCATION	EASTING	NORTHING	DATE
STATION A	-	253743.582	5931568.047	Mar-05
STATION B	-	253707.681	5931609.335	Mar-05
STATION C	-	253745.657	5931685.175	Mar-05
STATION D	-	253704.336	5931472.037	Mar-05
STATION E	-	253609.439	5931383.505	Mar-05
STATION F	-	253638.008	5931521.680	Apr-08
STATION G	-	253619.077	5931559.262	Dec-08
STATION H	RAISED & RELOC.	-	-	Feb-10
STATION H	-	253620.258	5931623.356	Apr-17
STATION I	-	253572.738	5931596.560	Apr-17
STATION J	-	253513.018	5931574.049	Mar-19
CKV	POWER STATION	253956.168	5831506.844	Mar-05
JT1	C STATION	253735.095	5931669.034	Mar-05
JT2	D STATION	253698.264	5931474.032	Mar-05
JT3	E STATION	253613.127	5931388.239	Mar-05
JT4	F STATION	253636.757	5931518.404	Apr-08
JT5	H STATION	253637.166	6931638.261	Feb-10
1	C STATION	253802.898	5931705.845	Mar-05
2	C STATION	253163.096	5931700.223	Mar-05
3	C STATION	253724.345	5931694.338	Mar-05
4	C STATION	UNSURVEYED		Mar-05
5	C STATION	253739.892	5931655.348	Mar-05
6	C STATION	253702.313	5931652.997	Mar-05
7	REMOVED	-	-	Mar-05
8	B STATION	253734.479	5931617.910	Mar-05
9	B STATION	253692.464	5931609.940	Mar-05
10	REMOVED	-	-	Mar-05
11	REMOVED	-	-	Mar-05
12	REMOVED	-	-	Mar-05
13	REMOVED	-	-	Mar-05
14	A STATION	253755.635	5931589.610	Mar-05
15	REMOVED	-	-	Mar-05
16	REMOVED	-	-	Mar-05
17	B STATION	253703.202	5931553.130	Mar-05
18	B STATION	253664.638	5931542.353	Mar-05
19	REMOVED	-	-	Mar-05
20	REMOVED	-	-	Mar-05
21	A STATION	253771.725	5931534.740	Mar-05
22	A STATION	UNSURVEYED		Mar-05
23	A STATION	253853.277	5931553.445	Mar-05
24	A STATION	253832.240	5931516.231	Mar-05
25	A STATION	253797.386	5931505.945	Mar-05
26	A STATION	25375766.280	5931494.383	Mar-05
27	A STATION	253778.048	5931471.046	Mar-05
28	REMOVED	-	-	Mar-05
29	D STATION	253685.571	5931458.397	Mar-05
30	D STATION	253762.320	5931445.622	Mar-05
31	REMOVED	-	-	Mar-05
32	D STATION	253740.279	5931419.528	Mar-05

COORDINATES				
DESCRIPTION	LOCATION	EASTING	NORTHING	DATE
33	D STATION	253703.047	5931398.637	Mar-05
34	D STATION	253685.838	5931424.748	Mar-05
35	E STATION	253645.387	5931408.414	Mar-05
36	E STATION	UNSURVEYED		Mar-05
37	E STATION	UNSURVEYED		Mar-05
38	E STATION	253665.021	5931390.636	Mar-05
39	E STATION	253632.335	5931369.964	Mar-05
40	E STATION	253601.924	5931357.787	Mar-05
41	REMOVED	-	-	Apr-08
42	F STATION	253658.190	5931541.429	Apr-08
43	F STATION	253603.038	5931492.805	Apr-08
44	REMOVED	-	-	Apr-08
45	REMOVED	-	-	Apr-08
46	F STATION	253634.312	5931485.093	Apr-08
47	REMOVED	-	-	Apr-08
48	F STATION	253655.317	5931524.867	Apr-08
49	F STATION	253644.316	5931554.860	Apr-08
50	F STATION	253629.146	5931512.918	Apr-08
51	REMOVED	-	-	Apr-08
Redrill 11	G STATION	UNSURVEYED		Dec-08
Redrill 15	A STATION	UNSURVEYED		Dec-08
Redrill 19	F STATION	UNSURVEYED		Dec-08
Redrill 41	G STATION	UNSURVEYED		Dec-08
Redrill 47	F STATION	UNSURVEYED		Dec-08
Redrill 51	REMOVED	-	-	Dec-08
52	REMOVED	-	-	Dec-08
53	REMOVED	-	-	Dec-08
54	REMOVED	-	-	Dec-08
55	REMOVED	-	-	Dec-08
56	REMOVED	-	-	Dec-08
Redrill 7	REMOVED	-	-	Feb-10
Redrill 10	H STATION	253652.149	5931613.085	Feb-10
Redrill 12	B STATION	253680.230	5931572.354	Feb-10
Redrill 20	A STATION	253735.601	5931529.842	Feb-10
57	G STATION	253595.425	5931589.986	Feb-10
58	G STATION	253595.983	5931563.301	Feb-10
59	G STATION	253586.545	6931538.915	Feb-10
60	G STATION	253576.558	6931512.732	Feb-10
61	REMOVED	-	-	Feb-10
62	REMOVED	-	-	Feb-10
63	REMOVED	-	-	Feb-10
64	REMOVED	-	-	Feb-10
Redrill 7	H STATION	253666.084	5931654.721	Apr-17
Redrill 13	B STATION	253718.862	5931586.109	Apr-17
Redrill 16	A STATION	253743.714	5931560.481	Apr-17
Redrill 28	D STATION	253716.319	5931472.565	Apr-17
Redrill 31	D STATION	253718.939	5931448.147	Apr-17
Redrill 44	F STATION	253587.088	5931456.013	Apr-17
Redrill 45	F STATION	253624.068	5931452.459	Apr-17

COORDINATES				
DESCRIPTION	LOCATION	EASTING	NORTHING	DATE
Redrill 51	H STATION	253599.395	5931653.796	Apr-17
Redrill 52	I STATION	253564.006	5931619.418	Apr-17
Redrill 53	I STATION	253538.056	5931592.130	Apr-17
Redrill 54	I STATION	253563.645	5931566.673	Apr-17
Redrill 55	I STATION	253522.554	5931559.550	Apr-17
Redrill 56	E STATION	253593.417	5931396.473	Apr-17
Redrill 61	H STATION	253629.359	5931641.915	Apr-17
Redrill 62	H STATION	253619.106	5931615.498	Apr-17
Redrill 63	H STATION	253589.901	5931622.957	Apr-17
Redrill 64	H STATION	253641.877	5931671.203	Apr-17
TW1	H STATION	253618.855	5931710.735	Apr-17
TW2	I STATION	253543.882	5931662.995	Apr-17
TW3	I STATION	253502.747	5931627.503	Apr-17
65	J STATION	UNSURVEYED		Mar-19
66	J STATION	UNSURVEYED		Mar-19
67	J STATION	UNSURVEYED		Mar-19
71	C STATION	253688.585		Mar-19
73	C STATION	253782.317	5931723.035	Mar-19
74	C STATION	253841.087	5931711.295	Mar-19
76	ON MAIN	253867.948	5931520.377	Mar-19
77	ON MAIN	253907.216	5931558.126	Mar-19
Redrill 9	B STATION	253695.399	5931613.137	Mar-19
Redrill 41	G STATION	253625.325	5931575.456	Mar-19
Redrill 43	F STATION	253604.800	5931497.485	Mar-19
Redrill 47	F STATION	253677.970	5931496.632	Mar-19
Redrill 60	G STATION	253579.828	5931515.473	Mar-19

AS BUILT

No	DATE	DRN	DESN	CHKD	APP	DESCRIPTION
5	25/07/17	OS	DD	DD	GF	17 WELLS REDRILLED. NEW TW1-3 & I STN. H STN RELOCATED.
4	18/04/16	OS	–	–	GF	WELLS 52-56 REMOVED AND OTHER LAYOUT UPDATES.
3	02/04/13	AAH	–	–	–	RENUMBERED FROM 2040-CA-003.
2	29/03/10	AAH	SF	DD	SF	WELLS 57-64 AND STATIONS G & H ADDED. WELL 12 REDRILLED
1	05/06/09	AAH	–	–	–	WELL STATION F AND WELLS 41-56 ADDED.
0	21/09/05	AAH	DKW	DKW	JF	AB – ORIGINAL ISSUE

REVISIONS

No	DATE	DRN	DESN	CHKD	APP	DESCRIPTION
6	11/04/19	JF	DD	RB	DD	5 WELLS REDRILLED. WELLS 65-67, 71, 73-74, 76-77 & STN J ADDED. 160MM MAIN ADDED.

REVISIONS

DRAWING NUMBER	DESCRIPTION

REFERENCE DRAWINGS

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LMS ENERGY

DRAWN: AAH
DATE: 02/12/04
DESIGN: DKW
DATE: 02/12/04
APPRVD: DKW
DATE: 04/10/05
A.B.N. 39 059 428 474

EAGLEHAWK (BENDIGO) RENEWABLE ENERGY FACILITY

GAS FIELD LAYOUT

SCALE	DRAWING NUMBER	PAGE	SIZE	REV
1:1000	30007-CA-003	2 OF 2	A1	6

LAST PLOTTED TIME: PLOTTED DATE: LAST MODIFIED TIME: MODIFIED DATE:

Appendix B

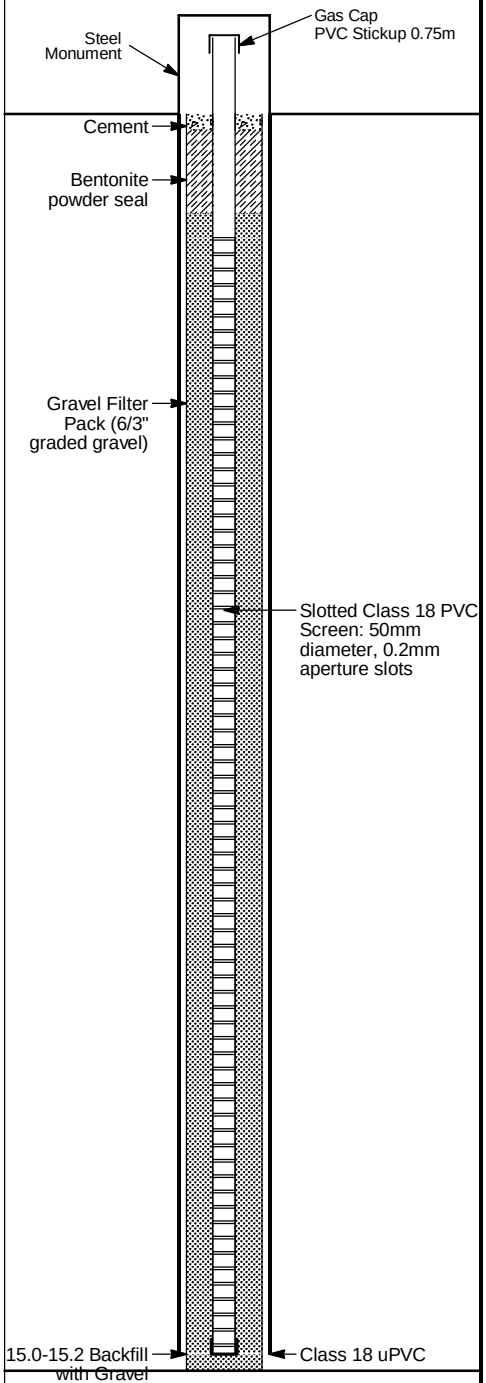
Borelogs BH29 – BH40

MONITORING WELL BH29

Project Name:	Eaglehawk Landfill	Client:	City of Bendigo
Drilling Contractor:	South Western Drilling	Location:	Bendigo
Project No:	60579200		
Logged By:	TDS	Bore Size:	150/125 mm
Checked By:	TDS	Total Depth:	15.20 m
Date Started:	18/06/2018	Casing Size:	50 mm
Date Finished:	18/06/2018	Top of Casing:	244.80 mRL
		Coordinates:	254061.00 mE
			5931659.00 mN
		Permit No:	N/A
		Drill Type:	Down hole hammer
		Drill Model:	DB250
		Drill Fluid:	None

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
Solid Face Auger				FILL	0.0m FILL: Gravelly SAND. Grey, fine to medium grained sand (siltsone) with fine to coarse grained gravels (siltsone). Trace silt fines (5-10%). Re-worked natural material.	D	0
				FILL FILL	2.0m FILL: Sandy GRAVEL. Brown-grey, fine to coarse grained, angular to rounded gravels (siltstone and concrete) with fine to coarse grained sand and fines. 2.2m FILL: SILT. Dark grey, fine grained, non-plastic with fine sand	D M	1 2 3
Down Hole Hammer					3.5m SEDIMENTARY: SILTSTONE. Grey and Orange, fine grained, weathered to residual soils	D	4
					4.5m Orange-brown, less weathered, bedding on chips 3-5mm	D	5
					7.0m Trace medium angular quartz grains (<5%). Sample is all fines, no chips for inspection	D	6 7
					8.0m Red-brown	D	8
					9.0m Orange-brown	D	9
					10.0m Dark-brown fine grained, weathered trace fine-medium quartz in matrix	D	10
					11.5m to 12.0m Drilling is very soft		11 12 13 14 15
					15.0m End of hole		

WELL CONSTRUCTION DETAILS



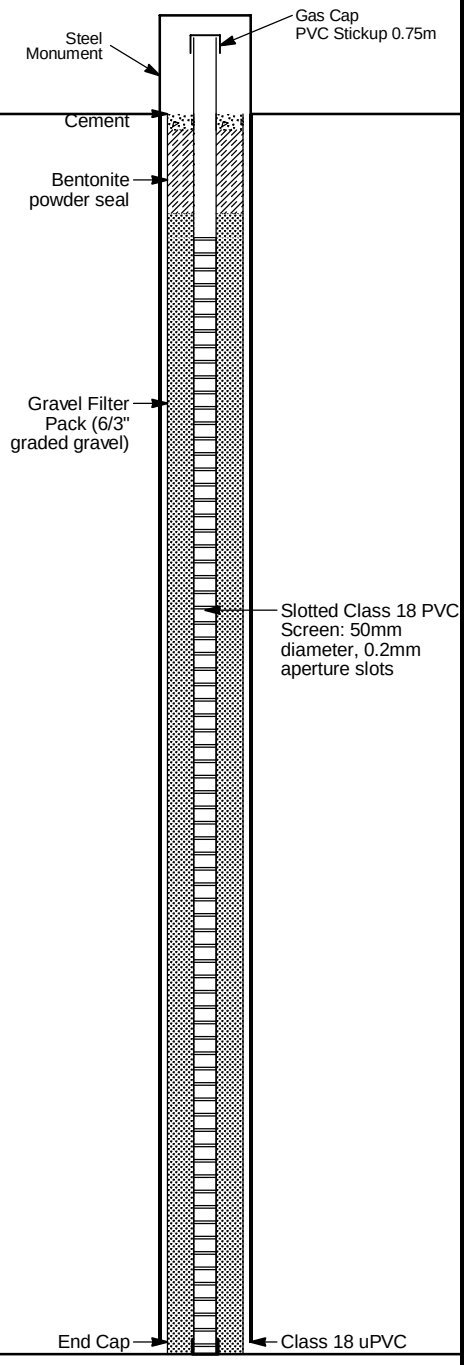
Remarks: Bore located within Recycle Centre
Bore adjacent to MB10
Bore Hammer Assembly 1.3m
5.0m Refusal with SFA at 5.0m, switch to DHH
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

MONITORING WELL BH30

Project Name:	Eaglehawk Landfill	Client:	City of Bendigo
Drilling Contractor:	South Western Drilling	Location:	Bendigo
Project No:	60579200		
Logged By:	TDS	Bore Size:	150/125 mm
Checked By:	TDS	Total Depth:	15.00 m
Date Started:	19/06/2018	Casing Size:	50 mm
Date Finished:	19/06/2018		
Top of Casing:	246.30 mRL	Drill Type:	Down hole hammer
Coordinates:	254220.00 mE 5931338.00 mN	Drill Model:	DB250
Permit No:	N/A	Drill Fluid:	None

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
SFA				FILL	FILL: SAND & GRAVEL. Grey, fine to coarse grained sand and fine to coarse grained gravels, well graded (siltstone & basalt)	D	0
					0.3m SEDIMENTARY: SILTSTONE. Grey-orange, fine grained, weathered, trace fine quartz sand in matrix (<10%)	D	1
					3.0m Yellow-grey, weathered, sample return is all fines	D	3
					5.0m Brown-grey, weathered, mostly fines with sand in matrix (10-15%)	D	5
					7.0m Brown, weathered	D	7
					8.0m Brown-grey, weathered	D	8
					10.0m Grey-brown, fine grained, weathered, trace fine to medium grained quartz sand in matrix. Driller notes moderately hard.	D	10
					11.7m to 11.8m Fractured, chips (5-10mm) lamination evident (~1mm)		12
DHH					14.5m SEDIMENTARY: SHALE. Grey/Black, fine grained, laminated. Chips 10-30mm and angular.	D	15
					15.0m End of Hole		

WELL CONSTRUCTION DETAILS



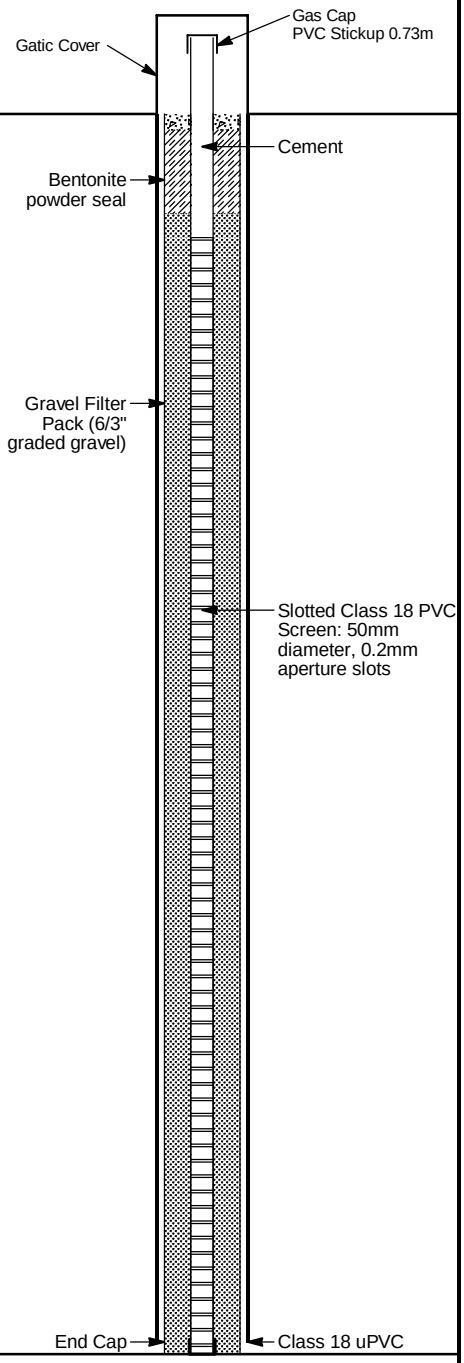
Remarks: Bore locatied within ASQ
Bore Hammer Assembly 1.3m
Refusal with SFA at 1.8m, switch to DHH
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

MONITORING WELL BH31

Project Name:	Eaglehawk Landfill	Client:	City of Bendigo
Drilling Contractor:	South Western Drilling	Location:	Bendigo
Project No:	60579200		
Logged By:	BC	Bore Size:	150/125 mm
Checked By:	TDS	Total Depth:	15.00 m
Date Started:	26/06/208	Casing Size:	50 mm
Date Finished:	26/06/208	Permit No:	N/A
Top of Casing:	247.70 mRL	Drill Type:	Down hole hammer
Coordinates:	253989.00 mE 5931347.00 mN	Drill Model:	DB250
		Drill Fluid:	None

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
SFA				FILL	0.0m FILL: SAND & GRAVEL. brown, fine to coarse grained sand with fine to coarse grained gravels, well graded (siltstone)	D	0
					0.5m SEDIMENTARY: SILTSTONE. Brown-red, weathered, silt matrix (sand <10%), Angular chips (<10mm), lamination evident on chips.	D	1
					3.0m Orange-brown, (sand 10%)	D	3
					4.0m Brown-grey, trace sand in sample (<5%), chips are strongly laminated	D	4
					9.0m Brown-orange		9
Down Hole Hammer					11.0m Brown/orange	D	11
					13.0m Brown/orange		13
					15.0m End of Hole		15

WELL CONSTRUCTION DETAILS



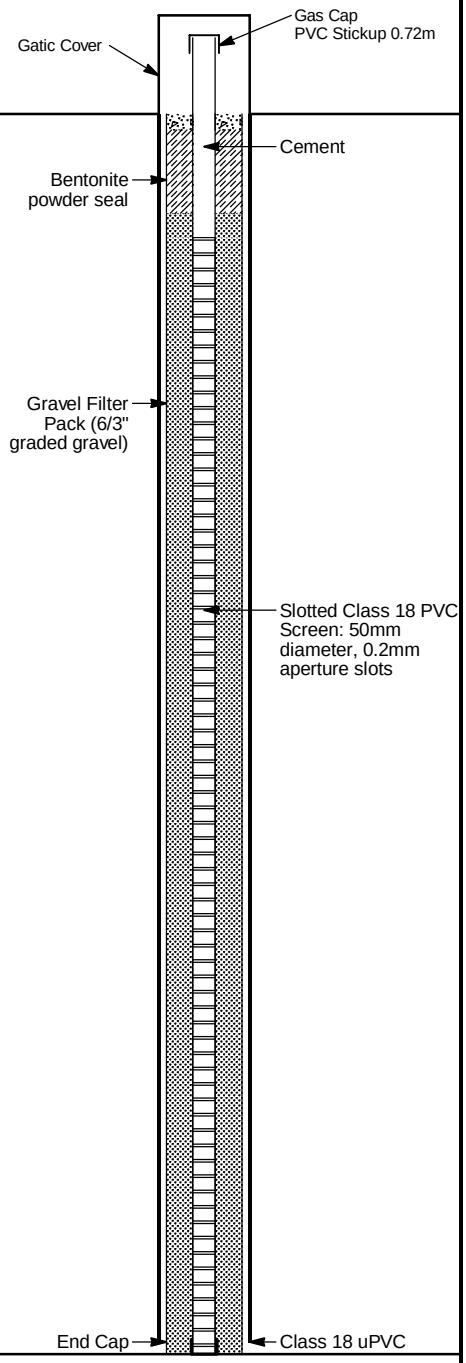
Remarks: Bore located within Park Area
Bore Hammer Assembly 1.3m
Refusal at 2.5m with SFA, switch to DHH
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

MONITORING WELL BH32

Project Name:	Eaglehawk Landfill			Client:	City of Bendigo
Drilling Contractor:	South Western Drilling			Location:	Bendigo
Project No:	60579200				
Logged By:	TDS	Bore Size:	150/125 mm	Top of Casing:	234.70 mRL
Checked By:	TDS	Total Depth:	15.00 m	Coordinates:	253568.00 mE
Date Started:	19/06/2018	Casing Size:	50 mm		5931243.00 mN
Date Finished:	19/06/2018			Permit No:	N/A
Drill Type:	Down hole hammer				
Drill Model:	DB250				
Drill Fluid:	None				

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
SFA					0.0m SEDIMENTARY: SHALE. Red-brown, fine grained, chips are laminated	D	0
							1
					2.0m Brown-red sample. Chips <10mm	D	2
					3.0m Grey-brown		3
					4.0m Brown-grey		4
							5
					5.5m SEDIMENTARY:SILSTONE. Grey fine grained, weathered. Soft drilling, chips are =<20-30mm, no obvious fabric spacing.	D	6
					6.2m - 6.4m Hard oxidised quartz band	D	
					7.0m Chips are laminated		7
							8
							9
					9.2m-9.3m SHALE. Red-brown.		
							10
					10.5m-10.6m SHALE. Red-brown		11
					11.8m-11.9m SHALE. Orange-brown		12
Down Hole Hammer					12.9m Orange-brown		13
					14.0m Grey-brown	D	14
					15.0m End of bore		15

WELL CONSTRUCTION DETAILS



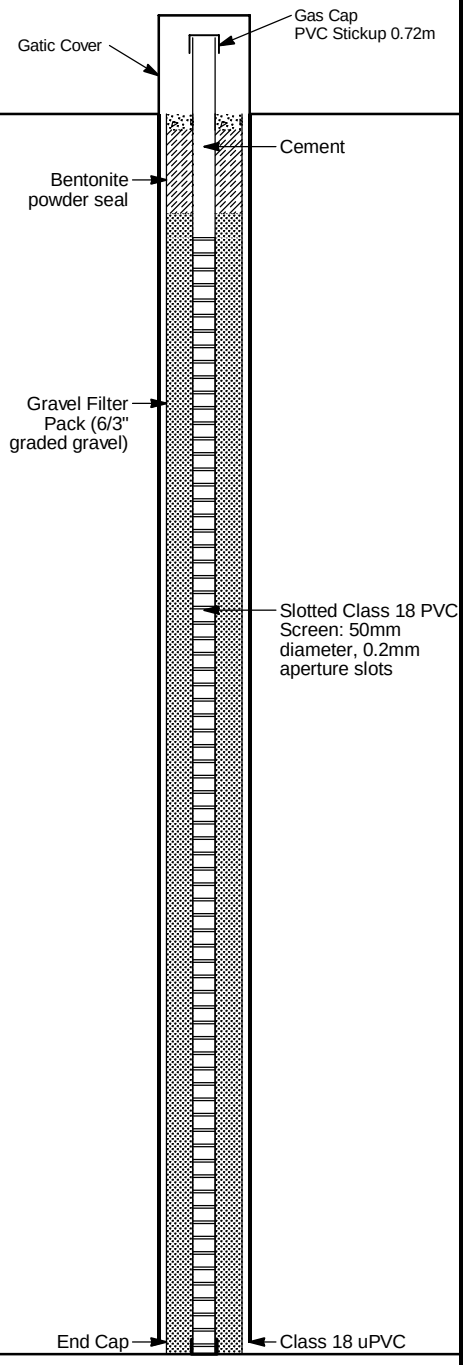
Remarks: Bore located within Park Area
Bore Hammer Assembly 1.3m
Refusal with SFA at 1.5m, switch to DHH
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

MONITORING WELL BH33

Project Name:	Eaglehawk Landfill	Client:	City of Bendigo
Drilling Contractor:	South Western Drilling	Location:	Bendigo
Project No:	60579200		
Logged By:	TDS	Bore Size:	150 mm
Checked By:	TDS	Total Depth:	15.00 m
Date Started:	20/06/2018	Casing Size:	50 mm
Date Finished:	20/06/2018		
Top of Casing:	220.20 mRL	Drill Type:	Down hole hammer
Coordinates:	232275.00 mE 5931281.00 mN	Drill Model:	DB250
Permit No:	N/A	Drill Fluid:	None

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
SFA					0.0m SEDIMENTARY: SILTSTONE. Yellow, fine grained, weathered. Trace fine quatrz sand in matrix. Chips are laminated <10mm	D	0
					2.0m Yellow-grey	D	2
					3.0 Yellow-brown		3
					7.8m-7.9m SHALE, grey, weathered, chips are laminated 2-3mm		8
Down Hole Hammer					9.8m SEDIMENTARY: SHALE. Grey, fine grained, weathered, chips =< 10mm, are laminated 1-2mm. Hard drilling.	D	10
					13.0m Chips <30mm highly angular, less weathered	D	13
					14.0m Blue-grey, chips appear slightly weathered to fresh 14.5m Brown-grey, more weathered		14
					15.0m End of hole		15

WELL CONSTRUCTION DETAILS



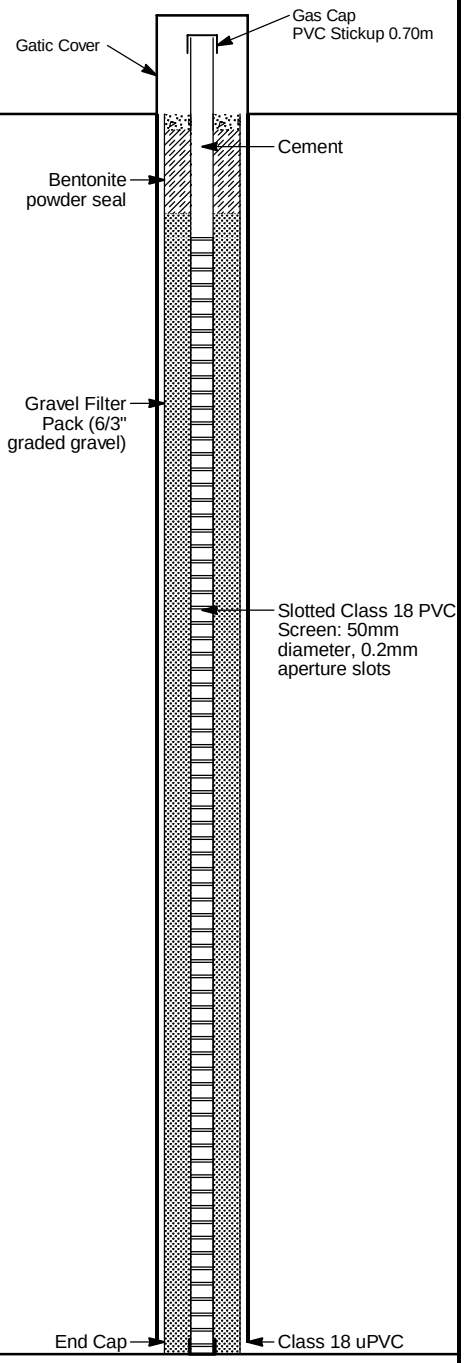
Remarks: Bore located within Park Area
Bore Hammer Assembly 1.3m
Refusal with SFA at 1.9m, switch to DHH
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

MONITORING WELL BH34

Project Name:	Eaglehawk Landfill	Client:	City of Bendigo
Drilling Contractor:	South Western Drilling	Location:	Bendigo
Project No:	60579200		
Logged By:	TDS	Bore Size:	150 mm
Checked By:	TDS	Total Depth:	15.00 m
Date Started:	20/06/2018	Casing Size:	50 mm
Date Finished:	20/06/2018		
Top of Casing:	225.00 mRL	Drill Type:	Down hole hammer
Coordinates:	232077.00 mE	Drill Model:	DB250
	5931429.00 mN	Drill Fluid:	None
Permit No:	N/A		

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
SFA					0.0m SEDIMENTARY: SILTSTONE. White, fine grained, weathered, chips laminated, mostly fines some <20mm	D	0
					2.0m Light Brown	D	2
					4.0m Grey, less weathered, chips are laminated (1-2mm), <10mm, angular.	D	4
					7.9m-8.3m SHALE, Grey.		8
					9.0m Light Brown		9
					11.0m Yellow brown, no chips all fines		11
Down Hole Hammer					12.0m Brown-grey	D	12
					13.8m Grey-brown shale band, fine grained, chips are laminated		14
					15.0m End of hole		15

WELL CONSTRUCTION DETAILS



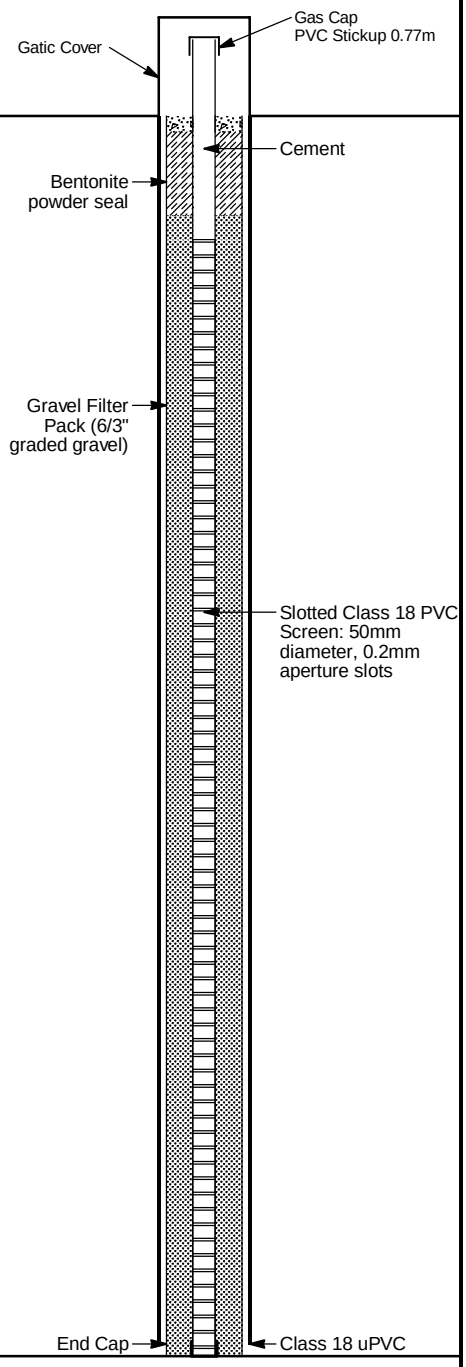
Remarks: Bore located within Park Area
Bore Hammer Assembly 1.3m
Refusal with SFA at 1.8m, switch to DHH
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

MONITORING WELL BH35

Project Name:	Eaglehawk Landfill	Client:	City of Bendigo
Drilling Contractor:	South Western Drilling	Location:	Bendigo
Project No:	60579200		
Logged By:	TDS	Bore Size:	150 mm
Checked By:	TDS	Total Depth:	15.00 m
Date Started:	20/06/2018	Casing Size:	50 mm
Date Finished:	21/06/208		
Top of Casing:	231.80 mRL	Drill Type:	Down hole hammer
Coordinates:	253288.00 mE	Drill Model:	DB250
	5931768.00 mN	Drill Fluid:	None
Permit No:	N/A		

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
Solid Face Auger					0.0m SEDIMENTARY: SILTSTONE. Brown-grey, fine grained, weathered, chips are laminated.	D	0
					2.0m Grey-brown, laminated <1mm, chips mostly fine <15mm		2
					3.0m Brown-grey		3
					7.3m-7.4m SHALE, dark grey, chips are laminated		7
					10.0m Brown-grey		10
					11.0m Grey	D	11
Down Hole Hammer					14.6m Brown-grey		14
					15.0m End of hole		15

WELL CONSTRUCTION DETAILS



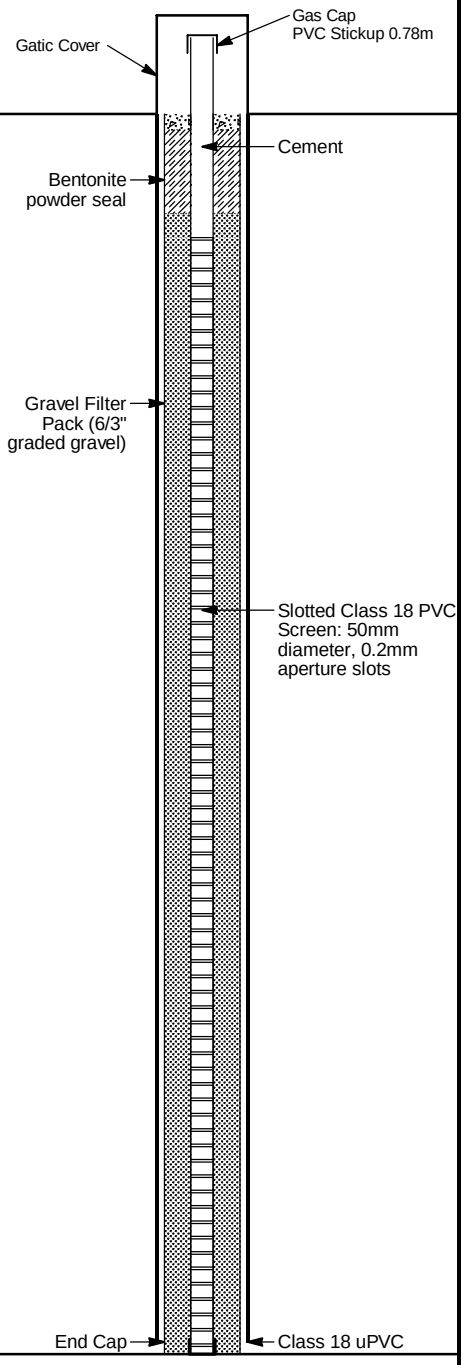
Remarks: Bore located within Park Area
Bore Hammer Assembly 1.3m
Refusal with SFA at 1.7m, switch to DHH
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

MONITORING WELL BH36

Project Name:	Eaglehawk Landfill	Client:	City of Bendigo
Drilling Contractor:	South Western Drilling	Location:	Bendigo
Project No:	60579200		
Logged By:	TDS	Bore Size:	150 mm
Checked By:	TDS	Total Depth:	15.00 m
Date Started:	21/06/208	Casing Size:	50 mm
Date Finished:	21/06/208		
Top of Casing:	236.80 mRL	Drill Type:	Down hole hammer
Coordinates:	253371.00 mE	Drill Model:	DB250
	5931976.00 mN	Drill Fluid:	None
Permit No:	N/A		

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
					SEDIMENTARY: SILTSTONE. Brown-yellow, fine grained, weathered, chips are < 10mm, laminated, mostly fines	D	0
					3.0m Brown	D	3
					4.0m Grey-red		4
					5.0m Red-grey		5
					6.0m Brown-grey	D	6
					10.0m Yellow, chips are <5mm		10
					11.0m Brown	D	11
					SEDIMENTARY: SILTSTONE/SANDSTONE. Yellow, fine grained siltstone with frequent bands of fined grained bands quartz sandstone.		13
					14.0m Chips mostly fines <5mm	D	14
					15.0m Chips are rounded <15mm, moist	M	15
					15.0m End of hole		

WELL CONSTRUCTION DETAILS



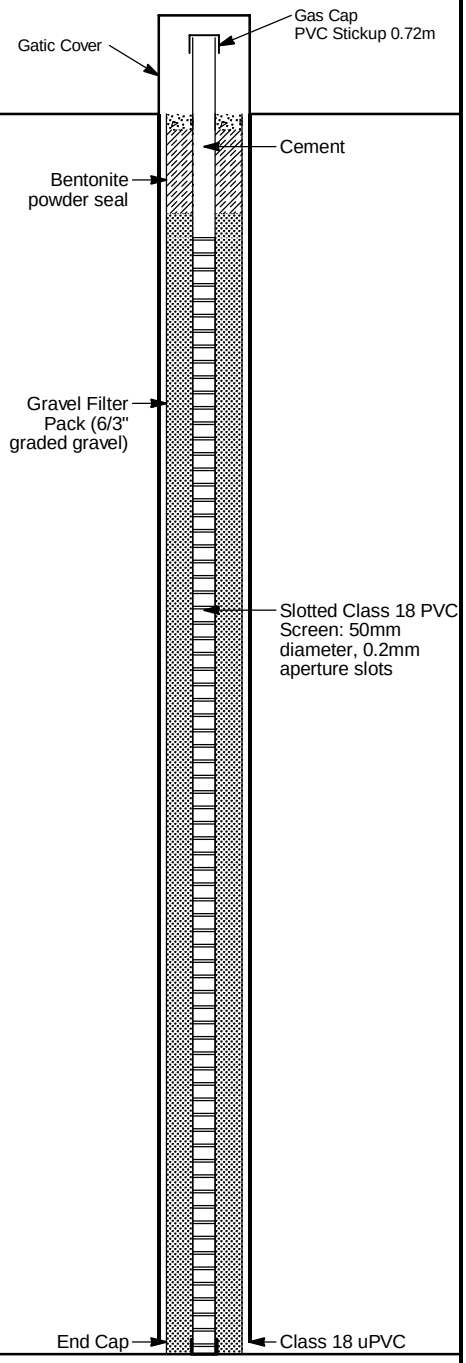
Remarks: Bore located within Park Area
Bore Hammer Assembly 1.3m
Refusal with SFA, switch to hammer
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

MONITORING WELL BH37

Project Name:	**Eaglehawk Landfill**	Client:	**City of Bendigo**
Drilling Contractor:	**South Western Drilling**	Location:	**Bendigo**
Project No:	**60579200**		
Logged By:	**TDS**	Bore Size:	**150 mm**
Checked By:	**TDS**	Total Depth:	**15.00 m**
Date Started:	**21/06/208**	Casing Size:	**50 mm**
Date Finished:	**22/06/208**		
Top of Casing:	**241.70 mRL**	Drill Type:	**Down hole hammer**
Coordinates:	**253446.00 mE**	Drill Model:	**DB250**
	5932023.00 mN	Drill Fluid:	**None**
Permit No:	**N/A**		

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
					0.0m SEDIMENTARY: SILTSTONE. Yellow-brown, fine grained, weathered, trace fine quartz sand through silt matrix (<5%). Chips are laminated, <5mm, mostly fines.	D	0
					2.0m Chips mostly fines <20mm and angular		2
					3.0m Chips are mostly fines <5mm		3
					4.0m Orange-brown		4
					6.0m Orange-brown	D	6
					7.0m Brown-grey, absence of sand in matrix.		7
					12.0m Chips mostly fines <10mm and rounded. Bedding not apparent.	D	12
					13.0m Brown-orange	D	13
					14.0m Red-brown, chips <10mm, mostly fines	D	14
					15.0m End of hole		15

WELL CONSTRUCTION DETAILS



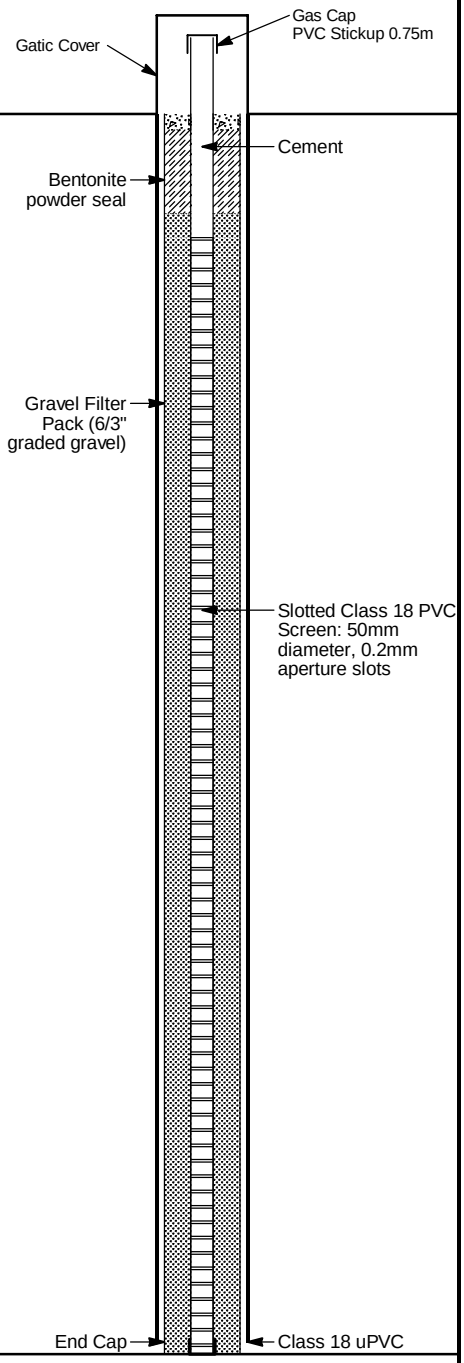
Remarks: Bore located within Park Area
Bore Hammer Assembly 1.3m
Refusal with SFA at 2.5m, switch to DHH
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

MONITORING WELL BH38

Project Name:	**Eaglehawk Landfill**	Client:	**City of Bendigo**
Drilling Contractor:	**South Western Drilling**	Location:	**Bendigo**
Project No:	**60579200**		
Logged By:	**BC**	Bore Size:	**150 mm**
Checked By:	**TDS**	Total Depth:	**15.00 m**
Date Started:	**22/06/208**	Casing Size:	**50 mm**
Date Finished:	**26/06/208**	Top of Casing:	**243.30 mRL**
		Coordinates:	**253540.00 mE**
			5931986.00 mN
		Permit No:	**N/A**
		Drill Type:	**Down hole hammer**
		Drill Model:	**DB250**
		Drill Fluid:	**None**

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
Solid Face Auger					0.0m SEDIMENTARY: SILTSTONE. Brown-red, fine grained, weathered, chips mostly fines, <5mm.	D	0
					1.0m Yellow-grey, chips mostly fines, <10mm		1
					2.0m Grey-pink, chips are thinly laminated		2
					3.0m Yellow-grey		3
					4.0m Yellow-grey, small angular chips		4
					5.0m Yellow-orange, silt matrix, trace sand (<5%)	D	5
					6.0m Grey-pink		6
					7.0m Chips becoming more angular		7
							8
							9
					9.5m Chips <5mm		
					10.0m Yellow-orange, silt matrix trace sand (5 - 10%)	D	10
							11
							12
Down Hole Hammer					13.0m Yellow-orange, silt matrix with sand (10 - 15%)		13
					14.0m Silt matrix with sand (15 - 20%)		14
					15.0m End of hole		15

WELL CONSTRUCTION DETAILS



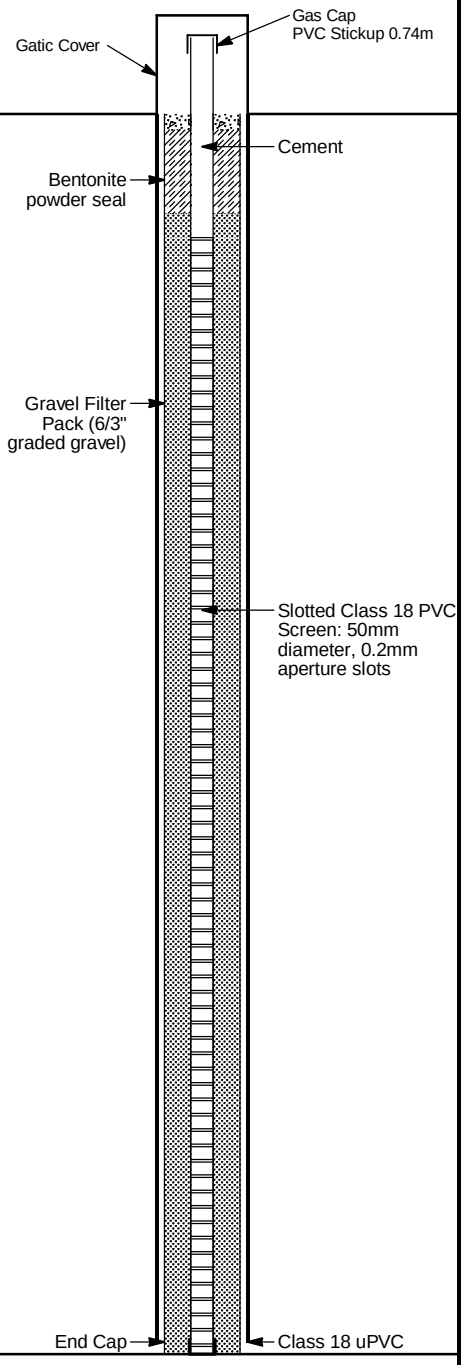
Remarks: Bore located within Park Area
Bore Hammer Assembly 1.3m
Refusal with SFA at 2.5m, switch to DHH
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

MONITORING WELL BH39

Project Name:	Eaglehawk Landfill	Client:	City of Bendigo
Drilling Contractor:	South Western Drilling	Location:	Bendigo
Project No:	60579200		
Logged By:	BC	Bore Size:	150 mm
Checked By:	TDS	Total Depth:	15.00 m
Date Started:	25/06/2018	Casing Size:	50 mm
Date Finished:	26/06/208		
Top of Casing:	250.20 mRL	Drill Type:	Down hole hammer
Coordinates:	253570.00 mE	Drill Model:	DB250
	5931901.00 mN	Drill Fluid:	None
Permit No:	N/A		

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
Solid Face Auger					0.0m SEDIMENTARY: SILTSTONE. Grey-yellow, fine grained, weathered, silt matrix trace sand (<5%). Chips are mostly fines with some =< 50mm and angular. Chips are laminated, some oxidation evident	D	0
							1
							2
							3
					4.0m Brown-red silt matrix trace sand (<5%), oxidised		4
					5.0m Chips are angular, <5mm		5
							6
							7
					8.0m Grey-white, 100% silt	D	8
					9.0m Red-brown		9
					10.0m Brown-orange		10
					11.0m Red-brown		11
					12.0m Red	D	12
Down Hole Hammer							13
					14.0m SEDIMENTARY: SILTSTONE/SANDSTONE. Red-orange, silt matrix with sand (10-20%)		14
					15.0m End of hole		15

WELL CONSTRUCTION DETAILS



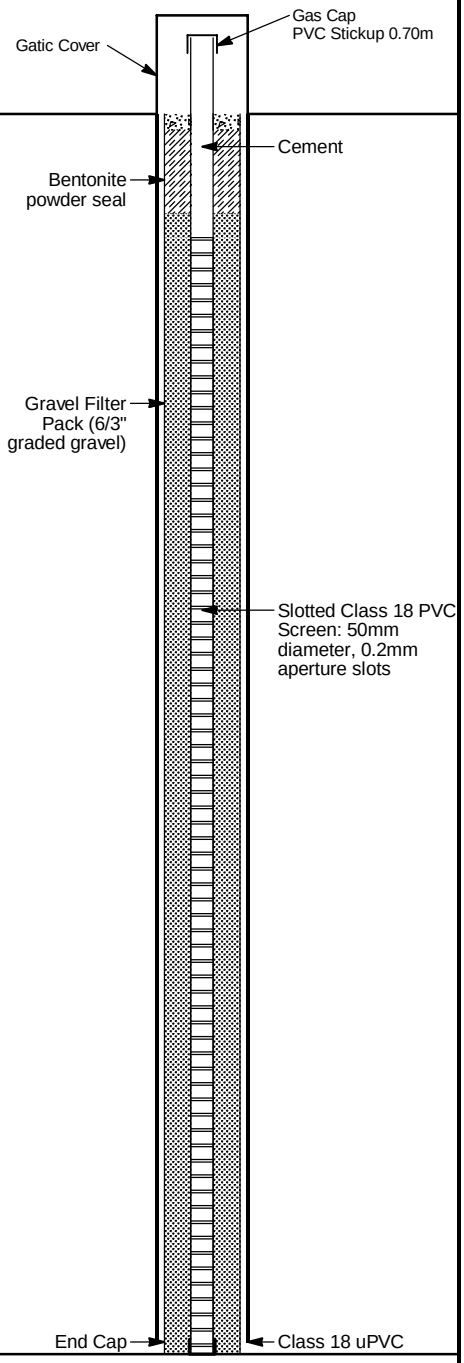
Remarks: Bore located within Park Area
Bore Hammer Assembly 1.3m
Refusal with SFA at 1.5m, switch to DHH
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

MONITORING WELL BH40

Project Name:	**Eaglehawk Landfill**			Client:	**City of Bendigo**
Drilling Contractor:	**South Western Drilling**			Location:	**Bendigo**
		Project No:	**60579200**		
Logged By:	**BC**	Bore Size:	**150 mm**	Top of Casing:	**248.70 mRL**	Drill Type:	**Down hole hammer**
Checked By:	**TDS**	Total Depth:	**15.00 m**	Coordinates:	**253553.00 mE**	Drill Model:	**DB250**
Date Started:	**25/06/2018**	Casing Size:	**50 mm**		**5931778.00 mN**		
Date Finished:	**26/06/208**			Permit No:	**N/A**	Drill Fluid:	**None**

Drill Method	Sample Interval PID (ppm)	Sample ID	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION	Moisture	Depth (m)
					0.0m SEDIMENTARY: SILTSTONE. grey-white, fine grained, weathered. Chips are laminated, mostly fines, <10mm	D	0
					2.0m White-red, 100% silt		2
					3.0m Silt matrix trace sand (5%)		3
					4.0m Red-brown	D	4
					5.0m Brown-red		5
					9.0m Brown-red		9
					11.0m Brown-red	D	11
					14.0 Brown-red, chips are angular, <5mm		14
					15.0m End of hole		15

WELL CONSTRUCTION DETAILS



Remarks: Bore located within Park Area
Bore Hammer Assembly 1.3m
Refusal at 1.5m with SFA, switch to DHH.
Survey and Elevation estimated from Photogrammetric 3D Mapping 10 July 2018 accuracy +/- 0.2m

Appendix C

LFG Monitoring Data

Appendix C LFG Monitoring Data

C1 Subsurface Geology LFG Monitoring Results

C2 2018 Services Walkover Monitoring Results

Gas concentration %v/v

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH01	Aug-01	0	0	18.9	81.1		0	0
BH01	Oct-01	0	0	17.9	82.1		0	0
BH01	Nov-01	0	0	16.1	83.9		0	0
BH01	Dec-01	0	0	19.1	80.9		0	0
BH01	Feb-02	0	0	18.3	81.7		0	0
BH01	Mar-02	0	0	19.5	80.5		0	0
BH01	Apr-02	0	0	19.1	80.9		0	0
BH01	May-02	0	0	19.9	80.1		0	0
BH01	Jun-02	0	0	19.3	80.7		0	0
BH01	Jul-02	0	0	19.8	80.2		0	0
BH01	Nov-03	0	0	18	82		0	0
BH01	Nov-04	0	0	19.1	80.9		0	0
BH01	Mar-05	0	0	19.5	80.5		0	0
BH01	Sep-05	0	0	19	81		0	0
BH01	Feb-09	0	0	18.3	81.7		0	0
BH01	Jun-09	0	0	20.6	79.4		0	0
BH01	Sep-09	0	0	19.3	80.7		0	0
BH01	Dec-09	0	0	16.9	83.1		0	0
BH01	Mar-10	0.1	0.1	16.2	83.6		0	0
BH01	Jun-10	0	0	18.5	81.5		0	0
BH01	Mar-11	0	0	12.3	87.7		0	0
BH01	Jun-11	0	0	19.3	80.7		0	0
BH01	Apr-12	**0.4**	0.4	18	81.2		0	0
BH01	Aug-12	0	0	20.2	79.8		0	0
BH01	Feb-13	0	0	19.1	80.9		0	0
BH01	Aug-13	0	0	18.9	81.1		0	0
BH01	Mar-14	0	0	16.4	83.6		0	0
BH01	Jul-14	0	0	18.6	81.4		0	0
BH01	Mar-15	0	0	15.5	84.5		0	0
BH01	Jul-15	0	0	19.8	80.2	0	0	0
BH01	Feb-16	0	0	18.3	81.7	-0.1	0	0
BH01	Jul-16	0	0	17	83	0	0	0
BH01	Aug-16	0	0	17	83		0	0
BH01	Sep-16	0	0	11.8	88.2		0	0
BH01	Feb-17	0	0	17.2	82.8	0	0	0
BH01	Jul-17	0	0	19.1	80.9	0	0	0
BH01	Feb-18	0	0	17.9	82.1	0	0	0
BH01	Aug-18	0	2.6	19	78.4	**0.1**	0	0.0026
BH01	Oct-18	0	1.6	18.9	79.5	0	0	0
	Qhg based on max concentration & max flow rate						**0.0004**	**0.0026**

NOTE:
Qhg (borehole hazardous gas flow rate) = q*(Chg/100)

Gas concentration %v/v

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH02	Aug-01	0	1.9	18.4	79.7		0	0
BH02	Oct-01	0	2.3	19	78.7		0	0
BH02	Nov-01	0	2.3	18.6	79.1		0	0
BH02	Dec-01	**2.4**	1	19.4	77.2		0	0
BH02	Feb-02		3.2	16.8	80		0	0
BH02	Mar-02	0	1.6	19.4	79		0	0
BH02	Apr-02	0.1	1.6	19.6	78.7		0	0
BH02	May-02	0	1.3	19.5	79.2		0	0
BH02	Jun-02	0	1.2	19.2	79.6		0	0
BH02	Jul-02	0	1.7	19	79.3		0	0
BH02	Aug-02	0	1.2	19.6	79.2		0	0
BH02	Feb-03	0	2.3	15.5	82.2		0	0
BH02	Jun-03	0	2	18.9	79.1		0	0
BH02	Sep-03	0	4.3	16.5	79.2		0	0
BH02	Nov-03	0	2.4	18.5	79.1		0	0
BH02	Feb-04	0	2.2	18.9	78.9		0	0
BH02	Jun-04	0.1	2.3	17.5	80.1		0	0
BH02	Sep-04	0	2.4	18.8	78.8		0	0
BH02	Nov-04	0	2	20.1	77.9		0	0
BH02	Mar-05	0	2.1	19.5	78.4		0	0
BH02	Sep-05	0	2.4	18.3	79.3		0	0
BH02	Feb-09	0	2.2	18.3	79.5		0	0
BH02	Jun-09	0	1.3	20.6	78.1		0	0
BH02	Sep-09	0	1.4	19.3	79.3		0	0
BH02	Dec-09	0	2	16.9	81.1		0	0
BH02	Mar-10	0	2.1	16.2	81.7		0	0
BH02	Jun-10	0	1.8	18.5	79.7		0	0
BH02	Mar-11	0	**5.6**	12.3	82.1		0	0
BH02	Jun-11	0	2	19.3	78.7		0	0
BH02	Apr-12	0.4	3.4	18	78.2		0	0
BH02	Aug-12	0	1.1	20.2	78.7		0	0
BH02	Feb-13	0	2.2	19.1	78.7		0	0
BH02	Aug-13	0	2	18.9	79.1		0	0
BH02	Mar-14	0	3.3	16.4	80.3		0	0
BH02	Jul-14	0	2.4	18.6	79		0	0
BH02	Mar-15	0	2.9	15.5	81.6		0	0
BH02	Jul-15	0	0.1	19.8	80.1	0	0	0
BH02	Feb-16	0	2.4	18.3	79.3	0	0	0
BH02	Jul-16	0	3.1	17	79.9	0	0	0
BH02	Aug-16	0	3	17	80		0	0
BH02	Sep-16	0	3.3	11.8	84.9		0	0
BH02	Feb-17	0	3	17.2	79.8	0	0	0
BH02	Jul-17	0	2.3	19.1	78.6	0	0	0
BH02	Feb-18	0	2.3	17.9	79.8	0	0	0
BH02	Aug-18	0	1.8	18.8	79.4	**0.1**	0	0.0018
BH02	Oct-18	0	1.3	18.9	79.8	0	0	0
	Qhg based on max concentration & max flow rate						**0.0024**	**0.0056**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH03	Aug-01	0	9.4	8.6	82		0	0
BH03	Oct-01	0	13	5	82		0	0
BH03	Nov-01	0	0	20.5	79.5		0	0
BH03	Dec-01	0	9.9	12.3	77.8		0	0
BH03	Feb-02	0	15	6.4	78.6		0	0
BH03	Mar-02	0	5.6	15	79.4		0	0
BH03	Apr-02	0	10	10.4	79.6		0	0
BH03	May-02	0	6.4	14.2	79.4		0	0
BH03	Jun-02	0	8.9	10.8	80.3		0	0
BH03	Jul-02	0	10.8	10.3	78.9		0	0
BH03	Aug-02	0	9.2	10.8	80		0	0
BH03	Feb-03	0	14	7.1	78.9		0	0
BH03	Jun-03	0	12	9.1	78.9		0	0
BH03	Sep-03	0	**16.6**	2.3	81.1		0	0
BH03	Nov-03	0	13.1	9.3	77.6		0	0
BH03	Feb-04	0	13.4	10.2	76.4		0	0
BH03	Jun-04	0	10.1	8.7	81.2		0	0
BH03	Sep-04	0	12.3	8.8	78.9		0	0
BH03	Nov-04	0	10	12.7	77.3		0	0
BH03	Mar-05	0	7.2	15.1	77.7		0	0
BH03	Sep-05	0	10.7	6.1	83.2		0	0
BH03	Mar-06		7.5	12.9	79.6		0	0
BH03	Jun-06	0.1	7.5	14.6	77.8		0	0
BH03	Feb-07	**0.3**	5.6	15.6	78.5		0	0
BH03	Jun-07	0.2	11.1	6.4	82.3		0	0
BH03	Feb-08	0	6.6	12.7	80.7		0	0
BH03	Jun-08	0	6.8	14.8	78.4		0	0
BH03	Feb-09	0	5.5	16.2	78.3		0	0
BH03	Jun-09	0	6.6	12.8	80.6		0	0
BH03	Sep-09	0	8.8	10.7	80.5		0	0
BH03	Dec-09	0	9.1	8.4	82.5		0	0
BH03	Mar-10	0.1	7.7	10.1	82.1		0	0
BH03	Jun-10	0.1	9.1	10.7	80.1		0	0
BH03	Mar-11	0	13.1	3.6	83.3		0	0
BH03	Jun-11	0	6.4	15.9	77.7		0	0
BH03	Apr-12	**0.3**	7.9	14	77.8		0	0
BH03	Aug-12	0	7	12.2	80.8		0	0
BH03	Feb-13	0	2.4	18.6	79		0	0
BH03	Aug-13	0	4.9	14	81.1		0	0
BH03	Mar-14	0	2.5	16.7	80.8		0	0
BH03	Jul-14	0	6.3	12.3	81.4		0	0
BH03	Mar-15	0	4.7	16.2	79.1		0	0
BH03	Jul-15	0	3.2	17.5	79.3	0	0	0
BH03	Feb-16	0	3.2	17.7	79.1	0	0	0
BH03	Jul-16	0	6.1	13.9	80	0	0	0
BH03	Aug-16	0	5.7	12.8	81.5		0	0
BH03	Sep-16	0	7.2	8.2	84.6		0	0
BH03	Feb-17	0	3.5	16.1	80.4		0	0
BH03	Jul-17	0	4.7	16.3	79	**0.1**	0	0.0047
BH03	Feb-18	0	1.9	17.8	80.3	0	0	0
BH03	Oct-18	0	2.3	18.1	79.4	0	0	0
	Qhg based on max concentration & max flow rate						**0.0003**	**0.0166**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH04	Aug-01	0	12	6.2	81.8		0	0
BH04	Oct-01	0	14	7.4	78.6		0	0
BH04	Nov-01	0	0	20.2	79.8		0	0
BH04	Dec-01	0	11	8.1	80.9		0	0
BH04	Feb-02	0	7.4	15	77.6		0	0
BH04	Mar-02	0	11	9	80		0	0
BH04	Apr-02		**30**	10.3	59.7		0	0
BH04	May-02	0	8.7	11.8	79.5		0	0
BH04	Jun-02	0	8.7	10.1	81.2		0	0
BH04	Jul-02	0	8.8	12	79.2		0	0
BH04	Aug-02	0	9	10.6	80.4		0	0
BH04	Feb-03	0	15	6.2	78.8		0	0
BH04	Jun-03	0	11.6	9.6	78.8		0	0
BH04	Sep-03	0	18.2	2.2	79.6		0	0
BH04	Nov-03	0.1	13	9.7	77.2		0	0
BH04	Feb-04	0	13.6	9.9	76.5		0	0
BH04	Jun-04	0	10.3	8.4	81.3		0	0
BH04	Sep-04	0	12.6	8.4	79		0	0
BH04	Nov-04	0	10.8	11.8	77.4		0	0
BH04	Mar-05	0	8.2	13.8	78		0	0
BH04	Sep-05	0	11.4	7.8	80.8		0	0
BH04	Mar-06		6.5	14.6	78.9		0	0
BH04	Jun-06	0.1	6.5	14.7	78.7		0	0
BH04	Feb-07	**0.4**	6.3	15.3	78		0	0
BH04	Jun-07	0.1	13.5	5.8	80.6		0	0
BH04	Feb-08	0	4.5	13.2	82.3		0	0
BH04	Jun-08	0.1	5.8	15.5	78.6		0	0
BH04	Feb-09	0	6.8	14.6	78.6		0	0
BH04	Jun-09	0	6.3	13.2	80.5		0	0
BH04	Sep-09	0	9	10.8	80.2		0	0
BH04	Dec-09	0	10.1	7.3	82.6		0	0
BH04	Mar-10	0	9.6	8.9	81.5		0	0
BH04	Jun-10	0	9.7	10.8	79.5		0	0
BH04	Mar-11	0	19	3	78		0	0
BH04	Jun-11	0	8	14.5	77.5		0	0
BH04	Apr-12	**0.4**	7.5	14	78.1		0	0
BH04	Aug-12	0	7	12.1	80.9		0	0
BH04	Feb-13	0	2.4	18.5	79.1		0	0
BH04	Aug-13	0	4.9	14	81.1		0	0
BH04	Mar-14	0	3	16.5	80.5		0	0
BH04	Jul-14	0	6.1	12.7	81.2		0	0
BH04	Mar-15	0	5.2	15.6	79.2		0	0
BH04	Jul-15	0	0.1	21.3	78.6	0	0	0
BH04	Feb-16	0	3.6	17.3	79.1	**0.1**	0	0.0036
BH04	Jul-16	0	6.4	13.2	80.4	0	0	0
BH04	Aug-16	0	5.7	12.4	81.9		0	0
BH04	Sep-16	0	8.2	6.9	84.9		0	0
BH04	Feb-17	0	3.6	17.4	79		0	0
BH04	Jul-17	0	5.3	15.9	78.8	0	0	0
BH04	Feb-18	0	0.1	16.7	83.2	0	0	0
BH04	Aug-18	0	3.6	17.4	79	**0.1**	0	0.0036
BH04	Oct-18	0	2.7	18	79	0	0	0
	Qhg based on max concentration & max flow rate						**0.0004**	**0.03**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH05	Aug-01	0	0.7	20.2	79.1		0	0
BH05	Oct-01	0	1.7	18.5	79.8		0	0
BH05	Nov-01	0	0	20.5	79.5		0	0
BH05	Dec-01	0	0.3	20	79.7		0	0
BH05	Feb-02	0	1.5	18.8	79.7		0	0
BH05	Mar-02	0	0.6	11	88.4		0	0
BH05	Apr-02		1.6	20.4	78		0	0
BH05	May-02	0	0.3	20.6	79.1		0	0
BH05	Jun-02	0	0.8	20.2	79		0	0
BH05	Jul-02	0	0.9	20.7	78.4		0	0
BH05	Nov-03	**0.1**	1.2	19.3	79.4		0	0
BH05	Nov-04	0	1.3	20.4	78.3		0	0
BH05	Mar-05	0	0.3	19.9	79.8		0	0
BH05	Sep-05	**0.1**	1.2	20.1	78.6		0	0
BH05	Feb-09	0	0.2	20.2	79.6		0	0
BH05	Jun-09	0	1.4	20.2	78.4		0	0
BH05	Sep-09	0	1.8	20.2	78		0	0
BH05	Dec-09	0	1.3	17.7	81		0	0
BH05	Mar-10	0	1	19.4	79.6		0	0
BH05	Jun-10	0	2	19.8	78.2		0	0
BH05	Mar-11	**0.1**	2.8	17	80.1		0	0
BH05	Jun-11	0	0.6	20.9	78.5		0	0
BH05	Apr-12	**0.1**	1.7	17.8	80.4		0	0
BH05	Aug-12	0	1.6	19.3	79.1		0	0
BH05	Feb-13	0	0.5	20.7	78.8		0	0
BH05	Aug-13	0	0.3	21.1	78.6		0	0
BH05	Mar-14	0	0.9	18.1	81		0	0
BH05	Jul-14	0	2.6	18.8	78.6		0	0
BH05	Mar-15	0	0.8	19.5	79.7		0	0
BH05	Jul-15	0	1	20.6	78.4	0	0	0
BH05	Feb-16	0	0.7	19.6	79.7	0	0	0
BH05	Jul-16	0	0.3	21.6	78.1	0	0	0
BH05	Aug-16	0			100		0	0
BH05	Sep-16	0			100		0	0
BH05	Feb-17	0	**6**	15.1	78.9	0	0	0
BH05	Jul-17	0	1.8	20.2	78	0	0	0
BH05	Feb-18	0	0.3	19.5	80.2	0	0	0
BH05	Aug-18	0	1.2	19.6	79.2	**0.1**	0	0.0012
BH05	Oct-18	0	1.3	18.5	80	0	0	0
	Qhg based on max concentration & max flow rate						**0.0001**	**0.006**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH06	Aug-01	0	0	20.6	79.4		0	0
BH06	Oct-01	0	0.4	19.9	79.7		0	0
BH06	Nov-01	0	0.5	19.7	79.8		0	0
BH06	Dec-01	0	0.5	19.8	79.7		0	0
BH06	Feb-02	0	0.4	20	79.6		0	0
BH06	Mar-02	0	0.4	20.1	79.5		0	0
BH06	Apr-02	0	0.5	19.4	80.1		0	0
BH06	May-02	0	0.6	20.3	79.1		0	0
BH06	Jun-02	0	0.2	20.4	79.4		0	0
BH06	Jul-02	0	0.3	20.8	78.9		0	0
BH06	Nov-03	0	0.7	19.7	79.6		0	0
BH06	Nov-04	0	0.5	21	78.5		0	0
BH06	Mar-05	0	0.4	20.7	78.9		0	0
BH06	Sep-05	0	0.3	21	78.7		0	0
BH06	Jun-09	0	0.6	21	78.4		0	0
BH06	Sep-09	0	1.4	18.7	79.9		0	0
BH06	Dec-09	0	1.1	17.7	81.2		0	0
BH06	Mar-10	**0.1**	0	20.2	79.7		0	0
BH06	Jun-10	0	1.3	19.1	79.6		0	0
BH06	Mar-11	**0.1**	2.4	16.7	80.8		0	0
BH06	Jun-11	0	0.7	20.2	79.1		0	0
BH06	Apr-12	**0.1**	1.8	18.1	80		0	0
BH06	Aug-12	0	0.2	21.5	78.3		0	0
BH06	Feb-13	0	0.4	20.8	78.8		0	0
BH06	Aug-13	0	1.4	18.1	80.5		0	0
BH06	Mar-14	0	0.8	18.1	81.1		0	0
BH06	Jul-14	0	4.5	16.5	79		0	0
BH06	Mar-15	0	4.5	16.1	79.4		0	0
BH06	Jul-15	0	4.4	17.3	78.3	0	0	0
BH06	Feb-16	0	**6.5**	14	79.5	0	0	0
BH06	Jul-16	0	3.4	19.3	77.3	0	0	0
BH06	Aug-16	0			100		0	0
BH06	Sep-16	0			100		0	0
BH06	Feb-17	0	5.7	15.2	79.1	0	0	0
BH06	Jul-17	0	6.3	15.4	78.3	0	0	0
BH06	Feb-18	0	2.9	17.7	79.4	0	0	0
BH06	Aug-18	0	**6.5**	14.9	78.6	**0.2**	0	0.013
BH06	Oct-18	0	4.6	16.2	79.3	0	0	0
	Qhg based on max concentration & max flow rate						**0.0002**	**0.013**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH07	Oct-01	0	4.2	8.5	87.3		0	0
BH07	Nov-01	0	4.4	10.5	85.1		0	0
BH07	Dec-01	0	3.6	14.5	81.9		0	0
BH07	Feb-02	0	5	10.2	84.8		0	0
BH07	Mar-02	0	1.9	18.2	79.9		0	0
BH07	Apr-02	0	4	14.8	81.2		0	0
BH07	May-02	0	2.5	16.9	80.6		0	0
BH07	Jun-02	0	4.3	10.9	84.8		0	0
BH07	Jul-02	0	4.7	12.2	83.1		0	0
BH07	Aug-02	0	4	13.2	82.8		0	0
BH07	Nov-03	0.1	4.5	11.3	84.1		0	0
BH07	Nov-04	0	3.8	13	83.2		0	0
BH07	Mar-05	0	5.5	11.9	82.6		0	0
BH07	Mar-06	0	3.3	13.4	83.3		0	0
BH07	Jun-09	0	1.4	20.2	78.4		0	0
BH07	Sep-09	0	0.7	19.9	79.4		0	0
BH07	Dec-09	0	2.9	12.5	84.6		0	0
BH07	Mar-10	0	1.9	18.6	79.5		0	0
BH07	Jun-10	0	1.2	19.3	79.5		0	0
BH07	Mar-11				100		0	0
BH07	Jun-11	**0.3**	1.7	18.7	79.3		0	0
BH07	Apr-12	0.1	5.1	8	86.8		0	0
BH07	Aug-12	0	2.2	17.9	79.9		0	0
BH07	Feb-13	0	2.1	17.8	80.1		0	0
BH07	Aug-13	0	2.1	18.5	79.4		0	0
BH07	Mar-14	0	4.7	12.7	82.6		0	0
BH07	Jul-14	0	5.7	10.6	83.7		0	0
BH07	Mar-15	0	2.5	15.9	81.6		0	0
BH07	Jul-15	0	1	19.8	79.2	0	0	0
BH07	Feb-16	0	2.9	17.6	79.5	0	0	0
BH07	Jul-16	0	2	13	85	0	0	0
BH07	Aug-16	0			100		0	0
BH07	Sep-16	0			100		0	0
BH07	Feb-17	0	**10.5**	11.7	77.8	0	0	0
BH07	Jul-17	0	3.1	16.8	80.1	0	0	0
BH07	Feb-18	0	5.6	15.6	78.8	0	0	0
BH07	Aug-18	0	1.1	19.5	79.4	**0.1**	0	0.0011
BH07	Oct-18	0	2.1	20	79	0	0	0
	Qhg based on max concentration & max flow rate						**0.0003**	**0.0105**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH08	Aug-01	**0.4**	7.5	3.1	89		0	0
BH08	Oct-01	0	6.2	7.8	86		0	0
BH08	Nov-01	0.1	7.6	8.1	84.2		0	0
BH08	Dec-01	0	3.1	16.6	80.3		0	0
BH08	Feb-02	0	**10.1**	8	81.9		0	0
BH08	Mar-02	0	3	17	80		0	0
BH08	Apr-02	0	4.6	13.4	82		0	0
BH08	May-02	0	9.3	16.4	74.3		0	0
BH08	Jun-02	0	4.4	11.4	84.2		0	0
BH08	Jul-02	0	4.1	13.1	82.8		0	0
BH08	Aug-02	0	3.8	14.3	81.9		0	0
BH08	Feb-03	0	7.8	10.6	81.6		0	0
BH08	Jun-03	0	5.8	11.5	82.7		0	0
BH08	Sep-03	0	6.7	8.2	85.1		0	0
BH08	Nov-03	0.1	8.2	7.8	83.9		0	0
BH08	Feb-04	0	7	14	79		0	0
BH08	Jun-04	0	5.3	11.4	83.3		0	0
BH08	Sep-04	0	3.7	14	82.3		0	0
BH08	Nov-04	0	4.7	15	80.3		0	0
BH08	Mar-05	0	6.0	13.9	80.1		0	0
BH08	Sep-05	0.1	6.1	6.5	87.3		0	0
BH08	Jun-09	0	3.9	15.7	80.4		0	0
BH08	Sep-09	0	0.5	20.7	78.8		0	0
BH08	Dec-09	0.1	5	11.8	83.1		0	0
BH08	Mar-10	0.1	0	20.6	79.3		0	0
BH08	Jun-10	0	4.3	15.2	80.5		0	0
BH08	Mar-11				100		0	0
BH08	Jun-11	0	0	20.6	79.4		0	0
BH08	Apr-12	0.1	5.5	5.5	88.9		0	0
BH08	Aug-12	0	2.3	20	77.7		0	0
BH08	Feb-13	0	1.3	19.3	79.4		0	0
BH08	Aug-13	0	0.2	21.4	78.4		0	0
BH08	Mar-14	0	6.5	10.7	82.8		0	0
BH08	Jul-14	0	3.2	15.7	81.1		0	0
BH08	Mar-15	0	4.5	12.2	83.3		0	0
BH08	Jul-15	0	0.3	20.5	79.2	0	0	0
BH08	Feb-16	0	2.3	18.6	79.1	-0.1	0	-0.0023
BH08	Jul-16	0	0.4	21.2	78.4	0	0	0
BH08	Aug-16	0			100		0	0
BH08	Sep-16	0			100		0	0
BH08	Feb-17	0	1.2	19	79.8	0	0	0
BH08	Jul-17	0	0.2	21.4	78.4	0	0	0
BH08	Feb-18	0	0.7	19.2	80.1	0	0	0
BH08	Aug-18	0	0.3	20.3	79.4	**0.1**	0	0.0003
BH08	Oct-18	0	1.4	18.8	80	0	0	0
	Qhg based on max concentration & max flow rate						**0.0004**	**0.0101**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH09	Aug-01	0	4.4	14.7	80.9		0	0
BH09	Oct-01	**0.1**	10	0.1	89.8		0	0
BH09	Nov-01	0	8.8	2.6	88.6		0	0
BH09	Dec-01	0	5	10	85		0	0
BH09	Feb-02	0	11	2.6	86.4		0	0
BH09	Mar-02	0	0.5	19.9	79.6		0	0
BH09	Apr-02	0	7.1	7.1	85.8		0	0
BH09	May-02	0	**20**	10	70		0	0
BH09	Jun-02	0	11	1.2	87.8		0	0
BH09	Jul-02	0	10.9	1	88.1		0	0
BH09	Aug-02	0	8.9	1.9	89.2		0	0
BH09	Feb-03	0	11	3.5	85.5		0	0
BH09	Jun-03	0	9.8	4.1	86.1		0	0
BH09	Sep-03	0	8.4	5.6	86		0	0
BH09	Nov-03	**0.1**	7.6	5	87.3		0	0
BH09	Feb-04	0	5.4	10	84.6		0	0
BH09	Jun-04	0	6.5	8.6	84.9		0	0
BH09	Sep-04	0	5.5	10	84.5		0	0
BH09	Nov-04	0	1.9	19.4	78.7		0	0
BH09	Mar-05	0	7.4	8.8	83.8		0	0
BH09	Sep-05	**0.1**	7.1	6.4	86.4		0	0
BH09	Feb-09		2.6	16.9	80.5		0	0
BH09	Jun-09	0	1.8	20.7	77.5		0	0
BH09	Sep-09	0	1.3	19.6	79.1		0	0
BH09	Dec-09	0	5.3	3.5	91.2		0	0
BH09	Mar-10	**0.1**	3.4	7.6	88.9		0	0
BH09	Jun-10	0	1.9	19.1	79		0	0
BH09	Mar-11	0	0	20.6	79.4		0	0
BH09	Jun-11	0	0.9	19.8	79.3		0	0
BH09	Apr-12	**0.1**	9.1	4	86.8		0	0
BH09	Aug-12	0	5.7	13	81.3		0	0
BH09	Feb-13	0	0.8	20.3	78.9		0	0
BH09	Aug-13	0	0.1	21.4	78.5		0	0
BH09	Mar-14	0	8.1	8.8	83.1		0	0
BH09	Jul-14	0	3.4	16.5	80.1		0	0
BH09	Mar-15	0	4.8	12.5	82.7		0	0
BH09	Jul-15	0	1	20.4	78.6	0	0	0
BH09	Feb-16	0	3.1	18	78.9	**0.1**	0	0.0031
BH09	Jul-16	0	2.3	20.5	77.2	0	0	0
BH09	Aug-16				100		0	0
BH09	Sep-16				100		0	0
BH09	Feb-17	0	2.1	18.1	79.8	0	0	0
BH09	Jul-17	0	2.5	19.9	77.6	-0.1	0	-0.0025
BH09	Feb-18	0	0.9	19	80.1	0	0	0
BH09	Aug-18	0	2.2	19.4	78.4	0	0	0
BH09	Oct-18	0	0.3	19.8	80	0	0	0
	Qhg based on max concentration & max flow rate						**0.0001**	**0.02**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH10	Aug-01	**0.5**	7.1	0.4	92		0	0
BH10	Oct-01	0.2	8.2	0.1	91.5		0	0
BH10	Nov-01	0.3	9.4	0.3	90		0	0
BH10	Dec-01	0	7.1	4.4	88.5		0	0
BH10	Feb-02	0	**12**	0.5	87.5		0	0
BH10	Mar-02	0	3.3	16.1	80.6		0	0
BH10	Apr-02	0	9.6	3	87.4		0	0
BH10	May-02	0	6.1	9.1	84.8		0	0
BH10	Jun-02	0	2.1	7.7	90.2		0	0
BH10	Jul-02	0	8.5	1.2	90.3		0	0
BH10	Aug-02	0	6.7	3.2	90.1		0	0
BH10	Feb-03	0		1.8	98.2		0	0
BH10	Jun-03	0		5	95		0	0
BH10	Sep-03	0		3.5	96.5		0	0
BH10	Nov-03	0.2	8.8	2.2	88.8		0	0
BH10	Feb-04	0	10.2	5	84.8		0	0
BH10	Jun-04	0	7.4	6.2	86.4		0	0
BH10	Sep-04	0	7.2	7.5	85.3		0	0
BH10	Nov-04	0	6.9	8.3	84.8		0	0
BH10	Mar-05	0	8.4	5.6	86		0	0
BH10	Sep-05	0	8.3	3.2	88.5		0	0
BH10	Feb-09	0	2.4	16.4	81.2		0	0
BH10	Jun-09	0	1.7	20	78.3		0	0
BH10	Sep-09	0	0.3	20.5	79.2		0	0
BH10	Dec-09	0	3.2	3.1	93.7		0	0
BH10	Mar-10	0.1	0	20.3	79.6		0	0
BH10	Jun-10	0	1.1	20.7	78.2		0	0
BH10	Mar-11	0.1	6.7	1.4	91.8		0	0
BH10	Jun-11	0	3.6	14.9	81.5		0	0
	Qhg based on max concentration & max flow rate						**NA**	**NA**

No historical flow measurements

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH11	Aug-01	0	1.5	19	79.5		0	0
BH11	Oct-01	0	4.8	18.7	76.5		0	0
BH11	Nov-01	0	1.6	18.2	80.2		0	0
BH11	Dec-01	0	2.6	17.2	80.2		0	0
BH11	Feb-02	0	3.9	16.3	79.8		0	0
BH11	Mar-02		**7.5**	18	74.5		0	0
BH11	Apr-02	0	2.9	16.8	80.3		0	0
BH11	May-02	0	2.4	18	79.6		0	0
BH11	Jun-02	0	3.0	17	80		0	0
BH11	Jul-02	0	3.2	17.9	78.9		0	0
BH11	Aug-02	0	2.5	17.2	80.3		0	0
BH11	Nov-03	**0.1**	3.4	16.6	79.9		0	0
BH11	Nov-04	0	3.4	17.8	78.8		0	0
BH11	Mar-05	0	3.3	17.6	79.1		0	0
BH11	Sep-05	0	2.5	18.9	78.6		0	0
							No historical flow measurements	
BH13	Aug-01	0	1.9	18.9	79.2		0	0
BH13	Oct-01	0	**11.0**	17.7	71.3		0	0
BH13	Nov-01	0	3.6	16.8	79.6		0	0
BH13	Dec-01	0	2.4	18.2	79.4		0	0
BH13	Feb-02	0	4.2	16.4	79.4		0	0
BH13	Mar-02		7.5	18.1	74.4		0	0
BH13	Apr-02		8.7	18.1	73.2		0	0
BH13	May-02		4.4	18.1	77.5		0	0
BH13	Jun-02	0	2.6	17.6	79.8		0	0
BH13	Jul-02	0	2.8	18.4	78.8		0	0
BH13	Aug-02	0	5.5	17.4	77.1		0	0
BH13	Nov-03	**0.2**	3.4	16.1	80.3		0	0
BH13	Nov-04	0	3.4	17.9	78.7		0	0
BH13	Mar-05	0	2.9	16.7	80.4		0	0
BH13	Sep-05	0	2.7	18.7	78.6		0	0
							No historical flow measurements	
BH15	Aug-01	0	0	21.1	78.9		0	0
BH15	Oct-01	0	6.7	16.4	76.9		0	0
BH15	Nov-01	0	7.2	12.6	80.2		0	0
BH15	Dec-01	0	5.4	13.9	80.7		0	0
BH15	Feb-02	0	**9.1**	12.1	78.8		0	0
BH15	Mar-02	0	5.2	16.1	78.7		0	0
BH15	Apr-02	0	6.2	13.6	80.2		0	0
BH15	May-02	0	3.2	18	78.8		0	0
BH15	Jun-02	0	7.7	12.2	80.1		0	0
BH15	Jul-02	0	7.6	12	80.4		0	0
BH15	Aug-02	0	6.4	10.9	82.7		0	0
BH15	Feb-03	0	7.3	11.5	81.2		0	0
BH15	Jun-03	0	7	14.5	78.5		0	0
BH15	Sep-03	0	4	18	78		0	0
BH15	Nov-03	**0.1**	6.8	14	79.1		0	0
BH15	Feb-04	0	7.4	13	79.6		0	0
BH15	Jun-04	**0.1**	5.4	16.7	77.8		0	0
BH15	Sep-04	0	5.9	15.8	78.3		0	0
BH15	Nov-04	0	7	14.1	78.9		0	0
BH15	Mar-05	0	7.1	14.8	78.1		0	0
BH15	Sep-05	0	6.7	14.7	78.6		0	0
BH15	Sep-09	0	3	17.3	79.7		0	0
BH15	Dec-09	0	3.7	13.5	82.8		0	0
BH15	Mar-10	**0.1**	1.2	19.7	79		0	0
BH15	Jun-10	0	2.2	19	78.8		0	0
BH15	Mar-11	**0.1**	4.4	13.3	82.2		0	0
BH15	Jun-11	0	1	19.7	79.3		0	0
BH15	Apr-12	**0.1**	4.2	13.2	82.5		0	0
BH15	Aug-12	0	3.3	17.7	79		0	0
BH15	Feb-13	0	2	16.8	81.2		0	0
BH15	Aug-13	0	3	17.5	79.5		0	0
BH15	Mar-14	0	3.3	16.2	80.5		0	0
BH15	Jul-14	0	2.6	19.6	77.8		0	0
BH15	Mar-15	0	3.5	14.5	82		0	0
BH15	Jul-15	0	0.9	20.9	78.2	0	0	0
BH15	Feb-16	0	2.9	14.5	82.6	0	0	0
BH15	Jul-16	0	1.7	20.5	77.8	0	0	0
BH15	Aug-16	0					0	0
BH15	Sep-16	0					0	0
BH15	Feb-17	0	3.9	16.3	79.8	0	0	0
BH15	Jul-17	0	0.9	21.1	78	0	0	0
BH15	Feb-18	0	2.6	16.4	81	0	0	0
BH15	Aug-18	0	1.5	20.8	77.7	**0.1**	0	0.0015
BH15	Oct-18	0	0.9	19.5	79.1	0	0	0
	Qhg based on max concentration & max flow rate						**0.0001**	**0.0091**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH12	Aug-01	0	3.8	16.2	80		0	0
BH12	Oct-01	0	3.3	16.4	80.3		0	0
BH12	Nov-01	0	3.4	16.2	80.4		0	0
BH12	Dec-01	0	1.2	18.9	79.9		0	0
BH12	Feb-02	0	1.4	18.9	79.7		0	0
BH12	Mar-02	0	1.2	19.3	79.5		0	0
BH12	Apr-02	0	1.2	19.4	79.4		0	0
BH12	May-02	0	**4.6**	19.5	75.9		0	0
BH12	Jun-02	0	1.2	18.8	80		0	0
BH12	Jul-02	0	1.2	19.5	79.3		0	0
BH12	Nov-03	**0.1**	2.4	18.5	79		0	0
BH12	Nov-04	0	2.0	19.3	78.7		0	0
BH12	Mar-05	0	1.7	18.3	80		0	0
BH12	Sep-05	**0.1**	1.3	20.2	78.4		0	0
							No historical flow measurements	
BH14	Aug-01	0	0.8	18.8	80.4		0	0
BH14	Oct-01	0	2.1	18.2	79.7		0	0
BH14	Nov-01	0	2.3	18.1	79.6		0	0
BH14	Dec-01	0	1.9	18.1	80		0	0
BH14	Feb-02	0	2.4	18	79.6		0	0
BH14	Mar-02	0	2.1	18.4	79.5		0	0
BH14	Apr-02	0	1.8	18.3	79.9		0	0
BH14	May-02	0	1.8	18.7	79.5		0	0
BH14	Jun-02	0	1.5	18.7	79.8		0	0
BH14	Jul-02	0	1.6	18.9	79.5		0	0
BH14	Nov-03	**0.2**	**3.4**	17.3	79.1		0	0
BH14	Nov-04	0	3.1	18.5	78.4		0	0
BH14	Mar-05	0	2.5	16.9	80.6		0	0
BH14	Sep-05	0	2.4	18.9	78.7		0	0
							No historical flow measurements	
BH16	Aug-01	0	2.2	18.1	79.7		0	0
BH16	Oct-01	0	3.7	16.4	79.9		0	0
BH16	Nov-01	0	3.9	16.8	79.3		0	0
BH16	Dec-01	0	2.9	17.5	79.6		0	0
BH16	Feb-02	0	4.3	16.7	79		0	0
BH16	Mar-02	0	**11**	16.9	72.1		0	0
BH16	Apr-02		2	17.6	80.4		0	0
BH16	May-02		9	17.2	73.8		0	0
BH16	Jun-02	0	3.1	16	80.9		0	0
BH16	Jul-02	0	4.1	12	83.9		0	0
BH16	Aug-02	0	4.1	14.6	81.3		0	0
BH16	Nov-03	**0.1**	4.6	16.1	79.2		0	0
BH16	Nov-04	0	4.5	17.1	78.4		0	0
BH16	Mar-05	0	3.2	16.3	80.5		0	0
BH16	Sep-05	0	3.5	18.1	78.4		0	0
							No historical flow measurements	

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH17	Feb-13	0	2.1	19	78.9		0	0
BH17	Aug-13	0	6.5	12.2	81.3		0	0
BH17	Mar-14	0	3.8	16.7	79.5		0	0
BH17	Jul-14	0	5.7	14.5	79.8		0	0
BH17	Mar-15	0	7.2	11.4	81.4		0	0
BH17	Jul-15	0	3.7	17.4	78.9	0	0	0
BH17	Feb-16	0	4.1	14.5	81.4	0	0	0
BH17	Jul-16	0	6.9	13.7	79.4	0	0	0
BH17	Aug-16	0	4.6	16.2	79.2		0	0
BH17	Sep-16	0	5.7	3.7	90.6		0	0
BH17	Feb-17	0	**7.9**	13.4	78.7	0	0	0
BH17	Jul-17	0	6.3	15.2	78.5	0	0	0
BH17	Feb-18	0	5.8	15.5	78.7	0	0	0
BH17	Aug-18	0	1.6	17.4	81	**0.1**	0	0.0016
BH17	Oct-18	0	3.4	17.3	79.3	**0.1**	0	0.0034
	Qhg based on max concentration & max flow rate					**0**		**0.0079**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH18	Feb-13	0	2.1	19	78.9		0	0
BH18	Aug-13	5.6	10.6	10.5	73.3		0	0
BH18	Mar-14	0	5.9	15.8	78.3		0	0
BH18	Jul-14	**15.6**	16.5	3.2	64.7		0	0
BH18	Mar-15	0	7.6	13	79.4		0	0
BH18	Jul-15	1.6	6.7	14.7	77	0	0	0
BH18	Feb-16	0	5.2	16.7	78.1	0	0	0
BH18	Jul-16	11.4	15.3	4.5	68.8	0	0	0
BH18	Aug-16	7.9	13.3	6.1	72.7		0	0
BH18	Sep-16	15.3	**17.6**	3.3	63.8		0	0
BH18	Feb-17	0	9.7	11.3	79	0	0	0
BH18	Jul-17	1.8	8	7.8	82.4	0	0	0
BH18	Feb-18	0.2	5.3	16	78.5	0	0	0
BH18	Jun-18	0	3.4	17.8	78.8		0	0
BH18	Jun-18	0	2.5	19.4	78.1		0	0
BH18	Jul-18	0	3.5	16.6	79.9	0	0	0
BH18	Aug-18	0	4.3	14.1	81.6	**0.1**	0	0.0043
BH18	Oct-18	0	4.4	16.1	79.5	0	0	0
	Qhg based on max concentration & max flow rate					**0.0156**		**0.0176**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH19	Feb-13	0	1.7	19.1	79.2		0	0
BH19	Aug-13	0	8.8	9.3	81.9		0	0
BH19	Mar-14	0	3.7	17.1	79.2		0	0
BH19	Jul-14	0					0	0
BH19	Mar-15		3.7	18.2	78.1		0	0
BH19	Jul-15	0	3.2	17.7	79.1	0	0	0
BH19	Feb-16	0	2.8	17.8	79.4	0	0	0
BH19	Jul-16	0	10.9	5.3	83.8	0	0	0
BH19	Aug-16	0	8.6	8.9	82.5		0	0
BH19	Sep-16	0	**12.5**	2.7	84.8		0	0
BH19	Feb-17	0	6.8	14.4	78.8	0	0	0
BH19	Jul-17	0	5	16	79	0	0	0
BH19	Feb-18	0	3	16.6	80.4	0	0	0
BH19	Jun-18	0	3.0	18	79		0	0
BH19	Jul-18	0	3.2	17.7	79.1	**0.1**	0	0.0032
BH19	Aug-18	0	4.6	16.6	78.8	**0.1**	0	0.0046
BH19	Oct-18	0	3.4	18	78.6	0	0	0
	Qhg based on max concentration & max flow rate					**0**		**0.0125**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH20	Feb-13	0	2.3	18.7	79		0	0
BH20	Aug-13	0	5.6	14.9	79.5		0	0
BH20	Mar-14	0	4.6	17.1	78.3		0	0
BH20	Jul-14		**5.8**	14.5	79.7		0	0
BH20	Mar-15	0	5.2	14.3	80.5		0	0
BH20	Jul-15	0	3.6	17.8	78.6	0	0	0
BH20	Feb-16	0	3.7	17.1	79.2	**0.1**	0	0.0037
BH20	Jul-16	0	4.9	15.7	79.4	0	0	0
BH20	Aug-16	0	4	17.1	78.9		0	0
BH20	Sep-16	0	4.3	15.2	80.5		0	0
BH20	Feb-17	0	4.9	16.4	78.7	0	0	0
BH20	Jul-17	0	3.9	17.4	78.7	0	0	0
BH20	Feb-18	0	3.9	16	80.1	0	0	0
BH20	Aug-18	0	3.3	17.9	78.8	0	0	0
BH20	Oct-18	3	3	18	79	0	0	0
	Qhg based on max concentration & max flow rate					**0.003**		**0.0058**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH21	Feb-13	0	1.4	19.8	78.8		0	0
BH21	Aug-13	0	6.5	10.5	83		0	0
BH21	Mar-14	0	**13.3**	1.3	85.4		0	0
BH21	Jul-14	0	5.5	8.2	86.3		0	0
BH21	Mar-15	0	8.2	11.6	80.2		0	0
BH21	Jul-15	0	2.2	19.9	77.9		0	0
BH21	Feb-16	0	4.4	16.6	79		0	0
BH21	Jul-16	0	6.5	9.4	84.1	0	0	0
BH21	Aug-16	0	6.5	6.8	86.7	0	0	0
BH21	Sep-16	0	3.5	8.7	87.8	0	0	0
BH21	Feb-17	0	3.7	18.4	77.9		0	0
BH21	Jul-17	0	3.7	18.5	77.8		0	0
BH21	Feb-18	0	3.2	16.5	80.3	**0.1**	0	0.0032
BH21	Jun-18	0	3.8	17.6	78.6	0	0	0
BH21	Jun-18	0	2.5	19.4	78.1	**0.1**	0	0.0025
BH21	Jul-18	0	2.9	19.1	78	**0.1**	0	0.0029
BH21	Aug-18	0	2.7	19.8	77.5	0	0	0
BH21	Oct-18	0	4.8	16.2	79	0	0	0
	Qhg based on max concentration & max flow rate					**0**		**0.0133**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH22	Feb-13	0	1	20.2	78.8		0	0
BH22	Aug-13	0	2.5	17.7	79.8		0	0
BH22	Mar-14	0	9.2	12.2	78.6		0	0
BH22	Jul-14	0	9.8	5.3	84.9		0	0
BH22	Mar-15	0	**15.2**	5.6	79.2		0	0
BH22	Jul-15	0	3.3	19.1	77.6		0	0
BH22	Feb-16	0	2.6	18	79.4		0	0
BH22	Jul-16	0	6.2	8.5	85.3	0	0	0
BH22	Aug-16	0	6.9	3.1	90	0	0	0
BH22	Sep-16	0	8	1.8	90.2	0	0	0
BH22	Feb-17	0	6.5	15.3	78.2		0	0
BH22	Jul-17	0	4.1	17.1	78.8		0	0
BH22	Feb-18	0	9.8	10.6	79.6	0	0	0
BH22	Jun-18	0	4.1	16	79.9	0	0	0
BH22	Jun-18	0	7.6	12.4	80	0	0	0
BH22	Jul-18	**0.1**	0.3	20.4	79.2	**0.1**	0.0001	0.0003
BH22	Aug-18	0	1.2	20.3	78.5	**0.1**	0	0.0012
BH22	Oct-18	0	5.7	14.4	79.9	0	0	0
	Qhg based on max concentration & max flow rate						**0.0001**	**0.0152**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH23	Feb-13	0	1.1	20.1	78.8		0	0
BH23	Aug-13	0	2.9	19.4	77.7		0	0
BH23	Mar-14	0	3.6	18.6	77.8		0	0
BH23	Jul-14	0	3.2	17.6	79.2		0	0
BH23	Mar-15	0	4	15	81		0	0
BH23	Jul-15	0	2.2	19.8	78	0	0	0
BH23	Feb-16	0	3.1	16.1	80.8	**0.1**	0	0.0031
BH23	Jul-16	0	3.2	19.2	77.6	0	0	0
BH23	Aug-16				100		0	0
BH23	Sep-16				100		0	0
BH23	Feb-17	0	**4.2**	16.2	79.6	0	0	0
BH23	Jul-17	0	3.6	17.8	78.6	0	0	0
BH23	Feb-18	0	3.8	16.1	80.1	0	0	0
BH23	Jun-18	0	3.3	16	80.7		0	0
BH23	Jun-18	0	1.7	18.6	79.7		0	0
BH23	Jul-18	**0.1**	0.4	20.3	79.2	**0.1**	0.0001	0.0004
BH23	Aug-18	0	1.2	20.3	78.5	**0.1**	0	0.0012
BH23	Oct-18	0	2.3	17.9	79.8	0	0	0
	Qhg based on max concentration & max flow rate						**0.0001**	**0.0042**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH24	Feb-13	0	1	21.6	77.4		0	0
BH24	Aug-13	0	3.5	15.9	80.6		0	0
BH24	Mar-14	0	3.5	17.1	79.4		0	0
BH24	Jul-14	0	3.8	20.8	75.4		0	0
BH24	Mar-15	0	4.2	14.3	81.5		0	0
BH24	Jul-15	0	2.2	19.2	78.6	0	0	0
BH24	Feb-16	0	2.9	14.8	82.3	0	0	0
BH24	Jul-16	0	4.4	17	78.6	0	0	0
BH24	Feb-17	0	**4.8**	16.4	78.8	0	0	0
BH24	Jul-17	0	2.9	19.2	77.9	0	0	0
BH24	Feb-18	0	3.2	16.4	80.4		0	0
BH24	Aug-18	0	1.7	20.6	77.7	0	0	0
BH24	Oct-18	0	2.1	19.1	78.7	0	0	0
	Qhg based on max concentration & max flow rate						**0**	**0**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH25	Jul-16	0	**9.5**	8.4	82.1	**0.1**	0	0.0095
BH25	Aug-16	0	7.2	9.3	83.5		0	0
BH25	Sep-16	0	9.1	5.0	85.9		0	0
BH25	Feb-17	0	3.5	17.2	79.3	**0.1**	0	0.0035
BH25	Jul-17	0	2.5	20.1	77.4	0	0	0
BH25	Feb-18	0	1.6	17.9	80.5	0	0	0
BH25	Jun-18	0	2.8	18.6	78.6		0	0
BH25	Jun-18	0	2.0	19.9	78.1		0	0
BH25	Jul-18	0	1.7	19.8	78.5	0	0	0
BH25	Aug-18	0	1.5	20.1	78.4	**0.1**	0	0.0015
BH25	Oct-18	0	2.6	17.9	79.5	0	0	0
	Qhg based on max concentration & max flow rate						**0**	**0.0095**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH26	Jul-16	0.2	1.1	20.2	78.5	0	0	0
BH26	Aug-16	5.8	10.6	7	76.6		0	0
BH26	Sep-16	**13.2**	10.7	0.1	76		0	0
BH26	Feb-17	2.5	**15.7**	3.9	77.9	0	0	0
BH26	Jul-17	11.9	15.3	1.3	71.5	0	0	0
BH26	Feb-18	1.3	14.8	7.5	76.4	0	0	0
BH26	Jun-18	0.7	11.8	6.9	80.6		0	0
BH26	Jun-18	0.4	9.6	10.2	79.8		0	0
BH26	Jul-18	4.3	11.5	9.6	74.6	0	0	0
BH26	Aug-18	8.5	14.4	5.6	71.5	**0.1**	0.0085	0.0144
BH26	Oct-18	2.8	10.8	7.4	78.9	0	0	0
	Qhg based on max concentration & max flow rate						**0.0132**	**0.0157**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)
BH27	Jul-16	0	4.5	14.2	81.3	0	0	0
BH27	Aug-16	0	0.1	21	78.9		0	0
BH27	Sep-16	0	6.6	10.8	82.6		0	0
BH27	Feb-17	0	**7.1**	13.2	79.7	0	0	0
BH27	Jul-17	0	3.6	17.4	79	0	0	0
BH27	Feb-18	0	4.9	16.4	78.7	**0.1**	0	0.0049
BH27	Jun-18	0	3.0	18.4	78.6		0	0
BH27	Jun-18	0	3.1	18.4	78.5		0	0
BH27	Jul-18	0	3.4	18.3	78.3	0	0	0
BH27	Aug-18	0	3.6	17.4	79	**0.1**	0	0.0036
BH27	Oct-18	0	3.7	17.4	78.9	0	0	0
	Qhg based on max concentration & max flow rate						**0**	**0.0071**

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)

May contain groundwater

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)	
BH28	Jul-16	0	**5.4**	15.8	78.8	0	0	0	
BH28	Aug-16	0	4.6	17.1	78.3		0	0	
BH28	Sep-16	0	3.8	17.2	79		0	0	
BH28	Feb-17	0	3.3	18.2	78.5	0	0	0	
BH28	Jul-17	0	3.3	18.5	78.2	0	0	0	
BH28	Feb-18	**0.1**	3.0	18.8	78.1	0	0	0	
BH28	Aug-18	0	2.5	19.6	77.9	**0.1**	0	0.0025	
BH28	Oct-18	0	3.3	17.8	78.9	0	0	0	
	Qhg based on max concentration & max flow rate						**0.0001**	**0.0054**	
BH29	Jun-18	0	9.7	7.3	83	**0.7**	0	0.0679	
BH29	Jun-18	0	9.9	7.1	83	0.4	0	0.0396	
BH29	Jul-18	0	0.9	7.8	91.3	0	0	0	
BH29	Aug-18	0	9.9	7.5	82.6	0	0	0	
BH29	Oct-18	0	**11.8**	6.8	81.5	0	0	0	
	Qhg based on max concentration & max flow rate						**0**	**0.0826**	
BH30	Jun-18	0	2.5	18.2	79.3	**0.1**	0	0.0025	
BH30	Jul-18	0	3.7	17.6	78.7	**0.1**	0	0.0037	
BH30	Aug-18	0	**3.9**	17.7	78.3	**0.1**	0	0.0039	
BH30	Oct-18	0	3.5	17.0	79.5	0	0	0	
	Qhg based on max concentration & max flow rate						**0**	**0.0039**	
BH31	Jun-18	0	1.9	18.9	79.2	0	0	0	
BH31	Jul-18	0	5.5	15.1	79.4	0	0	0	
BH31	Aug-18	0	**6.0**	15.0	79	0	0	0	
BH31	Oct-18	0	5.3	14.7	80.0	0	0	0	
	Qhg based on max concentration & max flow rate						**0**	**0**	
BH32	Jun-18	0	2.6	19.8	77.6	**0.5**	0	0.013	may contain groundwater / condensate
BH32	Jun-18	0	1.9	18.9	79.2	0	0	0	
BH32	Jul-18	0	4.1	19.5	76.4	0.1	0	0.0041	
BH32	Aug-18	0	**4.4**	19.5	76.1	0	0	0	
BH32	Oct-18	0	3.5	18.3	78.1	0.1	0	0.0035	
	Qhg based on max concentration & max flow rate						**0**	**0.022**	
BH33	Jun-18	0	2.3	19.3	78.4	0.1	0	0.0023	may contain groundwater
BH33	Jun-18	0	1.8	19.6	78.6	**0.4**	0	0.0072	
BH33	Jul-18	0	2.6	19.3	78.1	0	0	0	
BH33	Aug-18	0	2.6	19.3	78.1	0	0	0	
BH33	Oct-18	0	**2.9**	18.1	79.1	0	0	0	
	Qhg based on max concentration & max flow rate						**0**	**0.0116**	
BH34	Jun-18	0	2.6	19.2	78.2	**0.1**	0	0.0026	
BH34	Jun-18	0	2.4	19.6	78	**0.1**	0	0.0024	
BH34	Jul-18	0	0.1	21.6	78.3	0	0	0	
BH34	Aug-18	0	5.4	18.6	76	0	0	0	
BH34	Oct-18	0	**5.5**	16.4	78.1	0	0	0	
	Qhg based on max concentration & max flow rate						**0**	**0.0055**	
BH35	Jun-18	0	2.1	19.6	78.3	0.7	0	0.0147	
BH35	Jun-18	0	1.5	19.6	78.9	**0.8**	0	0.012	
BH35	Jul-18	0	3.0	19.5	77.5	0.1	0	0.003	
BH35	Aug-18	0	3.4	20.0	76.6	0	0	0	
BH35	Oct-18	0	**3.5**	17.9	78.6	0.1	0	0.0035	
	Qhg based on max concentration & max flow rate						**0**	**0.028**	
BH36	Jun-18	0	1.5	20.4	78.1	0.5	0	0.0075	
BH36	Jun-18	0	1.0	20.9	78.1	**0.8**	0	0.008	
BH36	Jul-18	0	1.8	20.3	77.9	0	0	0	
BH36	Aug-18	0	1.7	20.6	77.7	0.1	0	0.0017	
BH36	Oct-18	0	**2.7**	18.3	79.0	0	0	0	
	Qhg based on max concentration & max flow rate						**0**	**0.0216**	
BH37	Jun-18	0	1.9	19.2	78.9	**1.2**	0	0.0228	
BH37	Jul-18	0	1.1	20.0	78.9	0	0	0	
BH37	Aug-18	0	1.2	20.7	78.1	0.1	0	0.0012	
BH37	Oct-18	0	**2.3**	18.2	79.5	0	0	0	
	Qhg based on max concentration & max flow rate						**0**	**0.0276**	
BH38	Jun-18	0	0.7	21.2	78.1	0	0	0	
BH38	Jul-18	0	1.8	20.0	78.2	**0.1**	0	0.0018	
BH38	Aug-18	0	**2.9**	19.0	78.1	**0.1**	0	0.0029	
BH38	Oct-18	0	2.8	18.1	79.1	0	0	0	
	Qhg based on max concentration & max flow rate						**0**	**0.0029**	
BH39	Jun-18	0	1.6	20.0	78.4	0	0	0	
BH39	Jul-18	0	0.1	21.4	78.5	0	0	0	
BH39	Aug-18	0	**4.7**	15.5	79.8	0	0	0	
BH39	Oct-18	0	3.7	17.1	79.2	0	0	0	
	Qhg based on max concentration & max flow rate						**0**	**0**	
BH40	Jun-18	0	1.9	18.9	79.2	**0.7**	0	0.0133	
BH40	Jul-18	0	0.1	21.4	78.5	0.1	0	0.0001	
BH40	Aug-18	0	**2.2**	19.7	78.1	0	0	0	
BH40	Oct-18	0	2.1	18.6	79.3	0	0	0	
	Qhg based on max concentration & max flow rate						**0**	**0.0154**	

Bore ID	Date	CH4	CO2	O2	Balance	Flow l/hr	Qhg (CH4)	Qhg (CO2)

Instrument	TDL500		12/06/2018	7-9/8/2018			
ID	**Easting**	**Northing**	**CH4 ppm**	**CH4 ppm**	**Location**	**Comment**	**Additional Detail**
1	254011	5931704	4	2.1	Carpark	Ambient Air adjacent to Se7	
2	253996	5931703	6.7	2.4	Water Pit	Se7	
3	254005	5931718	11.40%	1305.0	Telstra Pit	Se6	
4	253873	5931908	3.9	2.6	SW	Offsite	
5	253875	5931925	3.8	2.5	SW	Offsite	cnr Violet
6	253831	5931945	4	2.6	CULVERT	Offsite	Empty Block
7	253817	5931957	3.7	2.6	Water Pit	Offsite	
8	253815	5931965	3.5	2.5	SW	Offsite	
9	253810	5931980	3.7	2.5	SW	Offsite	
10	253801	5931974	3.6	2.5	SW	Offsite	Outside 13 Violet
11	253788	5931988	3.6	2.5	CULVERT	Offsite	Outside 9 Violet
12	253780	5931995	3.6	2.5	SW	Offsite	Outside 9 Violet
13	253778	5931992	3.7	2.5	Telstra Pit	Offsite	Outside 9 Violet
14	253761	5932009	3.8	2.5	CULVERT	Offsite	
15	253746	5932023	3.8	2.5	CULVERT	Offsite	
16	253727	5932006	3.9	2.4	SW	Offsite	
17	253725	5932009	3.8	2.4	CULVERT	Offsite	
18	253708	5932007	3.9	2.4	CULVERT	Offsite	Outside 5 Violet
19	253667	5932040	4.1	2.4	CULVERT	Offsite	
20	253677	5932001	4.3	2.4	PIT	Offsite	
21	253683	5932000	3.9	2.4	Water Pit	Offsite	
22	253679	5931994	4.5	2.4	CULVERT	Offsite	
23	254029	5931864	4.4	2.1	Telstra Pit	Offsite	Next to Green traffic box
24	254028	2531862	4.6	2.1	SW	Offsite	Next to Give Way sign
25	254022	2531863	4.7	2.2	SW	Offsite	Worksource Eaglehawk sign
26	254012	5931855	4.8	2.1	Water Pit	Offsite	Outside Eaglehawk autoelectrical
27	253995	5931861	4.7	2.1	Telstra Pit	Offsite	Outside Eaglehawk autoelectrical
28	253996	5931867	4.6	2.1	SW	Offsite	Outside Eaglehawk autoelectrical
29	253959	5931902	4.5	2.1	Telstra Pit	Offsite	
30	253953	5931909	4.4	2.1	SW	Offsite	Large Grate
31	253944	5931908	4.4	2.1	SW	Offsite	Cnr Green shed
32	253935	5931915	4.6	2.1	SW	Offsite	Over rd from #31
33	253920	5931894	4.6	2.1	Telstra Pit	Offsite	Outside green roller door
34	253964	5931862	4.7	not measured	DOWN PIPE	Offsite	Closed gates
35	253925	5931841	4.5	2.1	Telstra Pit	Offsite	Outside Bendigo Insulation
36	253927	5931843	4.6	2.1	PIT	Offsite	Outside Bendigo Insulation
37	253935	5931839	4.5	2.1	Water Pit	Offsite	Outside Flood building
38	253965	5931830	4.5	2.1	SW	Offsite	Over rd from #39
39	253965	5931819	4.6	2.1	SW	Offsite	Ouside Central Vic Pet Cremations
40	253991	5931789	4.3	2.1	ELECTRICITY BOX	Offsite	
41	253992	5931797	4.7	2.1	DW	Offsite	
42	254002	5931806	4.5	2.1	DW	Offsite	
43	254016	5931824	4.4	2.1	DW	Offsite	Outside office 1
44	254016	5931820	4.5	2.1	Telstra Pit	Offsite	On footpath next to tree
45	254018	5931829	4.8	2.1	DOWN PIPE	Offsite	off building/shop
46	254029	5931841	23.4	2.1	GAS Manifold on Shop	Offsite	
47	253679	5931980	4.5	2.4	CULVERT	Offsite	
48	253677	5931968	44	2.4	CULVERT	Offsite	Outside 10 Walker Crescent
49	253677	5931953	4.5	2.4	CULVERT	Offsite	Outside 14 Walker Crescent
50	253844	5931876	4.4	2.3	CULVERT	Offsite	
51	253825	5931849	4.5	2.3	CULVERT	Offsite	
52	253885	5931925	3.9	2.1	SW	Offsite	
53	253918	5931962	4.1	2.1	SW	Offsite	Cnr Bragg and UCG rd
54	253915	5931975	4.1	2.1	SW	Offsite	Cnr Bragg and UCG rd
55	253896	5931987	4	2.1	SW	Offsite	Outside 201 UCG rd
56	253896	5931985	3.9	2.2	Telstra Pit	Offsite	Outside 201 UCG rd
57	253864	5932011	3.6	2.3	Water Pit	Offsite	Outside 203 UCG rd
58	253860	5932011	3.8	2.3	Telstra Pit	Offsite	
59	253860	5932014	3.8	2.3	SW	Offsite	Outside 203 UCG rd
60	253854	5932012	3.9	2.3	SW	Offsite	Outside 203 UCG rd
61	253780	5932082	3.6	2.4	SW	Offsite	
62	253740	5932081	3.3	2.4	Telstra Pit	Offsite	
63	253745	5932159	3.2	2.4	HOLLOW	Offsite	
64	253757	5932145	3.4	2.4	SW	Offsite	
65	253787	5932092	3.3	2.4	SW	Offsite	Outside Central Line Marking
66	253806	5932080	2.7	2.3	Telstra Pit	Offsite	Outside Greg Boyd Motors
67	253860	5932032	3.6	2.2	Telstra Pit	Offsite	Outside Midland Wrecking
68	253923	5931983	3.6	2.2	Telstra Pit	Offsite	
69	253951	5931942	3.6	2.1	SW	Offsite	Under Give Way sign
70	254030	5931846	4.6	2.1	SW	Offsite	Over rd from #69
71	254040	5931856	4.7	2.2	SW	Offsite	Under Scott Cr Sign
72	254043	5931856	4.7	2.2	Telstra Pit	Offsite	Under Scott Cr Sign
73	254040	5931845	4.7	2.3	SW	Offsite	Next to Give Way sign
74	254057	5931842	5.4	2.3	SW	Offsite	Next to Carpark (Tipshop)
75	254053	5931835	4.7	2.3	SW	Offsite	Cnr of Tipshop
76	254032	5931808	4.8	2.3	SW	Offsite	Near Cactus
77	254038	5931798	4.8	2.3	SW	Offsite	Near sign/entrance
78	254045	5931801	4.7	2.3	SW	Offsite	
79	254064	5931837	4.6	2.2	SW	Offsite	
80	254070	5931839	4.5	2.2	SW	Offsite	Cnr of UCG rd
81	254094	5931825	4.5	2.4	SW	Offsite	Ecocentre back entrance
82	254105	5931815	4.6	2.4	SW	Offsite	Ecocentre back entrance
83	254136	5931788	4.4	2.4	SW	Offsite	cnr UCG rd and Turner St
84	254142	5931780	4.4	2.4	SW	Offsite	cnr UCG rd and Turner St
85	254145	5931798	4.5	2.4	SW	Offsite	Under Power pole
86	254150	5931801	4.5	2.4	Telstra Pit	Offsite	Cnr Victoria and UCG rd
87	254199	5931864	4.4	2.4	CULVERT	Offsite	Outside 4 Victoria St
88	254257	5931914	4.4	2.4	SW	Offsite	
89	254256	5931933	4.6	2.4	SW	Offsite	West of Victoria St
90	254263	5931960	4.6	2.4	SW	Offsite	Cnr TT building
91	254227	5931978	4.7	2.4	DITCH	Offsite	
92	254203	5931924	4.7		DITCH	Offsite	Not accessible
93	254187	5931928	4.8		CONDUIT	Offsite	Not accessible
94	254154	5931933	4.7		CONDUIT	Offsite	Not accessible

Instrument	TDL500		12/06/2018	7-9/8/2018			
ID	**Easting**	**Northing**	**CH4 ppm**	**CH4 ppm**	**Location**	**Comment**	**Additional Detail**
95	254193	5931892	4.5	2.3	CLUBHOUSE	Offsite	
96	254167	5931887	4.6	2.3	CONDUIT	Offsite	
97	254141	5931870	4.4	2.3	SHIPPING CONTAINER	Offsite	
98	254053	5931054	6.2	2.3	SW	Offsite	
99	254029	5931898	4.2	2.1	SW	Offsite	
100	254009	5931888	4.1	2.1	SW	Offsite	
101	254192	5931764	3.6	2.4	SW	Offsite	
102	254207	5931752	3.7	2.4	Telstra Pit	Offsite	
103	254233	5931727	3.7	2.4	SW	Offsite	
104	254260	5931687	3.5	2.4	Telstra Pit	Offsite	
105	254359	5931605	3.5	2.4	Telstra Pit	Offsite	
106	254389	5931580	3.6	2.4	Telstra Pit	Offsite	
107	254392	5931582	3.5	2.4	SW	Offsite	171 UCG rd
108	254404	5931587	3.5	2.4	SW	Offsite	
109	254409	5931565	3.4	2.4	CONDUIT	Offsite	171 UCG rd
110	254470	5931510	3.4	2.4	Telstra Pit	Offsite	165 UCG rd
111	254508	5931483	3.1	2.3	SW	Offsite	
112	254525	5931491	3.3	2.3	SW	Offsite	
113	254584	5931519	3.2	2.4	SW	Offsite	Park entrance
114	254456	5931463	3.4	2.2	SW	Offsite	cnr Victoria St
115	254163	5931038	3.5	2.3	W	Offsite	
116	254179	5931028	3.9	2.4	CULVERT	Offsite	
117	254190	5931033	3.9	2.3	CULVERT	Offsite	73 Hosten
118	254206	5931037	4.1	2.4	CONDUIT	Offsite	
119	254226	5931048	4.1	2.4	W	Offsite	
120	254240	5931068	4.3	2.5	SW	Offsite	
121	254192	5931128	4.4	2.5	W	Offsite	32 Butler
122	254255	5931063	4.2	2.4	SW	Offsite	24 Staley
123	254356	5931113	4.4	2.4	SW	Offsite	
124	254429	5931163	4.3	2.2	F-HYDRANT	Offsite	Ouside School
125	254444	5931162	4.4	2.3	CULVERT	Offsite	Butler
126	254545	5931183	4.3	2.1	Telstra Pit	Offsite	
127	254544	5931212	4.3	not measured	Telstra Pit	Offsite	
128	254088	5931829	not measured	2.5	Telstra Pit	Offsite	Eaglehawk Ecocentre sign
129	254113	5931807	not measured	2.5	Telstra Pit	Offsite	Over rd from Victoria st
130	254192	5931849	not measured	2.4	Telstra Pit	Offsite	Victoria St
131	254217	5931872	not measured	2.4	Telstra Pit	Offsite	Under Watson Ave sign
132	254273	5931929	not measured	2.4	SW	Offsite	Cnr Brown and Victoria
133	254278	5931929	not measured	2.4	SW	Offsite	Cnr Brown and Victoria
134	254286	5931935	not measured	2.4	SW	Offsite	Cnr Brown and Victoria
135	254265	5931952	not measured	2.4	Hydrant	Offsite	Cnr of TT building
136	254259	5931940	not measured	2.4	Telstra Pit	Offsite	Near #89
137	254263	5931961	not measured	2.4	Small Drain	Offsite	Cnr of TT building
138	254272	5931971	not measured	2.4	SW grate	Offsite	
139	254290	5931985	not measured	2.3	DOWN PIPE	Offsite	Sandstone building
140	254292	5931985	not measured	2.3	Small SW grate	Offsite	
141	254303	5931987	not measured	2.3	Water Manifold	Offsite	Irrigation Control
142	254304	5931992	not measured	2.3	Sewer Vent	Offsite	3x Vents
143	254316	5932002	not measured	2.3	SW Grate	Offsite	
144	254307	5932014	not measured	2.3	SW Grate	Offsite	
145	254291	5932032	not measured	2.3	SW	Offsite	
146	254281	5932055	not measured	2.4	SW	Offsite	in Carpark
147	254276	5932063	not measured	2.4	SW Grate	Offsite	
148	254264	5932022	not measured	2.5	SW Grate	Offsite	
149	254260	5932023	not measured	2.5	SW Grate	Offsite	
150	254257	5932027	not measured	2.5	SW Grate	Offsite	
151	254249	5932030	not measured	2.5	SW Grate	Offsite	
152	254218	5932013	not measured	2.5	SW concrete	Offsite	
153	254218	5932013	not measured	2.5	Grate under Downpipe	Offsite	
154	254223	5932008	not measured	2.5	Grate under Downpipe	Offsite	
155	254227	5932009	not measured	2.5	Grate under Downpipe	Offsite	
156	254231	5931998	not measured	2.5	Grate under Downpipe	Offsite	
157	254238	5931989	not measured	2.5	Grate under Downpipe	Offsite	
158	254243	5931983	not measured	2.5	Grate under Downpipe	Offsite	
159	254250	5931976	not measured	2.4	Grate under Downpipe	Offsite	
160	254253	5931969	not measured	2.4	Grate under Downpipe	Offsite	
161	254198	5931894	not measured	2.4	Water Meter	Offsite	
162	254168	5931877	not measured	2.3	Sewer Vent on Toilet Block	Offsite	
163	253852	5932032	not measured	2.3	SW	Offsite	205 UCG rd
164	253763	5932103	not measured	2.4	Telstra Pit	Offsite	Cnr Everley and UCG rd
165	253676	5932074	not measured	2.4	SW	Offsite	Bracewell
166	253686	5932073	not measured	2.4	Telstra Pit	Offsite	Bracewell
167	253683	5932002	not measured	2.4	Telstra Pit	Offsite	
168	253725	5932005	not measured	2.4	Telstra Pit	Offsite	3 Violet
169	253880	5931928	not measured	2.6	SW grate	Offsite	
170	254427	5931127	not measured	2.3	Telstra Pit	Offsite	Cnr Bailey and Staley
171	254479	5931083	not measured	2.3	Telstra Pit	Offsite	22 Staley
172	254246	5931068	not measured	2.5	Telstra Pit	Offsite	22 Staley
173	254224	5931051	not measured	2.4	Telstra Pit	Offsite	Cnr Hosten and Butler
174	254168	5931022	not measured	2.2	Telstra Pit	Offsite	
175	254437	5931160	not measured	2.2	Telstra Pit	Offsite	Outside School
176	254514	5931296	not measured	2.1	Telstra Pit	Offsite	
177	254521	5931316	not measured	2.1	Telstra Pit	Offsite	15 Vinton
178	254503	5931322	not measured	2.1	Telstra Pit	Offsite	10A Vinton
179	254503	5931330	not measured	2.1	SW	Offsite	10A Vinton
180	254511	5931335	not measured	2.1	SW	Offsite	11 Vinton
181	254454	5931452	not measured	2.2	SW	Offsite	Cnr Vinton
182	254443	5931447	not measured	2.2	SW	Offsite	Cnr Vinton
183	254442	5931443	not measured	2.2	Hydrant	Offsite	Cnr Vinton
184	254424	5931550	not measured	2.1	Telstra Pit	Offsite	162C UCG rd

Appendix D

Field Records

Appendix D

Field Records

JUNE 2018 MONITORING

ThermoFisher SCIENTIFIC

The world leader in serving science

RENTALS

Equipment Certification Report – TPS 90FLMV Water Quality Meter

This Water Quality Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Span 1	Span 2	Traceability Lot #	Pass?
pH	pH 6.88 / pH 4.00	6.88 pH	4.00 pH	303304/301911	☑
Conductivity	58.6mS/cm	0.0 mS/cm	58.6 mS/cm	318208	☑
TDS	36 ppk	0.0 ppk	36.0 ppk	313394	☑
Dissolved Oxygen	Sodium Sulphite / Air	0.0 ppm in Sodium Sulphite	9.39 ppm Saturation in Air	629	☑

Check only

Redox (ORP) *	Electrode operability test	240mV +/- 10%	238 mV	314147/311902	☑

* This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading.

☑ Battery Status 8.39 V (min 7.2V)
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ Temperature 19.5 °C
☑ Electrodes Cleaned and checked

Tag No: 000 549

Valid to: 24/7/2018

Date: 21 / Jun / 18

Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☐	☐	90FLMV Unit. Ops check/Battery status: 8.39 V
☑	☐	pH sensor with wetting cap, 5m
☑	☐	Conductivity/TDS/Temperature K=10 sensor, 5m
☑	☐	Dissolved oxygen YSI5739 sensor with wetting cap, 5m
☑	☐	Redox (ORP) sensor with wetting cap, 5m
☑	☐	Power supply 240V to 12V DC 200mA
☑	☐	Instruction Manual
☑	☐	Quick Guide
☑	☐	Syringe with storage solution for pH and ORP sensors
☑	☐	Carry Case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 21 Jun 18

Signed: [signature]

TFS Reference	CM009908	Return Date:	/ /
Customer Reference	6057920012	Return Time:	
Equipment ID	90FLMV - VW1	Condition on return:	
Equipment Serial No.			

EAGLEHAWK LANDFILL 12 / 06 / 2018
TIM SMITH 1245 Walkover Services

Ambient Air in Land fill carpark 4.0ppm

LOC	E	N	CH4
Cal 1	253996	5931703	6.7 ppm
Cal L	254005	5931718	11.4 %
VIOLET ST			
PIT	253873	5931908	3.9
PIT	253875	5931 925	3.8
Culvert	253 331	5931 945	4.0
WATER	" 887	" 957	3.7
JN	" 815	" 965	3.5
SW PIT	" 810	" 980	3.7
PIT	" 801	" 974	3.6
CULVERT	" 788	" 988	3.6
SW PIT	780	" 995	3.6
TELSTRA	775	992	3.7
culvert	761	5932 009	3.8
culvert	745	" 023	3.8
SW	727	006	3.9
culvert	725	009	3.8
WILLOWS CRESCENT	708	007	3.9
"	667	040	4.1
PIT	677	001	4.3
WATER	683	000	3.9
culvert	679	5931 994	4.2

Eaglehawk landfill
Tim Smith 12 / 6 / 18

LOCATION	E	N
L01	253 540	5931986
L02	253570	5931981
L03	253553	5931778
L04	253288	5931768
L05	253 371	5931976
L06	253 446	5932006
L06A	253 437	5932023 → near Telstra Line.
L07	253 077	5931429
L08	253 275	5931 281
L09	253 568	5931243
L10	253 989	5931347
L11	254 061	5931659

1230 finish up service location

Gas Walkover
Eco Centre Area → Crates, Drainage Pits
Upper California Gully Rd
BETWEEN ↳ Bracewell St
↳ Staley Road
~~BMX TRACK → pits ≠ low lying areas~~
~~• Shops → entrance of landfill → South Cr loop~~
~~• Walker Cr~~ ~~• South Cres~~
~~• Violet St~~ ~~• Tip Entrance Rd~~
~~• Scotty~~ • Turner St
~~• Bragg St~~ • Batton St (development along here)
Staley Street.

Eaglehawk landfill
Tim Smith

12 / 6 / 18

WALKER CR

LOCATION	E	N	CHL
culvert	255 679	5931 989	4.5
culvert	" 677	" 168	4.4
"	" 677	" 953	4.5
"	844	870	4.4
"	825	849	4.5
BRAGG SW PIT	885	925	3.9
SW PIT	918	962	4.1
JOG SW	915	975	4.1
SW	896	997	4.0
Telstra	898	985	3.7
[illegible]	841	5932 011	3.6
Telstra	860	011	3.8
SW	860	014	3.8
SW	854	012	3.9
SW	790	082	3.6
T	760	081	3.3
EVELYN HOLLOW	745	159	3.2
SW	757	148	3.4
SW	787	092	3.3
T	806	080	2.7
T	860	032	3.6
T	923	5931 983	3.6
SW	951	942	3.6

Eaglehawk Landfill
Tim Smith

12/6/18

LOC	E	N	CH4
SW	254 030	5931846	4.6
SW	" 040	" 856	4.7
T	" 043	" 856	4.7
SW	040	845	4.7
SW	057	842	5.4
SW	053	835	4.7
LANDFILL ENTRANCE			
SW	032	808	4.8
SW	038	798	4.8
SW	045	801	4.7
SW	064	837	4.6
V.C.G RD SW	070	839	4.5
SW	094	825	4.5
SW	105	815	4.6
SW	136	788	4.4
SW	142	780	4.4
SW	145	798	4.5
VICTORIA T	150	801	4.5
Wtr Culvert	199	864	4.4
SW	257	914	4.4
SW	256	933	4.6
SW	263	960	4.6
BMX PITCH	227	978	4.4
"	203	924	4.7
conduit	187	928	6.8
4	154	933	6.7
Clubhouse	193	892	4.5

SCOTT CR

LOC	E	N	CH4
T	254 029	593' 864	4.4
SW	028	862	4.6
SW	022	863	4.7
W	012	855	4.8
T	2571 998	861	4.7
SW	996	867	4.6
T	959	902	4.5
SW	953	909	4.4
SW	944	908	4.4
SW	935	915	4.6
T	920	894	4.6
DOWN PIPE	904	862	4.7
T	925	841	4.5
Pit	927	843	4.6
Water	935	839	4.5
SW	965	830	4.5
SW	965	819	4.6
E-Box	991	789	4.3
SW	992	797	4.7
SW	254 002	806	4.5
SW	016	824	4.4
T	016	820	4.5
DOWN PIPE	018	829	4.8
GAS METER	029	841	23.4

EAGLEHAWK
LANDFILL

12 / 06 / 2018

LOCATION	E	N	CH4
STANLEY SW	256 240	5931 068	4.3
water	192	128	4.4
SW	255	063	4.2
SW	356	113	4.4
water f-hydrant	429	163	4.3
culvert	444	162	4.4
T	545	183	4.3
T	544	212	4.3

EAGLEHAWK L.F

Tim Smith

12 / 6 / 18

L	E	N	CH4
BMX toilet conduit	754 167	5931 881	4.6
SHED CONT	141	876	4.4
VCA SW	053	054	6.2
SW	029	878	4.2
SW	009	988	4.1
SW	254 192	5931 764	3.6
T	" 207	" 752	3.7
SW	" 233	" 727	3.7
T	" 260	" 687	3.5
T	" 359	" 605	3.5
T	" 389	" 580	3.6
SW	" 392	" 582	3.5
SW	" 404	" 587	3.5
conduit	" 409	" 565	3.4
T	" 470	" 510	3.4
SW	508	483	3.1
TURNER SW	525	491	3.3
SW	584	589	3.2
SW	456	463	3.4
BATTON H2O	254 163	5931 038	3.5
culvert	" 179	" 028	3.9
culvert	" 190	" 033	3.9
conduit	" 206	" 037	4.1
water	" 226	" 048	4.1

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

ECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	22-6-18
Client:	City of Bendigo	Project Location:	Bendigo	Fieldwork Staff:	TDS / BC	Monitoring Instrument and Serial Number:	GA5000-11

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH25	13:45	Ambient	0.0		0.1		20.7		79.2	6	6	0.4	997	0.0	
		Pre-purge	0.0		2.6		19.6		78.6	0	0				
		1 min	0.0		2.7		18.6		78.7	1	1				
		2 min	0.0		2.7		18.6		78.7	0	0				
		3 min	0.0		2.8		18.6		78.7	0	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 3.04

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH18	14:00	Ambient	0.0		0.1		21.2		78.7	0	0	0.4	997	-0.03	
		Pre-purge	0.0		2.7		20.4		77.1	1	2				Dry @
		1 min	0.0		3.3		17.9		78.8	1	1				13.68
		2 min	0.0		3.4		17.8		78.8	1	0				
		3 min	0.0		3.4		17.8		78.8	0	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH26	1406	Ambient		0.0		0.1		21.4	78.1	1	0	0.0	997	0.02	
		Pre-purge		0.0		11.6		19.2	75.2	0	1				
		1 min		0.6		11.7		7.1	80.6	1	0				
		2 min		0.7		11.8		7.0	80.6	0	1				
		3 min		0.7		11.8		6.9	80.6	1	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 1285

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH27		Ambient	0.0		0.1		21.7		78.3	1	0	0.3	996	0.03	
		Pre-purge	0.0		2.8		18.6		78.6	1	0				Dry @
		1 min	0.0		2.8		18.5		78.6	0	0				5.07
		2 min	0.0		2.9		18.5		78.6	1	0				
		3 min	0.0		3.0		18.4		78.7	1	0				

AN

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

ECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	22-6-18
Client:	City of Bendigo	Project Location:	Bendigo	Fieldwork Staff:	TDS / BC	Monitoring Instrument and Serial Number:	GA5000 -11

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH29	12:50	Ambient		0.0		0.1		20.8	79.1	0	0	0.7	996	0.07	
		Pre-purge		0.0		9.4		9.8	81.6	0	0		996		
		1 min		0.0		9.6		7.5	82.9	0	0				
		2 min		0.0		9.6		7.4	83.0	1	0				
		3 min		0.0		9.7		7.3	83.1	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													DRY @ 15.75

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH23	13:60	Ambient	0.0	0.0		0.1		20.0	79.8	0	0	0.6	997	0.10	
		Pre-purge		0.0		3.4		18.4	79.5	0	1				
		1 min		0.0		3.3		17.6	79.3	0	0				
		2 min		0.0		3.3		17.5	79.2	0	1				
		3 min		0.0		3.3		17.4	79.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 3.40

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH22	13:15	Ambient		0.0		0.1		20.1	79.8	0	0	0.5	997	-0.03	
		Pre-purge		0.0		3.2		19.3	78.1	0	0				
		1 min		0.0		3.3		16.9	79.8	0	1				
		2 min		0.0		3.5		16.7	79.8	0	0				
		3 min		0.0		4.1		18.0	79.9	0	2				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													DRY @ 4.64

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH21	13:30	Ambient		0.0		0.1		20.4	79.4	0	1	0.4	999	-0.03	
		Pre-purge		0.0		2.9		19.2	78.1	0	1				
		1 min		0.0		3.1		18.5	78.4	0	1				
		2 min		0.0		3.4		18.1	78.5	0	1				
		3 min		0.0		3.7		17.3	78.6	0	2				
	4m			0.0		3.8		17.6	78.7	0	1				Dry @ 2.64

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

Project Name:	Eaglehawk landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	22-6-18
Client:	City of Bendigo	Project Location:	Bendigo	Fieldwork Staff:	TDS / BC	Monitoring Instrument and Serial Number:	GA5000-11

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH15	1441	Ambient		0.0		2.1		22.0	77.9	0	0	0.4	997	-0.17	
		Pre-purge		0.0		2.2		21.8							
		1 min													
		2 min													
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Pump stop Lothing

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH36	15:55	Ambient		0.0		0.1		21.9	78.0	0	0	0.5	997	0.14	
		Pre-purge		0.0		0.1		21.3	77.3	0	0				
		1 min		0.0		1.5		20.4	78.1	0	0				
		2 min		0.0		1.5		20.4	78.1	0	0				
		3 min		0.0		1.5		20.4	78.1	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15.78

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH35	15:05	Ambient		0.0		0.1		21.9	78.0	0	0	0.7	998	0.47	
		Pre-purge		0.0		1.9		21.7	76.9	0	0				
		1 min		0.0		1.9		19.9	78.2	0	0				
		2 min		0.0		2.0		19.8	78.2	0	0				
		3 min		0.0		2.1		19.8	78.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15.77

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH32	15:20	Ambient		0.0		0.1		21.8	78.1	0	0	0.4	997	-0.02	
		Pre-purge		0.0		2.5		21.1	76.9	0	0	0.5			SWL=15.19
		1 min		0.0		2.6		19.8	77.6	0	0				
		2 min		0.0		2.6		19.8	77.6	0	0				
		3 min		0.0		2.6		19.8	77.6	0	0				TD=15.75

AI

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	22-6-18
Client:	City of Bendigo	Project Location:	Bendigo	Fieldwork Staff:	TDS / BC	Monitoring Instrument and Serial Number:	GA5000-11

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH33	15:35	Ambient		0.0		0.1	21.8	21	78.1	0	0	0.5	999	-0.05	SWL 15.10
		Pre-purge		0.0		0.1	21.7		78.2	0	0				DRILLING
		1 min		0.0		2.3	19.0		78.7	0	0				water
		2 min		0.0		2.3	19.3		78.8	0	0				
		3 min		0.0		2.3	19.3		78.8	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													TD=15.72

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH34	1541	Ambient		0.0		0.1		21.6	78.3	0	0	0.3	998	0.07	
		Pre-purge		0.0		2.2		19.8	78.2	0	0				
		1 min		0.0		2.5		19.2	78.3	0	0				
		2 min		0.0		2.6		19.2	78.3	0	0				
		3 min		0.0		2.6		19.1	78.3	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													TD 15.90

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													

AN

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

27/6/18

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	27/6/18
Client:	City of Bendigo	Project Location:	Bendigo	Fieldwork Staff:	TDS / BC	Monitoring Instrument and Serial Number:	GA5000-11

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH31	7:30	Ambient	0.0		0.1		21.1		78.8	0	0	0.0	1000	0.03	
		Pre-purge	0.0		0.1		21.0		78.9	0	0				
		1 min	0.0		0.2		20.9		78.9	0	0				
		2 min	0.0		0.3		20.8		78.9	0	0				
		3 min	0.0		0.7		20.2		78.9	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	5-0.0		1.9		18.9		79.1	0	0				Dry at 15.73

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH40	8.20	Ambient	0.0		0.1		21.6		78.4	0	0	0.0	999	-0.03	
		Pre-purge	0.0		1.5		20.3		78.3	0	0				
		1 min	0.0		1.5		20.2		78.4	0	0				
		2 min	0.0		1.5		20.1		78.4	0	0				
		3 min	0.0		1.5		20.1		78.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry at 15.70

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH39	8:40	Ambient	0.0		0.1		21.6		78.3	0	0	0.1	999	-0.05	
		Pre-purge	0.0		1.5		21.2		77.5	0	0				Dry at
		1 min	0.0		1.6		20.1		78.4	0	0				
		2 min	0.0		1.6		20.0		78.4	0	0				
		3 min	0.0		1.6		20.0		78.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													15.74

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH30	8.55	Ambient	0.0		6.1		21.7		78.2	0	8	0.0	1000	-0.03	
		Pre-purge	0.0		0.1		21.6		78.1	0					Dry @
		1 min	0.0		0.5		21.4		78.1	0	0				
		2 min	0.0		0.6		21.3		78.1	0	0				15.75
		3 min	0.0		0.7		21.2		78.1	0	0				

AN

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:							
Client:	City of Bendigo	Project Location:	Bendigo	Fieldwork Staff:	TDS / BC	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH21	14:00	Ambient	0.0		0.1		20.5		79.4	0	0	0.3	1000	0.02	TD=15.75
		Pre-purge	0.0		9.5		10.5		81.3	0	0				
		1 min	0.0		9.9		7.2		82.9	0	0				
		2 min	0.0		9.9		7.1		82.9	0	0				
		3 min	0.0		9.9		7.1		83.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													DRY TD

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH23	14:20	Ambient	0.0		0.1		19.9		80	0	0	0.4	1001	0.17	TD @ 3.40
		Pre-purge	0.0		2.4		17.9		79.7	0	0				
		1 min	0.0		1.8		18.6		79.6	0	0				
		2 min	0.0		1.7		18.6		79.6	0	0				
		3 min	0.0		1.7		18.6		79.6	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH22	14:40	Ambient	0.0		0.1		20.6		79.3	0	0	0.6	1001	0.16	
		Pre-purge	2.6		1.6		6.5		74.9	0	0				
		1 min	0.0		7.6		12.4		79.9	0	0				
		2 min	0.0		7.6		12.4		79.9	0	0				
		3 min	0.0		7.6		12.4		79.9	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 4.645

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH21	14:55	Ambient	0.0		0.1		20.7		79.2	0	0	0.5	1001	0.00	Dry @ 2.64
		Pre-purge	0.0		0.2		19.8		78.3	0	0				
		1 min	0.0		2.5		19.4		78.2	0	0				
		2 min	0.0		2.5		19.4		78.2	0	0				
		3 min	0.0		2.5		19.4		78.2	0	0				

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

Project Name:	Eaglehawk landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	26/6/18
Client:	City of Bendigo	Project Location:	Bendigo	Fieldwork Staff:	TDS / BC	Monitoring Instrument and Serial Number:	

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH32	26/6/18	Ambient	0.0		0.1		21.7		78.2	0	0	0.1	1001	0.1	
		Pre-purge	0.0		0.7		21.1		78.2	0	0				
		1 min	0.0		0.7		21.1		78.2	0	0				
		2 min	0.0		0.7		21.1		78.2	0	0				
		3 min	0.0		0.7		21.1		78.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													FD= Pg@ 15.75

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH36	27/6/18	Ambient	0.0		0.1		21.6		78.2	0	0	0.0	1001	-0.03	
		Pre-purge	0.0		0.7		21.1		78.4	0	0				
		1 min	0.0		0.9		20.9		78.2	0	0				
		2 min	0.0		0.9		20.9		78.2	0	0				
		3 min	0.0		1.0		20.9		78.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

Project Name:	Eaglehawk landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:							
Client:	City of Bendigo	Project Location:	Bendigo	Fieldwork Staff:	TDS / BC	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH27	15:20	Ambient	0.0		0.1		21.7		78.2	0	0	0.6	1007	-0.05	
		Pre-purge	0.0		3.0		20.5		77.6	0	0				
		1 min	0.0		3.1		18.5		78.4	0	0				
		2 min	0.0		3.1		18.4		78.5	0	0				
		3 min	0.0		3.1		18.4		78.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15:07

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH30	15:40	Ambient	0.0		0.1		21.8		78.2	8	0	0.1	1002	-0.02	
		Pre-purge	0.0		2.3		20.1		78.3		0				
		1 min	0.0		2.5		18.3		79.3	0	0				
		2 min	0.0		2.5		18.2		79.3	0	0				
		3 min	0.0		2.5		18.2		79.3	0	6				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15:77

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH34		Ambient	0.0		0.1		21.5		78.4	0	0	0.1	1002	-0.03	
		Pre-purge	0.0		2.3		19.7		78.0	0	0				
		1 min	0.0		2.4		19.6		78.0	0	0				
		2 min	0.0		2.4		19.6		78.0	0	0				
		3 min	0.0		2.4		19.6		78.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15.80

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH33		Ambient	0.0		0.1		21.6		78.3	0	0	0.0	1003	0.02	
		Pre-purge	0.0		0.6		21.3		78.0	0	0				
		1 min	0.0		1.8		19.8		78.5	0	0				
		2 min	0.0		1.8		19.6		78.6	0	0				
		3 min	0.0		1.8		19.6		78.6	0	0				Dry @ 15.72

AN

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:							
Client:	City of Bendigo	Project Location:	Bendigo	Fieldwork Staff:	TDS / BC	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
GMBH19	15:00	Ambient	0.0		0.2		20.4		79.2	0	0	0.6	1001	0.02	
		Pre-purge	0.0		0.2		20.3		77.4	0	0				
		1 min	0.0		2.9		18.3		78.9	0	0				
		2 min	0.0		3.0		18.0		79.0	0	0				Dry @
		3 min	0.0		3.0		18.0		79.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													6.11

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH25	15:15	Ambient	0.0		0.1		21.3		78.6	0	0	0.5	1001	0.05	
		Pre-purge	0.0		0.2		21.2		77.0	0	0				
		1 min	0.0		1.9		19.9		78.1	0	0				
		2 min	0.0		2.3		19.9		78.1	0	0				
		3 min	0.0		2.3		19.9		78.1	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 3.04

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH18	15:25	Ambient	0.0		4.0		21.6		78.3	0	0	0.3	1000	-0.03	
		Pre-purge	0.0		1.7		20.3		78.0	0	0				
		1 min	0.0		2.4		19.4		78.2	0	0				
		2 min	0.0		2.5		19.4		78.2	0	0				
		3 min	0.0		2.5		19.4		78.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 13.68

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH26	15:45	Ambient	0.0		0.1		21.7		78.2	0	0	0.5	1000	-0.03	
		Pre-purge	0.0		0.1		21.7		78.1	0	0				
		1 min	~~0.2~~ 0.5		1.4		10.5		79.7	0	0				
		2 min	0.4		1.6		10.3		79.8	0	0				Dry @ 12.85
		3 min	0.4		1.6		10.3		79.8	0	0				

AE

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	26/6/18
Client:	City of Bendigo	Project Location:	Bendigo	Fieldwork Staff:	TDS / BC	Monitoring Instrument and Serial Number:	GA5000-11

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
26/6/18 BH37	09:58	Ambient	0	0.0		0.1		20.7	79.1	0	0	1.2	1001	-0.03	Tot Depth 15.72
		Pre-purge		0.0		0.7		20.1	79.0	0	0				
		1 min		0.0		1.7		19.5	78.9	0	0				
		2 min		0.0		1.8		19.2	78.9	0	0				
		3 min		0.0		1.9		19.2	78.9	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH35	10:05	Ambient		0.0		0.1		20.6	79.3	0	0	0.8	1003	-0.02	TD 15.77
		Pre-purge		0.0		0.1		20.6	78.0	0	0				
		1 min		0.0		1.5		19.6	78.9	0	0				
		2 min		0.0		1.5		19.6	78.9	0	0				
		3 min		0.0		1.5		19.6	78.9	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													

JULY 2018 MONITORING

ThermoFisher SCIENTIFIC

The world leader in serving science

RENTALS

Equipment Report – Solinst Model 101 Water Level Meter

This Meter has been performance checked / calibrated* as follows:

Cleaned/Tested	**Pass?**
Probe	☑
Tape/Reel	☑

☑ Performance Test & Battery Voltage Check (8.6 v) 8.0v minimum

Date: 17TH JULY 2018 Checked by: DOS

Signed: _____

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☑	☐	☐	Water Level Meter
☑	☐	☐	Water Level Meter Tape Guide
☑	☐	☐	Spare 9V Battery
☑	☐	☐	Operating guide
☑	☐	☐	Probe Cleaning Brush
☑	☐	☐	Decon
☑	☐	☐	Carry Bag / Box
☐	☐	☐	

Processors Signature/ Initials PL

Quote Reference	CM010121	Condition on return
Customer Ref	6017922	
Equipment ID	S10160-2	
Equipment serial no.		
Return Date	/ /	
Return Time		

ThermoFisher SCIENTIFIC

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RENTALS

Equipment Report – Laser One Gas Detector

This Inspectra Analyser has been performance checked as follows:

Calibration PID	Actual Value	Reading	Pass?		
Zero – fresh air	0.0 ppm	1.0 ppm	☑		
Span – Methane	100 ppm	98.6 ppm	☑		
Operations Check					
☑	Performance Check (pump, lamp, sensor & battery voltage check)				
☑	Battery Charged	☑ Filters Check (new)			
☑	Electrical Safety Tag attached (AS/NZS 3760)	Tag No: 643		Valid to: 10/10/18	

Date: 17 Jul 18 Checked by: Horia Moga

Signed:

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Laser One Operational Check, plus Battery Voltage @ 5.73 V
☑	☐	Telescopic Rod and Suction Cup
☑	☐	Flexi probe (black)
☑	☐	Hand Held probe (steel)
☑	☐	Spare water trap filter(s) 0.45um Qty 2
☑	☐	Brass filter (suction cup)
☑	☐	GPS Antenna
☑	☐	Carry strap
☑	☐	Instruction Manual
☑	☐	Cigarette filters
☑	☐	Charger 240v to 12v 500mA
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)
☐	☐	

Processors Signature/ Initials

Quote Reference	CM070721	Condition on return
Customer Ref	60579200	
Equipment ID	Laser1 TDL.500-3	
Equipment serial no.		
Return Date	/ /	
Return Time		

ThermoFisher SCIENTIFIC

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RENTALS

Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0 %	60 %	923048	☑
CO_2	40 %	———	40 %	923048	☑
O_2	20.9 %	0 %	20.9 %	882418	☑
CO	100 ppm	0 ppm	100 ppm	882418	☑
H_2S	25 ppm	0 ppm	25 ppm	882418	☑
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	867138	☑

☑ Battery Status 100 %
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ In-Line filters checked
☑ Data cleared

Tag No: 000573

Valid to: 9/08/2018

Date: 17 Jul 18

Signed: JMay

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 2
☑	☐	H_2S filter
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 17 Jul 18

Signed: JMay

TFS Reference	CM0102	Return Date:	/ /
Customer Reference	60579200	Return Time:	
Equipment ID	GA5000-12	Condition on return:	
Equipment Serial No.			

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

Project Name:	Eaglehawk Landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	18/7/16
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:	GA5000 - 12

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH23	9.08	Ambient	0.1		0.1		20.5		79.3	0	0	0.1	989	007	
		Pre-purge	0.1		0.5		20.4		79.0	0	0				
		1 min	0.1		0.4		20.3		79.2	0	0				
		2 min	0.1		0.4		20.3		79.2	0	0				
		3 min	0.1		0.4		20.3		79.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs) 5min	0.1		0.4		20.3		79.2	0	0				Dry @ 5.58m

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH22	9:18	Ambient	0.1		0.1		20.6		79.4	0	0	0.1	988	0.15	
		Pre-purge	0.1		0.1		20.5		79.3	0	0				Dry @
		1 min	0.1		0.2		20.4		79.2	0	1				4.60
		2 min	0.1		0.3		20.4		79.2	0	1				
		3 min	0.1		0.3		20.4		79.2	0	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH21	9:27	Ambient	0.0		0.1		20.5		79.4	0	0	0.1	990	027	
		Pre-purge	0.1		2.9		20.3		77.1	0	0				
		1 min	0.0		2.9		19.1		77.9	0	0				
		2 min	0.0		2.9		19.1		78.0	0	0				
		3 min	0.0		2.9		19.1		78.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 2.81

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH19	9:40	Ambient	0.0		0.1		20.3		79.6	0	0	0.1	990	603	
		Pre-purge	0.0		2.1		19.6		78.6	0	1				
		1 min	0.0		3.2		18.4		79.4	0	0				Dry @ 6.49
		2 min	0.0		3.2		17.7		79.1	0	0				
		3 min	0.0		3.2		17.7		79.1	0	0				

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

18/07/18

Project Name:	Eaglehawk Landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:	

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH29	10:50	Ambient	0.0		0.2		20.9		79.0	0	0	0.0	990	0.09	
		Pre-purge	3.4		18.7		~~13.0~~	12.2	73.0	0	0				
		1 min	9.8		7.9		7.9		82.3	0	0				
		2 min													
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH29	10:50	Ambient	0.0		0.2		20.9		79.0	0	0	0.0	990	0.007	
		Pre-purge	0.0		3.4		18.7		73.0	0	0				
		1 min	0.0		9.8		7.9		82.3	0	0				
		2 min	0.0		9.8		7.8		82.3	0	0				
		3 min	0.0		7.8		7.8		82.3	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15.81

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
Telstra Pit 1	11:15	~~Ambient~~	0.0		0.2		20.6		79.1	0	0	0.0	990	0.009	
		Pre-purge	0.00		0.3		20.5		79.2	0	0				
		1 min	0.0		0.5		19.2		77.4	0	0				
		2 min	0.0		0.5		19.2		77.4						
		3 min	0.0		0.5		19.2		77.4						
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	# CH4 TDL = 1.9 ppm												

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
Telstra Pit 2	11:30	Ambient	0.0		0.1		21.1		78.8	0	0				
		Pre-purge	0.0		0.1		21.1		78.8	0	0				
		1 min	0.0		0.1		21.0		78.8	0	0				
		2 min	0.0		0.1		21.0		78.8	0	0				
		3 min	0.0		0.1		21.0		78.8	0	0				

CH4 TDL = 8.8 ppm

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

Project Name:	Eaglehawk Landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	4/07/18
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:	~~1125~~ GA5000-12

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH25	9:40	Ambient	0.0		0.1		20.8		79.0	0	0	5.0	989	-0.01	
		Pre-purge	0.0		~~3~~ 1.7		20.8		77.9	0	6				
		1 min	0.0		1.7		19.8		78.4	6	6				
		2 min	0.0		1.7		19.8		78.4	0	0				
		3 min	0.0		1.7		19.8		78.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 2.81

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH18	9:55	Ambient	0.0		0.1		20.9		78.9	0	0	0.0	990	0.03	
		Pre-purge	0.0		3.4		17.9		79.0	0	0				
		1 min	0.0		3.5		16.6		79.9	0	0				
		2 min	0.0		3.5		16.6		79.9	0	0				
		3 min	0.0		3.5		16.6		79.9	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 3.81

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH26	10:10	Ambient	0.0		0.1		20.8		79.0	0	0	6.0	989	0.09	
		Pre-purge	4.5		11.5		18.6		71.0	0	0				
		1 min	4.5		11.7		9.5		74.3	0	0				
		2 min	4.4		11.6		9.5		74.4	0	0				
		3 min	4.3		11.6		9.6		74.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	4.3 Stain		11.5		9.6		74.5	0	0				Dry @ 2.87

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH27		Ambient	0.0		0.1		21.1		79.0	0	0	6.0	989	0.22	
		Pre-purge	0.0		3.4		19.4		78.9	0	0				
		1 min	0.0		3.4		18.3		78.2	0	0				
		2 min	0.0		3.4		18.3		78.2	0	0				
		3 min	0.0		3.4		18.3		78.3	0	0				

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	18/7/18
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:	GA5000 -12

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH30	11:45	Ambient	0.1		0.1		21.0		78.8	0	0	0.1	989	0.11	
		Pre-purge	0.0		3.7		19.9		76.7	0	3				
		1 min	0.0		3.7		17.6		78.7	0	3				
		2 min	0.0		3.7		17.6		78.7	0	3				
		3 min	0.0		3.7		17.6		78.7	0	3				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													fly @ 5.77

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH31	12:15	Ambient	0.1		0.1		21.3		78.5	0	0	0.0	988	0.07	
		Pre-purge	0.1		0.1		20.3		75.7	0	0				
		1 min	0.0		5.5		15.1		79.3	0	0				
		2 min	0.0		5.5		15.1		79.3	0	0				
		3 min	0.0		5.5		15.1		79.3	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													fly @ 15.73

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH40	12:35	Ambient	0.0		3.1		21.7		78.7	0	0	0.0	988	0.02	
		Pre-purge	0.0		2.5		19.5		78.2	0	0				
		1 min	0.0		2.6		19.1		78.3	0	0				
		2 min	0.0		2.6		19.1		78.3	0	0				
		3 min	0.0		2.6		19.1		78.3	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													fly @ 15.70

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH39	12:45	Ambient	0.0		0.1		21.4		78.5	0	0	0.0	988	0.07	
		Pre-purge	0.0		2.2		21.1		78.7	0	0	0.1			
		1 min	0.0		0.1		21.3		78.6	0	0				
		2 min	0.0		0.1		21.4		78.5	0	0				
		3 min	0.0		0.1		21.4		78.5	0	0				fly @ 15.74

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	18/4/16
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:	GA5000-2

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH38	12:45	Ambient	0.0		0.1		21.5		78.5	0	0	0.1	989	0.15	
		Pre-purge	0.0		1.8		20.4		77.9	0	0				
		1 min	0.0		1.8		20.0		78.2	0	0				
		2 min	0.0		1.8		20.0		78.3	0	0				
		3 min	0.0		1.8		20.0		78.3	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15.75

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH36	12:57	Ambient	0.0		0.1		20.3		79.1	0	0	0.0	989	0.00	
		Pre-purge	0.0		1.7		20.5		77.9	0	0				
		1 min	0.0		1.7		20.3		77.9	0	0				
		2 min	0.0		1.7		20.3		77.9	0	0				
		3 min	0.0		1.8		20.3		77.9	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15.73

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH37	13:09	Ambient	0.0		0.1		20.4		79.5	0	0	0.0	988	0.12	
		Pre-purge	0.0		1.1		20.0		78.9	0	0				
		1 min	0.0		1.1		20.0		78.9	0	0				
		2 min	0.0		1.1		20.0		78.9	0	0				
		3 min	0.0		1.1		20.0		78.9	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15.72

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH35	8:16	Ambient	0.0		6.6		20.8		79.1	0	0	0.1	990	0.09	
		Pre-purge	0.0		3.0		20.1		77.2	0	0				
		1 min	0.0		3.0		19.5		77.5	0	0				
		2 min	0.0		3.0		19.5		77.5	0	0				
		3 min	0.0		3.0		19.5		77.5	0	0				Dry @ 15.77

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60579200	PM Name:	Tim Smith	Date:	18/1/18
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:	GA5000+2

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH28	13:20	Ambient	0.0		0.1		20.8		79.1	0	0	0.0	989	0.01	
		Pre-purge	0.0		0.1		21.0		78.9	0	0				
		1 min	0.0		0.1		21.2		78.7	0	0				
		2 min	0.0		0.1		21.2		78.7	0	0				
		3 min	0.0		0.1		21.2		78.7	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													dry @ 10.83

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH54	13:45	Ambient	0.0		0.1		21.4		78.5	0	0	6.0	990	0.07	
		Pre-purge	0.0		0.1		21.4		78.5	0	0				
		1 min	0.0		0.1		21.5		78.4	0	0				
		2 min	0.0		0.1		21.5		78.4	0	0				
		3 min	0.0		0.1		21.6		78.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													dry @ 15.80

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH53	13:55	Ambient	0.0		0.1		21.8		78.1	0	0	6.0	991	0.11	
		Pre-purge	0.0		~~0.1~~ 2.6		21.8		76.5	0	0				
		1 min	0.0		2.6		19.3		78.1	0	0				
		2 min	0.0		2.6		19.3		78.1	0	0				
		3 min	0.0		2.6		19.3		78.1	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													dry @ 15.72

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH52	14:08	Ambient	0.0		0.1		21.4		78.5	0	0	0.0	988	0.03	
		Pre-purge	0.0		0.1		21.8		78.1	0	0				
		1 min	0.0		4.0		20.0		76.2	0	0				
		2 min	0.0		4.1		19.5		76.4	0	0				
		3 min	0.0		4.1		19.5		76.4	0	0				dry @ 15.76

AUGUST 2018 MONITORING

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RENTALS

Equipment Report – Laser One Gas Detector

This Inspectra Analyser has been performance checked as follows:

Calibration PID	Actual Value	Reading	Pass?		
Zero – fresh air	0.0 ppm	2.4 ppm	☑		
Span – Methane	100 ppm	100 ppm	☑		
Operations Check					
☑	Performance Check (pump, lamp, sensor & battery voltage check)				
☑	Battery Charged	☑ Filters Check			
☑	Electrical Safety Tag attached (AS/NZS 3760)	Tag No: 000620	Valid to: 5/9/18		

Date: 6th August. 2018 Checked by: PETER

Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Laser One Operational Check, plus Battery Voltage @ ____ V
☑	☐	Telescopic Rod and Suction Cup
☑	☐	Flexi probe (black)
☑	☐	Hand Held probe (steel)
☑	☐	Spare water trap filter(s) 0.45um Qty 2
☑	☐	Brass filter (suction cup)
☑	☐	GPS Antenna
☑	☐	Carry strap
☑	☐	Instruction Manual
☑	☐	Cigarette filters
☑	☐	Charger 240v to 12v 500mA
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)
☐	☐	

Processors Signature/ Initials [signature]

Quote Reference	CM010224	Condition on return
Customer Ref	605 63317 / JUNE 2018 EVENT	
Equipment ID	Laser1 - 3	
Equipment serial no.		
Return Date	/ /	
Return Time		

This Air Velocity Meter has been performance checked as outlined below:

- [x] Powers On
- [x] 4 x AA Batteries installed
- [x] Electrical Safety Tag attached (AS/NZS 3760)

Tag No: 000533

Valid to: 13/7/18

Date: 6th August. 2018

Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
[x]	[ ]	VelociCalc Model 5725 with Vane Probe
[x]	[ ]	Power supply
[x]	[ ]	Spare AA Batteries (Qty 4)
[x]	[ ]	Calibration certificate
[x]	[ ]	LogDat2 software CD
[x]	[ ]	USB download cable
[x]	[ ]	Manual
[x]	[ ]	Carry case

Date: 6/8/18

Signed: [signature]

TFS Reference	CM010224	Return Date:	/ /
Customer Reference	60563317/JUNE 2018	Return Time:	
Equipment ID	VELOCI-3	Condition on return:	
Equipment Serial No.			

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RENTALS

Equipment Report - GEOTECHNICAL INSTRUMENTS GA5000

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
CH_4	60 %	0 %	60 %	923048	☑
CO_2	40 %	----------	40 %	923048	☑
O_2	20.9 %	0 %	20.9 %	882418	☑
CO	100 ppm	0 ppm	100 ppm	882418	☑
H_2S	25 ppm	0 ppm	25 ppm	882418	☑
H_2 CO/H2 compensated only	1000 ppm	0 ppm	1000 ppm	867138	☑

☑ Battery Status 100 %
☑ 10 minutes test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

Tag No: 000625

Valid to: 13.09.2018

Date: 6TH AUG 2018

Signed: [signature]

☑ In-Line filters checked
☑ Data cleared

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Performance check / Battery 100%
☑	☐	Sampling tubing with In-Line filter
☑	☐	Out let tubing (internal flow pod only)
☑	☐	Well cap Quick connect fitting with tubing and In-Line filter
☑	☐	Power Supply
☑	☐	Operating Quick Guide behind foam on lid of case "
☑	☐	Manual behind foam on lid of case "
☑	☐	Spare Inline Filters Qty 02
☑	☐	H_2S filter
☑	☐	Data Cable and Software CD
☑	☐	Soft case with carry strap
☑	☐	Carry case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 6TH AUG 2018

Signed: [signature]

TFS Reference	CM210722	Return Date:	/ /
Customer Reference	6056331 7June 2018	Return Time:	
Equipment ID	GA5000-11	Condition on return:	
Equipment Serial No.			

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RENTALS

Equipment Report – Solinst Model 122 Interface Meter

This Meter has been performance checked / calibrated* as follows:

Cleaned/Tested **Pass?** ☑**Yes** ☐**No**

☑Probe

☑Tape/Reel

☑Performance Test & Battery Voltage Check (8.6 v) 8.0v minimum

Date: 6TH AUG 2013 Checked by: DOS

Signed:

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☑	☐	☐	Operations check OK
☑	☐	☐	Plastic Box / Bag
☑	☐	☐	Spare 9V Battery Qty 1
☑	☐	☐	Probe Cleaning Brush
☑	☐	☐	Decon
☑	☐	☐	Instruction leaflet
☑	☐	☐	Tape Guide
☐	☐	☐	

Processors Signature/ Initials

Quote Reference	QM010221	Condition on return
Customer Ref	6043743/43574108.01000	
Equipment ID	80 Meter SOL122 - 15	
Equipment serial no.		
Return Date	/ /	
Return Time		

August 2018 walkover results

ID	Easting	Northing	CH4 (ppmv)	Location	Comment
1	254011	5931704	2.1	Carpark	Ambient Air adjacent to Se7
2	253996	5931703	2.4	Water Pit	Se7
3	254005	5931718	1305	Telstra Pit	Se6
4	253873	5931908	2.6	SW	Offsite
5	253875	5931925	2.5	SW	Offsite Cnr Violet
6	253831	5931945	2.6	CULVERT	Offsite Complex Block
7	253817	5931957	2.6	Water Pit	Offsite
8	253815	5931965	2.5	SW	Offsite
9	253810	5931980	2.5	SW	Offsite
10	253801	5931974	2.5	SW	Offsite Outside 13 Violet
11	253788	5931988	2.5	CULVERT	Offsite } outside
12	253780	5931995	2.5	SW	Offsite } 9
13	253778	5931992	2.5	Telstra Pit	Offsite } Violet
14	253761	5932009	2.5	CULVERT	Offsite
15	253746	5932023	2.5	CULVERT	Offsite
16	253727	5932006	2.4	SW	Offsite
17	253725	5932009	2.4	CULVERT	Offsite
18	253708	5932007	2.4	CULVERT	Offsite Outside 5 violet
19	253667	5932040	2.4	CULVERT	Offsite
20	253677	5932001	2.4	PIT	Offsite
21	253683	5932000	2.4	Water Pit	Offsite
22	253679	5931994	2.4	CULVERT	Offsite
23	254029	5931864	2.1	Telstra Pit next to Green	Offsite traffic box
24	254028	2531862	2.1	SW Next to Give Way Sy	Offsite
25	254022	2531863	2.2	SW Workshop Eaglehawk	Offsite Sign
26	254012	5931855	2.1	Water Pit	Offsite }
27	253995	5931861	2.1	Telstra Pit	Offsite } Outside Eaglehawk Auto Electrics
28	253996	5931867	2.1	SW	Offsite
29	253959	5931902	2.1	Telstra Pit	Offsite
30	253953	5931909	2.1	SW Grate large grate	Offsite
31	253944	5931908	2.1	SW cnr green shed	Offsite
32	253935	5931915	2.1	SW ave rd from 31	Offsite
33	253920	5931894	2.1	Telstra Pit outside gr	Offsite roller door
34	253964	5931862		DOWN PIPE	Offsite — Private!
35	253925	5931841	2.1	Telstra Pit on footpath	Offsite > outside Bendigo insulation
36	253927	5931843	2.1	PIT 100mm brown	Offsite
37	253935	5931839	2.1	Water Pit Hydrant	Offsite outside FLOOD building
38	253965	5931830	2.1	SW over rd from 39	Offsite
39	253965	5931819	2.1	SW outside	Offsite Central Vic Pet Cremations
40	253991	5931789	2.1	ELECTRICITY BOX	Offsite > together
41	253992	5931797	2.1	DW	Offsite
42	254002	5931806	2.1	DW SW	Offsite
43	254016	5931824	2.1	DW SW	Offsite outside office (1)
44	254016	5931820	2.1	Telstra Pit	Offsite on footpath next to tree
45	254018	5931829	2.1	DOWN PIPE	Offsite off building/shop
46	254029	5931841	2.1	GAS Manifold on Shop	Offsite
47	253679	5931980	2.4	CULVERT	Offsite
48	253677	5931968	2.4	CULVERT	Offsite Outside No. 10 Walker Crescent
49	253677	5931953	2.4	CULVERT	Offsite Outside 14 Walker "
50	253844	5931876	2.3	CULVERT	Offsite
51	253825	5931849	2.3	CULVERT	Offsite
52	253885	5931925	2.1	SW	Offsite
53	253918	5931962	2.1	SW	Offsite Cnr 6 Agg HCG Rd
54	253915	5931975	2.1	SW	Offsite " " " "
55	253896	5931987	2.1	SW	Offsite Outside 201 HCG Rd
56	253899	5931985	2.2	Telstra Pit	Offsite " "
57	253864	5932011	2.3	Water Pit	Offsite 233 HCG rd
58	253860	5932011	2.3	Telstra Pit	Offsite

August 2018 walkover results

59	253860	5932014	2.3	SW	Offsite 203 UCG rd
60	253854	5932012	2.3	SW grate	Offsite "
61	253780	5932082	2.4	SW	Offsite
62	253740	5932081	2.4	Telstra Pit	Offsite
63	253745	5932159	2.4	HOLLOW	Offsite
64	253757	5932145	2.4	SW broken	Offsite
65	253787	5932092	2.4	SW	Offsite Outside central line marking
66	253806	5932080	2.3	Telstra Pit	Offsite " Craig Boyd Motors
67	253860	5932032	2.2	Telstra Pit	Offsite outside Midland Wrecking
68	253923	5931983	2.2	Telstra Pit - covered.	Offsite excavation car Baldock + UCC
69	253951	5931942	2.4	SW under Give Way	Offsite
70	254030	5931846	2.1	SW over rd from Big	Offsite
71	254040	5931856	2.2	SW under Scott Cr sign	Offsite
72	254043	5931856	2.2	Telstra Pit "	Offsite
73	254040	5931845	2.7	SW Next to Giveaway Sign	Offsite
74	254057	5931842	2.3	SW next to carpark Tipshop	Offsite
75	254053	5931835	2.3	SW cnr of tipshop	Offsite
76	254032	5931808	2.3	SW near cactus	Offsite
77	254038	5931798	2.3	SW Mercantus	Offsite new sign/entrance
78	254045	5931801	2.3	SW	Offsite
79	254064	5931837	2.2	SW 5m from 80	Offsite
80	254070	5931839	2.2	SW cnr of UCG rd.	Offsite
81	254094	5931825	2.4	SW " "	Offsite + towards back entrance
82	254105	5931815	2.4	SW Mercs "	Offsite " "
83	254136	5931788	2.4	SW	Offsite cnr UCG rd + Turner St
84	254142	5931780	2.4	SW	Offsite " "
85	254145	5931798	2.4	SW	Offsite under power pole
86	254150	5931801	2.4	Telstra Pit	Offsite cnr Victoria + UCG rd
87	254199	5931864	2.4	CULVERT	Offsite Outside 4 V.St
88	254257	5931914	2.4	SW	Offsite
89	254256	5931933	2.4	SW	Offsite West of V.St.
90	254263	5931960	2.4	SW	Offsite cnr Tr building
91	254227	5931978	2.4	DITCH	Offsite
92	254203	5931924	/	DITCH	Offsite
93	254187	5931928	/	CONDUIT	Offsite Not
94	254154	5931933	/	CONDUIT	Offsite Accessible
95	254193	5931892	2.3	CLUBHOUSE	Offsite
96	254167	5931887	2.3	CONDUIT	Offsite
97	254141	5931870	2.3	SHIPPING CONTAINER	Offsite
98	254053	5931054	2.3	SW	Offsite ?
99	254029	5931898	2.1	SW	Offsite
100	254009	5931888	2.1	SW UCG rd	Offsite
101	254192	5931764	2.4	SW	Offsite
102	254207	5931752	2.4	Telstra Pit	Offsite
103	254233	5931727	2.4	SW	Offsite
104	254260	5931687	2.4	Telstra Pit	Offsite
105	254359	5931605	2.4	Telstra Pit	Offsite
106	254389	5931580	2.4	Telstra Pit	Offsite
107	254392	5931582	2.4	SW	Offsite 171 UCG rd
108	254404	5931587	2.4	SW	Offsite ~~[illegible]~~ rd opposite 109
109	254409	5931565	2.4	~~CONDUIT~~	Offsite ~~[illegible]~~ 171 UCG rd
110	254470	5931510	2.4	Telstra Pit	Offsite 165 UCG rd.
111	254508	5931483	2.3	SW Cnr UCG/Turner	Offsite
112	254525	5931491	2.3	SW " "	Offsite
113	254584	5931519	2.4	SW	Offsite ~~std~~ Path Entrance
114	254456	5931463	2.2	SW	Offsite cnr Victoria
115	254163	5931038	2.3	W	Offsite Opp 18
116	254179	5931028	2.4	CULVERT	Offsite
117	254190	5931033	2.3	CULVERT	Offsite 76 Hoskins

August 2018 walkover results

118	254206	5931037	2.4	CONDUIT PVC	Offsite
119	254226	5931048	2.4	W	Offsite
120	254240	5931068	2.3	SW	Offsite
121	254192	5931128	2.5	W	Offsite 32 Butler
122	254255	5931063	2.4	SW	Offsite 24 Staley
123	254356	5931113	2.4	SW	Offsite
124	254429	5931163	2.7	F-HYDRANT	Offsite Outside school
125	254444	5931162	2.3	CULVERT	Offsite Cutter
126	254545	5931183	2.1	Telstra Pit	Offsite
127	254544	5931212		Telstra Pit	Offsite
	254098	5931829	2.5	Telstra Pit	Eaglehawk Gas entre Sign
	113	307	2.5	Telstra Pit	Over rd from V.C.S.L.
	254192	849	2.4	"	Vic St
	254217	5931872	2.4	" (broken)	under watson Ave Sign
	273	929	2.4	SW	Cnr Brown + Victoria
	278	929	2.4	SW (broken)	" "
	286	935	2.4	SW	" "
	265	952	2.4	Hydrant	Cnr of TI building
	259	940	2.4	Telstra Pit (broken	near sign
	263	961	2.4	Small Drain	cnr TI building
	272	971	2.4	SW grate	
	290	995	2.3	Downpipe	Sandstone building
	297	985	2.3	Small SW grate	
	303	987	2.3	Water Manifold	Irrigation Control
	304	992	2.3	Sewer Vent	3x Vents
	316	2002	2.3	SW grate	
	307	2014	2.3	"	
	291	2032	2.3	SW	
	281	055	2.4	SW	in Car park
	276	063	2.4	SW grate	
	264	022	2.5	"	
	260	023	2.5	"	
	257	027	2.5	"	
	249	030	2.5	"	
	218	013	2.5	SW Concrete	
	218	013	2.5	Grate under downpipe	
	223	008	2.5	"	
	227	004	2.5	"	
	231	1998	2.5	"	
	238	986	2.5	"	
	243	983	2.5	"	
	250	976	2.4	"	
	253	969	2.4	"	
	198	994	2.4	Water Meter	
	168	977	2.3	Sewer Vent Toilet block	
	253852	5932032	2.3	SW	205 closed.
	763	103	2.4	Telstra	Cnr Evesley + Hill rd
	676	074	2.4	SW	Brewery
	636	073	2.4	Telstra	"
	687	002	2.4	"	
	725	005	2.4	"	3 Violet
	259 980	928	2.6	SW Grate	
	254427	5931127	2.3	Telstra Pit	Cnr Bailey + Staley
	479	083	2.3	Telstra	22 Staley
	246	068	2.5	"	"
	244	051	2.4	Telstra	Cnr Hobart + Butler
	168	022	2.2	Telstra	
	437	160	2.2	Telstra	Outside church
	514	2916	2.1	Telstra	

August 2018 walkover results

	E	N	CH4	LOC	
	254521	5931316	2.1	Tetra Pit	IS Vinton
	503	322	2.1	"	10A "
	503	330	2.1	SW	"
	511	335	2.1	"	Buried Pipe Vinton
	454	452	2.2	"	Cat Water
	443	447	2.2	"	" "
	442	443	2.2	Hydraulic	" "
	424	550	2.1	Tetra Pit	16ZC ULG id

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FQM - Landfill Weather Surveys Data Sheet

Q4AN(EV)-702-FM2

Project Name:	Upper California Gully Rd, Eaglehawk	**Project Number:**	City of Greater Bendigo
Project Location:		**Client:**	
PM Name:	Vera Levina	**Date:**	
Monitoring Instrument and Serial Number:		**Fieldwork Staff:**	BC WD

Field Data

7/8/18

Time	Activity	Weather	Wind direction	Wind speed (m/s)	Atmospheric pressure (mb)	Temperature (°C)	Field Representative
9.50	WALKOVER	OVERCAST	S	0.32		7.3	WD
10.30	"	"	S	0.72		8.4	|
11.00	"	"	S	1.05		10.1	|
12.00	"	"	S	1.00		11.5	|
12.40	"	"	S	1.35		12.7	|
13.30	"		S	0.41		12.7	|
14.20	ONSITE SOILS	"	S	0.13		12.7	|

Approval and Distribution

Fieldwork Staff Signature _____ Date _____

Project Manager Signature _____ Date _____

Distribution: Project Central File

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FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Vera Levina	Date:								
Client:	City of Greater Bendigo	Project Location:	Upper California Gully Rd, Eaglehav	Fieldwork Staff:	BC WD	Monitoring Instrument and Serial Number:						GA5000-11	7/8/16	

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH05	10:38	Ambient	0.0		0.1		20.2		79.1	0	1	0.1	979	0.15	G.C
		Pre-purge	0.0		1.2		19.6		79.2	0	0				
		1 min	0.0		1.2		19.6		79.2	0	0				
		2 min	0.0		1.2		19.6		79.2	0	0				
		3 min	0.0		1.2		19.6		79.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH04	10:45	Ambient	0.0		0.1		20.4		79.5	0	0	0.1	979	0.11	G.C
		Pre-purge	0.0		0.1		20.4		77.3	0	0				
		1 min	0.0		3.5		17.3		79.2	0	0				
		2 min	0.0		3.6		17.4		79.2	0	0				
		3 min	0.0		3.6		17.4		79.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH02	10:55	Ambient	0.0		0.1		19.4		79.9	0	0	0.1	979	0.10	G.C
		Pre-purge	0.0		1.7		14.8		78.8	0	0				
		1 min	0.0		1.8		18.9		79.4	0	0				
		2 min	0.0		1.8		18.8		79.4	0	0				
		3 min	0.0		1.8		18.8		79.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH01	11:05	Ambient	0.0		0.1		20.6		79.3	0	0	0.1	979	0.09	C.C
		Pre-purge	0.0		2.5		20.0		77.8	0	0				
		1 min	0.0		2.6		19.1		78.3	0	0				
		2 min	0.0		2.6		19.1		78.3	0	0				
		3 min	0.0		2.6		19.0		78.3	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Approval and Distribution

Fieldwork Staff Signature _____ Date _____ Project Manager Signature _____ Date _____

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FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

7/01

COM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Vera Levina	Date:	
Client:	City of Greater Bendigo	Project Location:	Upper California Gully Rd, Eaglehav	Fieldwork Staff:	BC WD	Monitoring Instrument and Serial Number:	GA5000-11 7/8/19

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH09	9:55	Ambient	0.0		0.1		20.9		79.0	0	0	0.0	979	.005	G.C
		Pre-purge	0.0		2.2		20.5		77.5	0	0				
		1 min	0.0		2.2		19.4		78.3	0	0				
		2 min	0.0		2.2		19.4		78.4	0	0				
		3 min	0.0		2.2		19.4		78.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH04	10:05	Ambient	0.0		0.1		20.5		79.4	0	0	0.1	977	027	G.C
		Pre-purge	0.0		0.5		20.3		79.4	0	0				
		1 min	0.0		0.3		20.3		79.4	0	0				
		2 min	0.0		0.3		20.3		79.4	0	0				
		3 min	0.0		0.3		20.3		79.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH07	10:15	Ambient	0.0		0.1		20.4		79.5	0	0	0.1	979	028	G.C
		Pre-purge	0.0		1.0		20.1		78.0	0	0				
		1 min	0.0		1.1		19.6		79.3	0	0				
		2 min	0.0		1.1		19.5		79.4	0	0				
		3 min	0.0		1.1		19.5		79.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH06	10:30	Ambient	0.0		0.1		20.4		79.5	0	0	0.2	979	022	G.C
		Pre-purge	0.0		6.4		17.0		77.5	0	0				
		1 min	0.0		6.5		15.3		78.4	0	0				
		2 min	0.0		6.5		14.9		78.6	0	0				
		3 min	0.0		6.5		14.9		78.6	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Approval and Distribution

Fieldwork Staff Signature _____ Date _____ Project Manager Signature _____ Date _____

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FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

7/8/18

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Vera Levina	Date:							
Client:	City of Greater Bendigo	Project Location:	Upper California Gully Rd, Eaglehav	Fieldwork Staff:	BC WD	Monitoring Instrument and Serial Number:					GP5000-H		

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH17	11:00	Ambient	0.0		~~2.0~~	0.1	~~18.9~~	21.0	78.9	0	0	0.1	979	0.12	G.C
		Pre-purge	0.0		1.6		17.6		~~80.8~~	0	0				Spider
		1 min	0.0		1.6		17.5		80.9	0	0				
		2 min	0.0		1.6		17.4		80.9	0	0				
		3 min	0.0		1.6		17.4		80.9	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH27	11:15	Ambient	0.0		0.1		21.0		78.8	0	0	0.1	~~977~~	0.22	G.C
		Pre-purge	0.0		0.1		21.0		78.8	0	0				
		1 min	0.0		3.6		17.7		78.8	0	0				
		2 min	0.0		3.6		17.4		79.0	0	0				
		3 min	0.0		3.6		17.4		79.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH26	11:30	Ambient	0.0		0.1		20.7		79.1	0	0	0.1	980	0.09	G.C
		Pre-purge	~~0.0~~ 8.4		~~8.1~~ 14.2		7.2		70.6	0	0				
		1 min	6.5		14.4		5.7		71.4	0	0				
		2 min	8.5		14.4		5.6		71.4	0	0				
		3 min	8.5		14.4		5.6		71.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH18	11:45	Ambient	0.0		0.1		20.6		79.3	0	0	0.1	980	0.12	G.C
		Pre-purge	0.0		~~4.2~~		18.2		79.4	0	0				
		1 min	0.0		4.3		14.3		81.5	0	0				
		2 min	0.0		4.3		14.1		81.6	0	0				
		3 min	0.0		4.3		14.1		81.6	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Approval and Distribution

Fieldwork Staff Signature _____ Date _____ Project Manager Signature _____ Date _____

Distribution: Project Central File

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FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

7/8/18 GA5000-11

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Vera Levina	Date:							
Client:	City of Greater Bendigo	Project Location:	Upper California Gully Rd, Eaglehav	Fieldwork Staff:	BC WD	Monitoring Instrument and Serial Number:						GA5000 11	

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH25	11:45	Ambient	0.0		0.2		20.7		79.1	0	0	0.1	981	0.11	G.C
		Pre-purge	0.0		1.5		20.4		78.2	0	0				
		1 min	0.0		1.5		20.1		78.4	0	0				
		2 min	0.0		1.5		20.1		78.4	0	0				
		3 min	0.0		1.5		20.1		78.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH19	12:00	Ambient	0.0		0.1		20.9		78.9	0	0	0.1	981	0.13	G.C
		Pre-purge	0.0		4.5		17.2		78.4	0	0				
		1 min	0.0		4.6		16.6		78.8	0	0				
		2 min	0.0		4.6		16.0		78.8	0	5				
		3 min	0.0		4.6		16.6		78.9	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH20	12:15	Ambient	0.0		0.1		21.2		78.7	0	0	0.0	981	0.11	G.C
		Pre-purge	0.0		5.2		14.1		78.0	0	0				
		1 min	0.0		5.2		18.0		78.8	0	0				
		2 min	0.0		5.3		17.9		78.8	0	8				
		3 min	0.0		5.3		17.9		78.8	0	8				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH21	12:25	Ambient	0.0		0.2		21.3		78.6	0	0	0.0	981	0.14	C.C
		Pre-purge	0.0		2.6		20.0		77.4	0	0				
		1 min	0.0		2.7		19.8		77.5	0	0				
		2 min	0.0		2.7		19.8		77.5	0	21				
		3 min	0.0		2.7		19.8		77.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Approval and Distribution

Fieldwork Staff Signature _____ Date _____ Project Manager Signature _____ Date _____

Distribution: Project Central File

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

7/8/18 GA5000-11

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Vera Levina	Date:	
Client:	City of Greater Bendigo	Project Location:	Upper California Gully Rd, Eaglehav	Fieldwork Staff:	BC WD	Monitoring Instrument and Serial Number:	

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH23	12:30	Ambient	6.0		0.1		21.2		78.7	0	0	0.1	980	0.08	G.C
		Pre-purge	0.0		0.6		20.7		78.5	0	0				
		1 min	0.0		1.2		20.3		78.5	0	0				
		2 min	0.0		1.2		20.3		78.5	0	0				
		3 min	0.0		1.2		20.3		78.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH22	12:45	Ambient	0.0		0.6		21.4		78.5	0	0	0.1	981	0.14	G.C
		Pre-purge	0.0		1.2		20.4		78.5	0	0				Lock fallen off - very rusty
		1 min	0.0		1.2		20.3		78.5	0	0				
		2 min	0.0		1.2		20.3		78.5	0	0				
		3 min	0.0		1.2		20.3		78.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH29	13:00	Ambient	6.0		0.1		21.6		78.5	0	0	0.0	981	0.16	G.C
		Pre-purge	0.0		9.5		16.2		78.3	0	1				
		1 min	0.0		9.9		7.6		82.5	0	0				Fly @
		2 min	0.0		9.9		7.6		82.5	0	0				
		3 min	0.0		9.9		7.5		82.6	0	0				TP 15.75
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH30	15:15	Ambient	0.0		0.6		21.5		78.4	0	0	0.1	980	0.17	G.C
		Pre-purge	0.0		3.4		18.4		77.2	0	0				
		1 min	0.0		3.9		17.7		78.3	0	0				Fly @
		2 min	0.0		3.9		17.7		78.4	0	2				
		3 min	0.0		3.4		17.7		78.3	0	1				15.77
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Approval and Distribution

Fieldwork Staff Signature _____ Date _____ Project Manager Signature _____ Date _____

Distribution: Project Central File

Mick - Boss

Josh - Supervisor

Kylie - ~~[illegible]~~ Contam boss

Kerri - weigh bridge

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

7/8/18 GASD08-11

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Vera Levina	Date:	
Client:	City of Greater Bendigo	Project Location:	Upper California Gully Rd, Eaglehav	Fieldwork Staff:	BC WD	Monitoring Instrument and Serial Number:	

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH31	13:20	Ambient	0.0		6.1		21.5		78.4	0	0	0.0	980	0.10	G.C
		Pre-purge	0.0		5.9		18.1		79.0	0	0				
		1 min	0.0		6.0		15.0		79.0	0	0				
		2 min	0.0		6.0		15.0		79.0	0	0				Fly @
		3 min	0.0		6.0		15.0		79.1	0	0				15:22
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH38	13:40	Ambient	0.0		0.1		20.8		78.7	0	0	0.1	979	0.08	G.C
		Pre-purge	0.0		2.8		19.8		77.7	0	0				
		1 min	0.0		2.8		19.1		78.1	0	0				
		2 min	0.0		2.8		19.0		78.1	0	0				Fly @
		3 min	0.0		2.9		19.0		78.1	0	0				15:20
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH39	14:10	Ambient	0.0		0.1		21.5		78.4	0	0	0.0	974	0.05	G.C
		Pre-purge	0.0		4.6		18.3		77.3	0	0				
		1 min	0.0		4.7		15.1		79.6	0	0				
		2 min	0.0		4.7		15.6		79.7	0	0				Fly @
		3 min	0.0		4.7		15.5		79.7	0	0				15:24
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH40	14:25	Ambient	0.0		0.2		21.4		78.5	0	0	0.0	980	-0.02	G.C
		Pre-purge	0.0		2.2		20.0		77.9	0	0				
		1 min	0.0		2.2		19.3		78.2	0	0				
		2 min	0.0		2.2		19.1		78.1	0	0				Fly @
		3 min	0.0		2.2		19.1		78.1	0	0				15:25
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Approval and Distribution

Fieldwork Staff Signature _____ Date _____ Project Manager Signature _____ Date _____

Distribution: Project Central File

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

7/8/19 GA5000-11

COM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Vera Levina	Date:	
Client:	City of Greater Bendigo	Project Location:	Upper California Gully Rd, Eaglehav	Fieldwork Staff:	BC WD	Monitoring Instrument and Serial Number:	

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH36	14:20	Ambient	0.0		0.1		21.6		78.4	0	0	0.1	980	0.02	G.C
		Pre-purge	0.0		1.7		20.6		77.7	0	0				
		1 min	0.0		1.7		20.6		77.7	0	8				Pg @
		2 min	0.0		1.7		20.6		77.7	0	8				
		3 min	0.0		1.7		20.6		77.7	0	0				15.75
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH37	14:40	Ambient	0.0		0.1		21.6		78.4	0	0	0.1	980	0.02 0.17	G.C
		Pre-purge	0.0		1.2		20.7		78.1	0	0				
		1 min	0.0		1.2		20.7		78.1	0	0				Pg
		2 min	0.0		1.3		20.7		78.1	0	0				
		3 min	0.0		1.3		20.7		78.1	0	0				15.72
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH35	14:51	Ambient	0.0		0.1		21.7		78.3	0	0	0.0	980	0.02	G.C
		Pre-purge	0.0		5.9		21.4		77.8	0	0				
		1 min	0.0		3.2		21.0		77.5	0	0				Pg @
		2 min	0.0		5.3		20.1		76.4	0	0				
		3 min	0.0		5.4		20.0		76.6	0	0				15.77
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH28		Ambient	0.0		0.1		21.7		78.3	0	0	0.1	982	0.04	G.C
		Pre-purge	0.0		2.5		19.6		77.9	0	0				
		1 min	0.0		2.5		19.6		77.9	0	0				Pg @
		2 min	0.0		2.5		19.6		77.9	0	0				
		3 min	0.0		2.5		19.6		77.9	0	0				10.87
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Approval and Distribution

Fieldwork Staff Signature _____ Date _____ Project Manager Signature _____ Date _____

Distribution: Project Central File

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

7/8/18 GA5000-11

COM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Vera Levina	Date:						
Client:	City of Greater Bendigo	Project Location:	Upper California Gully Rd, Eaglehaw	Fieldwork Staff:	BC WD	Monitoring Instrument and Serial Number:						

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH54	10:20	Ambient	0.0		0.1		21.8		78.1	0	0	0.0	982	0.04	G.C
		Pre-purge	0.0		5.2		20.1		74.9	0	0				Purge
		1 min	0.0		5.3		18.6		76.0	0	0				10
		2 min	0.0		5.4		18.6		76.0	0	0				15.80
		3 min	0.0		5.4		18.6		76.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH53	15:40	Ambient	0.0		0.1		21.7		78.1	0	0	0.0	982	0.05	G.C
		Pre-purge	0.0		2.6		20.0		77.7	0	0	0		SWL=10.49m	
		1 min	0.0		2.6		19.3		78.1	0	0				TD=15.75
		2 min	0.0		2.6		19.3		78.1	0	0				
		3 min	0.0		2.6		19.3		78.1	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
~~BH54~~ BH32	15:50	Ambient	0.0		0.1		22.0		77.9	0	0	0.0	982	0.00	G.C
		Pre-purge	0.0		4.3		19.8		76.0	0	0				SWL
		1 min	0.0		4.4		19.5		76.1	0	0				=14.83
		2 min	0.0		4.4		19.5		76.2	0	0				TD=15.75
		3 min			4.4		19.5		76.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH27		Ambient	0.0		0.1		21.9		78.0	0	0	0.0	980	0.00	G.C
		Pre-purge	0.0		1.7		21.4		77.3	0	0				
		1 min	0.0		1.7		20.6		77.7	0	0				
		2 min	0.0		1.7		20.6		77.7	0	0				
		3 min	0.0		1.7		20.6		77.7	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Approval and Distribution

Fieldwork Staff Signature _____ Date _____ Project Manager Signature _____ Date _____

Distribution: Project Central File

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

7/8/18 GAS000-11

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Vera Levina	Date:	
Client:	City of Greater Bendigo	Project Location:	Upper California Gully Rd, Eaglehav	Fieldwork Staff:	BC WD	Monitoring Instrument and Serial Number:	

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH15	8:50	Ambient	0.0		0.1		21.9		78.0	0	0	0.10	980	0.10	No old LFG connector on lid. Used given connector. 10mm hole exposed to ambient air.
		Pre-purge	0.0		1.5		21.2		77.6	0	0				
		1 min	0.0		1.7		20.8		77.7	0	0				
		2 min	0.0		1.5		20.8		77.7	0	0				
		3 min	0.0		1.5		20.8		77.7	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Approval and Distribution			
Fieldwork Staff Signature	Date	Project Manager Signature	Date
Distribution: Project Central File			

OCTOBER 2018 MONITORING

Instrument Quality Report
Interface Meter

Enqip #: 7719
Company: AECOM Australia Pty Ltd
Consultant: Tim Smith
PO #: 60563317/2
Certificate #: 10283

INSTRUMENT IDENTIFICATION

Instrument Type: Solinst Interface Meter
Model Number: 122
Serial Number: IM-1607

INSPECTION RECORD

Battery:	PASS	**Water Tone:**	PASS
Tape Condition:	PASS	**Hydrocarbon Tone:**	PASS

Tested By: Andrea Hill **Test Date:** 24/10/2018

enqip
116 Thistlethwaite St, South Melbourne 3205
P 1300 218 987
E info@enqip.com.au | W www.enqip.com.au

Equipment Calibration Form
GA5000

RESULT#13

Enqip #: 7719
Company: AECOM Australia Pty Ltd
Consultant: Tim Smith
PO #: 60563317/2
Certificate #: 10284

INSTRUMENT IDENTIFICATION

Model Number: GA5KA0F-100
Serial Number: GA5000BA
Instrument Type: GTI - GA5000

INSPECTION RECORD

Date & Time: PASS
Flow Rate: 630 mL/min

CALIBRATION DETAILS

Sensor	Standard	Reading	Traceability Lot #
CH_4	N_2 UHP	0 %	901331
	2.5 %	2.5 %	811847
	60 %	60.0 %	923048
CO_2	5 %	5.0 %	762650
	40 %	40.0 %	923048
O_2	N_2 UHP	0 %	901331
	20.9 %	20.9 %	N/A
CO	N_2 UHP	0 ppm	901331
	100 ppm	100 ppm	811847
H_2S	N_2 UHP	0 ppm	901331
	25 ppm	25 ppm	972407

Calibration Successful: YES

Calibrated By: Andrea Hill **Test Date:** 24/10/2018

enqip
116 Thistlethwaite St, South Melbourne 3205
P 1300 218 987
E info@enqip.com.au | W www.enqip.com.au

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

1/8

25/10/18

Project Name:	Eaglehawk	Project Number:	60563317	PM Name:	Tim Smith	Date:						GA5000 BA	
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill, Upper Californo	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH29	8:50	Ambient	0.0		0.2		21.2		78.7	0	0	0.0	993	0.03	Dry @ 16.4m
		Pre-purge	0.0		11.7		10.1		78.9	0	0				
		1 min	0.0		11.7		7.6		80.8	0	0				
		2 min	0.0		11.8		7.0		81.3	0	0				
		3 min	0.0		11.8		6.8		81.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
* BH09	9:20	Ambient	0.0		0.0		20.8		79.6	0	0	0.0	993	0.0	Dry @ 1.32m
		Pre-purge	0.0		0.3		19.8		80.0	0	0				
		1 min	0.0		0.5		19.8		80.0	0	0				
		2 min	0.0		0.3		19.8		80.0	0	0				
		3 min	0.0		0.3		19.8		80.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
* BH08	9:40	Ambient	0.0		5.1		19.9		80.0	0	0	0.0	993	0.0	3.07 Dry @
		Pre-purge	0.0		1.5		18.7		80.0	0	0				
		1 min	0.0		1.4		18.6		80.0	0	0				
		2 min	0.0		1.4		18.8		80.0	0	0				
		3 min	0.0		1.4		19.8		80.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
* ~~BH09~~	10:00	Ambient	0.0		0.1		19.9		~~CH4 TVO~~ 79.0	0	0	0.0	993	0.0	Dry @ 1.07
BH07		Pre-purge	0.0		3.0		17.0		79.0	0	0				
		1 min	0.0		2.9		19.9		79.0	0	0				
		2 min	0.0		2.7		20.0		79.0	0	0				
		3 min	0.0		2.6		20.0		79.0	0	0				

No fitting on gas bore.

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

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25/10/18 GN5000BA

Project Name:	Eaglehawk	Project Number:	60563317	PM Name:	Tim Smith	Date:						
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill, Upper Californo	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:						

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH06	10:10	Ambient	0.0		0.1		19.5		80.4	0	0	0.0	994	0.13	Ayg @
		Pre-purge	0.0		4.4		16.6		79.1	1	1	0.0			1.25
		1 min	0.0		4.5		16.2		79.3	1	0	0.0			
		2 min	0.0		4.5		16.2		79.3	1	0				
		3 min	0.0		4.6		16.2		79.3	1	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH05	10:15	Ambient	0.0		0.1		19.5		80.4	0	0	0.0	994	0.08	Ayg @
		Pre-purge	0.0		1.1		18.6		80.3	0	0				
		1 min	~~1.2~~ 0.0		~~18.6~~ 1.2		18.6	~~50.1~~	80.1	1	0				10.57
		2 min	~~1.3~~ 0.0		~~18.5~~ 1.3		18.5	~~20.1~~	80.1	1	0				
		3 min	0.0		1.3		18.5		80.0	1	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH04	10:25	Ambient	0.0		0.1		19.8		80.2	0	0	0.0	994	0.10	Ayg @
		Pre-purge	0.0		1.9		18.6		79.3	0	0				1.24
		1 min	0.0		2.6		18.1		79.4	0	0				
		2 min	0.0		2.6		18.1		79.3	0	0				
		3 min	0.0		2.7		18.0		79.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH03	10:35	Ambient	0.0		0.1		19.8		80.2	0	0	0.0	994	0.08	Ayg @
		Pre-purge	0.0		1.9		18.6		79.3	0	0				10.52
		1 min	0.0		2.2		18.3		79.3	0	0				
		2 min	0.0		2.3		18.3		79.4	0	0				
		3 min	0.0		2.3		18.1		79.4	0	0				

No fitting on gas bore

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

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AECOM

Q4AN(EV)-703-FM1

25/10/18 GA5000BA

Project Name:	Eaglehawk	Project Number:	60563317	PM Name:	Tim Smith	Date:							
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill, Upper Californo	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
* BH02	10:40	Ambient	0.0		0.1			19.7	79.0	0	0	0.0	994	0.05	Dry @ 3.3m
		Pre-purge	0.0		1.1			19.0	79.8	1	1				
		1 min	0.0		1.7			19.0	79.8	1	1				
		2 min	0.0		1.3			19.0	79.8	1	1				
		3 min	0.0		1.3			18.9	79.8	1	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
* 40BH01	10:50	Ambient	0.0		0.1			19.7	79.0	0	0	0.0	994	0.07	Dry @ 6.5m
		Pre-purge	0.0		1.5			19.0	79.5	0	0				
		1 min	0.0		1.6			18.9	79.5	0	0				
		2 min	0.0		1.6			18.9	79.5	0	0				
		3 min	0.0		1.6				79.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH17	11:00	Ambient	0.0		6.1		19.7		79.0	0	0	0.1	994	0.10	Dry @ 11.0m
		Pre-purge	6.0		5.4		17.3		79.3	0	1				
		1 min	6.0		3.4		17.3		79.3	0	1				
		2 min	0.6		3.4		17.3		79.3	0	1				
		3 min	0.0		3.4		17.3		79.3	0	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH27	11:10	Ambient	0.3		0.0		20.7		19.5	0	1	0.0	994	0.09	Dry @ 2.8
		Pre-purge	0.3		3.7		17.4		78.9	0	1				
		1 min	0.0		3.7		17.4		78.9	0	1				
		2 min	0.0		3.7		17.4		78.9	0	1				
		3 min	0.0		3.7		17.4		78.9	0	1				

* No Gas fitting for old bore.

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

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AECOM

Q4AN(EV)-703-FM1

25/10/18 GA5000BA

Project Name:	Eaglehawk	Project Number:	60563317	PM Name:	Tim Smith	Date:							
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill, Upper Californo	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH26	11:15	Ambient	0.0		6.0		20.7		79.3	0	0	0.0	993	0.07	Dry @
		Pre-purge	2.8		10.8		7.5		78.9	0	1				
		1 min	2.8		10.8		7.5		78.9	0	1				
		2 min	2.8		10.8		7.5		78.9	0	1				13.07
		3 min	2.8		10.8		7.4		78.9	0	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH18	11:20	Ambient	0.0		0.0		20.6		79.4	0	0	0.0	993	0.06	Dry
		Pre-purge	0.0		4.4		16.1		79.5	0	1				
		1 min	0.0		4.4		16.1		79.5	0	1				Dry @
		2 min	0.0		4.4		16.1		79.5	0	1				
		3 min	0.0		4.4		16.1		79.5	0	1				13.0
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH25	11:30	Ambient	0.0		0.0		20.7		79.3	0	0	0.0	993	0.09	Dry @
		Pre-purge	0.0		2.7		17.8		79.5	0	1				2.90
		1 min	0.0		2.6		17.8		79.6	0	1				
		2 min	0.0		2.6		17.9		79.5	0	1				
		3 min	0.0		2.6		17.9		79.5	0	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH19	11:35	Ambient	0.0		0.0		20.7		79.3	0	0	0.0	993	0.08	Dry @
		Pre-purge	0.0												
		1 min	0.0		3.4		18.0		78.6	0	1				5.62
		2 min	0.0		3.4		18.0		78.6	0	1				
		3 min	0.0		3.4		18.0		78.6	0	1				

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FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

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GA5000 BA
25/10/18

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk	Project Number:	60563317	PM Name:	Tim Smith	Date:							
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill, Upper Californor	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH20	11:50	Ambient	0.0			6.0	20.7		79.3	0	0	0.0	993	0.09	Dry
		Pre-purge	0.0			5.0	18.0		79.0	0	6				@ 4.65
		1 min	0.0			5.0	18.0		79.0	0	6				
		2 min	0.0			5.0	18.0		79.0	0	6				
		3 min	0.0			5.0	18.0		79.0	0	6				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH21	13:35	Ambient	~~0.0~~ 0.1		0.1		20.5		79.4	0	0	5.0	995	0.05	Dry @
		Pre-purge	0.0		4.8		16.3		78.9	0	1				2.85
		1 min	0.0		4.8		16.2		79.0	0	1				
		2 min	0.0		4.8		16.2		79.0	0	1				
		3 min	0.0		4.8		16.2		79.0	0	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
~~BH30~~ BH23	13:45	Ambient	0.1		0.1		20.5		79.4	0	0	0.0	995	0.10	Dry @
		Pre-purge	0.0		2.3		17.9		79.8	0	1				3.67
		1 min	0.0		2.3		17.9		79.8	0	1				
		2 min	0.0		2.3		17.9		79.8	0	1				
		3 min	0.0		2.3		17.9		79.8	0	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH22	15:55	Ambient	0.1		0.1		20.5		79.4	0	0	0.0	995	0.08	Slwly
		Pre-purge	0.0		5.7		14.4		79.9	0	1				=4.64
		1 min	0.0		5.7		14.4		79.9	0	1				
		2 min	0.0		5.7		14.4		79.9	0	1				
		3 min	0.0		5.7		14.4		79.9	0	1				

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FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

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GA5000BA
25/10/18

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk	Project Number:	60563317	PM Name:	Tim Smith	Date:							
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill, Upper Californo	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH30	14:10	Ambient	0.1		0.1		20.5		79.4	0	0	0.0	995	0.07	
		Pre-purge	0.0		3.6		18.9		79.5	0	3				dry @
		1 min	0.0		3.5		17.0		79.5	0	3				
		2 min	0.0		3.5		17.0		79.5	0	3				16.08
		3 min	0.0		3.5		17.0		79.5	0					
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH31	14:25	Ambient	0.1		0.1		20.5		77.4	0	0	0.0	995	0.10	
		Pre-purge	0.0		4.8		14.8		80.3	0	0				dry @
		1 min	0.0		5.2		14.7		80.1	0	0				15.89
		2 min	0.0		5.3		14.7		80.6	0	0				
		3 min	0.0		5.3		14.7		80.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH38	14:40	Ambient	0.0		0.1		20.6		79.3	0	1	0.0	991	0.08	0.08
		Pre-purge	0.0		2.8		18.7		78.8	0	1				
		1 min	0.0		2.8		18.1		79.1	0	1				
		2 min	0.0		2.8		18.1		79.1	0	1				dry @
		3 min	0.0		2.8		18.1		79.1	1	1				16.0
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH39	14:50	Ambient	0.0		0.1		20.6		79.3	0	1	0.0	991	0.10	
		Pre-purge	0.0		3.7		17.1		79.2	0	1				dry @
		1 min	0.0		3.7		17.1		79.2	0	1				15.76
		2 min	0.0		3.7		17.1		79.2	0	1				
		3 min	0.0		3.7		17.1		79.2	0	1				

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

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GA5000GA

25/10/18

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk	Project Number:	60563317	PM Name:	Tim Smith	Date:						
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill, Upper Californor	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:						

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH40	15:05	Ambient	0.0		2.1		20.6		79.3	0	1	0.0	991	0.11	
		Pre-purge	0.0		2.1		18.6		79.3	0	1				
		1 min	0.0		2.1		18.6		79.3	0	1				
		2 min	0.0		2.1		18.6		79.3	0	1				
		3 min	0.0		2.1		18.6		79.3	0	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15.75

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH36	15:15	Ambient	0.0		2.6		20.9		79.0	0	5	0.0	993	0.09	
		Pre-purge	0.0		2.6		19.7		78.1	0	0				
		1 min	0.0		2.7		18.3		79.0	0	0				
		2 min	0.0		2.7		18.3		79.0	0	0				
		3 min	0.0		2.7		18.3		79.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15.80

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH37	15:25	Ambient	0.0		0.0		20.9		79.0	0	0	0.0	993	0.13	
		Pre-purge	0.0		~~18.9~~ 2.3		18.2		79.5	0	0				
		1 min	0.0		2.3		18.2		79.5	0	0				
		2 min	0.0		2.3		18.2		79.5	0	0				
		3 min	0.0		2.3		18.2		79.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 15.72

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH35	15:30	Ambient	0.0		0.0		20.9		79.0	0	0	0.1	993	0.09	
		Pre-purge	0.0		3.5		17.9		78.6	0	0				
		1 min	0.0		3.5		17.9		78.6	0	0				
		2 min	0.0		3.5		17.9		78.6	0	0				
		3 min	0.0		3.5		17.9		78.6	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													Dry @ 16.12

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

8/8

GA5000 BA

25/10/18

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk	Project Number:	60563317	PM Name:	Tim Smith	Date:						
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill, Upper Californo	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:						

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH38	15:25	Ambient	0.0		0.0		20.9		79.1	0	1	0.0	994	0.03	Dry @ 10.92m
BH28		Pre-purge	~~3.3~~ 0.0		3.3		20.2		78.8	0	1				
		1 min	0.6		3.3		17.8		78.9	0	1				
		2 min	0.0		3.3		17.8		78.9	0	1				
		3 min	0.0		3.3		17.8		78.9	0	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH34	15:40	Ambient	0.0		0.0		20.9		79.1	0	0	0.0	995	0.05	Dry @ 16.08
		Pre-purge	~~4.7~~ 0.0		4.7		17.0		78.1	0	6				
		1 min	0.0		~~4.7~~ 5.5		16.4		~~78.1~~ 78.1	0	8				
		2 min	0.0		~~4.7~~ 5.5		16.4		78.1	0	8				
		3 min	0.0		5.5		16.4		78.1	0	8				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH33	15:50	Ambient	0.0		0.0		20.9		79.1	0	0	0.0	992	0.04	SWL = 10.75 TD = 15.95
		Pre-purge	0.0		2.7		18.1		79.1	0	0				
		1 min	0.0		2.9		18.0		79.1	0	0				
		2 min	0.0		2.9		18.1		79.1	0	0				
		3 min	0.0		2.9		18.1		79.1	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH52	14:00	Ambient	0.0		2.0		21.0		79.0	0	0	0.1	992	0.11	SWL 14.985m TD = 15.99
		Pre-purge	~~0.0~~ 0.0		3.5		18.4		78.1	0	1				
		1 min	0.6		3.5		18.3		78.1	0	1				
		2 min	0.6		3.5		18.3		78.1	0	1				
		3 min	0.0		3.5		18.3		78.1	0	1				

ANZ

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

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GA50000 BQ
25/10/18

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk	Project Number:	60563317	PM Name:	Tim Smith	Date:						
Client:	City of Bendigo	Project Location:	Eaglehawk Landfill, Upper Californ	Fieldwork Staff:	Bernie Chomley	Monitoring Instrument and Serial Number:						

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
~~BH16~~ BH24	15:10	Ambient	0.0		0.0		20.4		79.1	0	0	0	998	0.05	Ayg @ 1.79
		Pre-purge	0.0		2.1		19.1		78.7	0	1				
		1 min	0.0		2.1		19.1		78.7	0	1				
		2 min	0.0		2.1		19.1		78.7	0	1				
		3 min	0.0		2.1		19.1		78.7	0	1				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH16		Ambient	0.0		0.0		20.4		79.1	0	0	0	998	0.04	Ayg @ 5.04
		Pre-purge	0.0		0.9		19.5		79.1	0	0				
		1 min	0.0		0.9		19.5		79.1	0	0				
		2 min	0.0		0.9		19.5		79.1	0	0				
		3 min	0.0		0.9		19.5		79.1	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													

Appendix E

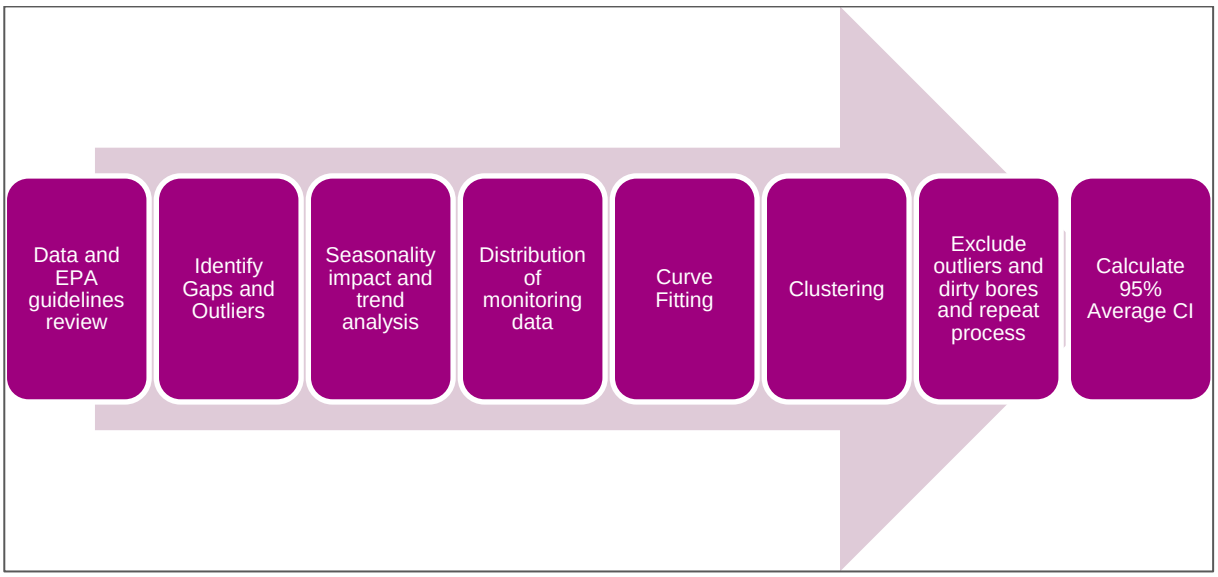
Assessment of Background Soil Gas Concentrations

E1.1 Introduction

The purpose of this report is to document the approach used to analyse landfill gas fugitive emissions monitoring data collected for Eaglehawk Landfill. AECOM has followed EPA Victoria guidelines (publication 1684, February 2018) to verify this project meets the requirements of Environment Protection Act 1970.

E1.2 Methodology

Broadly the methodology followed for this assessment included the following steps:



- Review of EPA Guidelines review to verify suitability and to identify relevant clauses to this project.
- Review bore monitoring data for completeness
- Visual replay of monitoring data to identify gaps and outliers
- Assess seasonality impact and trends
- Verify if the data follows normal distribution
- Eliminate outliers and dirty bores and repeat process
- Calculate 95% confidence interval average and provide recommendations

The following data was provided for analysis:

- Bore ID (all soil gas monitoring bores (BH01-BH40))
- Bore installation date
- Bore easting and northing
- Bore depth (as drilled)
- Monitoring dates throughout 2001 – 2018 (continuous monitoring data for BH18 and BH26 were excluded)
- Concentrations of CH_4, CO_2 and O_2 (March 2006 BH03 and BH04 anomalous methane readings due to instrument malfunction were excluded)
- Approximate distance from the waste (from aerial images)
- Thickness of fill based on bore logs

- Anticipated transmissivity (two categories assuming higher transmissivity in the zones of shaft clusters, as shafts were developed in the areas of highly fractured auriferous sand-rich sediments of both Bendigonian and Chewtonian bedrock units).

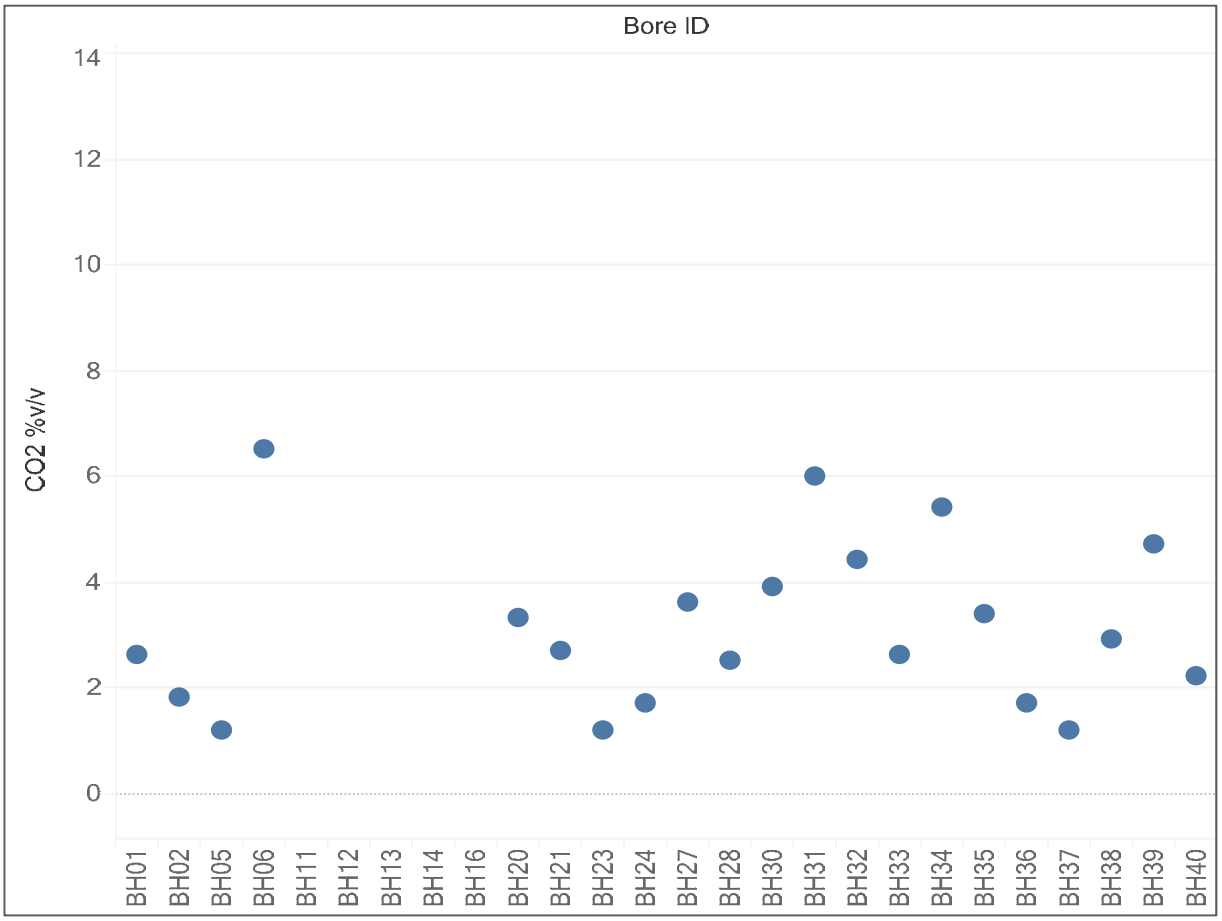
Prior to statistical analysis, some bores were eliminated in accordance with known soil gas conditions affected by the landfill (i.e. non background). These included bores where methane at concentrations exceeding instrument detection limit have been consistently detected and bores located within 20m of the known waste footprint where concentrations of carbon dioxide, oxygen and %balance were consistently indicative of methane oxidation.

E1.3 Analysis

Modelling involved regression analysis and clustering, with analysis undertaking using Python.

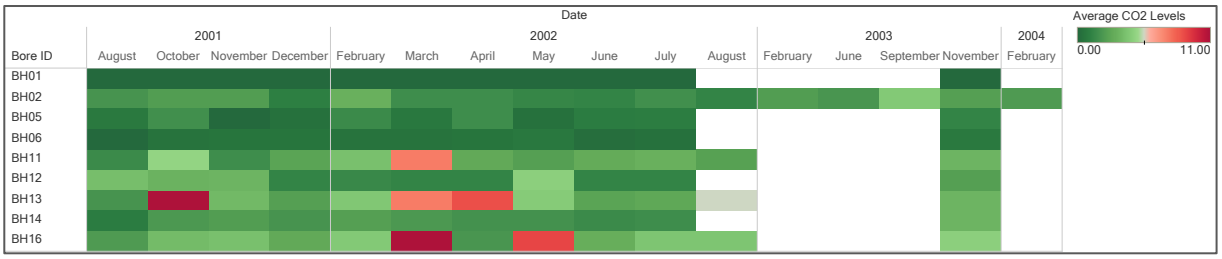
The analysis and conclusions are summarised below. Charts below illustrate the process and outcome of the analysis. Note that for the iterative elements of the assessment, such as visual replay, seasonal counts, scatter plots, illustrations are limited to random selected charts.

E1.3.1 Visual Replay



Data was replayed in a visual format shown above for the entire period of monitoring, with each frame representing an event snapshot. This format of visual replay helps to quickly inspect the completeness of the dataset and to identify data gaps, range of values for different bores, their highs and lows, etc.

E1.3.2 Survey Intervals and Seasonal Counts



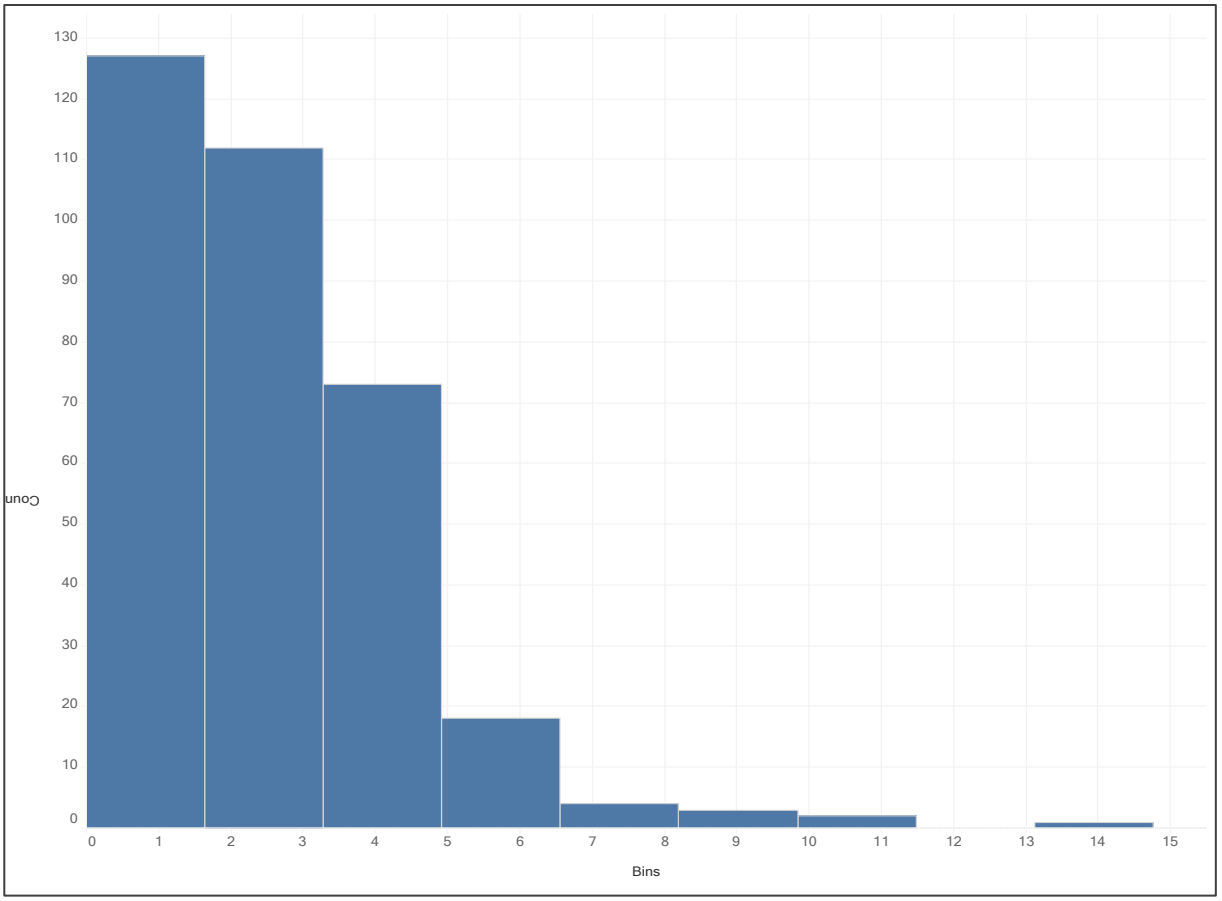
It is important that the spatial and temporal variability of the data used in the stable dataset is considered, given that the purpose is to represent natural ground gas conditions.

For example, obtaining ground gas monitoring data during summer only would likely produce a stable dataset but would not be representative of seasonal variations. Subsequent statistical analysis on this dataset would produce a 'background' ground gas concentration that was either too high and would hide gas migration, or too low and would trigger unnecessary regulatory remedies or sanctions from EPA. For this reason, we inspected the monitored gas data to check if enough seasonal variability has been accounted for. Chart above offers a model output snapshot showing the early years of monitoring at the site, when after two years of frequent monitoring, frequency was reduced to annual for all bores with exception of selected bores where greater monitoring frequency was maintained.

Note that barometric pressure conditions were not included into analysis (archived data unavailable). However it was assumed that over the 2001-2018 monitoring period, sufficient data representative of soil gas conditions in the vicinity of the landfill have been collected, with scheduling of the monitoring events at times favourable for gas release (i.e. falling barometric conditions).

It was concluded that the available data satisfactorily represents seasonal variations.

E1.3.3 Curve Fitting



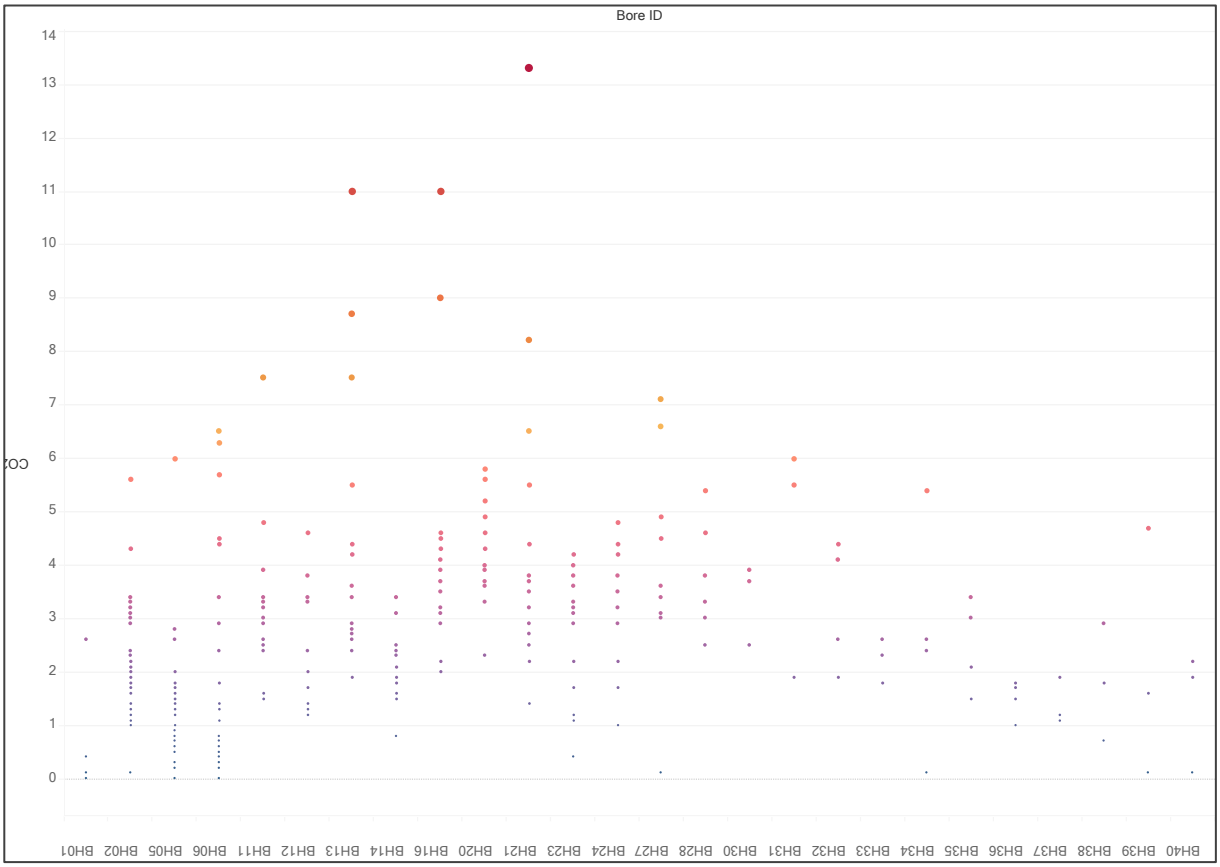
EPA guidelines state that for the purpose of this exercise, care should be taken to use stable datasets with approximately normal (Gaussian) distribution. The purpose of using stable data is to allow for natural variability in the ground gas to be accounted for so unnecessary investigation is not undertaken.

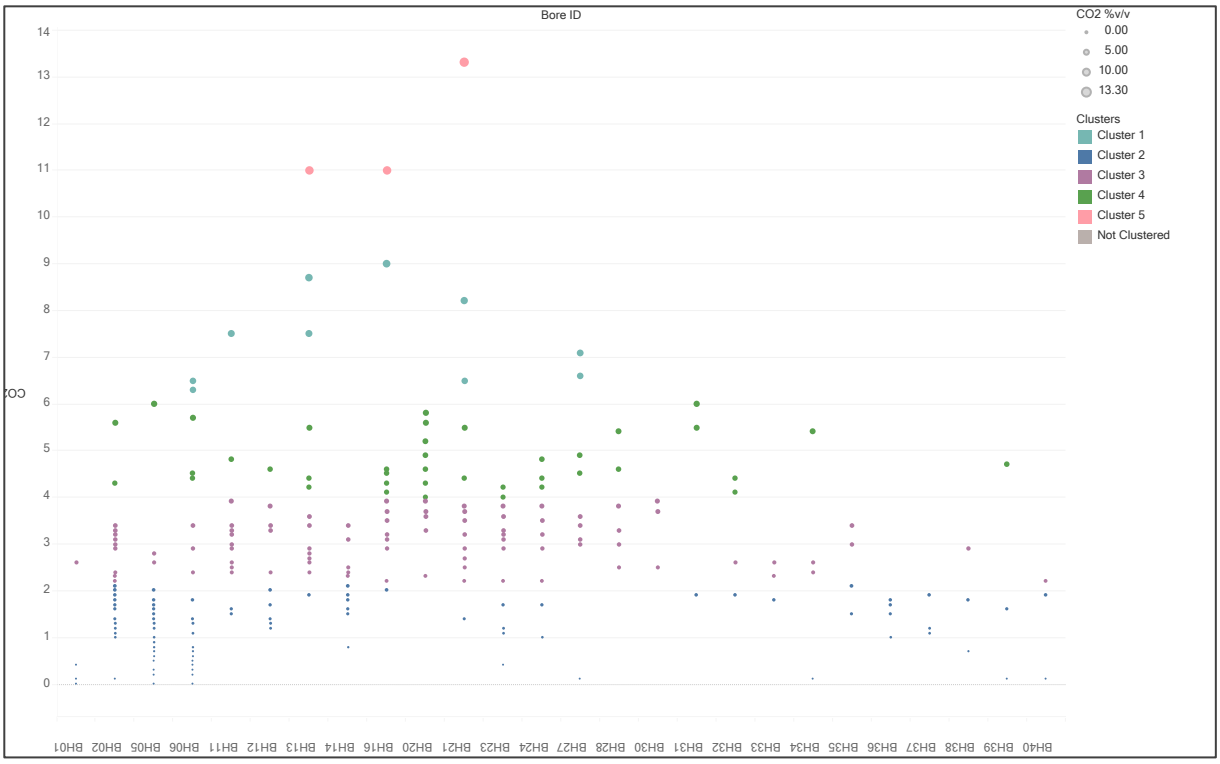
Curve fitting demonstrated that the available data appears normally distributed.

E1.3.4 Scatter Plots and Clustering

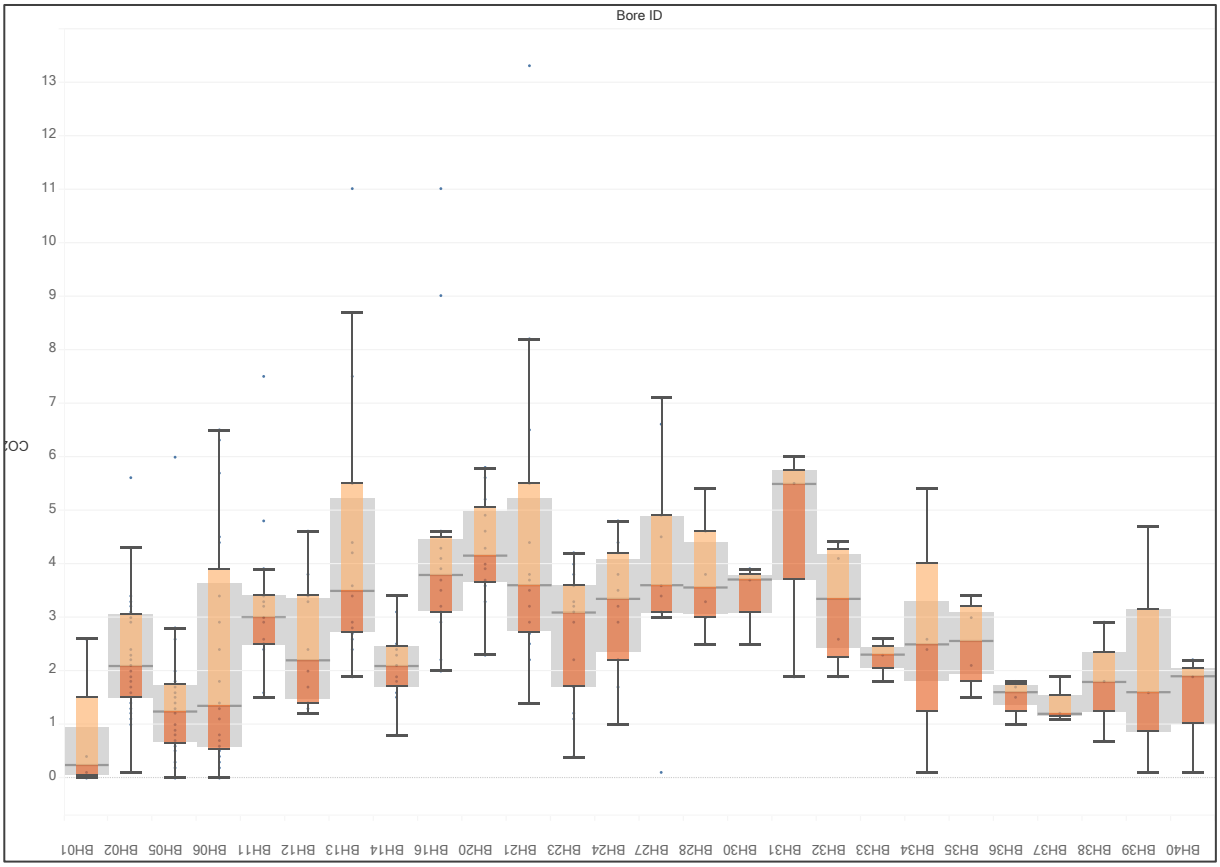
Scatter plots and clustering techniques were applied to identify and eliminate outliers and “dirty” bores. The whole process was then repeated until we had a stable dataset.

Bores selected for analysis excluded those determined to be affected by LFG or located too close to the known landfill footprint. These included: BH03, BH04 (the longest record due to elevated CO2); BH07-BH10, BH19, BH20, BH22, BH25 (20m or less from the landfill cells and some elevated CO2); BH15, BH17 (elevated CO2); BH18, BH26 - CH4.





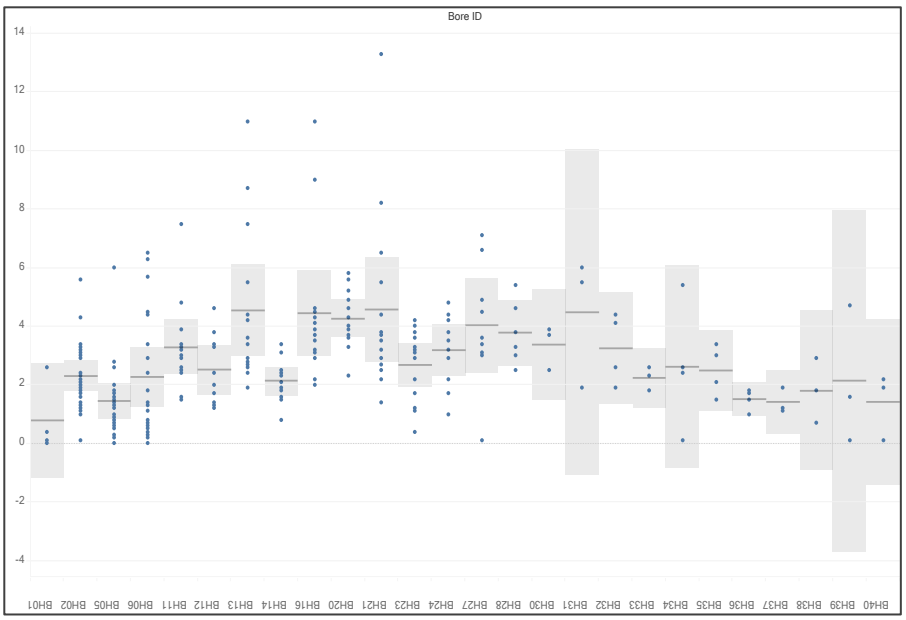
Analysis indicated that there is no correlation between bore depth or distance to waste and carbon dioxide concentrations over time.

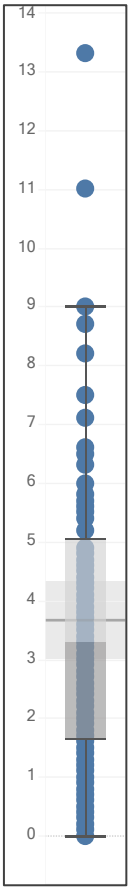


E1.3.5 Average with 95% confidence interval

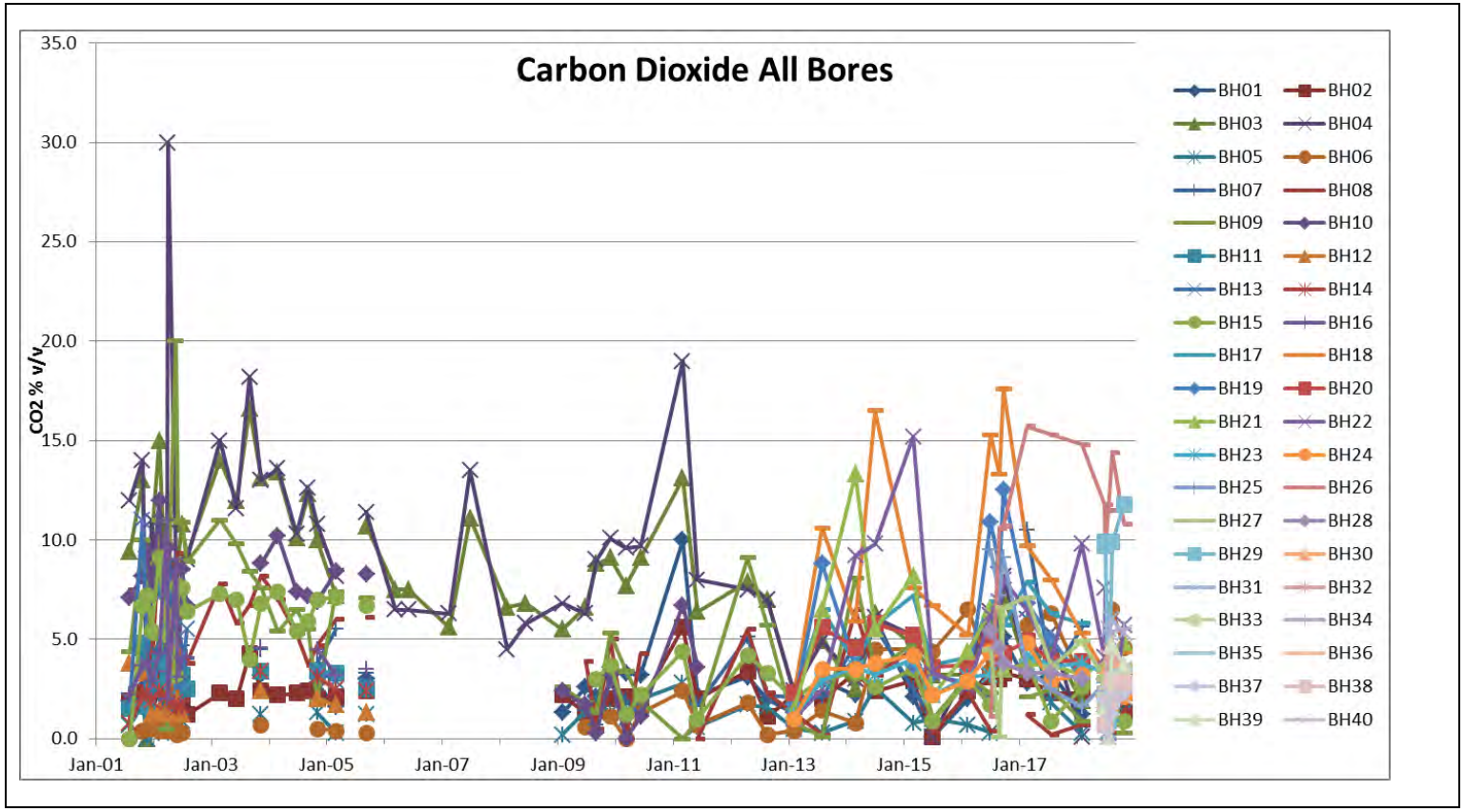
Once a stable dataset was obtained, statistics including the 95% confidence intervals were calculated for individual bores, and acceptable range and outliers assessed. Then the average statistics across the dataset was calculated to arrive at the following values:

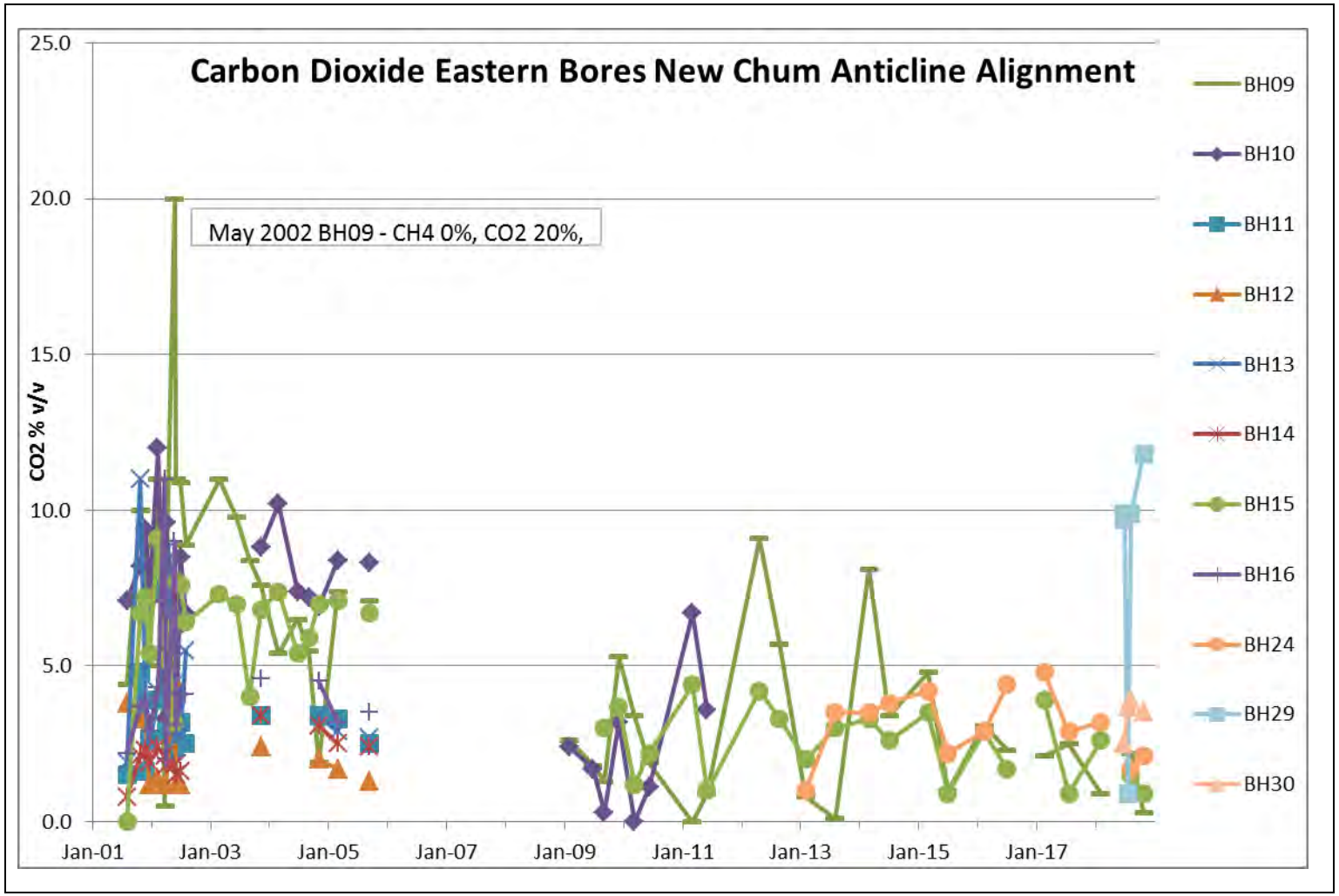
- 25th percentile (lower hinge) = 1.65%
- 50th percentile (median) = 3.3%
- **75th percentile (upper hinge) = 5.05%**
- **95% confidence interval = 3.02%**

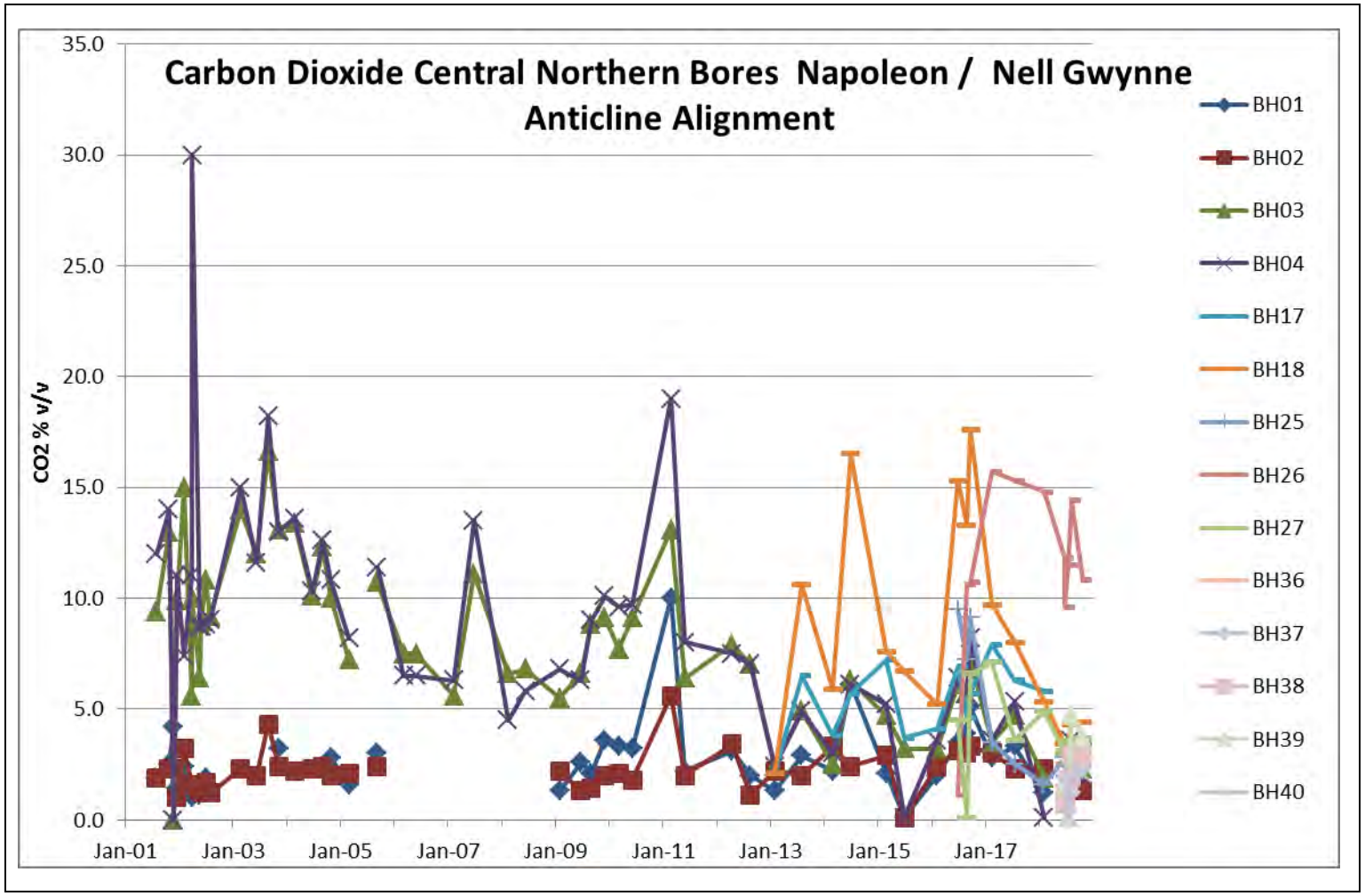


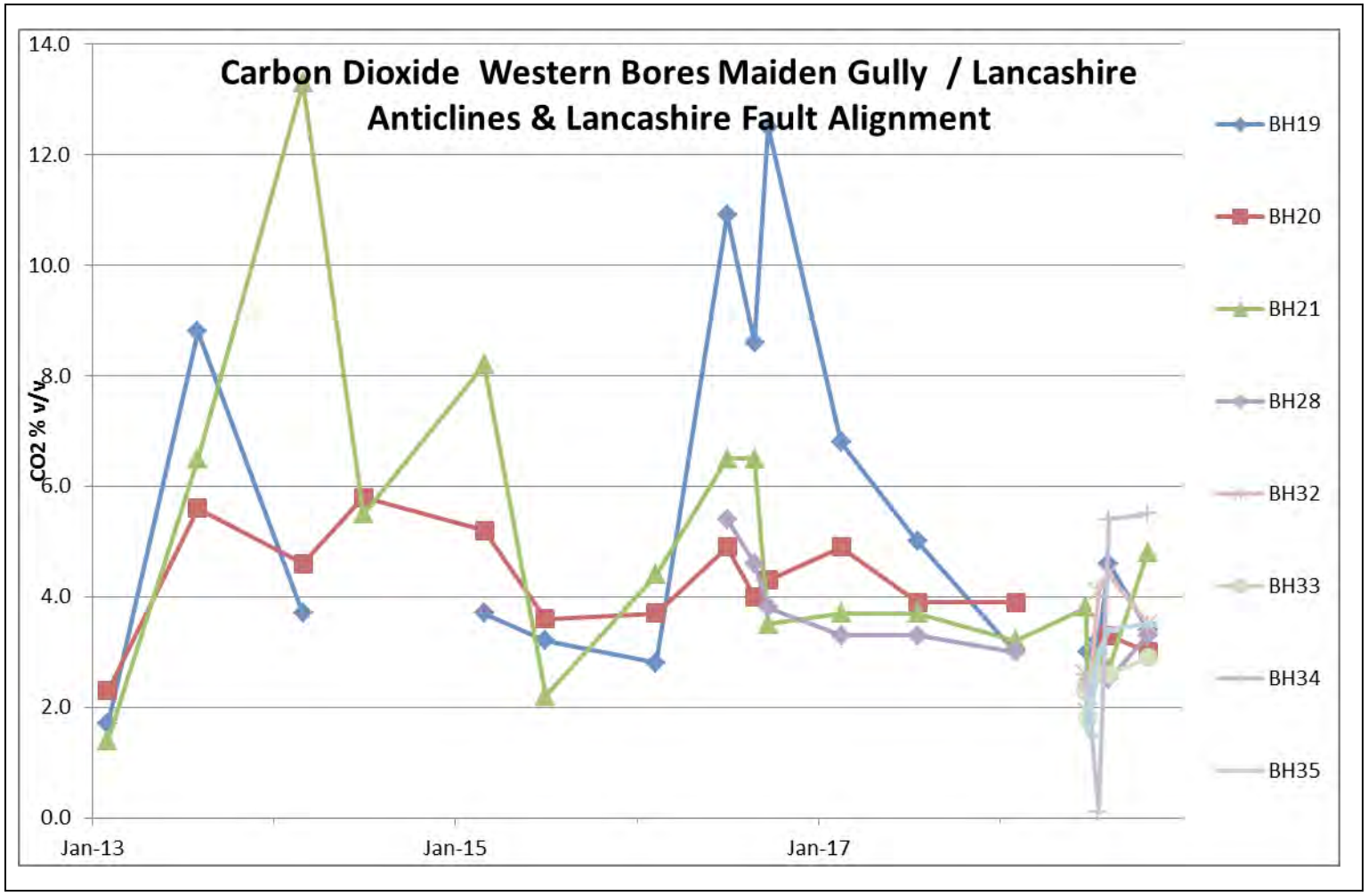


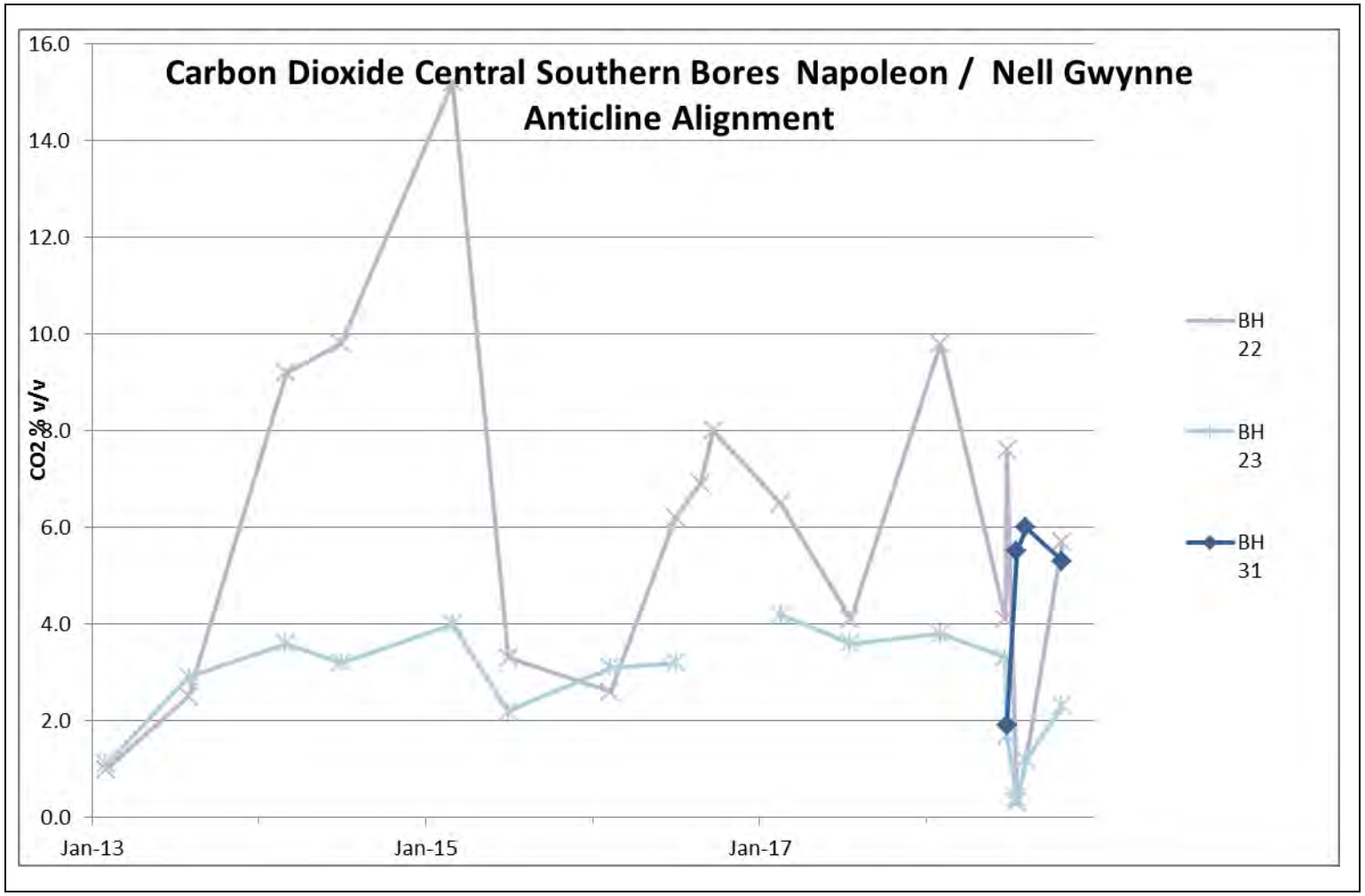
E2.1 CO_2 Time Series Charts

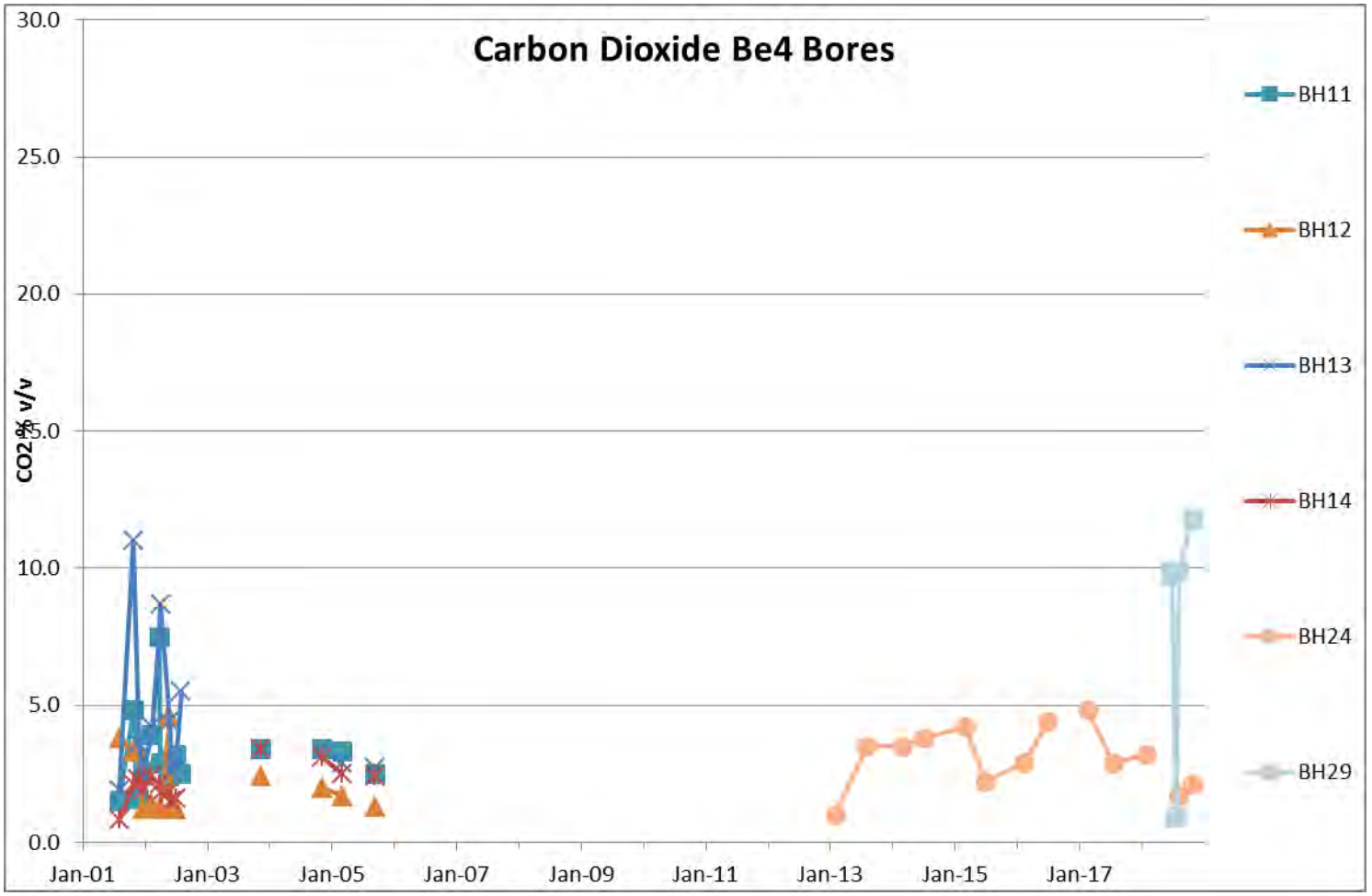


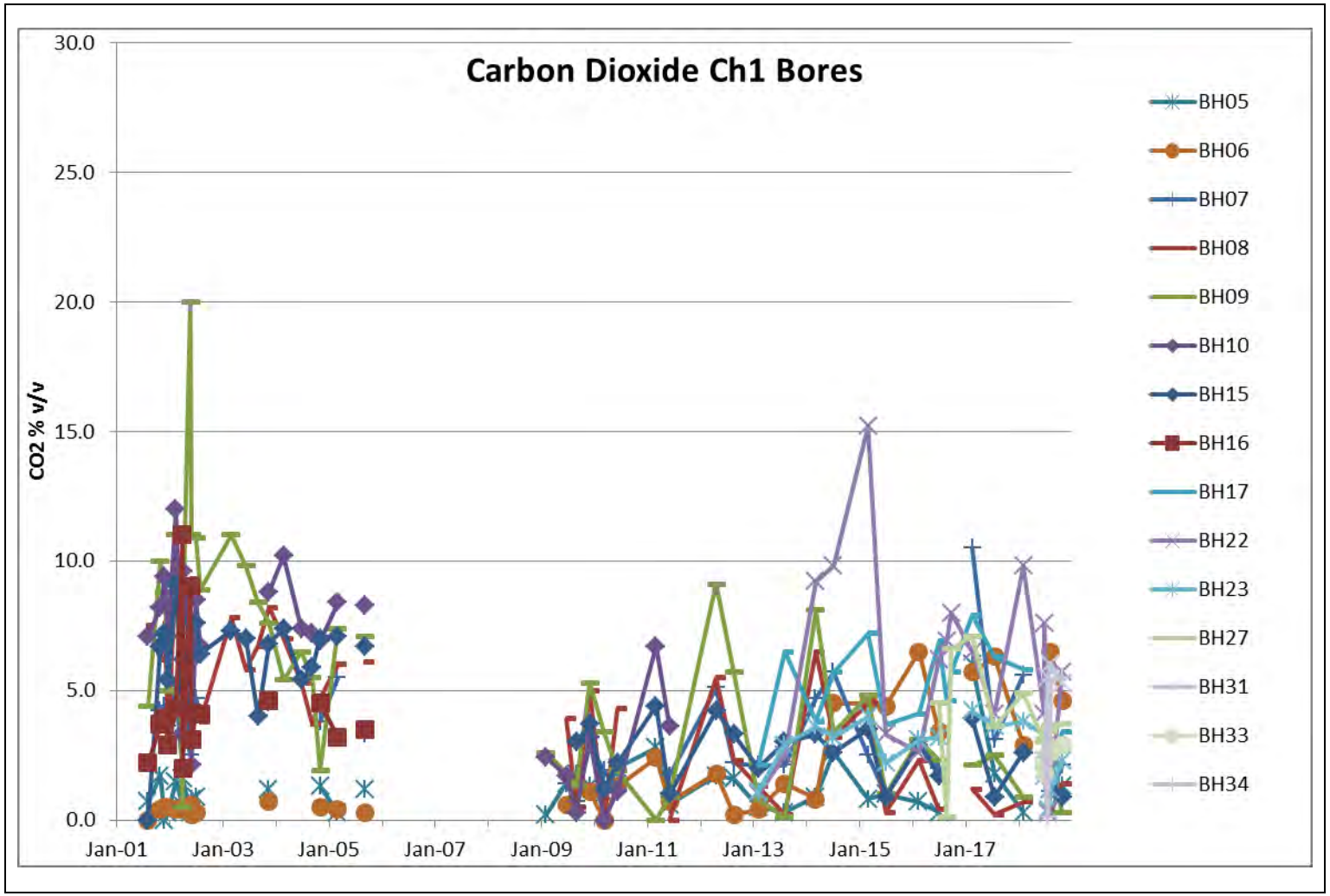

Carbon Dioxide Eastern Bores New Chum Anticline Alignment
May 2002 BH09 - CH4 0%, CO2 20%,
CO2 % v/v
25.0
20.0
15.0
10.0
5.0
0.0
Jan-01
Jan-03
Jan-05
Jan-07
Jan-09
Jan-11
Jan-13
Jan-15
Jan-17
BH09
BH10
BH11
BH12
BH13
BH14
BH15
BH16
BH24
BH29
BH30

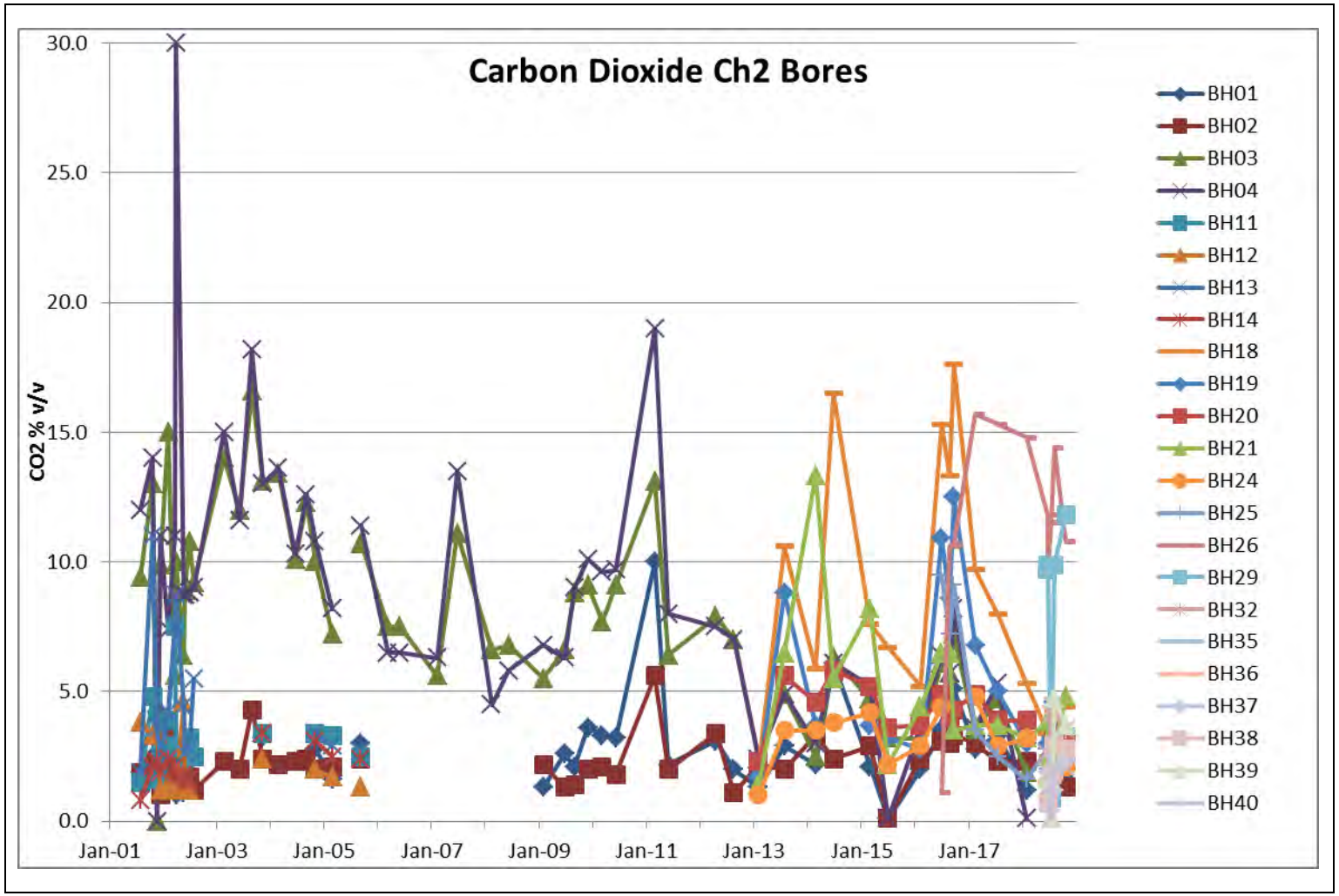

Carbon Dioxide Central Northern Bores Napoleon / Nell Gwynne Anticline Alignment
CO2 % v/v
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Jan-01
Jan-03
Jan-05
Jan-07
Jan-09
Jan-11
Jan-13
Jan-15
Jan-17
BH01
BH02
BH03
BH04
BH17
BH18
BH25
BH26
BH27
BH36
BH37
BH38
BH39
BH40


Carbon Dioxide Western Bores Maiden Gully / Lancashire Anticlines & Lancashire Fault Alignment
CO2 % v/v
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Jan-13
Jan-15
Jan-17
BH19
BH20
BH21
BH28
BH32
BH33
BH34
BH35


Carbon Dioxide Central Southern Bores Napoleon / Nell Gwynne Anticline Alignment
CO2 % v/v
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Jan-13
Jan-15
Jan-17
BH 22
BH 23
BH 31


Carbon Dioxide Be4 Bores
CO2 % v/v
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Jan-01
Jan-03
Jan-05
Jan-07
Jan-09
Jan-11
Jan-13
Jan-15
Jan-17
BH11
BH12
BH13
BH14
BH24
BH29


Carbon Dioxide Ch1 Bores
CO2 % v/v
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Jan-01
Jan-03
Jan-05
Jan-07
Jan-09
Jan-11
Jan-13
Jan-15
Jan-17
BH05
BH06
BH07
BH08
BH09
BH10
BH15
BH16
BH17
BH22
BH23
BH27
BH31
BH33
BH34


Carbon Dioxide Ch2 Bores
CO2 % v/v
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Jan-01
Jan-03
Jan-05
Jan-07
Jan-09
Jan-11
Jan-13
Jan-15
Jan-17
BH01
BH02
BH03
BH04
BH11
BH12
BH13
BH14
BH18
BH19
BH20
BH21
BH24
BH25
BH26
BH29
BH32
BH35
BH36
BH37
BH38
BH39
BH40

Appendix F

Landfill Gas Modelling

LandGEM is a first order decomposition model that estimates potential LFG generation from municipal solid waste landfills, based on the following equation.

First-Order Decomposition Rate Equation: $$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,
Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate ($year^{-1}$)
L_o = potential methane generation capacity (m^3/Mg)
M_i = mass of waste accepted in the i^{th} year (Mg)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{t} year (*decimal years*, e.g., 3.2 years)

Major limitations were associated with limited detailed waste acceptance data. Therefore we have modelled two scenarios to assess LFG generation to date in order to assess potential generation against volume extraction only:

1. Modelling the period 1998- 2018 using waste acceptance records;
2. Modelling from landfill open (1975) to 2018, supplementing missing records with waste volumes that assume a 5% increase in volume each year from open to 1997.

For **Scenario 1**. the start of the model is delayed by over 20 years due to no detailed data available prior to 1997. Therefore zero LFG volume at the start of the model is not representative of actual conditions at the site. However the potential LFG emissions have been estimated in **Scenario 2**.

The input waste volume data is based on the site waste acceptance data and includes the recorded volumes of all waste accepted and landfilled (as provided to AECOM).

The model parameters are presented in **Table F1** below.

Table F1 Model Parameters for LandGEM

Model Parameters	Value-Scenario 1	Value-Scenario 2	Basis / Assumption
Landfill open year	1998	1975	Site data not available prior to 1997. For the purposes of this model (to compare empirical LFG generation and extraction data), the opening date has been set at 1998 for one scenario. Estimated waste volumes have then
Landfill closure year	2019	2019	This model has not been used to predict future LFG generation rates, but rather to assess potential current LFG generation. Therefore, the closure date has been set at 2019.
Methane generation rate, k	0.05 $year^{-1}$	0.05 $year^{-1}$	Model CAA conventional in LandGEM
Potential generation capacity, Lo	100 m^3/tonnes	100 m^3/tonnes	Inventory conventional in LandGEM
Methane content	42% v/v	42% v/v	Average concentration recorded in the LFG extraction system.

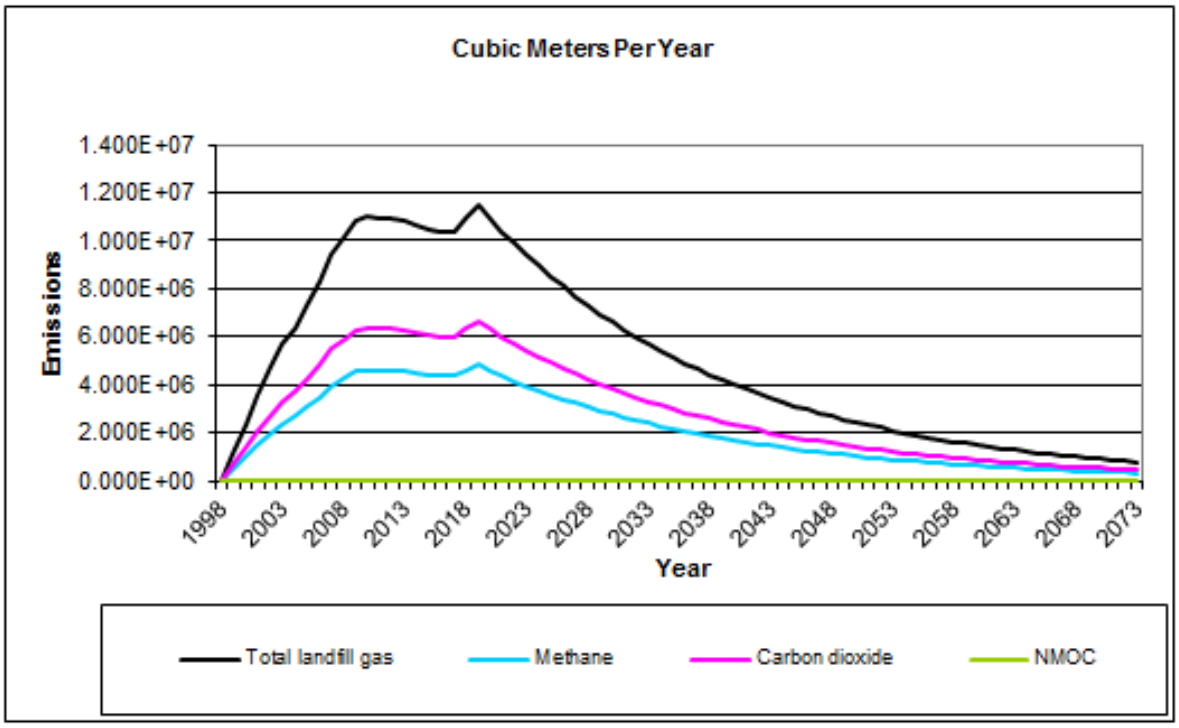
The output from the Scenario 1 model is shown in **Table F2** and the Scenario 2 model is shown in **Table F3**.

For both modelled scenarios, the trend of the LFG production is similar, and based on the simulated period of actual data (about 25 years) it appears that LFG generation stabilises. Given the landfill closure date has been set at 2019 for the purposes of this model, the reduction of LFG production is

not representative of future LFG generation. The peak LFG generation rate will occur one year after last waste placement before declining, which will then follow a similar pattern as shown.

When the estimated generation data is compared to the LFG collection rates, the total LFG generation rate between 2013- 2018 is, in general, within the same magnitude as the extraction data, assuming that the LFG extraction system will not be 100% efficient in extracting all LFG generated for a number of reasons. However, as shown, the LFG extraction system could be capturing between 66 - 84% (**Scenario 1**) and 47-59% (**Scenario 2**) of the total LFG generated indicating primary control of the LFG.

Table F2 LFG Generation Modelling Results – Scenario 1



Scenario 1 – Comparison with LMS measured flow rate

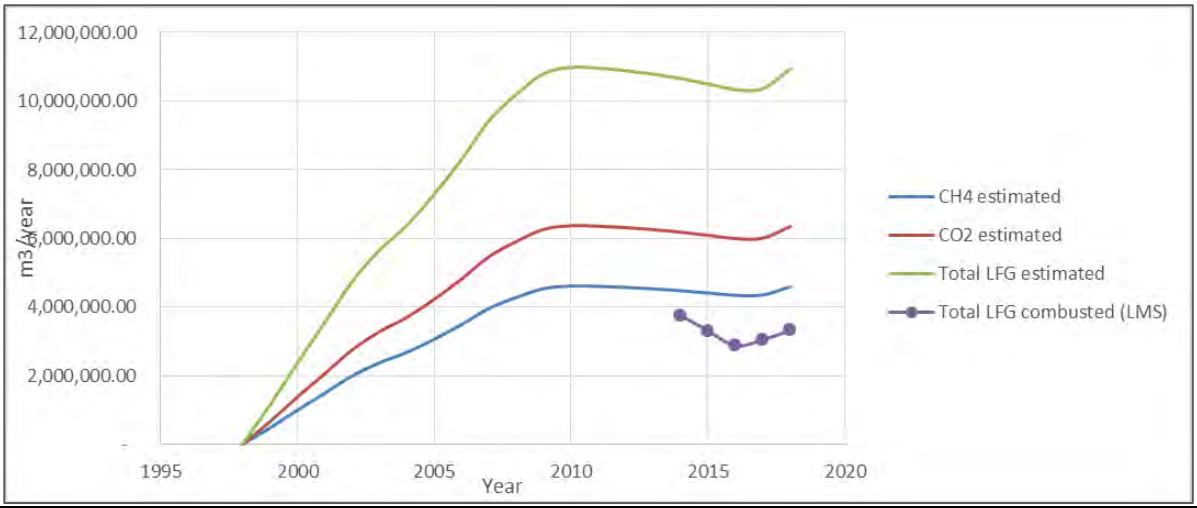
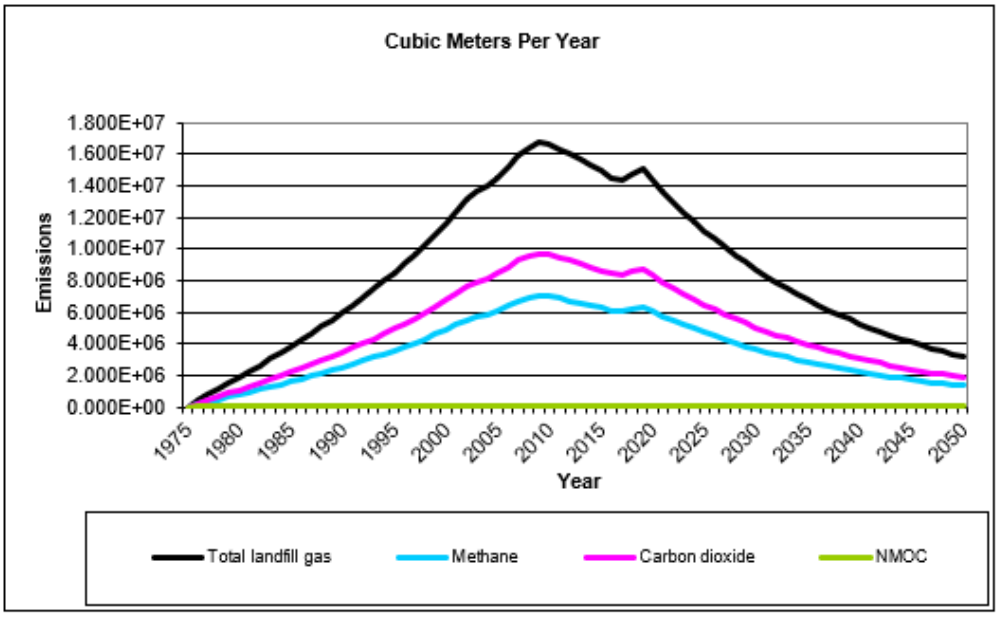
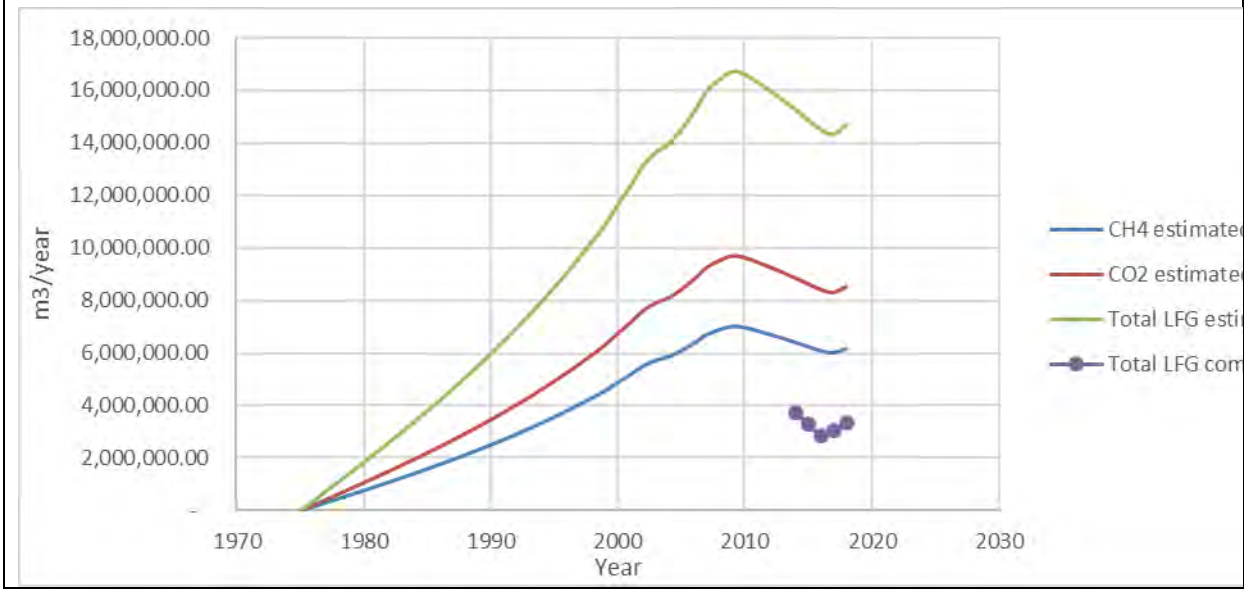


Table F3 LFG Generation Modelling Results – Scenario 2

Outputs – Scenario 2



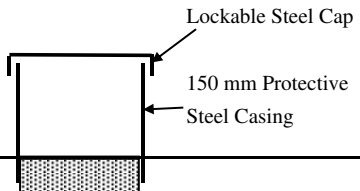
Scenario 2 – Comparison with LMS measured flow rate



Supplementary Folder

PROJECT :	ANNUAL MONITORING REVIEW	JOB NO:	1861
LOCATION:	Eaglehawk Landfill - BENDIGO	BORE NO:	MB1
DATE DRILLED:	26-Jul-93	NAT. SURFACE	196.07 (mAHD)
INSTALLED BY:	K.H. ADAMS & SONS	TOP OF PVC.	-
INSPECTED BY:	B.Chadwick-AGC WOODWARD-CLYDE		

MB1

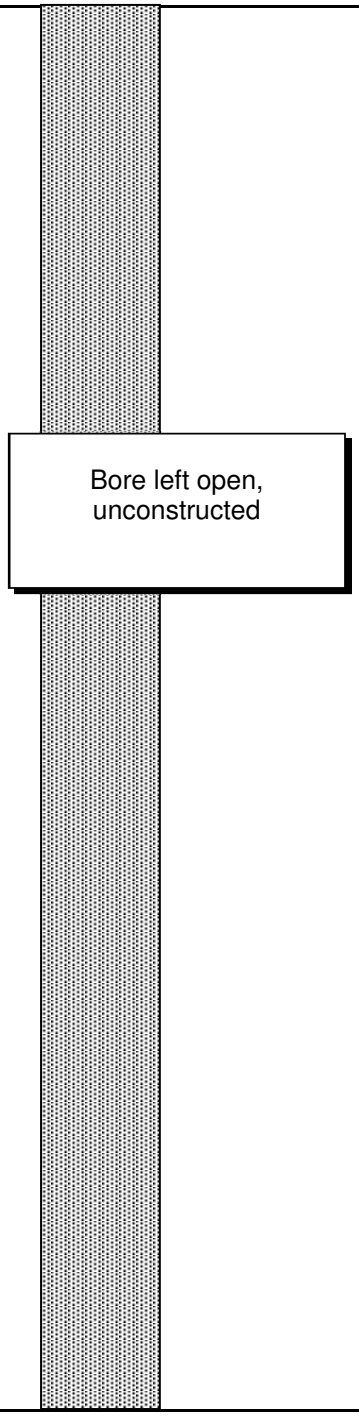


Lithological Log	Depth (m)	Remarks
TOP SOIL - Loose dry clay and sand, grey brown colour.		Blade Bit
MUDSTONE - v.fine grained, yellow/tan	2	Hammer Bit
	4	
VOID - old mine shaft.	6	Loss of circulation, no returns
Base dry, no water	8	
MUDSTONE - v.fine grained, light tan, some qtz. fragment. Poss. large qtz. vein at 8.75m		Reduced circulation, few returns
VOID - old mine shaft.	10	Loss of circulation
Base dry, no water		
MUDSTONE - tan/yellow		Reduced circulation, few returns, 80% lost
	12	
	14	
	16	
Qtz. frag. 1-2mm, possible fracture		
	18	
	20	
	22	
	24	
SANDSTONE - course to med. grained sdst., 1-3mm, tan colouration.	26	
VOID - old mine shaft		
	28	Loss of circulation
Base dry, no water	30	
MUDSTONE ?		
	32	

Bore left open, unconstructed

MB1 (cont.)

Lithological Log	Depth (m)	Remarks
	34	
	36	
SHALE/SLATE - grey/blue, more resistant than above formation.	38	No returns, 100% loss of cuttings
	40	
	42	
	44	
	46	
	48	
	50	
	52	
	54	
	56	
	58	



TOTAL DEPTH 58.5 METRES

Woodward-Clyde

Bore Construction Log

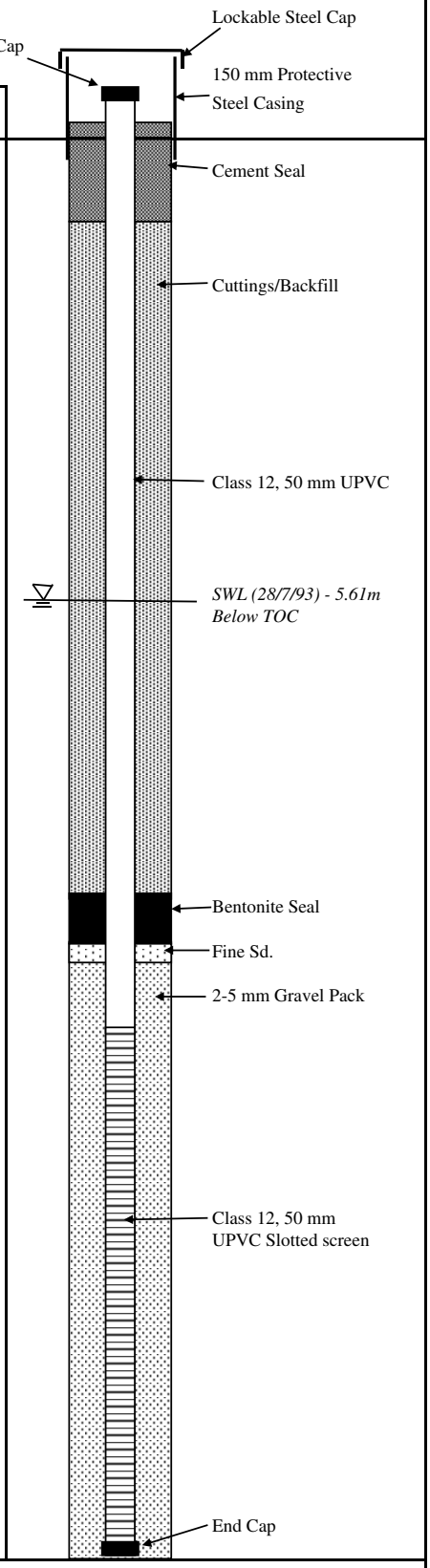
MB1

Eaglehawk Landfill - BENDIGO

PROJECT :	ANNUAL MONITORING REVIEW	JOB NO:	1861
LOCATION:	Eaglehawk Landfill - BENDIGO	BORE NO:	MB2
DATE DRILLED:	26-Jul-93	NAT. SURFACE	221.27 (mAHD)
INSTALLED BY:	K.H. ADAMS & SONS	TOP OF PVC.	221.72 (mAHD)
INSPECTED BY:	B.Chadwick-AGC WOODWARD-CLYDE		

MB2

Lithological Log	Depth (m)	Remarks
TOP SOIL - Loose dry clay and sand, grey brown colour.		Blade Bit
MUDSTONE - v.fine grained, brown/orange	1	Hammer Bit High dusting
Tan colouration to mudstone	2	
	3	
	4	
	5	
SANDY MUDSTONE - tan mudstone, with 20% rounded qtz. grains	6	High dusting
	7	
MUDSTONE - v.fine grained, tan 7.5 to 7.75m bright orange colouration to mudstone	8	Low dusting High dusting
	9	Making water during change of rods
	10	
SHALE/SLATE - light tan/grey	11	High dusting
	12	
MUDSTONE - v.fine grained, tan Brown/red mudstone	13	
CLAYEY GRAVEL - rounded qtz/ lithological, 1-6mm, brown red.	14	Moist
MUDSTONE - v.fine grained, tan	15	Mod. dusting
	16	



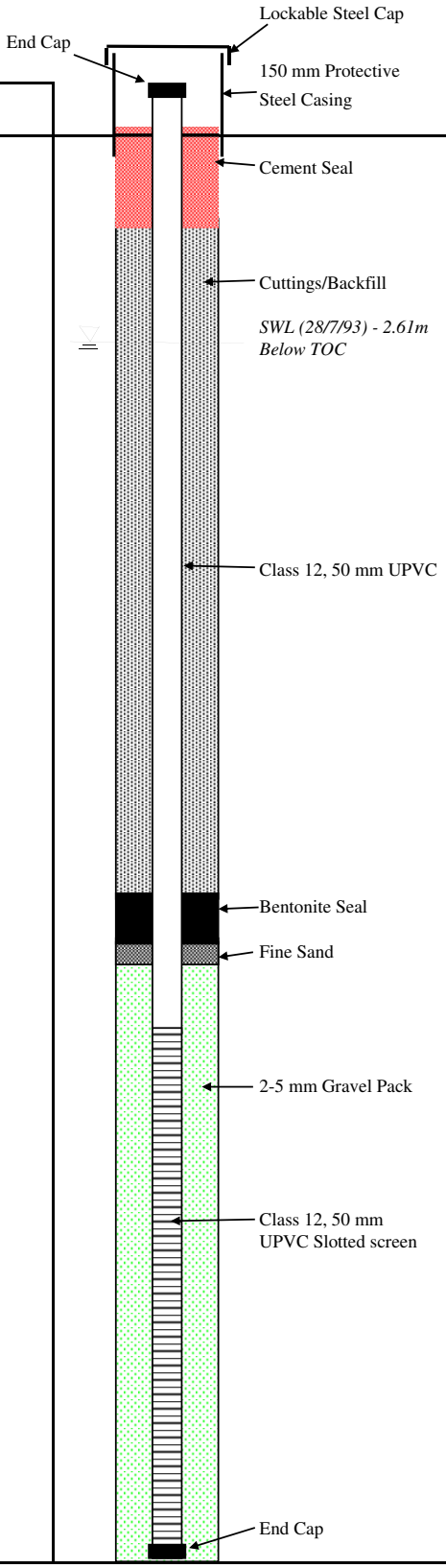
TOTAL DEPTH 16 METRES

Woodward-Clyde

Bore Construction Log
MB2
Eaglehawk Landfill - BENDIGO

PROJECT :	ANNUAL MONITORING REVIEW	JOB NO:	1861
LOCATION:	Eaglehawk Landfill - BENDIGO	BORE NO:	MB3
DATE DRILLED:	26-Jul-93	NAT. SURFACE	223.01 (mAHD)
INSTALLED BY:	K.H. ADAMS & SONS	TOP OF PVC.	223.29 (mAHD)
INSPECTED BY:	B.Chadwick-AGC WOODWARD-CLYDE		

MB3 - replaced



Lithological Log	Depth (m)	Remarks
FILL - loose rubble, sandstone and mudstone	1	Blade Bit
CLAY - dry, orange/yellow		
MUDSTONE - v.fine grained, tan.	2	Hammer Bit
	3	
	4	
	5	
	6	
6 to 6.2m red/brown colouration to mudstone	7	Mod. dusting
	8	
SANDSTONE - med. to course qtz. grains, rounded clasts.	9	
Med. grained qtz. sand, rounded clasts	10	Moist
	11	
	12	
MUDSTONE - brown/yellow, v.fine grained	13	
	14	
	15	
	16	

TOTAL DEPTH 16 METRES

Woodward-Clyde

Bore Construction Log
MB3
Eaglehawk Landfill - BENDIGO

Woodward-Clyde

MONITORING WELL MB03

AGC Woodward-Clyde Pty. Ltd.
URS House, 658 Church Street Richmond
Phone (03) 9279 2888
Fax (03) 2979 2850

Drilling Contractor: **AQUA DRILLING & GROUTING**

Logged By: **MH**
Checked By: **BRC**
Date Started: **12-05-00**
Date Finished: **12-05-00**

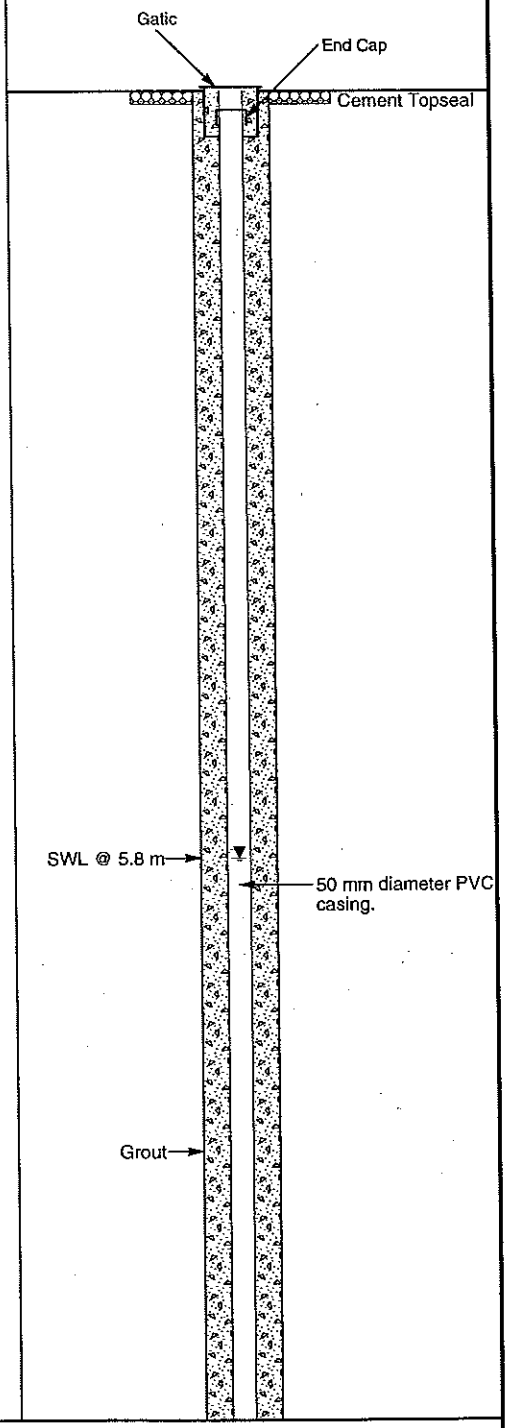
Bore Size: **100 mm**
Total Depth: **16.20 m**
Casing Size: **50 mm**

Project Reference: **Eaglehawk Landfill**
Project No.: **A31/507/0004**
Relative Level: **mRL**
Coordinates: **mN**
mE
Permit No:

Client: **City of Greater Bendigo**
Location: **Upper California Gully Road, Eaglehawk**
Drill Type: **Down hole hammer**
Drill Model:
Drill Fluid: **none**

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations)	Moisture	Depth (m)
			FILL	FILL-Sandstone pebbles, silty, fine to medium grained.		0
			SST	SANDSTONE-light brown, some red/brown silt.		1
			SST	silty SAND-silty coarse grained sand, dark brown.		2
			SLST	SILTSTONE-light brown, powdery.		3
				Yellow brown siltstone.		
				Dark brown, powdery, moist.	M	4
						5
				Becoming lighter brown, moist.	M	6
			SST	SANDSTONE-light brown, fine grained, silty, moist.	M	
				Lighter brown, moist.	M	7
				Darker brown, coarser than above, grey slatey pebbles and quartz pebbles.		
				Becoming harder.		8
			SLTST	SILTSTONE-fine grained, yellow/brown, very powdery.		9

WELL CONSTRUCTION DETAILS



Woodward-Clyde

MONITORING WELL MB03

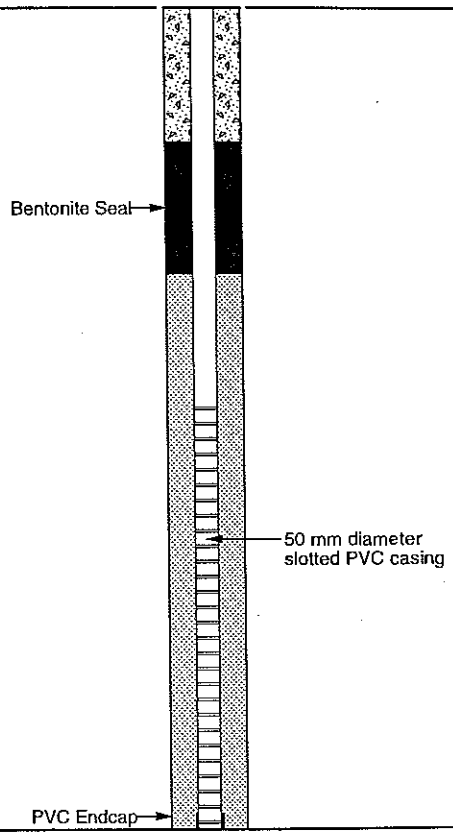
AGC Woodward-Clyde Pty. Ltd.
URS House, 658 Church Street Richmond
Phone (03) 9279 2888
Fax (03) 9279 2850

Project No.: A31/507/0004

Project Reference: Eaglehawk Landfill

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
				Darker brown, fine grained, powdery, moist.	M	10
				Light brown, some slatey grey pebbles, very small.		11
				Powdery siltstone, no pebbles.		
				Tan brown, very powdery, moist.	M	12
						13
						14
						15
				Darker brown, moist.	M	16
				EOH @ 16.2 metres.		17
						18
						19
						20
						21

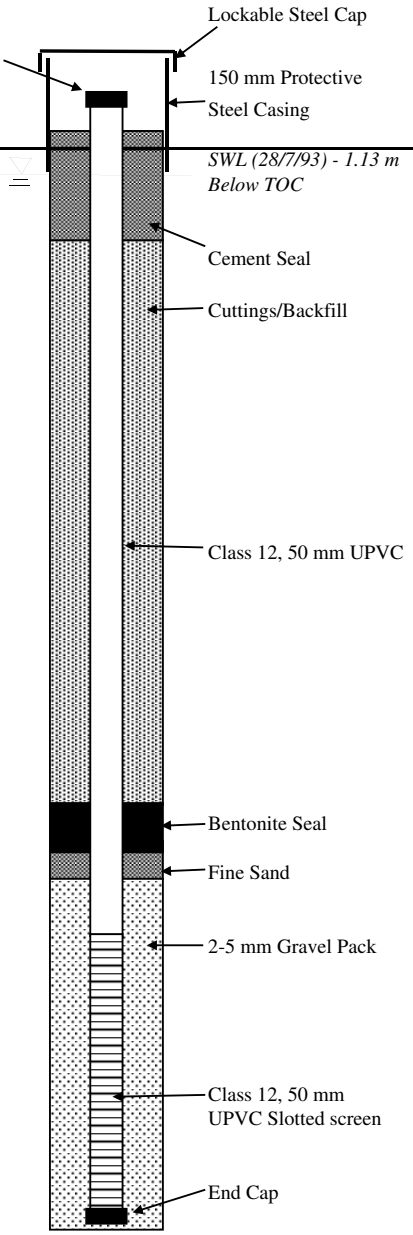
WELL CONSTRUCTION DETAILS



PROJECT :	ANNUAL MONITORING REVIEW	JOB NO:	1861
LOCATION:	Eaglehawk Landfill - BENDIGO	BORE NO:	MB4
DATE DRILLED:	26-Jul-93	NAT. SURFACE	236.40 (mAHD)
INSTALLED BY:	K.H. ADAMS & SONS	TOP OF PVC.	236.77 (mAHD)
INSPECTED BY:	B.Chadwick-AGC WOODWARD-CLYDE		

MB4

Lithological Log	Depth (m)	Remarks
FILL - sandy gravel, dark brown		Blade Bit
CLAY - dark brown, dry.		
	2	
MUDSTONE - orange/brown, v.fine grained		Hammer Bit
		Low dusting
	4	
	6	
	8	
	10	
	12	
Fracture - 13 to 13.5 m		
	14	
	16	
		Making water
	18	
	20	
	22	
	24	



TOTAL DEPTH 22 METRES

Woodward-Clyde

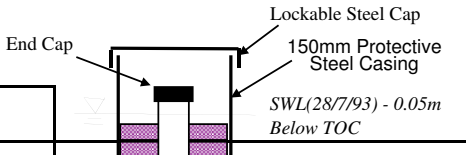
Bore Construction Log

MB4

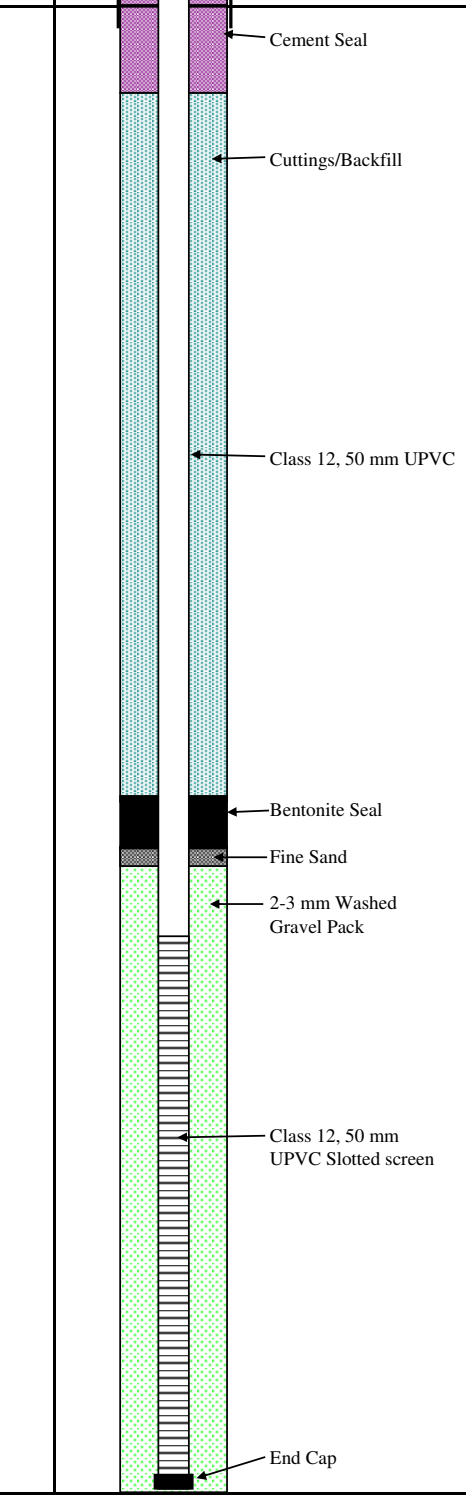
Eaglehawk Landfill - BENDIGO

PROJECT :	ANNUAL MONITORING REVIEW	JOB NO:	1861
LOCATION:	Eaglehawk Landfill - BENDIGO	BORE NO:	MB5
DATE DRILLED:	26-Jul-93	NAT. SURFACE	229.80 (mAHD)
INSTALLED BY:	K.H. ADAMS & SONS	TOP OF PVC.	230.36 (mAHD)
INSPECTED BY:	B.Chadwick-AGC WOODWARD-CLYDE		

MB5



Lithological Log	Depth (m)	Remarks
TAILINGS - grey, medium grained sand		Blade Bit
CLAY - brown/grey, dry		
MUDSTONE - v.fine grained, tan	1	Hammer Bit High dusting
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	Making water after change in rod
Grey/tan colour	11	
	12	
	13	
FRACTURE - short colour change to red/brown with some qtz. returns.	14	
	15	
	16	



TOTAL DEPTH 16 METRES

Woodward-Clyde

Bore Construction Log
MB5
Eaglehawk Landfill - BENDIGO

URS

MONITORING WELL MB6

URS Australia Pty Ltd
Level 6, 1 Southbank Boulevard, Southbank VIC 3006
Phone 8699 7500
Fax 8699 7550

Drilling Contractor: South Western Drilling		Project Name: MB6 Project No.: 432706222	Client: City of Greater Bendigo Location: Eaglehawk Landfill
Logged By: SC Checked By: PG Date Started: 15-03-05 Date Finished: 15-03-05	Bore Size: 150 mm Total Depth: 22.50 m Casing Size: 50 mm	Relative Level: mRL Coordinates: mN mE Permit No:	Drill Type: Push Tube Drill Model: Geoprobe Drill Fluid: None

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
				Gravelly fill, large pebbles in pale orange clay Mudstone, dark orange becoming paler, dry		0	Stick up →
				Mudstone, dark orange becoming paler, dry		1	
						2	
						3	Cement/Bentonite grout →
						4	
				Pale, gray		5	
						6	
						7	
				Dark brown/brown Siltstone, some small pebbles (QTZ), dry		8	
						9	

WELL MB6.GPJ F4QWGN01.GDT 26/04/05

URS

MONITORING WELL MB6

URS Australia Pty Ltd
Level 6, 1 Southbank Boulevard, Southbank VIC 3006
Phone 8699 7500 Fax 8699 7550

Project No.: 432706222

Project Reference: MB6

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
				Pale brown, less QTZ		10	
				Red, no QTZ		11	
				Brown Mudstone, dry, some minor QTZ pebbles <0.5cm		12	
				Changing colour from brown to tan to orange to pale gray, no QTZ		13	
						14	
						15	
						16	Bentonite seal
						17	50mm Slotted Sc
				Groundwater encountered within an hour. End of hole		18	
						19	Sand filter pack
						20	
						21	SWL @ 21.28mbgs on 16/03/05

URS

MONITORING WELL MB6

URS Australia Pty Ltd
Level 6, 1 Southbank Boulevard, Southbank VIC 3006
Phone 8699 7500 Fax 8699 7550

Project No.: 432706222

Project Reference: MB6

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
						22	End Cap
						23	
						24	
						25	
						26	
						27	
						28	
						29	
						30	
						31	
						32	
						33	

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MONITORING WELL MB07

URS Australia Pty Ltd
Level 6, 1 Southbank Boulevard, Southbank VIC 3006
Phone 8699 7500
Fax 8699 7550

Project Name: **Eaglehawk Landfill**

Client: **City of Greater Bendigo**

Location:

Drilling Contractor: **South Western Drilling**

Project No.: **43271080**

Logged By:	**KC**	Bore Size:	**125 mm**	Relative Level (PVC):	**234.88 mAHD**
Checked By:		Total Depth:	**35.00 m**	Coordinates:	**5931611.15 mN**
Date Started:	**22-2-10**	Casing Size:	**50 mm**		**253430.10 mE**
Date Finished:	**23-2-10**			Permit No:	**WLE045664**

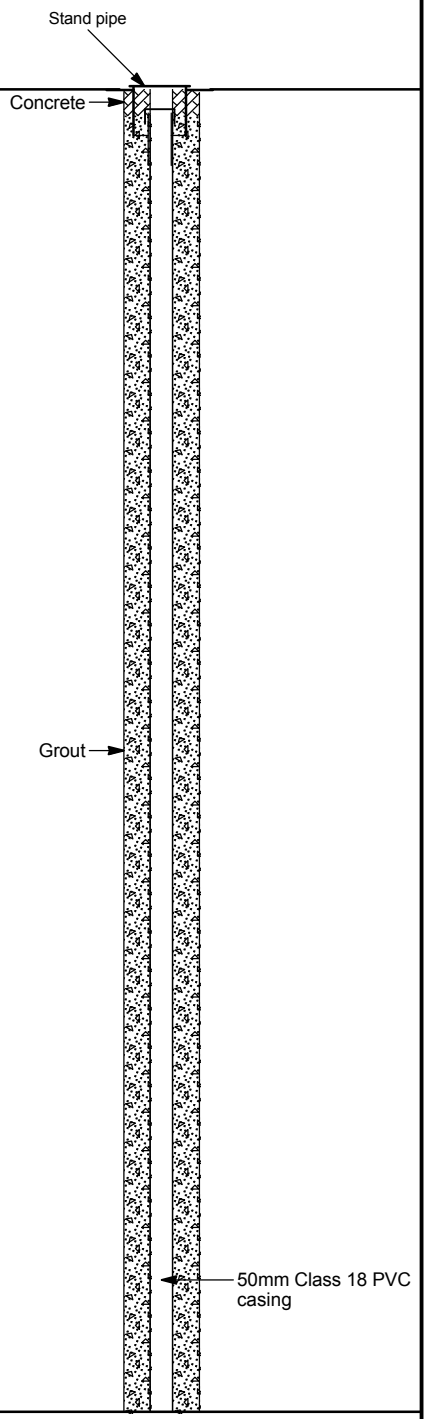
Drill Type: **Down hole hammer**

Drill Model: **Geoprobe**

Drill Fluid: **None**

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)
							0
					SILTSTONE: Fine, hard, red-brown, some brown clay.	D	1
					SILSTONE: Fine yellow dust, ~40%; friable siltstone chips, ~60%, <1.5cm	D	2
					~60% dust, very fine; ~40% soft, friable siltstone chips, <1.5cm (avg. 0.5cm)		3
							4
							5
					Darker yellow, fine dust; ~60% siltstone chips, friable, <1cm		6
							7
							8
							9

WELL CONSTRUCTION DETAILS



WELL_NUMBER MB07-MB09.GPJ WCC_AUS.GDT 16/7/10

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Project No.: **43271080**

Project Reference: **Eaglehawk Landfill**

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
					Dust finer		10	
					Extremely fine dust ~50%, floury, light yellow; chips easily broken, ~50%		11	
					Yellow-brown, very fine dust, ~70%, very soft.		12	
							13	
					SILTSTONE: light brown, chips friable but harder than above, ~70%; dust fine but coarser than above, minor clay	D/M	14	
					Light brown; ~50% friable chips, <0.5cm; fine dust; minor clay		15	
					Finer, very fine dust, no clay; ~30% siltstone chips; ~10% fine sand	D	16	
							17	
					SILTSTONE: Red-brown; extremely fine dust, floury, no chips, no sand, ~15% clay.	D/M	18	
					SILTSTONE: Pale brown, fine dust; small chips <0.5cm (avg 0.1cm), ~15% sand	D	19	
					Fine dust; ~70% chips, ~1cm, harder than above but still breakable		20	
					Very fine dust, ~40% chips, some sand		21	

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		Project No.: **43271080**	Project Reference: **Eaglehawk Landfill**

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
					Extremely fine dust, floury		22	
					SILTSTONE: Brown; ~40% friable, soft siltstone chips; ~15% clay	D/M	23	
					SILTSTONE: Light grey, very fine dust, ~80% siltstone chips, breakable, <1cm	D	24	
					Smaller chips, avg ~0.5cm		25	
					Light brown, very fine dust, floury, ~50% friable siltstone chips		26	
					Light grey		27	Bentonite seal
						M	28	
							29	Coarse sand filter pack
							30	
					Light brown		31	
					Brown, extremely fine dust, floury, some very friable siltstone chips		32	Slotted 50mm Class 18 PVC casing
					Grey-brown, ~80% harder siltstone chips, can't break with hands.	M	33	

WELL_NUMBER MB07-MB09.GPJ WCC_AUS.GDT 16/7/10

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		Project No.: 43271080	Project Reference: Eaglehawk Landfill

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
							34	
					EOH		35	
							36	
							37	
							38	
							39	
							40	
							41	
							42	
							43	
							44	
							45	

WELL_NUMBER MB07-MB09.GPJ WCC_AUS.GDT 16/7/10

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MONITORING WELL MB08

URS Australia Pty Ltd
Level 6, 1 Southbank Boulevard, Southbank VIC 3006
Phone 8699 7500
Fax 8699 7550

Project Name: **Eaglehawk Landfill**

Client: **City of Greater Bendigo**

Location:

Drilling Contractor: **South Western Drilling**

Project No.: **43271080**

Logged By:	**KC**	Bore Size:	**125 mm**	Relative Level (PVC):	**247.16 mAHD**
Checked By:		Total Depth:	**35.00 m**	Coordinates:	**5931803.42 mN**
Date Started:	**5-5-10**	Casing Size:	**50 mm**		**253774.18 mE**
Date Finished:	**5-5-10**			Permit No:	**WLE045664**

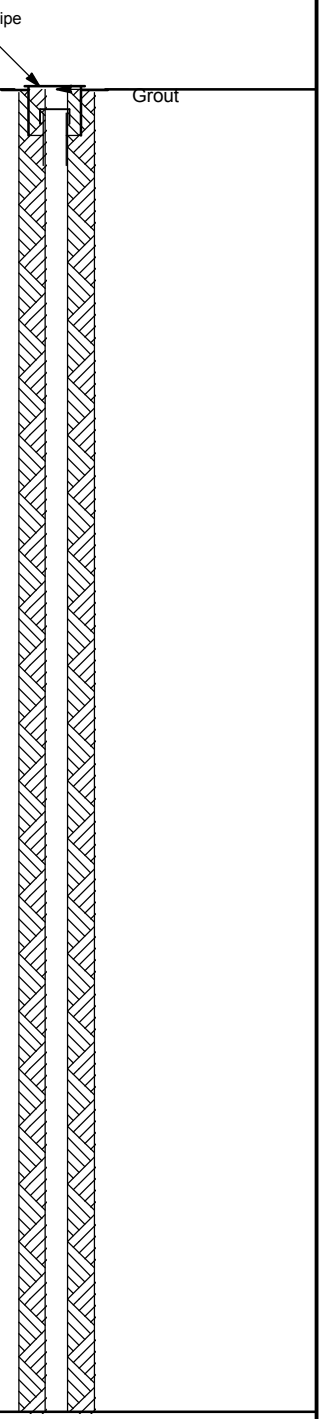
Drill Type: **Down hole hammer**

Drill Model: **Geoprobe**

Drill Fluid: **None**

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)
26					TOPSOIL: Brown, fine, silty, clay, m. sand.		0
							1
							2
					SILTY CLAY: Dark Grey, fine, mod. plasticity, m. sand, sticky.		3
					Brown.		4
					SILTSTONE 5m: Fine, floury, ~15% chips.		5
					~20% chips.		6
					Orange-grey. Chips hard. Can't break with hands. ~50% chips.		7
							8
							9

WELL CONSTRUCTION DETAILS

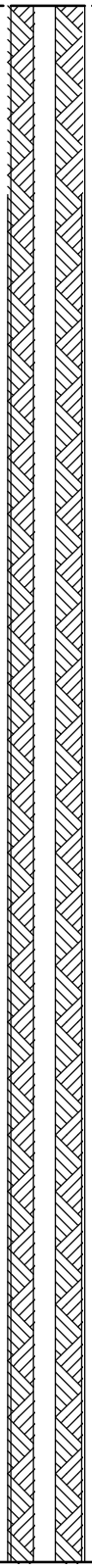


WELL_NUMBER MB07-MB09.GPJ WCC_AUS.GDT 16/7/10

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		Project No.: **43271080**	Project Reference: **Eaglehawk Landfill**

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
					Grey. Extra fine. No chips. Soft.		10	
					Some m. chips, hard. Orange, floury powder. Light grey.		11	
							12	
							13	
					~40% chips, hard.		14	
					~50% chips. Small, ~0.5cm.		15	
					Pinkish orange.		16	
							17	
							18	
							19	
					Chips ~60%, small, gravelly.		20	
							21	



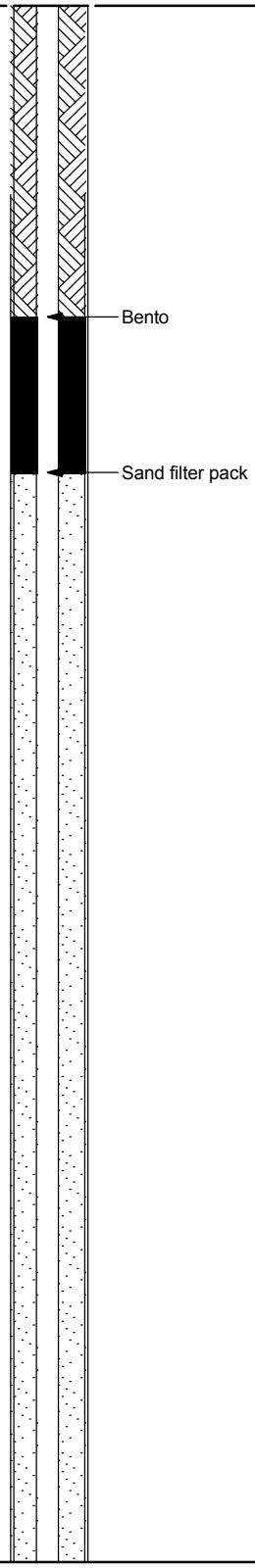
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Project No.: **43271080**

Project Reference: **Eaglehawk Landfill**

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)
					Pinkish-brown.		22
							23
							24
					Softer, chips easily broken in hands.		25
35							26
					Brown - mottled with red.		27
					Hard, brown.		28
					Soft, easily broken, dark brown with red.		29
							30
					Brown-grey, semi-hard. ~60% chips, small, gravelly.		31
							32
					Brown, soft.		33

WELL CONSTRUCTION DETAILS



WELL_NUMBER MB07-MB09.GPJ WCC_AUS.GDT 16/7/10

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Project No.: **43271080**

Project Reference: **Eaglehawk Landfill**

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
							34	
					EOH.		35	
							36	
							37	
							38	
							39	
							40	
							41	
							42	
							43	
							44	
							45	

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MONITORING WELL MB09

URS Australia Pty Ltd
Level 6, 1 Southbank Boulevard, Southbank VIC 3006
Phone 8699 7500
Fax 8699 7550

Project Name: **Eaglehawk Landfill**

Client: **City of Greater Bendigo**

Location:

Drilling Contractor: **South Western Drilling**

Project No.: **43271080**

Logged By:	**KC**	Bore Size:	**125 mm**	Relative Level (PVC):	**222.42 mAHD**
Checked By:		Total Depth:	**35.00 m**	Coordinates:	**5931425.36 mN**
Date Started:	**4-5-10**	Casing Size:	**50 mm**		**253255.06 mE**
Date Finished:	**4-5-10**			Permit No:	**WLE045664**

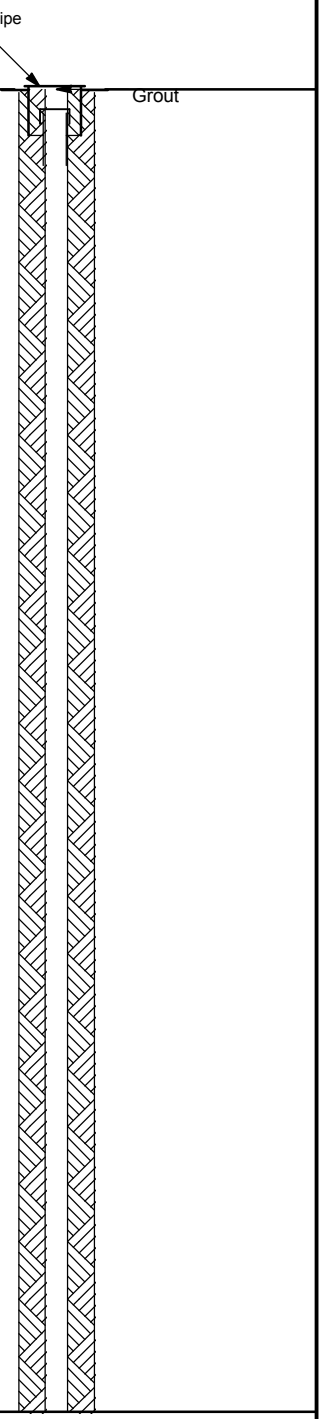
Drill Type: **Down hole hammer**

Drill Model: **Geoprobe**

Drill Fluid: **None**

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)
25.5					Lots of dust to 30m.		0
					1-2m: Dark yellow, extra-fine grained, floury ~50% hard chips. 2m: No sample.	D	1
					Darker, yellow brown.	D	2
					Yellow, tan. ~70% chips. Friable, easily broken ~0.5 to 1cm.	D	3
					Yellowish tan.	D	4
							5
							6
					Greyish yellow.	D	7
					Yellow-grey. Harder chips, don't break in hand. ~80% chips. Very fine grained.	D	8
							9

WELL CONSTRUCTION DETAILS



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Project No.: **43271080**

Project Reference: **Eaglehawk Landfill**

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
							10	
					Not as hard. Grey yellow.	D	11	
					Yellow brown. Minor clay. Chips breakable. Very fine.	D	12	
							13	
							14	
					Occasional quartz fragments.	D	15	
					Grey-brown. No clay.	D	16	
					Harder, larger chips. Grey. Some not broken.	D	17	
							18	
							19	
							20	
					Brown-grey. Clay. Damp. Some able to be broken; moderately hard.	D/M	21	

WELL_NUMBER MB07-MB09.GPJ WCC_AUS.GDT 16/7/10

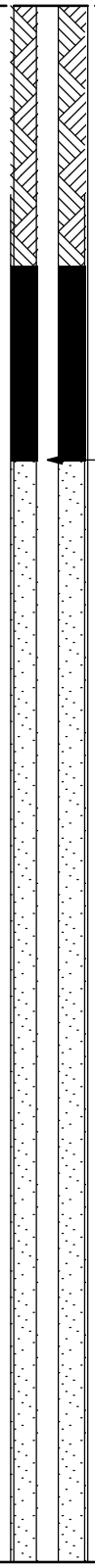
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Project No.: **43271080**

Project Reference: **Eaglehawk Landfill**

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)
							22
					Softer, yellow grey. Breakable. Damp. ~85% chips.	D/M	23
					Grey. Some breakable. ~85%. Mica.	D/M	24
35					Grey. 90% chips. Mica.	D/M	25
					Hard, dark grey. 95% chips. Mica.	D/M	26
					Hard drilling.	D/M	27
							28
					Water. Unable to sample. No dust.	W	29
							30
							31
							32
							33

WELL CONSTRUCTION DETAILS



WELL_NUMBER MB07-MB09.GPJ WCC_AUS.GDT 16/7/10

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		Project No.: 43271080	Project Reference: Eaglehawk Landfill

Drill Method	Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
					EOH.		34	
							35	
							36	
							37	
							38	
							39	
							40	
							41	
							42	
							43	
							44	
							45	

WELL_NUMBER MB07-MB09.GPJ WCC_AUS.GDT 16/7/10

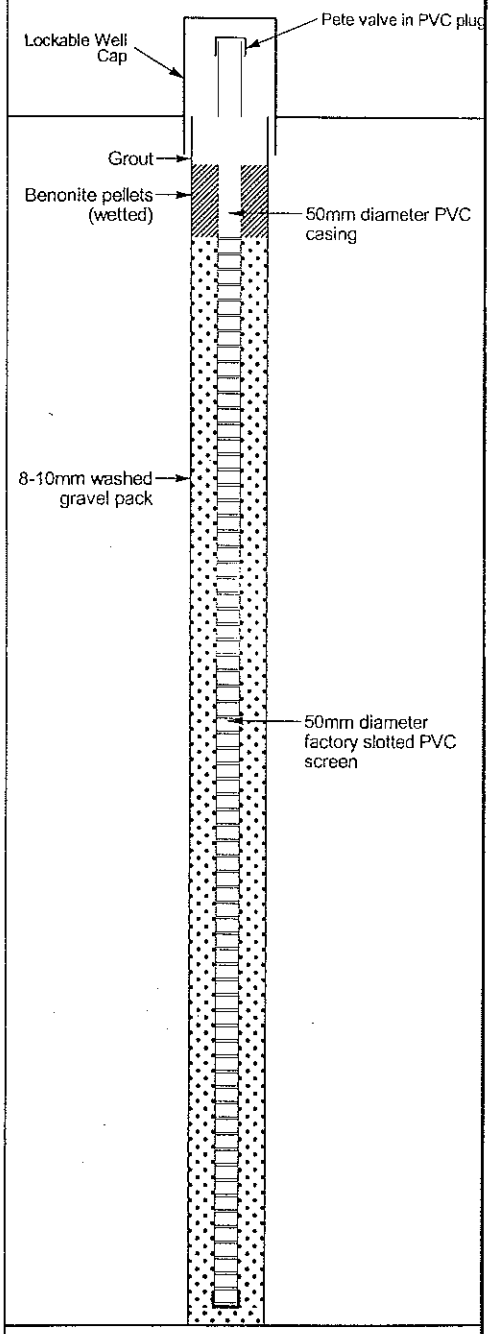
URS

MONITORING WELL BH01

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 10.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations)	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, some sandstone pebbles, LP, light brown, soft, moist	M	0
			SILTST	SILTSTONE, light brown-yellow, chips (<30mm), some powder, hard, dry	D	
				As above, brown-orange, powdery		3
				As above, darker orange		5
				As above, slightly moist	D/M	6
				SILTSTONE, very powdery, very small chips (<5mm), white-light grey, slightly moist	D/M	7
				End of Hole @ 10m (Target Depth)		10

WELL CONSTRUCTION DETAILS



WELL_LOGS.GPJ WCC_AUS.GDT 13/08/01

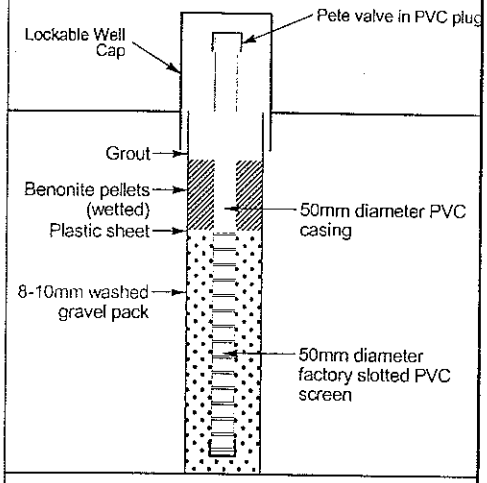
URS

MONITORING WELL BH02

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 3.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, some sandstone pebbles, LP, light brown, soft, moist	M	0
			SILTST	SILTSTONE, light brown-yellow, chips (<30mm), some powder, hard, dry	D	1
						2
				End of Hole @ 3m (Target Depth)		3
						4
						5
						6
						7
						8
						9
						10

WELL CONSTRUCTION DETAILS



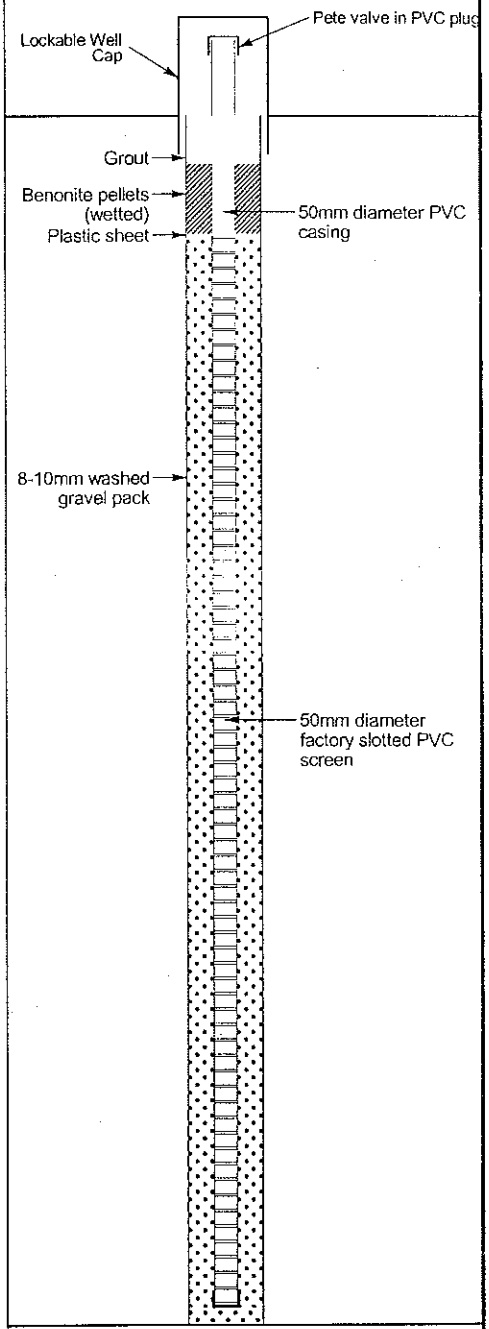
MONITORING WELL BH03

URS

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 10.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations)	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, LP, light brown-grey, some grass and roots, soft, moist	M	0
				As above, dark brown, dry-moist	D/M	1
			SILTST	SILTSTONE, light brown-yellow, chips (<20mm), some grey slate and quartz pebbles, some powder, hard, dry	D	2
				SILTSTONE, light brown-yellow, chips (<20mm), some powder, hard, dry		3
						4
				SILTSTONE, very powdery, very small chips (<5mm), white-light grey, slightly moist	D/M	5
						6
						7
				As above, orange-brown, more chips (<10mm)	D/M	8
						9
				SILTSTONE, white-grey, chips (<40mm), very hard, slightly moist	D/M	10
				End of Hole @ 10m (Target Depth)		

WELL CONSTRUCTION DETAILS



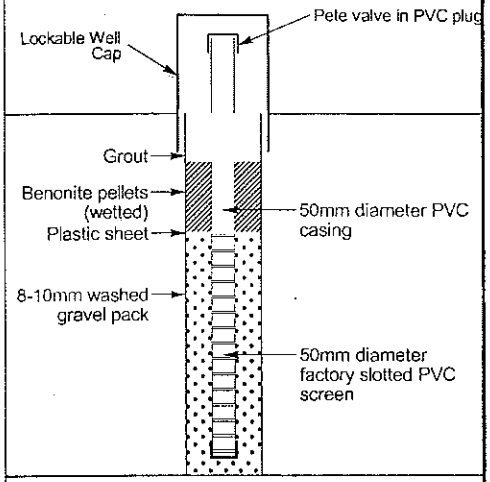
MONITORING WELL BH04

URS

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 3.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, LP, light brown-grey, some grass and roots, soft, moist	M	0
				As above, lots of wood chips, bark, drilling through an old tree	D/M	1
			SILTST	SILTSTONE, light brown-yellow, chips (<20mm), some grey slate and quartz pebbles, some powder, hard, dry	D	2
				End of Hole @ 3m (Target Depth)		3
						4
						5
						6
						7
						8
						9
						10

WELL CONSTRUCTION DETAILS



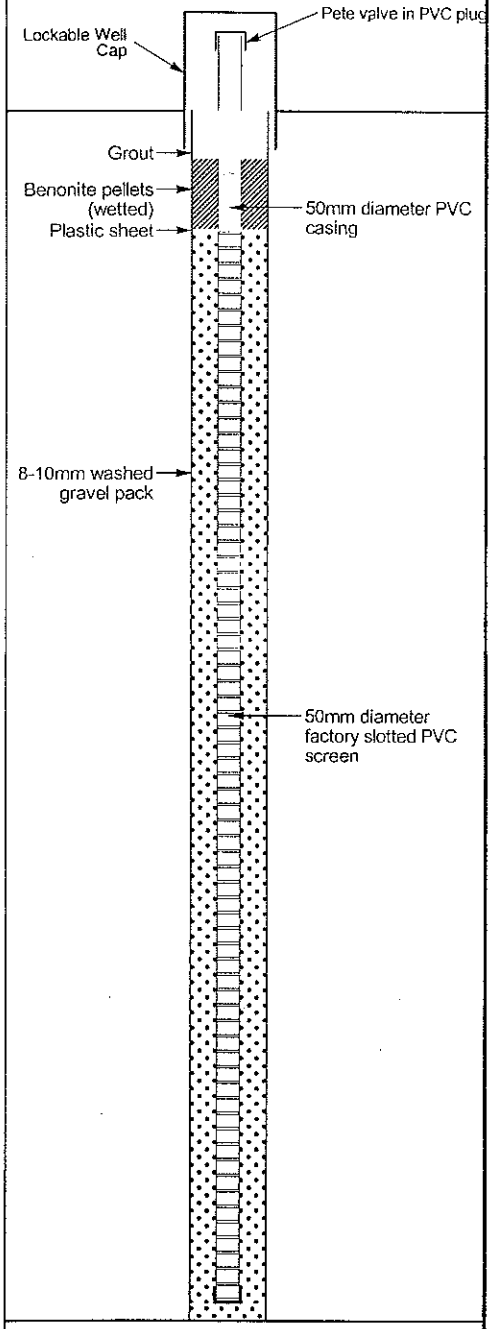
URS

MONITORING WELL BH05

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 10.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			FILL	FILL, gravel, siltstone pebbles, silty, yellow-brown, moist	M	0
			SILTST	SILTSTONE, light brown-yellow, pebbles (<5mm), powdery, hard, dry	D	1
						2
						3
						4
				SILTSTONE, harder (<20mm), less powder, white-light brown, slightly moist	D/M	5
						6
				SILTSTONE, light brown-yellow, very powdery, no pebbles, hard, slightly moist	D/M	7
				As above, orange-tan		8
				SILTSTONE, white-grey, powdery, pebbles (<5mm), slightly moist	D/M	9
				End of Hole @ 10m (Target Depth)		10

WELL CONSTRUCTION DETAILS



WELL LOGS.GPJ WCC_AUS.GDT 13/08/01

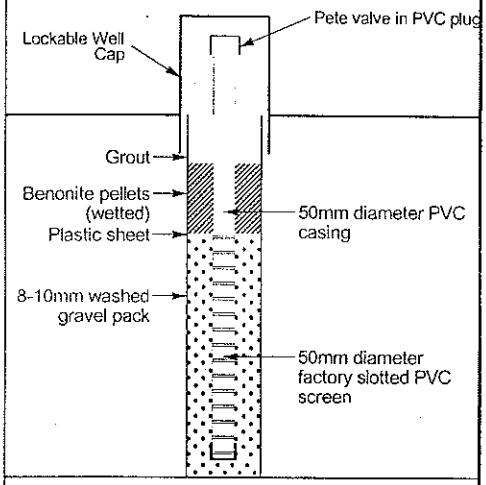
URS

MONITORING WELL BH06

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 3.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	
Date Finished: 23-07-01		Permit No:	Drill Fluid: AIR

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			FILL	FILL, gravel, siltstone pebbles, silty, yellow-brown, moist	M	0
			SILTST	SILTSTONE, light brown-yellow, pebbles (<5mm), powdery, hard, dry	D	1
						2
				End of Hole @ 3m (Target Depth)		3
						4
						5
						6
						7
						8
						9
						10

WELL CONSTRUCTION DETAILS

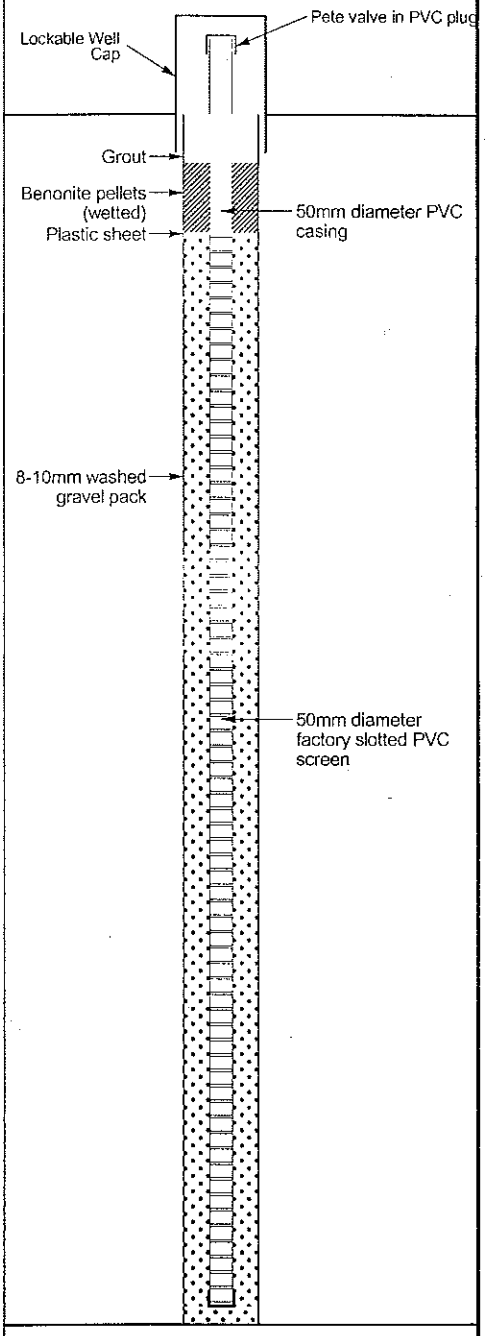


MONITORING WELL BH07

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 10.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			CL-ML	silty CLAY, some sand, low plasticity, stiff, dark brown, moist	M	0
			SILTST	SILTSTONE, light brown-yellow, pebbles (<5mm), powdery, hard, dry	D	1
				As above, tan-orange	D/M	3
				As above, light-brown-yellow, very powdery		4
				SILTSTONE, orange-brown, pebbles (<20mm), hard, slightly moist	D/M	6
				SILTSTONE, light brown-yellow, very powdery, no pebbles, hard, slightly moist	D/M	7
				As above, orange-tan		8
				End of Hole @ 10m (Target Depth)		10

WELL CONSTRUCTION DETAILS



WELL_LOGS.GPJ WCC_AUS.GDT 13/08/01

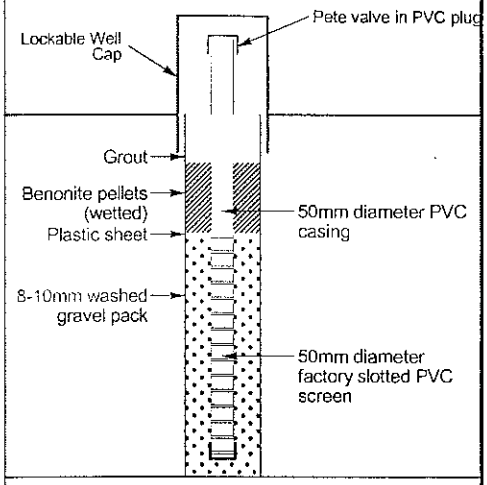
URS

MONITORING WELL BH08

AGC Woodward-Clyde Pty. Ltd. Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo	
Drilling Contractor: KH ADAMS & SONS	Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo	
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 3.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	
Date Finished: 23-07-01		Permit No:	Drill Fluid: AIR

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			CL-ML	silty CLAY, some sand, low plasticity, stiff, dark brown, moist	M	0
			SILTST	SILTSTONE, light brown-yellow, pebbles (<5mm), powdery, hard, dry	D	1
						2
				End of Hole @ 3m (Target Depth)		3
						4
						5
						6
						7
						8
						9
						10

WELL CONSTRUCTION DETAILS



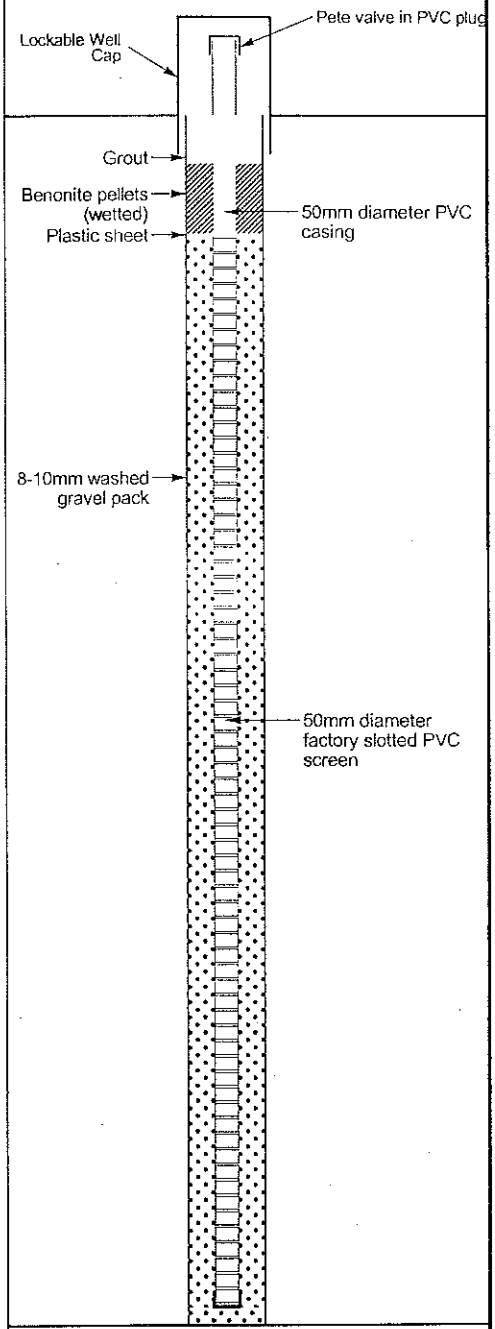
URS

MONITORING WELL BH09

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 10.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, some sand, low plasticity, dark brown-grey, grass and roots, soft, moist	M	0
			SILTST	SILTSTONE, light brown-yellow, pebbles (<10mm), some powder, hard, dry	D	1
			CLS	sandy CLAY, some silt, dark brown-grey, low plasticity, loose, moist	M	2
			SILTST	SILTSTONE, white-light grey, pebbles (<30mm), hard, slighty moist	D/M	3
				SILTSTONE, tan-orange, very powdery, no pebbles, hard, slightly moist	D/M	4
						5
						6
						7
						8
						9
				End of Hole @ 10m (Target Depth)		10

WELL CONSTRUCTION DETAILS



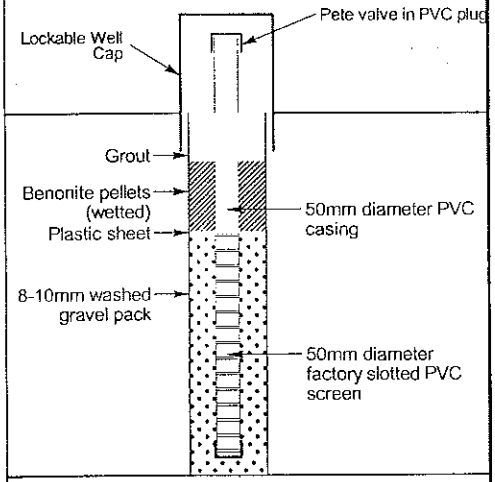
URS

MONITORING WELL BH10

AGC Woodward-Clyde Pty Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 3.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations)	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, some sand, low plasticity, dark brown-grey, grass and roots, soft, moist	M	0
			SILTST	SILTSTONE, light brown-yellow, pebbles (<10mm), some powder, hard, dry	D	2
			CLS	sandy CLAY, some silt, dark brown-grey, low plasticity, loose, moist	M	
				End of Hole @ 3m (Target Depth)		3

WELL CONSTRUCTION DETAILS



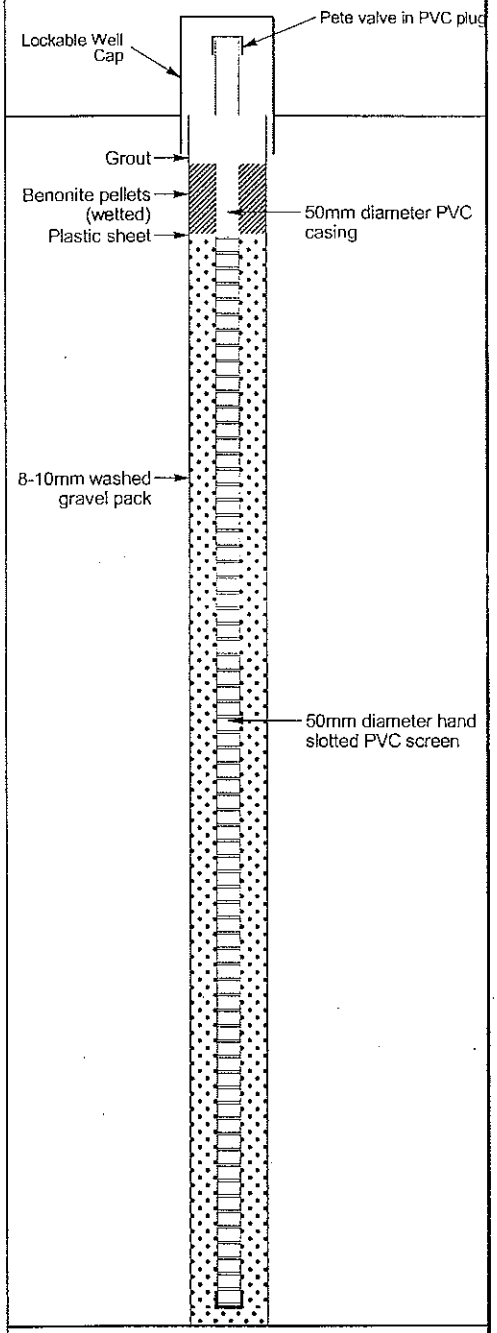
MONITORING WELL BH11

URS

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 10.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, low plasticity, light brown, soft, grass and roots, moist	M	0
			SILTST	SILTSTONE, light brown-yellow, pebbles (<20mm), very hard, dry	D	1
						2
						3
				As above, very powdery		4
						5
						6
				SILTSTONE, white-light yellow, pebbles (<10mm), quartz pebbles, hard, dry	D	7
				SILTSTONE, light orange, very powdery, no pebbles, hard, slightly moist	D/M	8
				As above, orange-tan		9
				End of Hole @ 10m (Target Depth)		10

WELL CONSTRUCTION DETAILS



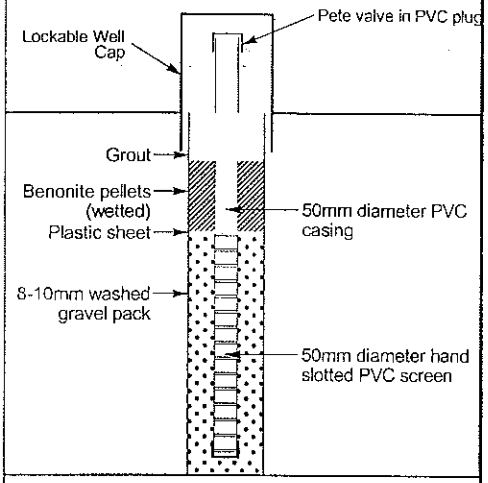
WELL LOGS.GPJ WCC_AUS.GDT 13/08/01

MONITORING WELL BH12

AGC Woodward-Clyde Pty. Ltd	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 3.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, low plasticity, light brown, soft, grass and roots, moist	M	0
			SILTST	SILTSTONE, light brown-yellow, pebbles (<20mm), very hard, dry	D	1
						2
				End of Hole @ 3m (Target Depth)		3
						4
						5
						6
						7
						8
						9
						10

WELL CONSTRUCTION DETAILS



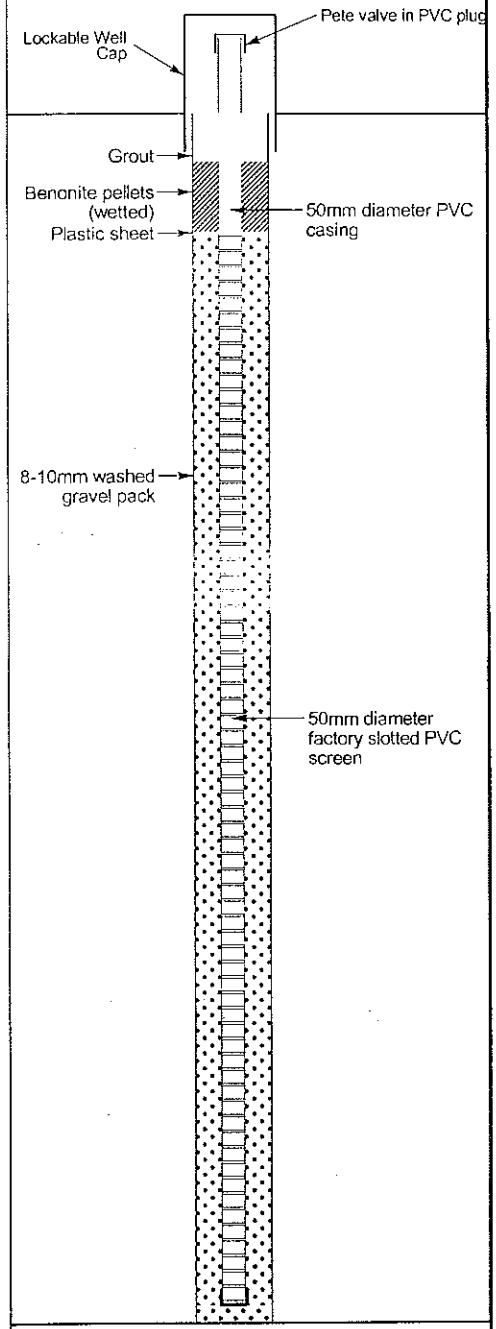
MONITORING WELL BH13

URS

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 10.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, low plasticity, dark brown, soft, grass and roots, moist	M	0
			SILTST	SILTSTONE, orange-pink, pebbles (<5mm), hard, dry	D	1
				As above, more powdery		2
				SILTSTONE, light yellow-grey, pebbles (<20mm), hard, dry	D	3
				As above, more powdery	D/M	4
				As above, darker orange		5
						6
						7
						8
				SILTSTONE, orange-tan, very powdery, no pebbles		9
				End of Hole @ 10m (Target Depth)		10

WELL CONSTRUCTION DETAILS



WELL_LOGS.GPJ WCC_AUS.GDT 13/08/01

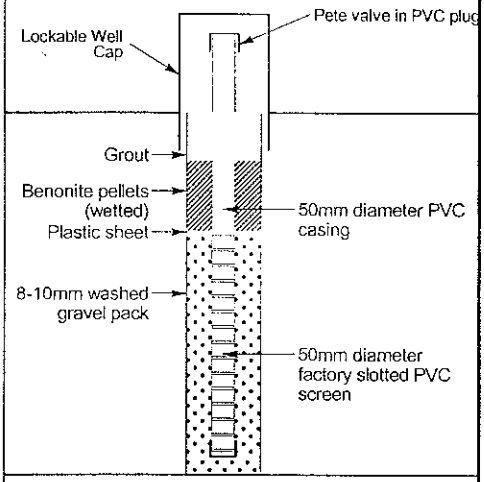
MONITORING WELL BH14

URS

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 3.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, low plasticity, dark brown, soft, grass and roots, moist	M	0
			SILTST	SILTSTONE. orange-pink, pebbles (<5mm), hard, dry	D	1
				As above, more powdery		2
				End of Hole @ 3m (Target Depth)		3
						4
						5
						6
						7
						8
						9
						10

WELL CONSTRUCTION DETAILS



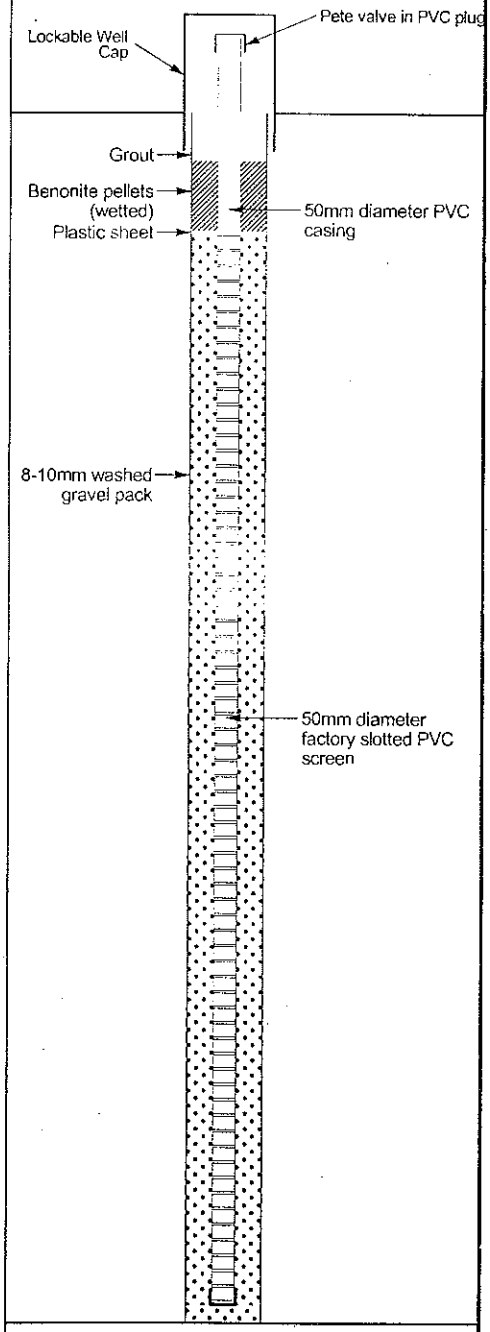
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MONITORING WELL BH15

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 10.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, low plasticity, dark brown, soft, grass and roots, organic matter, moist	M	0
			SILTST	SILTSTONE, light yellow-grey, pebbles (<10mm), hard, dry	M	1
				SILTSTONE, light orange-brown, pebbles (<10mm), some powder, hard, dry		2
				As above, more powdery		3
				SILTSTONE, orange-pink, pebbles (<5mm), powdery, hard, dry	D	4
						5
				As above, yellow		6
						7
						8
						9
				End of Hole @ 10m (Target Depth)		10

WELL CONSTRUCTION DETAILS



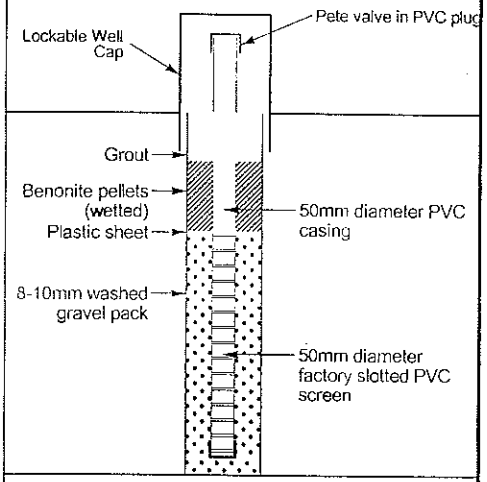
URS

MONITORING WELL BH16

AGC Woodward-Clyde Pty. Ltd.	Phone / Fax	Project Reference: Eaglehawk Landfill Gas Management Investigation	Client: City of Greater Bendigo
Drilling Contractor: KH ADAMS & SONS		Project No.: 46073-005-5001	Location: Eaglehawk, Bendigo
Logged By: AL	Bore Size: 150 mm	Relative Level: mRL	Drill Type: Hollow stem auger
Checked By: LT	Total Depth: 3.00 m	Coordinates: mN	Drill Model: EDSON 6000
Date Started: 23-07-01	Casing Size: 50 mm	mE	Drill Fluid: AIR
Date Finished: 23-07-01		Permit No:	

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
			TOPS	topsoil, silty CLAY, low plasticity, dark brown, soft, grass and roots, organic matter, moist	M	0
			SILTST	SILTSTONE, light yellow-grey, pebbles (<10mm), hard, dry	M	1
				SILTSTONE, light orange-brown, pebbles (<10mm), some powder, hard, dry		2
				End of Hole @ 3m (Target Depth)		3
						4
						5
						6
						7
						8
						9
						10

WELL CONSTRUCTION DETAILS



LANDFILL GAS BORE BH17

URS Australia Pty. Ltd.
L6, 1 Southbank Blvd, Southbank VIC 3006
Phone: (03) 8699 7500
Fax: (03) 8699 7550

Drilling Contractor: **South Western Drilling**

Project Reference: **Eaglehawk Landfill Gas Bores 2012**

Project No.: **43271277**

Client: **City of Greater Bendigo**

Location: **Eaglehawk Landfill, Bendigo**

Logged By: **HS**
Checked By: **KS**
Date Started: **29-8-12**
Date Finished: **29-8-12**

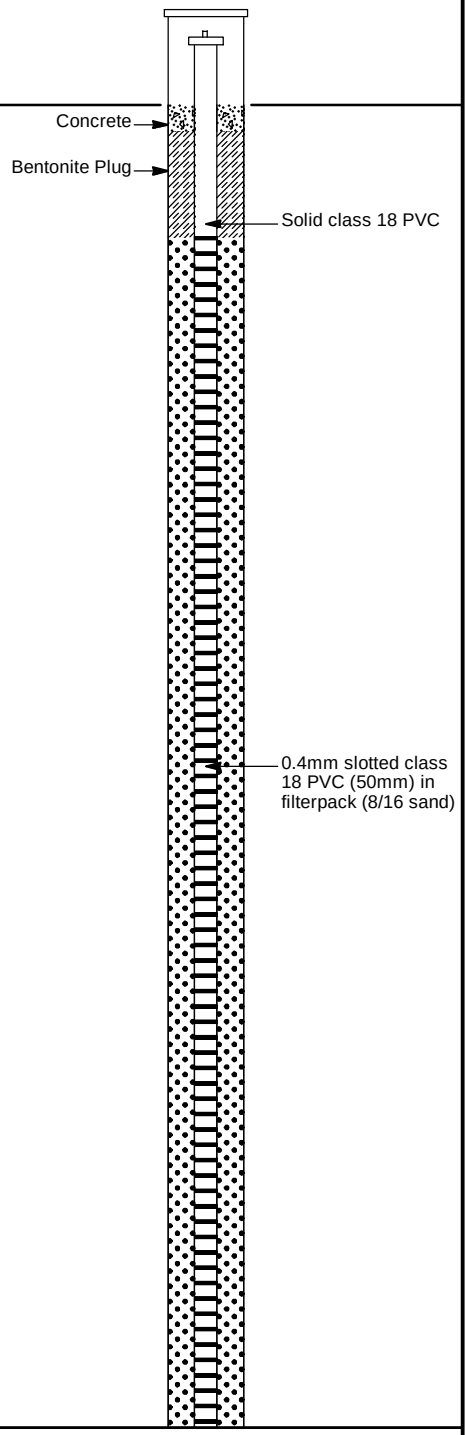
Drilled Depth: **10.0 m**

Coordinates: **5931785 mN**
253697 mE

Drill Type: **Solid stem auger**
Drill Model: **Geoprobe**
Drill Fluid: **NA**

Depth (m)	Legend	USC DESCRIPTION OF STRATA	Moisture	Classification
0		**FILL;** clay (dark brown-black, high plasiticity), rubble (brick fragments, quartz cobbles up to 100mm)	Dry	
1				
		SILTSTONE; pale brown, moderate strength, very fine grained	Dry	
2				
3				
4				
5		transition to grey, reduced to low strength		
6				
7				
8				
9		**Terminal Depth 10.0m**, Target Depth Achieved		

CONSTRUCTION DETAILS



Remarks: During drilling LEL 0%, O2: 20.9%
Easier drilling from 5.5m, occasional harder band, usually around 100mm thick

LANDFILL GAS BORE BH18

URS Australia Pty. Ltd.
L6, 1 Southbank Blvd, Southbank VIC 3006
Phone: (03) 8699 7500
Fax: (03) 8699 7550

Drilling Contractor: **South Western Drilling**

Project Reference: **Eaglehawk Landfill Gas Bores 2012**

Project No.: **43271277**

Client: **City of Greater Bendigo**

Location: **Eaglehawk Landfill, Bendigo**

Logged By: **HS**
Checked By: **KS**
Date Started: **28-8-12**
Date Finished: **28-8-12**

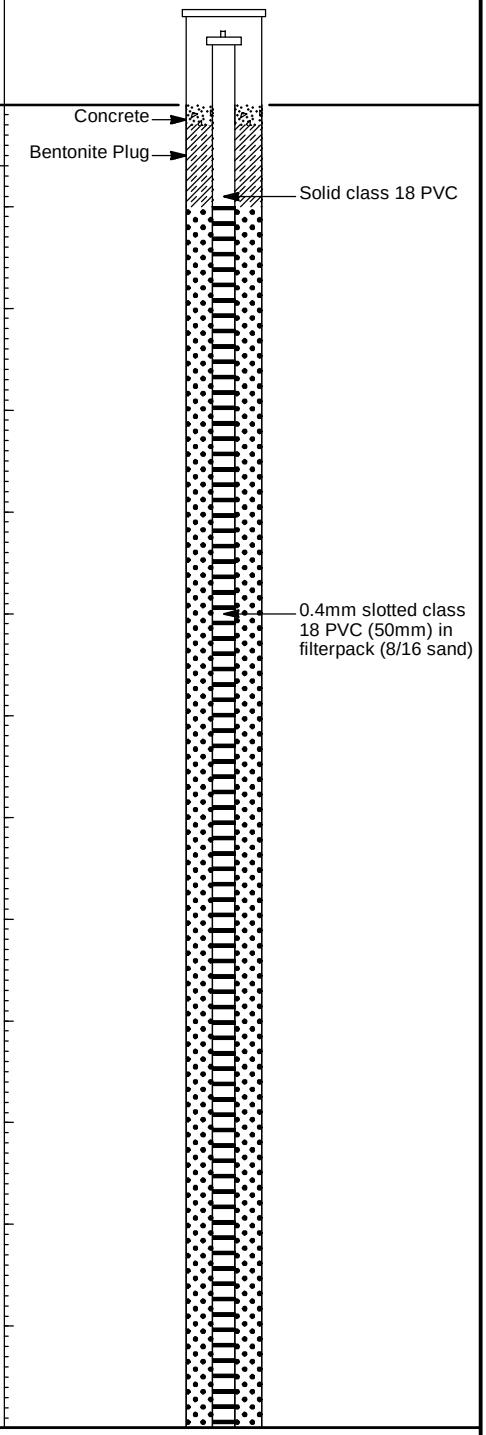
Drilled Depth: **13.0 m**

Coordinates: **5931685 mN**
253515 mE

Drill Type: **Solid stem auger**
Drill Model: **Geoprobe**
Drill Fluid: **NA**

Depth (m)	Legend	USC DESCRIPTION OF STRATA	Moisture	Classification
0		**FILL;** clay (pale brown, low plasticity), quartz cobbles up to 100mm	Dry	
1		**SILTSTONE;** brown, low strength, very fine grained, occassional 1-2cm bands of moderate strength material which is darker coloured (red-brown)	Dry	
2		transition to brown-grey		
3				
4		return to brown		
5				
6		becoming paler brown, less frequent bands of moderate strength material		
7		transition to grey		
8				
9				
10				
11				
12		**Terminal Depth 13.0m**, Target Depth Achieved		

CONSTRUCTION DETAILS



Remarks: During drilling LEL 0%, O2: 20.9%

LANDFILL GAS BORE BH19

URS Australia Pty. Ltd.
L6, 1 Southbank Blvd, Southbank VIC 3006
Phone: (03) 8699 7500
Fax: (03) 8699 7550

Drilling Contractor: **South Western Drilling**

Project Reference: **Eaglehawk Landfill Gas Bores 2012**

Project No.: **43271277**

Client: **City of Greater Bendigo**

Location: **Eaglehawk Landfill, Bendigo**

Logged By: **HS**
Checked By: **KS**
Date Started: **28-8-12**
Date Finished: **28-8-12**

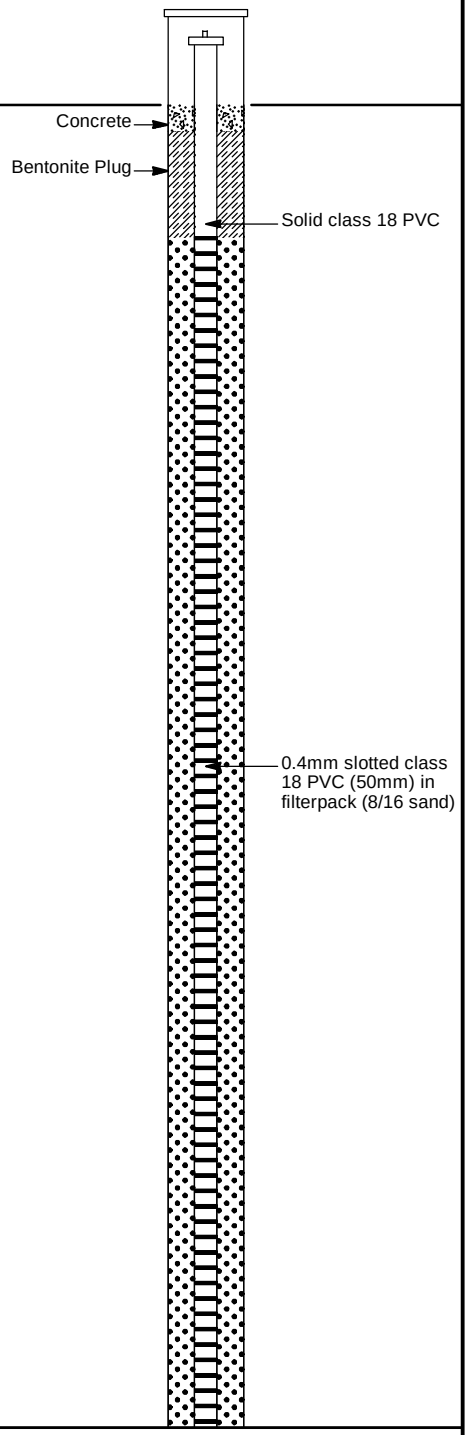
Drilled Depth: **10.0 m**

Coordinates: **5931606 mN**
253413 mE

Drill Type: **Solid stem auger**
Drill Model: **Geoprobe**
Drill Fluid: **NA**

Depth (m)	Legend	USC DESCRIPTION OF STRATA	Moisture	Classification
0		**CLAY;** orange-yellow, low plasticity	Dry	
1		**SILTSTONE;** yellow, low strength, very fine grained (powder)	Dry	
2		transition to pale yellow/tan		
3				
4				
5				
6				
7				
8				
9		**Terminal Depth 10.0m**, Target Depth Achieved		

CONSTRUCTION DETAILS



Remarks: During drilling LEL 0%, O2: 20.9%

LANDFILL GAS BORE BH20

URS Australia Pty. Ltd.
L6, 1 Southbank Blvd, Southbank VIC 3006
Phone: (03) 8699 7500
Fax: (03) 8699 7550

Drilling Contractor: **South Western Drilling**

Project Reference: **Eaglehawk Landfill Gas Bores 2012**

Project No.: **43271277**

Client: **City of Greater Bendigo**

Location: **Eaglehawk Landfill, Bendigo**

Logged By: **HS**
Checked By: **KS**
Date Started: **28-8-12**
Date Finished: **28-8-12**

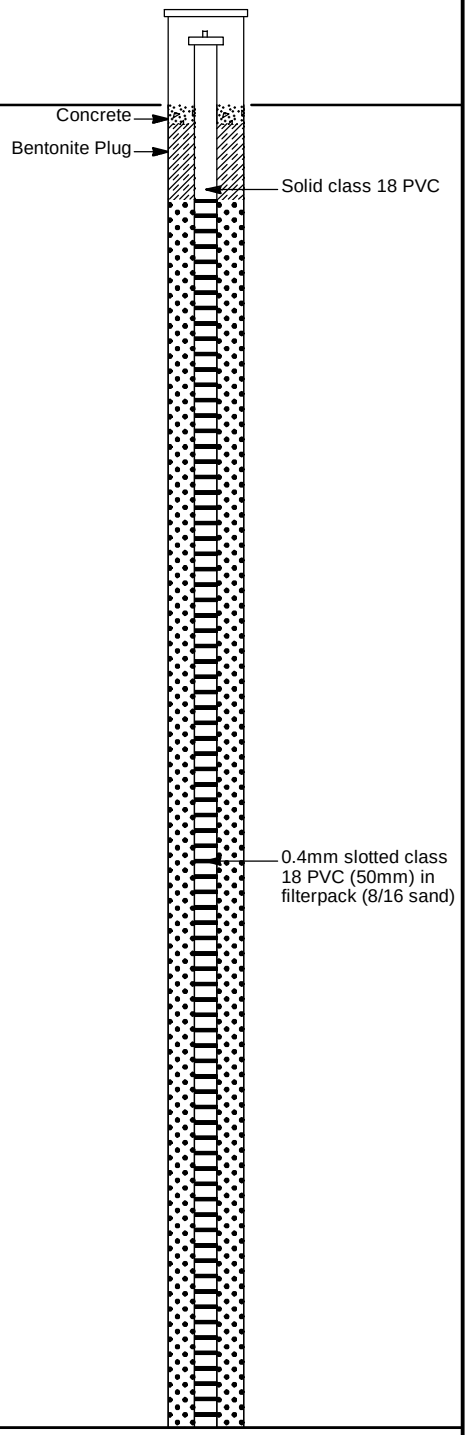
Drilled Depth: **14.0 m**

Coordinates: **5931638 mN**
253326 mE

Drill Type: **Solid stem auger**
Drill Model: **Geoprobe**
Drill Fluid: **NA**

Depth (m)	Legend	USC DESCRIPTION OF STRATA	Moisture	Classification
0		**CLAY;** pale brown, low plasticity	Dry	
1		**SILTSTONE;** pale red-orange, moderate strength, very fine grained	Dry	
2				
3				
4		transition to tan coloured, low strength		
5				
6		return to darker brown material, still low strength		
7				
8				
9				
10				
11				
12				
13		**Terminal Depth 14.0m**, Target Depth Achieved		

CONSTRUCTION DETAILS



Remarks: During drilling LEL 0%, O2: 20.9%

LANDFILL GAS BORE BH21

URS Australia Pty. Ltd.
L6, 1 Southbank Blvd, Southbank VIC 3006
Phone: (03) 8699 7500
Fax: (03) 8699 7550

Drilling Contractor: **South Western Drilling**

Project Reference: **Eaglehawk Landfill Gas Bores 2012**

Project No.: **43271277**

Client: **City of Greater Bendigo**

Location: **Eaglehawk Landfill, Bendigo**

Logged By: **HS**
Checked By: **KS**
Date Started: **28-8-12**
Date Finished: **28-8-12**

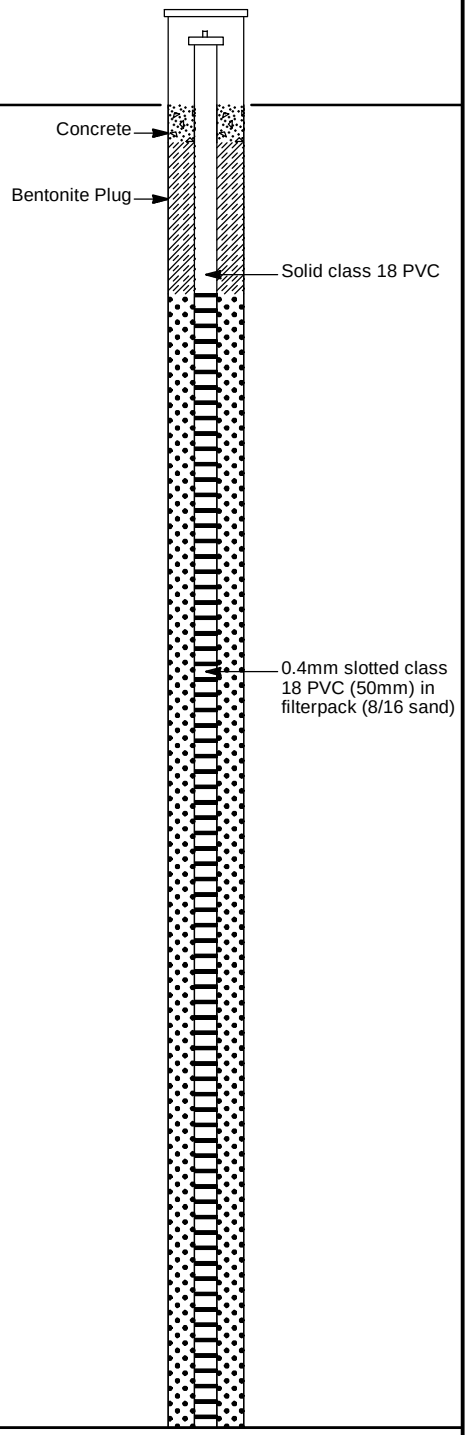
Drilled Depth: **7.0 m**

Coordinates: **5931316 mN**
253379 mE

Drill Type: **Solid stem auger**
Drill Model: **Geoprobe**
Drill Fluid: **NA**

Depth (m)	Legend	USC DESCRIPTION OF STRATA	Moisture	Classification
0		**SILTSTONE;** pale grey, moderate strength, very fine grained	Dry	
3		moderate-low strength		
4		transition to darker grey-pale brown moderate strength material		
6		**Terminal Depth 7.0m**, Target Depth Achieved		

CONSTRUCTION DETAILS



Remarks: During drilling LEL 0%, O2: 20.9%
Easier drilling 3m to 4.5m

LANDFILL GAS BORE BH22

URS Australia Pty. Ltd.
L6, 1 Southbank Blvd, Southbank VIC 3006
Phone: (03) 8699 7500
Fax: (03) 8699 7550

Drilling Contractor: **South Western Drilling**

Project Reference: **Eaglehawk Landfill Gas Bores 2012**

Project No.: **43271277**

Client: **City of Greater Bendigo**

Location: **Eaglehawk Landfill, Bendigo**

Logged By: **HS**
Checked By: **KS**
Date Started: **28-8-12**
Date Finished: **28-8-12**

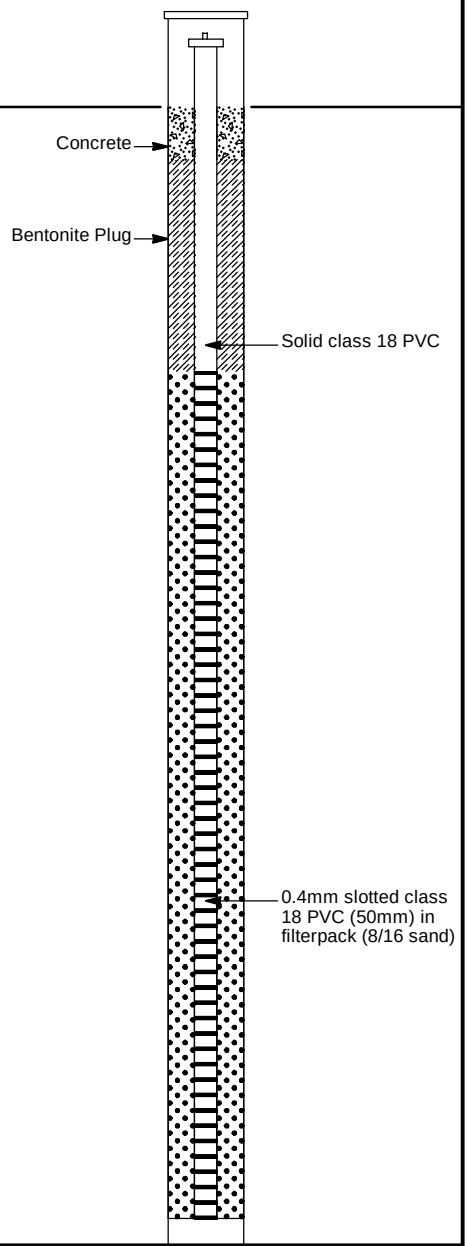
Drilled Depth: **4.3 m**

Coordinates: **5931410 mN**
253788 mE

Drill Type: **Solid stem auger**
Drill Model: **Geoprobe**
Drill Fluid: **NA**

Depth (m)	Legend	USC DESCRIPTION OF STRATA	Moisture	Classification
0		**CLAY;**dark brown, moderate plasticity	Moist	
		SAND;dark brown-white, approximately 60% sub-rounded fine grained white quartz, remainder of material angular brown fine grained material	Moist	
4		**CLAY;** dark grey, high plasticity with approximately 40% sand as above	Wet	
		Terminal Depth 4.2m, Borehole terminated due to water struck		

CONSTRUCTION DETAILS



Remarks: During drilling LEL 0%, O2: 20.9%
Water struck at 4.2 metres is likely to be perched water on the clay layer located at 4.2m

LANDFILL GAS BORE BH23

URS Australia Pty. Ltd.
L6, 1 Southbank Blvd, Southbank VIC 3006
Phone: (03) 8699 7500
Fax: (03) 8699 7550

Drilling Contractor: **South Western Drilling**

Project Reference: **Eaglehawk Landfill Gas Bores 2012**

Project No.: **43271277**

Client: **City of Greater Bendigo**

Location: **Eaglehawk Landfill, Bendigo**

Logged By: **HS**
Checked By: **KS**
Date Started: **29-8-12**
Date Finished: **29-8-12**

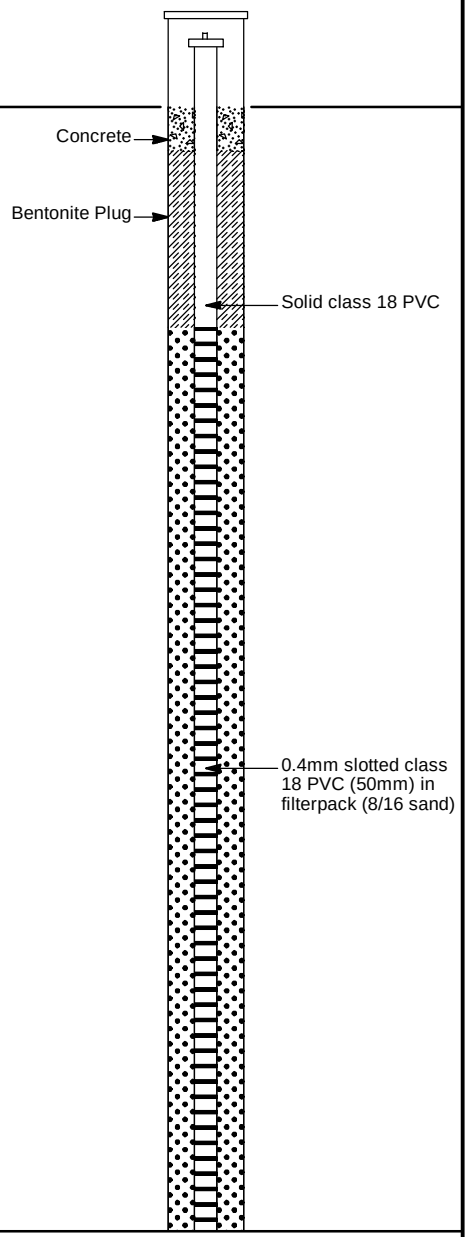
Drilled Depth: **5.1 m**

Coordinates: **5931452 mN**
253961 mE

Drill Type: **Solid stem auger**
Drill Model: **Geoprobe**
Drill Fluid: **NA**

Depth (m)	Legend	USC DESCRIPTION OF STRATA	Moisture	Classification
0		**CLAY;** yellow-orange, low plasticity; with bands of red siltstone ~ 2cm	Dry	
1		**SILTSTONE;** yellow, low strength, very low grainsize	Dry	
2		becoming darker yellow		
3		orange		
4				
5		**Terminal Depth 5.1m**, Target Depth Achieved		

CONSTRUCTION DETAILS



Remarks: During drilling LEL 0%, O2: 20.9%

LANDFILL GAS BORE LOG GAS BORES AUGUST 2012.GPJ WCC_AUS.GDT 30/8/12

LANDFILL GAS BORE BH24

URS Australia Pty. Ltd.
L6, 1 Southbank Blvd, Southbank VIC 3006
Phone: (03) 8699 7500
Fax: (03) 8699 7550

Drilling Contractor: **South Western Drilling**

Project Reference: **Eaglehawk Landfill Gas Bores 2012**

Project No.: **43271277**

Client: **City of Greater Bendigo**

Location: **Eaglehawk Landfill, Bendigo**

Logged By: **HS**
Checked By: **KS**
Date Started: **29-8-12**
Date Finished: **29-8-12**

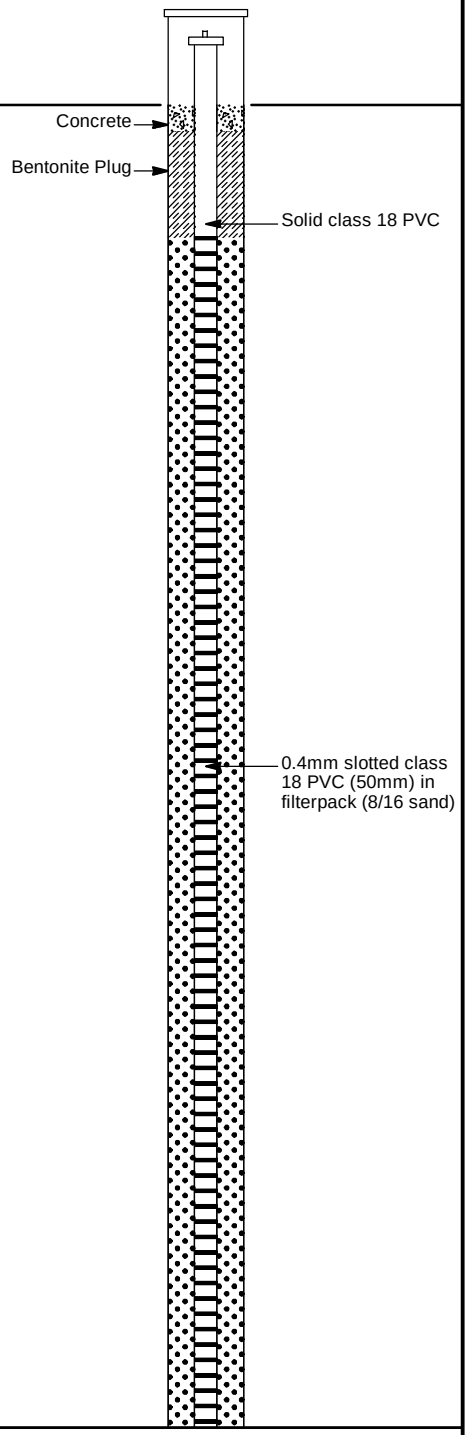
Drilled Depth: **10.0 m**

Coordinates: **5931817 mN**
254091 mE

Drill Type: **Solid stem auger**
Drill Model: **Geoprobe**
Drill Fluid: **NA**

Depth (m)	Legend	USC DESCRIPTION OF STRATA	Moisture	Classification
0		**FILL;** clay (pale grey, low plasiticity), rubble quartz cobbles up to 150mm); hard drilling through quartz fragments	Dry	
2		**MUDSTONE;** tan coloured, low strength	Dry	
4		grading to yellow coloured, then into orange		
5		pale brown		
10		**Terminal Depth 10.0m**, Target Depth Achieved		

CONSTRUCTION DETAILS



Remarks: During drilling LEL 0%, O2: 20.9%

Edwards Geotechnical Services - Engineering Log

Project: City of Bendigo - Eaglehawk Transfer Station

Log Number: GWMW
Job No: EGS1503

Borehole Location; Ref Dwg
Equipment; Geoprob G6620 DT
Borehole Diameter; 150mm Works Licence No. WLE063403

Date: 26 October 2015
By: AE
R.L:

method	Penetration 1	2	3	4	support	water	Samples	Depth (m)	Symbol	Material Description	Moisture condition	Consistency	Est Strength (kPa)	Observations
A						none encountered			GC	Clayey Sandy Gravel & Clayey Silty Sand, Low plasticity, Lt grey brown, G-fine-medium	D/M	MD		Fill
									CL	Silty Sandy Clay, low plasticity, lt brown	M	St		Residual
H								10	SM	Silty Sand, Lt brown, Sand fine to medium	M	MD		HW Siltstone
										as above - yellow brown				
										as above - orange brown				
								20		as above - lt grey brown				MW Siltstone
								30						
								40		as above - dark grey, sand fine				
										Borehole GWMW terminated at 46.5m				
								50						
								60						

Method	Penetration	Moisture	Consistency	
N - natural exposure	1 - no resistance	D - Dry	S - Soft	VL - Very Loose
E - Excavation	4 - Refusal	M - Moist	F - Firm	L - Loose
BH - Borehole	Water level ▼	W - Wet	St - Stiff	MD - Medium Dense
A - Auger	Water inflow →		VSt - Very stiff	D - Dense
H - Hammer Drill			H - Hard	VD - Very Dense

Edwards Geotechnical Services - Engineering Log

Project: Installation of landfill gas monitoring wells,
Eaglehawk landfill, Upper California Gully Road, City of Bendigo

Location: Ref B1 (a) Conceptual Model
Equipment; Geoprobe 7720 DT
Dimensions; 125mm

Log Number: BH 25
Job No: EGS1503
Date: 24th June 2016
By: AE
R.L : ESL

method	Penetration 1	2	3	4	support	water	Samples	Depth (m)	Symbol	Material Description	Moisture condition	Consistency	Est Strength (kPa)	Observations
A D					N	N		0.5	GC	Silty Sandy Clayey Gravel, low plasticity, yellow brown, fine to coase grained	M	MD		EW Siltstone
H										Yellow-brown	D	D		MW Sandstone - fine grained
								3.8		400mm Quartz band - white/red				Quartz band
								5.0		Yellow-brown				MW Sandstone
								7.0		Yellow-brown				MW Sandstone/Siltstone
								10.0						
								12.0		BH 25 terminated at 12.0m Screened 1.5m to 12.0m 50mm Class 18 PVC 2mm slots 5/3mm Sand backfill 1.3m to 12.0m Bentonite 0.3m to 1.3m Concrete to surface Gatic cover and gas plug installed				

Method	Penetration	Moisture	Consistency	
N - natural exposure	1 - no resistence	D - Dry	S - Soft	VL - Very Loose
E - Excavation	4 - Refusal	M - Moist	F - Firm	L - Loose
BH - Borehole	Water level ▼	W - Wet	St - Stiff	MD - Medium Dense
HA - Hand Auger	Water inflow →		VSt - Very stiff	D - Dense
TP - Test pit			H - Hard	VD - Very Dense

Edwards Geotechnical Services - Engineering Log

Project: Installation of landfill gas monitoring wells,
Eaglehawk landfill, Upper California Gully Road, City of Bendigo

Log Number: BH 26
Job No: EGS1503
Location: Ref B1 (a) Conceptual Model
Date: 24th June 2016
Equipment; Geoprobe 7720 DT
By: AE
Dimensions; 150mm
R.L : ESL

method	Penetration 1	2	3	4	support	water	Samples	Depth (m)	Symbol	Material Description	Moisture condition	Consistency	Est Strength (kPa)	Observations
A D					N	N		1.0	GC	Silty Sandy Clayey Gravel, low plasticity, yellow brown, fine to coarse grained	M	MD		EW Siltstone
H										Yelow-brown	D	D		MW Siltstone
								3.5		Grey-brown				
								5.0		Yellow-brown				
								6.0		Grey-yellow-brown				
								10.0		Dark grey				
								12.0		BH 26 Terminated at 12.0m Screened 1.5m to 12.0m 50mm Class 18 PVC 2mm slots 5/3mm Sand backfill 1.3m to 12.0m Bentonite 0.3m to 1.3m Concrete to surface Gatic cover + gas plug installed				

Method	Penetration	Moisture	Consistency	
N - natural exposure	1 - no resistence	D - Dry	S - Soft	VL - Very Loose
E - Excavation	4 - Refusal	M - Moist	F - Firm	L - Loose
BH - Borehole	Water level ▼	W - Wet	St - Stiff	MD - Medium Dense
HA - Hand Auger	Water inflow →		VSt - Very stiff	D - Dense
TP - Test pit			H - Hard	VD - Very Dense

Edwards Geotechnical Services - Engineering Log

Project: Installation of landfill gas monitoring wells,
Eaglehawk landfill, Upper California Gully Road, City of Bendigo

Location: Ref B1 (a) Conceptual Model
Equipment; Geoprobe 7720 DT
Dimensions; 125mm

Log Number: BH 27
Job No: EGS1503
Date: 24th June 2016
By: AE
R.L : ESL

method	Penetration 1	2	3	4	support	water	Samples	Depth (m)	Symbol	Material Description	Moisture condition	Consistency	Est Strength (kPa)	Observations
A D					N	N			GP	Silty Sandy Gravel, low plasticity, yellow brown, fine to coarse grained	M	MD		EW Siltstone
H								1.0		Grey-brown	D	D		MW Siltstone
								7.0		Dark grey				
								11.0		BH 27 terminated at 11.0m Screened 1.0m to 11.0m 50mm Class 18 PVC 2mm slots 5/3mm Sand backfill 0.8m to 11.0m Bentonite 0.3m to 0.8m Concrete to surface Gatic cover and gas plug installed Siltstone bedding orientation $10^0/190^0$ M Bedding slope 80^0 west				

Method	Penetration	Moisture	Consistency	
N - natural exposure	1 - no resistence	D - Dry	S - Soft	VL - Very Loose
E - Excavation	4 - Refusal	M - Moist	F - Firm	L - Loose
BH - Borehole	Water level ▼	W - Wet	St - Stiff	MD - Medium Dense
HA - Hand Auger	Water inflow →		VSt - Very stiff	D - Dense
TP - Test pit			H - Hard	VD - Very Dense

Edwards Geotechnical Services - Engineering Log

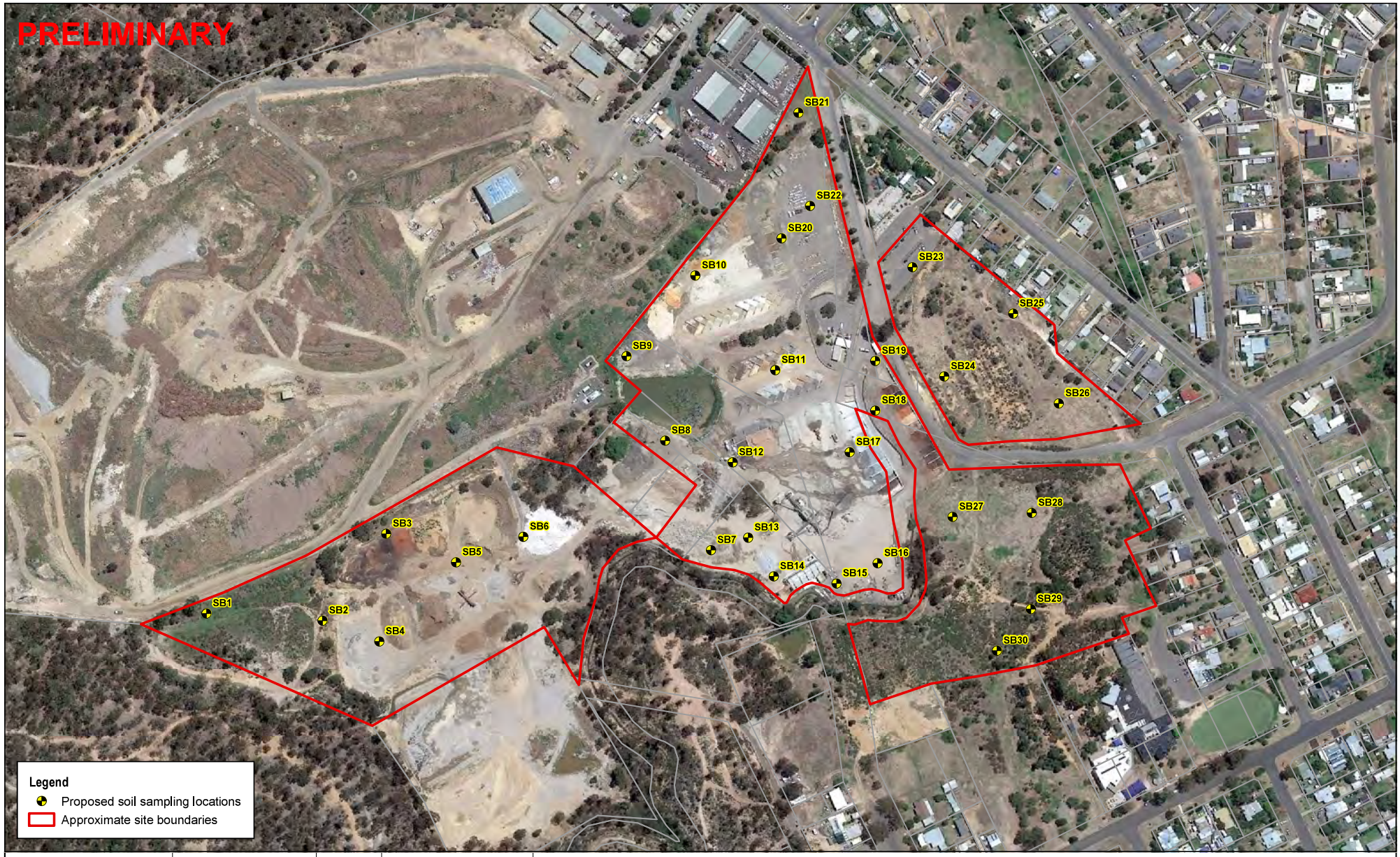
Project: Installation of landfill gas monitoring wells,
Eaglehawk landfill, Upper California Gully Road, City of Bendigo

Location: Ref B1 (a) Conceptual Model
Equipment: Geoprobe 7720 DT
Dimensions: 125mm

Log Number: BH28
Job No: EGS 1503
Date: 24th June 2016
By: AE
R.L: ESL

method	Penetration 1	2	3	4	support	water	Samples	Depth (m)	Symbol	Material Description	Moisture condition	Consistency	Est Strength (kPa)	Observations
A D H					N	N		1.0	GC	Silty Sandy Clayey Gravel, yellow brown, low plastcity, fine to coarse grained	M	MD		EW Siltstone
										Yellow-brown	D	D		MW Siltstone
														Some minor quartz bands
								4.0		Grey-yellow-brown				MW Siltstone
								10.0		BH 28 Terminated at 10.0m Screened 1.0m to 10.0m 50mm Class 18 PVC 2mm slots 5/3mm Sand backfill 0.8m to 10.0m Bentonite 0.3m to 0.8m Concrete to surface Gatic cover and gas plug installed				

Method	Penetration	Moisture	Consistency	
N - natural exposure	1 - no resistence	D - Dry	S - Soft	VL - Very Loose
E - Excavation	4 - Refusal	M - Moist	F - Firm	L - Loose
BH - Borehole	Water level ▼	W - Wet	St - Stiff	MD - Medium Dense
HA - Hand Auger	Water inflow →		VSt - Very stiff	D - Dense
TP - Test pit			H - Hard	VD - Very Dense



Map: PS106580_GIS_002_A2	Author: Angela.Sun		0 30 60 m 1:3,000
Date: 14/03/2018	Approved by: -		Coordinate system: GDA 1994 MGA Zone 55 Scale ratio correct when printed at A3

Data source: Google Earth 2017, Copyright © The State of Victoria, Department of Environment, Land, Water & Planning 2018

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Allstone Quarry

Figure 2
Proposed soil sampling locations

BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB01

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 253623 N 5931310**

Borehole Information | **Field Material Description**

2 METHOD	3 SUPPORT	4 WATER	5 WELL CONSTRUCTION	RL(m)	DEPTH(m)	6 FIELD TEST	7 SAMPLE	8 GRAPHIC LOG	9 USC SYMBOL	10 SOIL/ROCK MATERIAL FIELD DESCRIPTION	11 MOISTURE	12 RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	13 STRUCTURE AND ADDITIONAL OBSERVATIONS
PT					0	PID=0.2 ppm	GRAB			FILL: SILT; brown/grey, dry, with silt stone sub-angular inclusions.			SB01_0.2
						PID=0.3 ppm	GRAB						SB01_0.5
					0.60					FILL: SILT; brown/green, dry to moist, with rootlets/decomposed organics.			
					1	PID=0.1 ppm	GRAB						SB01_1.0
					1.10					FILL: SILT; dry to moist, fine grain sand, with trace organics.			
					1.15					END OF BOREHOLE AT 1.15 m			
					2								

This borehole log should be read in conjunction with WSP | Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB02

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 253722 N 5931310**

Borehole Information							Field Material Description					
	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST H FB VL L MD D VD	STRUCTURE AND ADDITIONAL OBSERVATIONS
				0.10	PID=0.4 ppm	GRAB			TOPSOIL: brown/grey, dry.			
					PID=0.2 ppm	GRAB			FILL: Sandy CLAY; brown/green, dry to moist, fine to medium grain.			SB02_0.2
				0.65								SB02_0.5
HA				1	PID=0.6 ppm	GRAB			FILL: Clayey SILT; brown/green, dry to moist, with trace fine grain gravel.			SB02_1.0
					PID=0.9 ppm	GRAB						SB02_1.4
				1.50					END OF BOREHOLE AT 1.50 m			Hand auger refusal @ 1.5 mBGL
				2								

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB03

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**21/2/18**
Project:	**All Stone Quarries**	Date Completed:	**21/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 253777 N 5931380**

Borehole Information							Field Material Description					
2	3	4		5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA				1					FILL: Sandy CLAY; brown/grey, low plasticity, dry, fine to coarse grain sand, some fine to coarse grain gravel, some trace tailings and brick fragments.			SB03_0.2
												SB03_0.5
												SB03_1.0
				1.10					FILL: Clayey SILT; brown/yellow, dry to moist, some trace tailings.			
				1.30					FILL: Clayey SILT; orange/red, low to medium plasticity, dry to moist.			
				1.40					FILL: Silty SAND; grey, fine grain, dry to moist.			SB03_1.5
				1.90					FILL: Silty SAND; orange, fine grain, dry to moist, trace brick fragments.			
				2								SB03_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB04

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**21/2/18**
Project:	**All Stone Quarries**	Date Completed:	**21/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 253771 N 5931290**

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA					PID=0 ppm	GRAB			FILL: Gravelly clay; dry, some shale inclusions.			SB04_0.2
				0.50	PID=0.1 ppm	GRAB			FILL: Sandy CLAY; brown, fine grain sand, dry.			SB04_0.5
				0.70					FILL: Organics, some silt.			
				1	PID=0.1 ppm	GRAB						SB04_1.0
				1.20					FILL: Clayey SILT.			
					PID=0 ppm	GRAB						SB04_1.9
				1.95					END OF BOREHOLE AT 1.95 m			Refusal @ 1.95 mBGL
				2								

This borehole log should be read in conjunction with WSP | Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB05

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**21/2/18**
Project:	**All Stone Quarries**	Date Completed:	**21/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 253836 N 5931360**

Borehole Information							Field Material Description					
2	3	4		5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					PID=0 ppm	GRAB			FILL: Silty GRAVEL; brown/orange, dry.			SB05_0.2
				0.30					FILL: Sandy SILT; grey,dry, fine grain sand, some fine-medium gravel inclusions.			
					PID=0.1 ppm	GRAB						SB05_0.5
				0.60					FILL: Sandy SILT; grey, dry to moist, fine grain sand.			
HA				1	PID=0.3 ppm	GRAB						SB05_1.0
				2	PID=0 ppm	GRAB						SB05_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB06

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**21/2/18**
Project:	**All Stone Quarries**	Date Completed:	**21/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 253894 N 5931380**

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST H FB VL L MD D VD	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA				0.30	PID=0 ppm	GRAB			FILL: Silty GRAVEL; grey/brown, dry, fine to coarse gravels.			SB06_0.2
				0.50	PID=1 ppm	GRAB			FILL: Sandy SILT; brown, dry, fine to coarse gravels and sand.			SB06_0.5
				1	PID=0.5 ppm	GRAB			FILL: Gravelly sandy CLAY; brown, medium plasticity, dry to moist, fine to coarse grain sand, fine to medium gravels.			SB06_1.0
					PID=0.8 ppm	GRAB						SB06_1.8
				1.95					END OF BOREHOLE AT 1.95 m			Refusal @ 1.95 mBGL
				2								

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB07

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**22/2/18**
Project:	**All Stone Quarries**	Date Completed:	**22/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254054 N 5931370**

Borehole Information							Field Material Description					
2	3	4		5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA				0.20	PID=0 ppm	GRAB			FILL: Silty CLAY; some fine to coarse gravel.			
									FILL: Reworked natural siltstone			SB07_0.2
												Hand auger refusal @ 0.3m
												SB07_0.5
SF				1								SB07_1.0
				2								SB07_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

This borehole log should be read in conjunction with WSP | Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB08

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**21/2/18**
Project:	**All Stone Quarries**	Date Completed:	**21/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254015 N 5931460**

Borehole Information | **Field Material Description**

1 METHOD	2 SUPPORT	3 WATER	4 WELL CONSTRUCTION	5 RL(m) / DEPTH(m)	6 FIELD TEST	7 SAMPLE	8 GRAPHIC LOG	9 USC SYMBOL	10 SOIL/ROCK MATERIAL FIELD DESCRIPTION	11 MOISTURE	12 RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	13 STRUCTURE AND ADDITIONAL OBSERVATIONS
HA				0.40	PID=0.2 ppm	GRAB			FILL: Gravelly sandy CLAY; grey, dry, fine to coarse grain sand, fine to medium gravel.			SB08_0.2
					PID=0.1 ppm	GRAB			FILL: Fine gravels, crushed rock, dry.			SB08_0.5
				0.60					FILL: Gravelly clayey SAND; white/grey, dry to moist.			
				1	PID=0.6 ppm	GRAB						SB08_1.0
SF				1.30					FILL: Reworked siltstone, yellow/brown.			Hand auger refusal @ 1.4m
				2	PID=0.1 ppm	GRAB						SB08_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

This borehole log should be read in conjunction with WSP | Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB09

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 253982 N 5931530**

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	STRUCTURE AND ADDITIONAL OBSERVATIONS
				0.10					FILL: Gravelly CLAY; brown/grey, dry to moist, medium grained gravel.			
HA					PID=0.1 ppm	PID			FILL: Clayey GRAVEL; black/grey, dry to moist, fine to coarse gravels, some clay.			SB09_0.2
					PID=0 ppm	PID						Hand auger refusal @ 0.4m
												SB09_0.5
				1	PID=0.3 ppm	PID						SB09_1.0
SF				1.20					FILL: SILT; brown/grey, with some fine grain sand			
				2	PID=0 ppm	PID						SB09_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB10

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254041 N 5931600**

Borehole Information							Field Material Description					
2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST H FB VL L MD D VD	STRUCTURE AND ADDITIONAL OBSERVATIONS
									FILL: Gravelly CLAY; brown/orange			
				0.20	PID=0.1 ppm	GRAB			FILL: Sandy CLAY; brown/orange/grey, some fine to coarse gravels.			SB10_0.2
HA					PID=0.3 ppm	GRAB						SB10_0.5
				0.80					FILL: Clayey SAND; grey/green, low plasticity, dry.			
				1.00 1	PID=0.4 ppm	GRAB			FILL: SAND; fine to medium grain, some brown low plasticity clay.			SB10_1.0
SF												Hand auger refusal @ 1.15m on side rock Bore continued from 1.15-2.05 mBGL with solid flight auger on 21/2/2018
				2	PID=0 ppm	GRAB						SB10_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

This borehole log should be read in conjunction with WSP | Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB11

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**21/2/18**
Project:	**All Stone Quarries**	Date Completed:	**21/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254109 N 5931520**

Borehole Information							Field Material Description					
2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST H FB VL L MD D VD	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA				0	PID=0 ppm	GRAB			FILL: Gravelly CLAY; grey/brown, low plasticity, fine to coarse slate gravel.			SB11_0.2
					PID=0 ppm	GRAB						SB11_0.5
				0.70					FILL: Gravels, sands, silts; white/brown/orange, some concrete and plastic inclusions.			
				1	PID=0 ppm	GRAB						SB11_1.0
					PID=0 ppm	GRAB						SB11_1.3
				1.40					END OF BOREHOLE AT 1.40 m			Refusal @ 1.4 mBGL
				2								

This borehole log should be read in conjunction with WSP | Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB12

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**21/2/18**
Project:	**All Stone Quarries**	Date Completed:	**21/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254072 N 5931440**

Borehole Information							Field Material Description					
2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST H FB VL L MD D VD	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA				0.10	PID=0.3 ppm	GRAB			FILL: Clayey SAND; brown, moist, fine to coarse grain sand, some fine to coarse gravel.			SB12_0.1
									FILL: Clayey SAND; brown, moist, fine to medium grain sand, traces of fine gravel.			
				0.45	PID=0.4 ppm	GRAB						SB12_0.4
									END OF BOREHOLE AT 0.45 m			Refusal @ 0.4 mBGL on 2nd attempt. Refusal @ 0.1 mBGL on 1st attempt.
				1								
				2								

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB13

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**22/2/18**
Project:	**All Stone Quarries**	Date Completed:	**22/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254086 N 5931380**

Borehole Information							Field Material Description					
	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST H FB VL L MD D VD	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA					PID=0 ppm	GRAB			FILL: Clayey SAND; brown, fine grain sand, dry, low plasticity, some sub-angular fine grain boulders			SB13_0.2
				0.30					END OF BOREHOLE AT 0.30 m			First attempt 0.2 m refusal. Second attempt refusal at 0.3 m.
				1								
				2								

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB14

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**22/2/18**
Project:	**All Stone Quarries**	Date Completed:	**22/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254107 N 5931340**

Borehole Information							Field Material Description					
	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST H FB VL L MD D VD	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA				0.25	PID=51.8 ppm PID=1.2 ppm	GRAB GRAB			FILL: Silty GRAVELS; compact, fine to coarse grain, some clay.			Diesel staining on surface. SB14_0.2 (Location 2) SB14_0.25 (Location 1) Refusal @ 0.25m on first attempt (location 1) Refusal @ 0.2 mBGL on second attmept (location 2)
									END OF BOREHOLE AT 0.25 m			
				1								
				2								

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB15

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**22/2/18**
Project:	**All Stone Quarries**	Date Completed:	**22/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254161 N 5931340**

Borehole Information							Field Material Description					
	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST H FB VL L MD D VD	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA				0.60					FILL: Silty GRAVEL; blue/grey, compacted, fine to coarse gravel, some fine to coarse grain sand, trace quartz.			SB15_0.2
												SB15_0.5
				0.70					FILL: Silty GRAVEL; grey, reworked natural.			
				0.85					FILL: Light brown/yellow, reworked natural, extremely weathered siltstone, some coarse grain gravel.			SB15_0.8
				1					END OF BOREHOLE AT 0.85 m			Refusal with hand auger on finely grained boulders; blue/grey siltstone @ 0.85 mBGL No further drilling in operational area
				2								

This borehole log should be read in conjunction with WSP | Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB16

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**22/2/18**
Project:	**All Stone Quarries**	Date Completed:	**22/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254196 N 5931350**

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	STRUCTURE AND ADDITIONAL OBSERVATIONS
				0.15	PID=0 ppm	GRAB			FILL: Gravelly CLAY; grey, dry, fine to medium gravel.			
									FILL: Clayey SAND; brown/orange, fine to coarse grain sand, some fine grain gravel.			SB16_0.2
HA				0.50	PID=0.1 ppm	GRAB			FILL: Clayey SILT; brown/orange/red, medium plasticity, dry.			SB16_0.5
				0.80					As above with extremely weathered siltstone.			
				1	PID=0 ppm	GRAB						SB16_1.0
SF												
				2	PID=0.3 ppm	GRAB						SB16_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

This borehole log should be read in conjunction with WSP | Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB17

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**22/2/18**
Project:	**All Stone Quarries**	Date Completed:	**22/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254172 N 5931450**

Borehole Information							Field Material Description					
	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST H FB VL L MD D VD	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA				0.10	PID=0.1 ppm	GRAB			FILL: GRAVEL; Harcourt granite. Some clay. Compact.			
									FILL: Clayey GRAVEL; Fine to coarse grained sub-angular white crushed granite, low plasticity brown clay, some fine grain boulders			SB17_0.2
				0.30					END OF BOREHOLE AT 0.30 m			Refusal @ 0.1 mBGL on 1st attempt Refusal @ 3 mBGL on 2nd attempt
				1								
				2								

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB18

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**21/2/18**
Project:	**All Stone Quarries**	Date Completed:	**21/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254194 N 5931490**

Borehole Information							Field Material Description					
2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	STRUCTURE AND ADDITIONAL OBSERVATIONS
				0.05					Asphalt.			
				0.10					FILL: Clayey GRAVEL; Fine to medium grained, brown, low to moderate plasticity clay.			
HA					PID=0.0 ppm	GRAB			FILL: Reworked extremely weathered siltstone.			SB18_0.2
				0.40					NATURAL: Brown/orange/yellow to pink, extremely weathered silstone/silt.			
					PID=0.0 ppm	GRAB						SB18_0.5
				0.60					END OF BOREHOLE AT 0.60 m			Hand auger refusal @ 0.6 mBGL on pink/light brown/orange heavily to extremely weathered siltstone
				1								
				2								

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB19

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**21/2/18**
Project:	**All Stone Quarries**	Date Completed:	**21/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254194 N 5931530**

Borehole Information | **Field Material Description**

1 METHOD	2 SUPPORT	3 WATER	4 WELL CONSTRUCTION	5 RL(m) / DEPTH(m)	6 FIELD TEST	7 SAMPLE	8 GRAPHIC LOG	9 USC SYMBOL	10 SOIL/ROCK MATERIAL FIELD DESCRIPTION	11 MOISTURE	12 RELATIVE DENSITY /CONSISTENCY (VS S F ST H / FB VL L MD D VD)	13 STRUCTURE AND ADDITIONAL OBSERVATIONS
									Asphalt.			
HA				0.20	PID=0 ppm	GRAB			FILL: Clayey GRAVEL; Brown, fine to medium grain, hardstand/compacted roadway gravel mix.			SB19_0.2
				0.30					NATURAL: Silty CLAY; Orange, hard, dry.			
				0.50					NATURAL: SILT; Orange/brown, dry, trace fine grain sand.			
					PID=0.1 ppm	GRAB						SB19_0.5
SF				0.90					NATURAL; SILSTONE; Extremely to highly weathered with depth, pink/orange/light brown			Hand auger refusal on extremely weathered siltstone @ 0.9 mBGL
				1	PID=0 ppm	GRAB						SB19_1.0
				2	PID=0 ppm	GRAB						SB19_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB20

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**19/2/18**
Project:	**All Stone Quarries**	Date Completed:	**19/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254114 N 5931630**

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA				0.30	PID=0 ppm	SB20_0.2			FILL: Clayey sandy GRAVEL; Roadbase, fine to medium grain blue aggregate, fine to course grain grey/blue sand, low plasticity			
									FILL: Sandy CLAY; orange/brown, low to moderate plasticity, fine grain sand			
				0.60	PID=0.1 ppm	SB20_0.6			NATURAL: Highly to extremely weathered siltstone, orange/brown			
SF				1	PID=0 ppm	SB20_1.0						Moderate to highly weathered quartz band @ 1.5 mBGL
				2	PID=0 ppm	SB20_2.0						
				2.05					END OF BOREHOLE AT 2.05 m			

This borehole log should be read in conjunction with WSP | Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB21

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**19/2/18**
Project:	**All Stone Quarries**	Date Completed:	**19/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254129 N 5931740**

Borehole Information | **Field Material Description**

2 METHOD	3 SUPPORT	4 WATER	5 WELL CONSTRUCTION	RL(m)	DEPTH(m)	6 FIELD TEST	7 SAMPLE	8 GRAPHIC LOG	9 USC SYMBOL	10 SOIL/ROCK MATERIAL FIELD DESCRIPTION	11 MOISTURE	12 RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	13 STRUCTURE AND ADDITIONAL OBSERVATIONS
HA						PID=0.1 ppm	GRAB			FILL: Sandy GRAVEL; fine to course grain, some brown clay, trace fine grain boulders, brown/grey			SB21_0.2
						PID=0.1 ppm	GRAB						SB21_0.5
SF				0.55		PID=0.1 ppm	GRAB			NATURAL: SILTSTONE; clays and sands at interface			Hand auger refusal on bedrock @ 0.55 mBGL
					1	PID=0 ppm	GRAB						SB21_1.0
				1.20						NATURAL: SILTSTONE; yellow, extremely weathered			
					2	PID=0.1 ppm	GRAB						SB21_2.0
				2.05						END OF BOREHOLE AT 2.05 m			

This borehole log should be read in conjunction with WSP | Parsons Brinckerhoff's accompanying standard notes.

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB22

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**19/2/18**
Project:	**All Stone Quarries**	Date Completed:	**19/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254138 N 5931660**

Borehole Information | **Field Material Description**

2 METHOD	3 SUPPORT	4 WATER	5 WELL CONSTRUCTION	RL(m) / DEPTH(m)	6 FIELD TEST	7 SAMPLE	8 GRAPHIC LOG	9 USC SYMBOL	10 SOIL/ROCK MATERIAL FIELD DESCRIPTION	11 MOISTURE	12 RELATIVE DENSITY /CONSISTENCY	13 STRUCTURE AND ADDITIONAL OBSERVATIONS
HA				0.30	PID=0.1 ppm	GRAB			FILL: Clayey GRAVEL; Fine to medium grain, blue aggregate, fine to course grain sand.			SB22_0.2
				0.40					FILL: Clayey SILT: brown/orange, some fine grain sand.			
									FILL: Extremely weathered siltstone, blue.			
				0.55	PID=0 ppm	GRAB						SB22_0.5
SF									NATURAL: SILT; brown/orange, weathered.			Hand auger refusal @ 0.55 mBGL
				1		GRAB						SB22_1.0
				1.20					NATURAL: SILSTONE; highly weathered, light brown/yellow.			
				2		GRAB						SB22_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

RELATIVE DENSITY /CONSISTENCY: VS S F ST VST H | FB VL L MD D VD

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB23

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254226 N 5931610**

Borehole Information							Field Material Description					
2	3	4		5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST H FB VL L MD D VD	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA					PID=0 ppm	GRAB			NATURAL: SILTSTONE; light brown/orange, extremely weathered.			SB23_0.2
				0.55	PID=0 ppm	GRAB						SB23_0.5
SF				1	PID=0 ppm	GRAB			NATURAL: SILTSTONE; Light brown/yellow, highly weathered.			Hand auger refusal @ 0.55 mBGL
												SB23_1.0
				2	PID=0 ppm	GRAB						SB23_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB24

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254253 N 5931510**

Borehole Information | **Field Material Description**

2 METHOD	3 SUPPORT	4 WATER	5 WELL CONSTRUCTION	RL(m) / DEPTH(m)	6 FIELD TEST	7 SAMPLE	8 GRAPHIC LOG	9 USC SYMBOL	10 SOIL/ROCK MATERIAL FIELD DESCRIPTION	11 MOISTURE	12 RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	13 STRUCTURE AND ADDITIONAL OBSERVATIONS
				0.05	PID=0.5 ppm	GRAB			FILL: GRAVEL; blue/orange.			
									NATURAL: SILTSTONE; highly to extremely weathered, brown/yellow/white.			SB24_0.2
HA				0.50	PID=0.5 ppm	GRAB			As above, highly to moderately weathered			SB24_0.5
				1	PID=0.5 ppm	GRAB						SB24_1.0
				1.15					As above, moderately to highly weathered			Hand auger refusal @ 1.15 mBGL
SF				2	PID=0.2 ppm	GRAB						SB24_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB25

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254312 N 5931570**

Borehole Information | **Field Material Description**

2 METHOD	3 SUPPORT	4 WATER	5 WELL CONSTRUCTION	RL(m)	DEPTH(m)	6 FIELD TEST	7 SAMPLE	8 GRAPHIC LOG	9 USC SYMBOL	10 SOIL/ROCK MATERIAL FIELD DESCRIPTION	11 MOISTURE	12 RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	13 STRUCTURE AND ADDITIONAL OBSERVATIONS
HA						PID=0 ppm	GRAB			NATURAL: SILTSTONE; Moderately to highly weathered, grey.			SB25_0.2
						PID=0 ppm	GRAB						SB25_0.5
Sf				0.55		PID=0 ppm	GRAB			As above; moderately weathered, pink, dry.			Hand auger refusal @ 0.55 mBGL
					1	PID=0 ppm	GRAB						SB25_1.0
				2.00	2	PID=0 ppm	GRAB			END OF BOREHOLE AT 2.00 m			SB25_2.0

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB26

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254351 N 5931490**

Borehole Information | **Field Material Description**

2 METHOD	3 SUPPORT	4 WATER	5 WELL CONSTRUCTION	RL(m)	DEPTH(m)	6 FIELD TEST	7 SAMPLE	8 GRAPHIC LOG	9 USC SYMBOL	10 SOIL/ROCK MATERIAL FIELD DESCRIPTION	11 MOISTURE	12 RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	13 STRUCTURE AND ADDITIONAL OBSERVATIONS
					0	PID=0 ppm	GRAB			TOPSOIL; Clayey SILT, brown, dry, trace brick.			SB26_0.2
					0.30					NATURAL: SILTSTONE; extremely weathered, white/grey.			
HA					0.5	PID=0 ppm	GRAB						SB26_0.5
					0.60					As above; highly weathered, white			
					1	PID=0 ppm	GRAB						SB26_1.0
SF													Hand auger refusal @ 1.15 mBGL on moderately weathered siltstone
					2	PID=0 ppm	GRAB						
					2.05					END OF BOREHOLE AT 2.05 m			SB26_2.0

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB27

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254260 N 5931390**

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST H FB VL L MD D VD	STRUCTURE AND ADDITIONAL OBSERVATIONS
									FILL: TOPSOIL; reworked.			
				0.20	PID=0 ppm	GRAB			FILL: gravelly CLAY; low plasticity, fine to course grain gravel. Plastic inclusions @ 0.3 mBGL Siltstone fragements @ 0.8 mBGL			SB27_0.2
					PID=0.2 ppm	GRAB						SB27_0.5
				1.00 1	PID=0 ppm	GRAB			FILL: Silty GRAVELS; grey, moist, some slate fragments			SB27_1.0
				1.50					FILL: SLATE.			
				1.60					FILL: SILSTONE; Clay, orange, extremely weathered.			
				2	PID=0.1 ppm	GRAB						SB27_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB28

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254328 N 5931400**

Borehole Information							Field Material Description					
	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT				0.10	PID=0.4 ppm	GRAB			FILL: Silty CLAY; brown, moist.			
									FILL: Grey, moderately weathered sandstone Trace river gravels/sands @ 0.3 mBGL			SB28_0.2
				0.30	PID=0.4 ppm	GRAB			FILL: SANDSTONE; moderately weathered, orange/brown, some clay.			SB28_0.5
				0.90	PID=0.3 ppm	GRAB			FILL: CLAY; brown/orange, low to medium plasticity, some sands.			SB28_1.0
				1.80					FILL: GRAVEL; trace quartz, some sands.			
				2.00	PID=0.7 ppm	GRAB			END OF BOREHOLE AT 2.05 m			SB28_2.0

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB29

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254327 N 5931320**

Borehole Information | **Field Material Description**

2 METHOD	3 SUPPORT	4 WATER	5 WELL CONSTRUCTION	RL(m)	DEPTH(m)	6 FIELD TEST	7 SAMPLE	8 GRAPHIC LOG	9 USC SYMBOL	10 SOIL/ROCK MATERIAL FIELD DESCRIPTION	11 MOISTURE	12 RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	13 STRUCTURE AND ADDITIONAL OBSERVATIONS
PT					0	PID=0.3 ppm	GRAB			NATURAL: SILTSTONE; White/brown/grey, extremely weathered.			SB28_0.2
						PID=0.3 ppm	GRAB						SB28_0.5
					0.80					As above, highly weathered.			
SF					1	PID=0.5 ppm	GRAB						SB28_1.0
						PID=0.6 ppm	GRAB						SB28_1.7
					1.80					END OF BOREHOLE AT 1.80 m			
					2								

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BOREHOLE NO.

BOREHOLE ENVIRONMENTAL LOG

SB30

SHEET 1 OF 1

Client:	**Department of Treasury and Finance**	Date Commenced:	**20/2/18**
Project:	**All Stone Quarries**	Date Completed:	**20/2/18**
Borehole Location:	**Eaglehawk, VIC**	Recorded By:	**JM**
Project Number:	**PS106580**	Log Checked By:	**MH**

Drill Model/Mounting:	**GeoProbe**	Driller:		Surface RL:	
Borehole Diameter:	**70 mm**	Driller Lic No:		Co-ords:	**E 254298 N 5931280**

Borehole Information | **Field Material Description**

1 METHOD	2 SUPPORT	3 WATER	4 WELL CONSTRUCTION	5 RL(m) / DEPTH(m)	6 FIELD TEST	7 SAMPLE	8 GRAPHIC LOG	9 USC SYMBOL	10 SOIL/ROCK MATERIAL FIELD DESCRIPTION	11 MOISTURE	12 RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	13 STRUCTURE AND ADDITIONAL OBSERVATIONS
PT				0.05	PID=0.1 ppm	GRAB			FILL: Silty GRAVEL.			SB25_0.2
									FILL:SILTSTONE; reworked.			
				0.40	PID=0.1 ppm	GRAB			FILL: SANDSTONE; highly weathered, reworked.			SB25_0.5
				0.65					NATURAL: SILTSTONE; white.			PT refusal @ 0.7 mBGL on sandstone/siltstone
SF				1	PID=0.3 ppm	GRAB						SB25_1.0
				2	PID=0.1 ppm	GRAB						SB25_2.0
				2.05					END OF BOREHOLE AT 2.05 m			

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Albert Roy Reserve
Eaglehawk

Preliminary Geotechnical Investigation for City of Greater Bendigo

Report 16C 0399
June, 2016

GTS
GEOTECHNICAL TESTING SERVICES

Albert Roy Reserve
Victoria St, Eaglehawk

Preliminary Geotechnical Investigation

for

City of Greater Bendigo

Revision

Revision	Date	Authorised
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Sandhurst Geotech Pty Ltd, Trading as **Geotechnical Testing Services – Southern.** ABN: 18 169 924 109 ACN: 169 924 109

Email: info@geotestsouthern.com.au; Ph: 03 5441 4881; Fax: 03 5441 5089; Mail Address: PO Box 13, STRATHDALE, Vic, 3550
Offices: • La Trobe University Applied Science 2 Building 7 Sharon Street, Flora Hill, VIC 3550; • Shed 3, 140 Ogilvie Avenue, Echuca , VIC 3654,

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APPENDIX

Site Plan
Engineering Logs
Descriptive Terms

1 INTRODUCTION

The City of Greater Bendigo commissioned Geotechnical Testing Services (GTS) to undertake a preliminary geotechnical investigation for the proposed upgrade of the Albert Roy Reserve off of Victoria Street, Eaglehawk.

The purpose of the investigation was to assess general subsurface conditions at the site with a view to providing comments on the existing subsurface profile.

2 SITE AND GEOLOGY

2.1 SITE LOCATION AND GENERAL CONDITIONS

The proposed development site is located on the south side of the first baseball diamond and to the west of the sealed car park.

The site has a slight fall and is currently vacant. At the time of the investigation, the surface was moist with a sparse grass covering. There are some medium to large trees just outside the baseball diamond. There was no visual evidence of surface cracking or surface rock.

2.2 GEOLOGY

The Department of Primary Industries online “Geovic” map shows the site to be underlain by Ordovician aged sedimentary rock with this generally confirmed by the field data at depths below the fill.

3 FIELDWORK

This geotechnical investigation was conducted on the 3rd June 2016 and involved the drilling of 4 boreholes by a Gemco drilling rig to depths of 2.4 to 3.0 metres.

The field investigation was conducted by a technician under the direction of a Geotechnical Engineer who logged the subsurface profile. The engineering logs are included in the Appendix with their locations shown on the enclosed site plan.

The field investigation indicated that the soil profile is slightly variable across the site due to fill deposits, but may be summarized as follows:

FILL: Gravelly Silty/Sandy CLAY, low plasticity, brown, orange, yellow, or
GRAVEL, grey
to depths of between 0.15 and 0.3 metres
Overlying
FILL: SAND, grey, mine tailings
To depths of between 0.4 and 1.2 metres
Overlying
FILL: Gravelly Silty/Sandy CLAY, low plasticity, brown, orange, yellow, grey, stiff
to depths of between 1.4 and 2.0 metres
Overlying
SILTSTONE, extremely weathered, pale brown, pale yellow, soft to moderate rock
To termination depths

There are variations to the above including the absence of fill over the mine sands in BH1. Therefore, reference should be made to the appended engineering logs for a full description of subsurface conditions at each location.

No groundwater inflow was encountered over the investigated depths.

4 DISCUSSION

Based on the results of this investigation, there is uncontrolled fill across the site to depths of between 1.4 and 2.0 metres. The uncontrolled fill is considered an unsuitable founding medium and footings would need to extend through this into the weathered Siltstone rock.

It is noted that in all boreholes, grey tailings sand was encountered. The thickness of this sand layer varied from 150mm to 1.05 metres. This sand generally has an elevated arsenic concentration above the limits of clean fill. In addition, there may also be lead and mercury levels above the allowable limits. As such, if it is to be disposed of offsite, it would need to be stockpiled and tested in accordance with EPPA guidelines.

5 IMPORTANT NOTES ABOUT THIS REPORT

Material types and quality in areas away from the test locations are inferred only and may vary from those encountered during the investigation. It is recommended that the base of all foundation excavations are inspected by a Geotechnical Engineer to ensure the founding medium and

strength requirements referenced herein are met. If further variations in descriptions in soil types, colour or depths are discovered during construction, this office should be notified immediately so that potential influence on the footings may be assessed.

The soil colours provided in the borelogs attached may vary with soil moisture content and individual interpretation, therefore colour alone should not be used to identify these soils.

Strength characteristics of soils often exhibit a large variation between wet and dry conditions. Soil characteristics of a soil profile are given on the soil conditions at the time of the investigation.

6 DISCLAIMER

This investigation has been carried out in goodwill and under the instructions of the City of Greater Bendigo. The investigation has been undertaken with the care and skill of competent personnel as defined within Geotechnical Testing Services quality system. It is not a comprehensive investigation but a guide to the conditions throughout the designated area.

The results from this investigation relate to the specified sites labelled throughout this document, and hence the information obtained may need to be extrapolated to the rest of the designated area. While care has been taken throughout this investigation, soil conditions can vary between each individual test site and at depths greater than that drilled during this investigation. Hence, if variations from this report are found during excavations/construction then Geotechnical Testing Services should be notified so it can be assessed and appropriate advice provided.

This document has been prepared for City of Greater Bendigo, and hence no responsibility or liability is being accepted to any third party, where any part of the report is used in either isolation or without consideration of the whole document. This document is not appropriate where there has been a significant change in the project or either for the specific needs of the reader.

Please, don't hesitate to contact the undersigned, if you require any further information or assistance.



Shane Hampton (BE (Hons))
Senior Geotechnical Engineer

Telephone: (03) 5441 4881
Mobile: 0437 496 215
Email: shaneh@geotestsouthern.com.au

APPENDIX



GTS GEOTECHNICAL TESTING SERVICES

GEOTECHNICAL INVESTIGATION

APPROXIMATE LOCATIONS: NOT TO SCALE

CLIENT: ADRIAN CUMMINS

PROJECT: ALBERT ROY RESERVE, EAGLEHAWK

GTS REF: 16C 0432

DATE: 3rd June 2016

ENGINEERING BOREHOLE LOG

GEOTECHNICAL TESTING SERVICES
PO Box 13, Strathdale 3550
Ph (03) 54414881 Fax (03) 5441 5089

Borehole no. 1
Sheet no. 1 of 1
Job no. 16C 0432

Client :	Adrian Cummins			Date:	3/06/2016
Project :	Albert Roy Reserve Redevelopment			Logged by:	BB
Location :	Eaglehawk				
Drill model :	Gemco HS7	Slope	90 deg	RL surface:	*Not measured*
Hole diameter :	100mm	Bearing	- deg	Datum :	-

Material Description	Depth (m)	Graphic log	Water	Moisture condition	Consistency density, index	Structure, additional observations	Notes Samples Tests	Method	Support
FILL: SAND (SP), grey, fine tailing sand				M	MD	FILL			
FILL: Gravelly Silty CLAY (CL), low plasticity, pale brown, mottled pale orange, pale yellow, pale grey, trace of mullock stone	0.50			D	MD-D	FILL			
	1.00								
FILL: Sandy Silty CLAY (CL), low plasticity, pale brown, trace of fine gravel				D-M	St-VSt				
	1.50								
SILTSTONE, highly weathered, pale brown, pale yellow	2.00			D	Moderate Rock				
	2.50								
	3.00								
BH1 - Terminated at 3.0 metres									
	3.50								
	4.00								

ENGINEERING BOREHOLE LOG

GEOTECHNICAL TESTING SERVICES
PO Box 13, Strathdale 3550
Ph (03) 54414881 Fax (03) 5441 5089

Borehole no. 2
Sheet no. 1 of 1
Job no. 16C 0432

Client :	Adrian Cummins			Date:	3/06/2016
Project :	Albert Roy Reserve Redevelopment			Logged by:	BB
Location :	Eaglehawk				
Drill model :	Gemco HS7	Slope	90 deg	RL surface:	*Not measured*
Hole diameter :	100mm	Bearing	- deg	Datum :	-

Material Description	Depth (m)	Graphic log	Water	Moisture condition	Consistency density, index	Structure, additional observations	Notes Samples Tests	Method	Support
FILL: Gravelly Sandy CLAY (CL), low plasticity, pale brown, mottled pale orange, pale yellow				D-M	F-St	FILL			
FILL: SAND (SP), grey, fine tailing sand 450mm	0.50			D	MD	FILL			
FILL: Gravelly Silty CLAY (CL-CI), low to medium plasticity, pale brown, mottled pale orange, pale grey, pale yellow	1.00			D	St - VSt	FILL			
	1.50								
FILL: Gravelly Silty CLAY (CL-CI), low to medium plasticity, pale brown	2.00			D	St	FILL			
SILTSTONE, highly weathered, pale brown, pale yellow	2.50			D	Moderate Rock				
	3.00								
BH2 - Terminated at 3.0 metres	3.50								
	4.00								

ENGINEERING BOREHOLE LOG

GEOTECHNICAL TESTING SERVICES
PO Box 13, Strathdale 3550
Ph (03) 54414881 Fax (03) 5441 5089

Borehole no. 3
Sheet no. 1 of 1
Job no. 16C 0432

Client :	Adrian Cummins			Date:	3/06/2016
Project :	Albert Roy Reserve Redevelopment			Logged by:	BB
Location :	Eaglehawk				
Drill model :	Gemco HS7	Slope	90 deg	RL surface:	*Not measured*
Hole diameter :	100mm	Bearing	- deg	Datum :	-

Material Description	Depth (m)	Graphic log	Water	Moisture condition	Consistency density, index	Structure, additional observations	Notes Samples Tests	Method	Support
FILL: Gravelly Silty CLAY (CL), low plasticity, brown 150mm				M	St	FILL			
FILL: SAND (SP), grey, fine tailing sand, some mullock/siltstone/clay	0.50			D	MD	FILL			
FILL: Gravelly Silty CLAY (CL), low plasticity, pale brown, mottled pale orange, pale yellow, off white, some siltstone	1.00			D	St	FILL			
SILTSTONE, highly weathered, pale brown, pale yellow	1.50			D	Soft Rock				
SILTSTONE, highly weathered, pale brown, pale yellow	2.00			D	Hard Rock				
	2.50								
BH3 - Terminated at 3.0 metres	3.00								
	3.50								
	4.00								

ENGINEERING BOREHOLE LOG

GEOTECHNICAL TESTING SERVICES
PO Box 13, Strathdale 3550
Ph (03) 54414881 Fax (03) 5441 5089

Borehole no. 4
Sheet no. 1 of 1
Job no. 16C 0432

Client :	Adrian Cummins			Date:	3/06/2016
Project :	Albert Roy Reserve Redevelopment			Logged by:	BB
Location :	Eaglehawk				
Drill model :	Gemco HS7	Slope	90 deg	RL surface:	*Not measured*
Hole diameter :	100mm	Bearing	- deg	Datum :	-

Material Description	Depth (m)	Graphic log	Water	Moisture condition	Consistency density, index	Structure, additional observations	Notes Samples Tests	Method	Support
FILL: GRAVEL (GW), grey, crushed rock 150mm				M	MD	FILL			
FILL: SAND (SP), grey, fine tailing sand				M	MD	FILL			
	0.50								
	1.00								
FILL: Gravelly Silty CLAY (CL), low plasticity, pale brown, pale orange				M	St	FILL			
SILTSTONE, highly weathered, pale brown, pale yellow	1.50			D	Hard Rock				
	2.00								
BH4 - Refusal at 2.4 metres	2.50								
	3.00								
	3.50								
	4.00								

DESCRIPTIVE TERMS
BOREHOLE/EXCAVATION LOG

Classification Symbol & Soil Name

Classification of material and its description is based on the Unified Classification System as referenced in AS1726 – 1993 Geotechnical Site Investigations, Appendix A. A summary of the more common terms is included within.

Particle Size Descriptive Terms

Name	Subdivision	Size
Boulders		>200mm
Cobbles		63 – 200mm
Gravel	Coarse	20 – 63mm
	Medium	6 – 20mm
	Fine	2.36 – 6mm
Sand	Coarse	0.6 – 2.36mm
	Medium	200 – 600 micron
	Fine	75 – 200 micron
Silt		2 – 75 micron
Clay		< 2 micron

Consistency of Cohesive Soils

Term	Undrained shear strength, s_u (kPa)	Field Guide
Very Soft (VS)	<12	A finger can be pushed well into the soil with little effort
Soft (S)	12 – 25	A finger can be pushed into the soil to about 25mm depth
Firm (F)	25 – 50	The soil can be indented about 5mm with the thumb
Stiff (St)	50 – 100	The surface of the soil can be indented with the thumb
Very Stiff (VSt)	100 – 200	The surface of the soil can be indented by thumb nail
Hard (H)	>200	The surface of the soil can be marked only with the thumbnail
Friable (F)	-	Crumbles or powders when scraped by thumbnail

Density of Granular Soils

Term	Density Index (%)
Very Loose (VL)	< 15
Loose (L)	15 – 35
Medium Dense (MD)	35 – 65
Dense (D)	65 – 85
Very Dense (VD)	> 85

Minor Components

Term	Field Guide	Proportion of Minor Component In:
Trace of	Presence just detectable by feel or eye	Coarse grained soils: <5% Fine grained soils: <15%
Some	Presence easily detectable by feel or eye	Coarse grained soils: 5-12% Fine grained soils: 15-30%

Moisture Condition

Dry (D) — Looks & feels dry. Cohesive soils are usually hard, powdery or friable. Granular soils run freely through the hand.

Moist (M) — Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere. Free water does not form.

Wet (W) — As for moist, but with free water forming on hands when remoulded.

Method

S Auger Screwing
D Auger Drilling
R Roller/tricone
W Washboring
N Natural Exposure
E Existing Excavation
B Blade/bucket
C Coring
H Hammer Drill

Support

***** Nil
C Casing
M Mud/polymer

Water

* Not observed
Observed water level (date shown)
Observed water inflow
Observed water outflow
R Refer to report for details

Notes, Samples, Tests

U63 Undisturbed sample, 63mm diameter
D Disturbed sample
N* Standard Penetration Test, (*) Sample Figure = results

Structures, Additional Observations

PP Pocket Penetrometer test (kPa)
DCP Dynamic Cone Penetrometer test (blows/100mm)

Surface

_____ Known boundary
- - - - - - - - - - Probably boundary
-?-?-?-?-?-?- Possible boundary

SHANE MUIR
CONSULTING ENGINEERS P/L
ABN 35 090 257 855
• CIVIL ENGINEERS • STRUCTURAL ENGINEERS
• PLANNING & PROJECT MANAGEMENT • GEOTECHNICAL

Client: CITY OF GREATER BENDIGO

SITE INVESTIGATION AND CLASSIFICATION AT BMX FACILITY, EAGLEHAWK.

REPORT No. 1607067 10th August, 2016.

GENERAL SITE CLASSIFICATION TO A.S. 2870–2011:

CLASS 'P' – PROBLEM SITE (Due to Fill & Trees)

Floor & Footing Details	Bearing Capacity	Soil Type	Recommended Minimum Footing Depth*
Slab (Waffle Pod)	50kPa	Class M	550mm to 2200mm
Slab (Raft)	100kPa	Class M	550mm to 2200mm
Stumps	100kPa	Class M	550mm to 2200mm
Strip Footings	100kPa	Class M	550mm to 2200mm

* *Actual founding depth are from the existing surface level at the time of investigation*

Note: This report consists of written sections, recommendations, borelogs and a locality plan. These elements are not to be interpreted independently. Any reproduction must be in full and only used for the project indicated in this report.

468 Hargreaves Street
Bendigo Vic 3550
Phone: (03) 5444 2741 Fax: (03) 5444 2751
www.smce.com.au

1.0 INTRODUCTION

We have undertaken a site investigation to assess foundation conditions for the proposed upgrade works at the BMX facility in Eaglehawk.

2.0 METHOD

Information was gathered in relation to this site enabling classification and recommendations in accordance with A.S. 2870-2011.

Three test holes were excavated on site with a 100mm dia. mechanical auger. Excavated materials have been logged and hand classified. Refer to borelogs for descriptions. For the encountered materials, and assuming normal seasonal soil moisture conditions only, we estimate the characteristic surface movements to be between **25mm and 40mm.**

3.0 SITE FEATURES

3.1 Vegetation:
The proposed building areas are partly covered with natural grasses, partly bare and crushed rock and some concrete paving. Several trees exist adjacent to the proposed building areas. No surface cracking was encountered.

3.2 Slope:
The site is generally flat with some slight grades to the West and North for surface water run-off. A steep stating ramp, sheds and toilet facilities currently exist on the site. Site cut/filling is possible on this allotment.

3.3 Drainage:
Surface water drainage is fair.

3.4 Rock:
Rock was encountered during excavations and recorded in the borelogs.

4.0 SOIL PROFILES

Typical soil profiles observed on this site consist of;

Various layers of crushed rock fill, gravely silty clay fill and gravely silty clay & rock fill from 450mm to 2000mm deep overlying pale brown gravely silty clay from 600mm to 2400mm in depth overlying pale brown weathered mudstone or pale brown/off white weathered siltstone from 1500mm to 3000mm.

Should sub-surface conditions vary substantially from those encountered in this report, this office must be notified immediately.

5.0 CLASSIFICATION

In accordance with A.S. 2870-2011, this site is classified as **Class 'P'– Problem Site (Due to Fill & Trees).**

6.0 RECOMMENDATION

We recommend that an Engineer's designed floor and footing system be adopted for the site. Once the site is stripped of vegetation and cleared, the surface should be proof rolled for soft spots. All load bearing beams on a Raft Slab or Waffle Pod Slab shall be founded a minimum of 550mm to 2200mm below existing surface level extending into the firm natural pale brown gravely silty clay or into the weathered rock. Refer attached borelogs for recommended minimum footing depths for current site conditions. Piers or blinding concrete may be placed beneath footings to achieve the minimum depths nominated. The Waffle pods shall be 225mm high pods.
Strip footings and stump pad footings shall be founded a minimum of 550mm to 2200mm below existing surface level extending into the same firm natural soil or weathered rock. Consideration must be given to the installation of a root barrier system based on the proposed building location and proximity to the trees, if being retained.

Attached to this report is an information sheet on the care and maintenance of foundations as provided by CSIRO (10-91).

7.0 ARTICULATION

Articulation in all brickwork shall be in accordance with the Cement and Concrete Association of Australia Technical Note TN61 and to relevant Building Codes of Aust.

8.0 TREES

Differential ground movement and significant soil moisture variations may be caused by the close proximity of trees to foundations or tree removal. To minimise the risk of damage, it is recommended that trees are not planted within 0.75 x mature height (Class M sites), 1.0 x mature height (Class H sites) and 1.5 x mature height (Class E sites).

9.0 DRAINAGE

The ground's surface adjacent to foundations should be graded away to prevent ponding of surface water. Where footings may be affected by seepage, the design engineer must consider the installation of subsurface drains.

Shane Muir Consulting Engineers P/L.

per.....
SHANE MUIR B.Eng. (Hons.) M.I.E.Aust.
EC 17729

SHANE MUIR CONSULTING ENGINEERS P/L.

468 Hargreaves Street, Bendigo, 3550. Ph.(03) 5444 2741 Fax.(03) 5444 2751

Date of Testing: 10/08/2016
Report No.: 1607067 Client: City of Greater Bendigo
Location: BMX Facility, Eaglehawk

BORE HOLE No.1

Graphic Log	Soil Profile (mm)	SOIL DESCRIPTION Soil Type, Color, Particle Characteristics	Moisture	Density Index	Remarks
	200	Crushed Rock Fill Brown/Grey	Moist	Firm	-
	450	Gravely Silty Clay Fill Brown	Slightly Moist	Soft/Firm	-
	550 600	***Recommended Minimum Footing Depth*** Gravely Silty Clay Pale Brown	Dry	Firm/Stiff	100-120kPa
	1500	Weathered Siltstone Pale Brown/Off White	Dry	Dense	200kPa+

BORE HOLE No.2

Graphic Log	Soil Profile (mm)	SOIL DESCRIPTION Soil Type, Color, Particle Characteristics	Moisture	Density Index	Remarks
	2000	Gravely Silty Clay & Rock Fill Brown	Slightly Moist	Soft/Firm	-
	2200 2400	***Recommended Minimum Footing Depth*** Gravely Silty Clay Pale Brown	Dry	Firm/Stiff	100-120kPa
	3000	Weathered Mudstone Pale Brown	Dry	Dense	200kPa+

SHANE MUIR CONSULTING ENGINEERS P/L.

468 Hargreaves Street, Bendigo, 3550. Ph.(03) 5444 2741 Fax.(03) 5444 2751

Date of Testing: 10/08/2016
Report No.: 1607067 Client: City of Greater Bendigo
Location: BMX Facility, Eaglehawk

BORE HOLE No.3

Graphic Log	Soil Profile (mm)	SOIL DESCRIPTION Soil Type, Color, Particle Characteristics	Moisture	Density Index	Remarks
	450	Gravely Silty Clay Fill Brown	Moist	Soft/Firm	-
	550	***Recommended Minimum Footing Depth***			
	750	Gravely Silty Clay Pale Brown	Slightly Moist	Firm/Stiff	100-120kPa
	1500	Weathered Mudstone Pale Brown	Dry	Dense	200kPa+

BORE HOLE No.4

Graphic Log	Soil Profile (mm)	SOIL DESCRIPTION Soil Type, Color, Particle Characteristics	Moisture	Density Index	Remarks
		N/A			

Locality Plan



July 2019
Monitoring Report

AECOM Imagine it. Delivered.

AECOM Australia Pty Ltd
Level 10, Tower Two
727 Collins Street
Melbourne VIC 3008
Australia
www.aecom.com

+61 3 9653 1234 tel
+61 3 9654 7117 fax
ABN 20 093 846 925

17 September 2019

Kylie Douglas
City of Greater Bendigo
PO Box 733

Bendigo VIC 3552

Dear Kylie

Compliance environmental monitoring at Eaglehawk Landfill Event - July 2019

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) is pleased to present the City of Greater Bendigo (Council) with the results of the environmental compliance monitoring event undertaken on 9 - 12 July 2019 at Eaglehawk Landfill. This event was conducted in accordance with our proposal dated 2 July 2019 and represents the first biannual environmental monitoring event of 2019.

Ongoing monitoring is required to comply with EPA Waste Discharge Licence 46490 (last amended in November 2017). Since 2012, site monitoring has been based on the requirements of the risk-based monitoring program (EMP) verified by the environmental auditor appointed pursuant to the Act (the latest revision was verified in 2017).

This letter-report summarises the scope of completed work, the recorded monitoring results and comments on conditions of monitoring infrastructure. The results are briefly discussed with respect to adopted environmental quality objectives and recommendations are made with regard to future monitoring, where considered necessary. A summary of compliance assessment with the relevant licence conditions is also provided.

There were no OHS issues during the monitoring event.

Attachments:

1. Figures
2. Field Records
3. QAQC
4. Laboratory Reports
5. Tabulated Water Results
6. Tabulated Gas Results
7. Plates

2.0 Scope of Works and Methodology

2.1 Water Monitoring

The works were undertaken in accordance with methodologies outlined in the EMP (AECOM, 2017).

Water monitoring locations are illustrated in **Figure F1** in **Attachment 1**. Selected water monitoring location photos are presented in **Attachment 7**.

The compliance monitoring tasks completed in February and July 2019 are summarised in Table 1 below. This table can be referred to in preparation of the Annual Performance Statement (APS) for the landfill, in relation to compliance with EMP requirements.

The table also provides a summary of groundwater, leachate, stormwater and surface water monitoring network details and relevant EMP requirements and deviations that occurred during 2019 monitoring events.

Monitoring requirements that were not required or could not be implemented due to encountered conditions in February or July 2019 are marked as NA (Not applicable).

Table 1 February and July 2019 Scope and Methodology – Compliance with Water Monitoring Requirements

Monitoring Requirements									EMP Compliance Comments	
Locations	Location details				Water Levels / Flow rate Frequency		Sampling Frequency			
					Feb-2019	Jul-2019	Feb-2019	Jul-2019	Feb-2019	Jul-2019
Groundwater monitoring bores:	**Date Installed**	**TOC (mAHD)**	**Depth (mbgl)**	**Screen Interval (mbgl)**	6-monthly		6-monthly			
MB02	1993	221.72	16	10 – 16	5/2/19	12/7/19	5/2/19	12/7/19	Monitoring data for MB02 mislabelled as MB09; field and lab data were entered and assessed under the correct bore number	COGB cut lock
MB03	2000	223.34	16	10 – 16	4/2/19	12/7/19	4/2/19	12/7/19	Steel Gatic lid was missing; hole covered with stone	Steel Gatic lid missing; hole covered with stone
MB04	1993	236.82	22	16 – 22	5/2/19	12/7/19	5/2/19	12/7/19	Ok	
MB05	1993* Extended	230.31* 249.34	16* 35.4	10 – 16* 29.4 - 35.4	5/2/19	11/7/19	5/2/19	11/7/19	Location of the bore requires confirmation	Location of the bore requires confirmation
MB06	2005	248.04	22.5	16.5 – 22.5	4/2/19	10/7/19	4/2/19	10/7/19	Ok	Ok
MB07	2010	234.88	35	29 – 35	5/2/19	10/7/19	5/2/19	10/7/19	Access impeded by stormwater drain	Ok
MB08	2010	247.16	35.8	29.8 – 35.8	4/2/19	10/7/19	4/2/19	10/7/19	Bore cap was missing	Bore cap was missing
MB09	2010	222.42	35.9	29.9 – 35.9	5/2/19	12/7/19	5/2/19	NA	Monitoring data for MB09 mislabelled as MB02; field and lab data were entered and assessed under the correct bore number	COGB cut lock, was not sampled due to tubing stuck in well
MB10	2015	244.88	46.5	40.0-46.5	5/2/19	11/7/19	5/2/19	11/7/19	Ok	Ok
Leachate sumps:					6-monthly		6-monthly			
LS_1 Cells 1-2					5/2/19	10/7/19	5/2/19	10/7/19	Samples from sump LS_1 were inadvertently labelled LO_1. Data was entered and assessed under the correct location ID. Grab sample collected (using a dedicated bailer)	Ok
LS_2 Cells 3A and 3B					5/2/19	10/7/19	NA	NA	Sump LS_2 was dry (sludge) and too tall to safely sample (Plate 8 in Attachment 7)).	Sump LS_2 could only be gauged as there was no bailer access
LS_3 Cell 5					5/2/19	10/7/19	NA	NA	Sump LS_3 in Cell 5 was dry. Protective outer casing damaged (Plate 9 in Attachment 7))	Sump LS_3 was dry
Leachate monitoring bores (Cell 1):	**Date Installed**	**Construction details**			6-monthly		6-monthly			
LB01	2015	• Total Drilled Depth 15.0 • Depth After Backfill** 9.9 • Screen Interval 4 – 9.9			5/2/19	10/7/19	NA	NA	Bore dry at 10 mbTOC	Bore dry at 10 mbTOC

Monitoring Requirements							EMP Compliance Comments	
Locations	Location details		Water Levels / Flow rate Frequency		Sampling Frequency			
			Feb-2019	Jul-2019	Feb-2019	Jul-2019	Feb-2019	Jul-2019
LB02	2015	• Total Drilled Depth 16.0 • Depth After Backfill** 14.0 • Screen Interval 5 – 14.0	5/2/19	10/7/19	5/2/19	10/7/19	Gauged and sampled (using a dedicated bailer).	Gauged and sampled
LB03	2015	• Total Drilled Depth 29.0 • Depth After Backfill** 24.95 • Screen Interval 8 – 24.95	5/2/19	10/7/19	NA	NA	Bore dry at 26.3 mbTOC	Bore dry at 25.7 mbTOC
LB04	2015	• Total Drilled Depth 22.0 • Depth After Backfill** 19.95 • Screen Interval 8 - 19.95	5/2/19	10/7/19	NA	NA	Bore dry at 21.1 mbTOC	Bore dry at 20.4 mbTOC
Leachate pond			Freeboard (frequency TBC)	10/7/19	Annually NA	10/7/19	New gauge has been installed in the leachate pond; reading taken (Plates 5 and 6 in Attachment 7). Sampling is due in winter	Gauged and sampled
Leachate outflows LO_1 and LO_2			6-monthly (flow) NA	NA	6-monthly NA	NA	Leachate outlets LO_1 and LO_2 and leachate pond were partially submerged, and no outflow was apparent (Plates 5 and 7 in Attachment 7)).	Leachate outlets LO_1 and LO_2 were submerged
Stormwater:			6-monthly (flow)		Annually and/or if flows			
SW01	Doctors Gully Creek west of the site		NA	NA	NA	NA	Periodic sampling not required in February	SW01 not flowing during event.
SW02	Stormwater dam onsite		NA	10/7/19	NA	10/7/19	Periodic sampling not required in February. No overflow observed (Plate 4 in Attachment 7)	Sampled on 10/7/19.
SD01	Main SW offsite drainage – at perimeter		5/2/19	11/7/19	NA	11/7/19	Dry (Plate 1 in Attachment 7)	Sampled on 11/07/2019 at ~10L/min***, observed to be flowing for brief period
SD02A	NW offsite drainage – at perimeter		5/2/19	NA	NA	NA	Dry (Plate 2 in Attachment 7)	Very low flow observed on 11/7/19, not enough to sample
SD03	NE offsite drainage – at perimeter		NA	12/7/19	NA	12/7/19	Dry	Sampled on 12/07/2019 at ~10L/min***
SD04	SW offsite drainage – at perimeter		NA	NA	NA	NA	Dry (Plate 3 in Attachment 7)	Dry
SD05	NW offsite drainage – at perimeter		NA	NA	NA	NA	Dry	Very low flow observed on 11/7/19, not enough to sample
SD06	Beginning of Devonshire Gully - offsite		NA	11/7/19	NA	11/7/19	Dry	Sampled on 11/07/2019 at ~5L/min***, observed to be flowing for brief period
SD07#	Doctors Gully Creek at Bracewell Road (eastern side) - offsite		NA	NA	NA	NA	Dry	Very low flow observed on 11/7/19, not enough to sample

Monitoring Requirements						EMP Compliance Comments	
Locations	Location details	Water Levels / Flow rate Frequency		Sampling Frequency			
		Feb-2019	Jul-2019	Feb-2019	Jul-2019	Feb-2019	Jul-2019
QA/QC Samples	• One field duplicate (intra-laboratory sample) per sampling event, • One field triplicate (inter-laboratory sample) per sampling event, • One rinsate blank per sampling day (estimated 2); • One field blank per sampling event.					• One (1) intra-laboratory duplicate (QC02) (field duplicate) collected from bore MB06; • One (1) inter-laboratory duplicate (field triplicate) (QC03) collected from bore MB06; • Two (2) rinsate blanks (QC01 collected off a glove and QC04 collected off the water level dip meter). Both samples did not report detects above LORs. • Field blank not collected (another rinsate blanks collected instead, refer above.)	• One (1) intra-laboratory duplicate (QC01) (field duplicate) collected from bore MB07; • One (1) inter-laboratory duplicate (field triplicate) (QC02) collected from bore MB07; • Three (3) rinsate blanks (QC04 collected off the pump, QC05 collected off a water level dip meter and QC06 collected off the pump). • One (1) field blank collected (QC03).
Water testing and analysis	Field Parameters: pH, electrical conductivity (EC), redox potential, dissolved oxygen (DO) concentration and temperature. Laboratory analysis: • Major ions (Ca, Mg, Na, K, alkalinity, SO4, Cl); • TDS • Nitrate as N, nitrite as N, ammonia as N, TKN, total phosphorus • *Metals (**all filtered**):* As, Cd, Cu, Cr, Ni, Pb, Zn, Fe and Mn • BOD, COD and TOC Total and free cyanide					Ok	Ok

* *These depths correspond to the time when the bore was drilled and constructed. Casing has since been extended to keep up with waste filling.*

** *In April 2016 leachate bores LB01-LB04, which had been inadvertently drilled through the base of the landfill, were backfilled to the base of waste (by cement grouting tremie method; both drilling and backfilling by an external consultant other than AECOM).*

*** *Stormwater flow is estimated using a bucket test.*

\# *Water is only sampled at monitoring location SD07 if there is any water discharge going offsite.*

Sampling was performed in accordance with the requirements of EPA Publications 669 “Groundwater Sampling Guidelines” (EPA, 2000) and IWRG 701 “A Guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes” (EPA, 2009), and the site-specific monitoring program. Copies of field sampling sheets and equipment calibration certificates are presented in **Attachment 2.**

Standing water levels in monitoring bores and sumps were measured using an electronic water level meter prior to any disturbance by sampling. Micropurge sampling technique was used to sample all groundwater monitoring wells. Grab samples of leachate were collected using disposable bailers (where leachate was present). Grab samples of surface water were collected using a sterile container, rinsed with the surface water sample prior to collection.

During purging of each bore, field water quality parameters including pH, temperature, dissolved oxygen (DO), electrical conductivity (EC) and reduction/oxidation potential (redox) were recorded. This was to ensure stabilised groundwater conditions were achieved during purging and waters representative of formation were sampled. Field water quality parameters of collected leachate and surface water were also recorded.

All collected samples were placed into bottles containing the appropriate preservatives as provided by the analytical laboratory, and transported to the laboratory in the chilled, insulated containers within the required holding times.

Sample transfer to the laboratory was undertaken in accordance with AECOM Chain of Custody procedures. The samples were analysed at ALS (primary laboratory) and Eurofins (secondary laboratory), which are accredited by the National Association of Testing Authorities (NATA) for the required analytical suite.

2.2 LFG Monitoring

The works were undertaken in accordance with methodologies outlined in the EMP (AECOM, 2017). In addition to the verified EMP scope requirements, monitoring of the (2018 installed) offsite soil gas monitoring bores BH29-BH40 as well offsite services in the near vicinity of the landfill was carried out in July 2019.

LFG monitoring locations, including bores, sumps, services, building and structures, and emissions walkover grid, are shown in **Figures F2** to **F4** in **Attachment 1**.

The compliance monitoring tasks completed in July 2019 are summarised in Table 2 below. The table also provides a summary of soil gas and LFG monitoring network details and relevant EMP requirements and deviations that occurred during July 2019 monitoring event.

Table 2 July 2019 Scope and Methodology – Compliance with LFG Monitoring Requirements

Monitoring Requirements - Soil gas monitoring bores						2019 EMP Compliance Comments	
Bore ID	Distance to landfill, m	Screen Interval, mbgl	Equipment	Parameters	Frequency	February	July
BH01	~30	1-10	Extractive landfill gas analyser detection limit 0.1%v/v	Flow, differential/ or relative pressure, atmospheric pressure, methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulphide	6-monthly (**9 July 2019**)	Ok	5.4%v/v CO_2
BH02	~30	1-3				Ok	Ok
BH03	30-35	1-10				Ok	Ok
BH04	30-35	1-3				Ok	Ok
BH05	~35	1-10				Ok	Ok
BH06	~35	1-3				Ok	Ok
BH07	20-25	1-10				Ok	Ok
BH08	20-25	1-3				Ok	7.4%v/v CO_2
BH09	~20	1-10				Ok	9.3%v/v CO_2
BH15	>150	1-10				Ok	Gas cap missing
BH17	25-30	1-10				Ok	Ok
BH18	15-20	1-10				Ok	Ok, not subject to compliance
BH19	<10	1-10				Ok	Ok, not subject to compliance
BH20	<15	1-14				Landfill odour	Ok, not subject to compliance

Monitoring Requirements - Soil gas monitoring bores						2019 EMP Compliance Comments	
BH21	~90 (Cell5); ~140 (Cell 1)	1-7				Ok	13.1%v/v CO_2
BH22	<10	1-4.2				Ok	Ok, not subject to compliance
BH23	50-55	1-5.1				Gas tight cap loose (tightened when sampled)	Ok
BH24	>150	1-10				Field record mislabelled as BH13	Ok
BH25	10-15	1.5-12				Ok	Ok, not subject to compliance
BH26	10-15	1.5-12				GasClam	Ok, not subject to compliance
BH27	<20	1-11				Ok	Ok, not subject to compliance
BH28	100 (Cell 5) >140 (Cell 3B)	1-10				Ok	5.8%v/v CO_2
BH29	30	1.5-15				GasClam	4m water present: SWL 11.530mbTOC, TD 15.69mbTOC
BH30	330	1.5-15				GasClam	6.0%v/v CO_2
BH31	160	1.5-15				Ok	8.0%v/v CO_2
BH32	70	1.5-15				Minor water present: SWL 15.275mbTOC, TD 15.85mbTOC	8.8%v/v CO_2

Monitoring Requirements - Soil gas monitoring bores						2019 EMP Compliance Comments	
BH33	125	1.5-15				5m water present: SWL 10.92mbTOC, TD 15.86mbTOC	4m water present: SWL 11.803mbTOC, TD 15.69mbTOC
BH34	190	1.5-15				Ok	9.6%v/v CO_2
BH35	165	1.5-15				Ok	6.2%v/v CO_2
BH36	335	1.5-15				Ok	Ok
BH37	320	1.5-15				Ok	Ok
BH38	65	1.5-15				Ok	Ok
BH39	160	1.5-15				Ok	5.8%v/v CO_2
BH40	260	1.5-15				Ok	No Cap or lock on bore, not sampled
MB06 (if dry)	~30	16.5-22.5				>2m water present – LFG not sampled	>2m water present – LFG not sampled

Note: Bore IDs highlighted in bold apply to bores adopted for compliance assessment.

Monitoring Requirements - Cap surface				2019 EMP Compliance Comments	
Location	Equipment	Parameters	Frequency	February	July
Surface sweep (on a 25m grid basis)	Low concentration gas detector (detection range of 0 to 10,000 ppm)	Methane	6-monthly	Covered majority of final and interim cover at 25 m intervals over passable areas, i.e. excluding steep slopes, stockpiles, etc. Included Cell 3B / Cell 5 liner junction.	Covered majority of final and interim cover at 25 m intervals over passable areas, i.e. excluding steep slopes, stockpiles, etc. Included Cell 3B / Cell 5 liner junction.

Monitoring Requirements - Buildings, structures and service trenches					2019 EMP Compliance Comments	
Location		Equipment	Parameters	Frequency	February	July
B1	Brick (Nth side)	Low concentration gas detector (detection range of 0 to 10,000 ppm), Extractive landfill gas analyser detection limit 0.1%v/v	Atmospheric pressure, methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulphide	6-monthly (**9 July 2019**)	Ok	Ok
B2	Brick (East side)				Ok	Ok
B3	Recycling centre (South side)				Ok	Ok
B4	1st aid room (Recycling centre South side)				Ok	Ok
B5	Inside site office/smoke room				Not in EMP 2017	Not in EMP 2017
B6	Shed Site Office (Ecocentre)				Not in EMP 2017	Not in EMP 2017
B7	New portable (lunchroom/office)				Not sampled / not in EMP 2017	Not in EMP 2017
B8	New portable (toilets)				Not sampled / not in EMP 2017	Not in EMP 2017
Se1	SW drain (West of site office)				Recorded as Se2	Ok
Se2	SW pit (Site entrance)				Duplicate entry (Se1)	Ok
Se3	Telephone line (Nth-East corner brick building)				Ok	Ok
Se4	Drain gatic brick building (East side)				Ok	Ok
Se5	Water mains service pit				Ok	Ok
Se6	Telstra pit (West of garages)				Ok	16.3%v/v CH_4 detected
Se7	Open steel gatic (West of garages)				Ok	Ok
Se8	SW pit (West of site building)				Ok	Ok
Se9	SW pit (SW of weighbridge / west roadside)				Not in EMP 2017	Not in EMP 2017
Se10	SW pit (SW of weighbridge / east curb near electric box)				Not in EMP 2017	Not in EMP 2017

Monitoring Requirements - Buildings, structures and service trenches					2019 EMP Compliance Comments	
Se11	SE downpipe (Recycling shed)				Ok	Ok
Se12	SW downpipe (Recycling shed)				Ok	Ok
Se13	NW downpipe (Recycling shed)				Ok	Ok
Se14	NE downpipe (Recycling shed)				Ok	Ok
Se15	Pit next to wheel wash				Not in EMP 2017	Not in EMP 2017
Se16	SW drain entrance (Ecocentre)				Ok	Ok
Se17	SW drain carpark (Ecocentre)				Ok	Ok
Se18	SW pit exit (Ecocentre)				Ok	Ok
Se19	SW drain exit (Ecocentre)				Ok	Ok
Se20	SW drain (near timber frames) (Ecocentre)				Ok	Ok
Se21	Shed downpipe (Ecocentre)				Ok	Ok
Se22	Telstra Pit 2 (South of office, SE of wheel wash)				Not in EMP 2017	Not in EMP 2017
St1	Exit Weighbridge (North)				Ok	Ok
St2	Entry Weighbridge (North)				Ok	Ok

Monitoring methodologies were based on general requirements of EPA Publication 1684 "Landfill Gas Fugitive Emissions Monitoring Guidelines" (EPA, 2018), and in accordance with the site-specific EMP (revision, AECOM, 2017). Copies of field records and equipment calibration certificates are presented in **Attachment 2**. The instruments (GA5000, Inspectra Laser) were calibrated, operated and maintained according to the manufacturer's instructions.

The previously utilised compliance assessment approach has been amended to reflect the most recent EPA advice (Pub. 1684, 2018). This applies to surface emission monitoring assessment:

EPA will accept an average of the surface emissions data to be used for reporting compliance where the maximum concentration below is not exceeded:

- *Intermediate cover – a mean of 200 ppm with no individual result exceeding 500 ppm, except at 50 mm from penetrations where the 1000 ppm gas action level must be met.*
- *Final cap – a mean of 100 ppm with no individual result exceeding 200 ppm.*

In relation to subsurface geology monitoring, EPA Pub.788.3 (2015) advises that to ensure validity of the landfill gas monitoring data, monitoring bores should be located at least 20m from the boundary of the landfilled waste. Due to space restrictions at some landfill boundary locations at Eaglehawk landfill, there is a number of bores located closer than 20m – these have been excluded from the compliance assessment in this report, while used to assess soil gas conditions in the vicinity of the landfill.

EPA also provides guidance for determining background ground gas concentrations and advises that landfill perimeter monitoring bores should not be used. Previously, average concentrations in bores with no elevated concentrations of carbon dioxide were used as background, complemented by soil gas concentrations in the relatively remote off-site bore BH28, suggested as a background bore by the LGRAP (Tonkin, 2016). The latest verified EMP (AECOM, 2017) adopted the concentration of 3.5%v/v of carbon dioxide as a background. In 2018, AECOM conducted a statistical assessment of background soil gas concentrations data, which suggested that background concentrations of carbon dioxide are relatively elevated ($\geq$3%) in the vicinity of the landfill, potentially attributed to natural processes in the underlying geology.

EPA guidelines in relation to LFG monitoring (Publication 1684, 2018) specify a range of meteorological and environmental conditions that have significant potential to impact the collection of representative monitoring data. EPA advises that if a monitoring event must be completed during some of these conditions, these issues should be taken into consideration during subsequent assessment of the data.

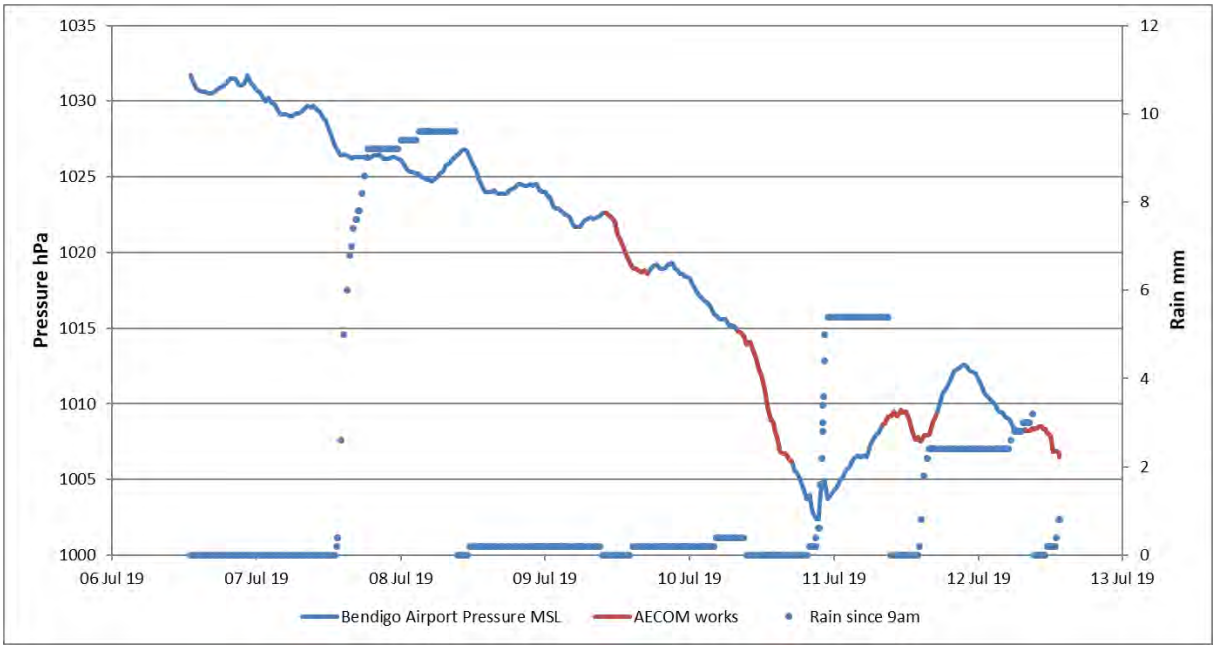
Weather parameters prior to and during the monitoring event were downloaded from the BOM website for Bendigo Airport station 081123. Changes in atmospheric pressure and precipitation based on the downloaded data are illustrated in **Figure 1**. Assessment of weather and environmental conditions during July 2019 event against minimum EPA requirements is summarised in Table 3 below.

Table 3 July 2019 LFG monitoring event - suitability of weather conditions

EPA recommendations	July 2019 observations
Rapid or long-term fluctuations of atmospheric pressure immediately before or during monitoring (avoid sharply rising or very much higher than the average atmospheric pressure).	Monitoring event was carried out following several days of falling barometric pressure with some semi-diurnal fluctuations. Barometric pressure continued to fall over the days of monitoring (9th and morning of the 10th of July).
Heavy rainfall and/or any other meteorological or environmental conditions that may result in saturation and temporary reduction of the gas permeability of the landfill cover and render obtained data unrepresentative (false lows).	There was rainfall recorded the day prior to the monitoring event (~9mm). Minor rainfall was also observed during the monitoring (<1mm). The cap surface was observed to be relatively dry thus not limiting potential vertical LFG emissions.

EPA recommendations	July 2019 observations
Wind speeds in excess of 10 km/hr (approx. 2.8 m/s) cause dilution of surface LFG emissions and lead to false lows	Wind conditions were measured periodically at 50mm above ground during the walkover with recorded speeds of 0.5 m/s to 2.7 m/s. These conditions are below the EPA recommended speed of 2.8 m/s (10 km/h).
Avoid frost, excessive vegetation, and effect of temperature changes on instrumentation.	Large areas of excessive vegetation and stockpiles were observed over the cap, monitoring points were taken in between these areas. Temperatures during walkover varied from 10.4°C and 14.0°C on the 9th and 7.7°C and 10.1°C on the 10th of July. This variation in temperature is not considered to have any adverse impact on the equipment used.

Figure 1 Bendigo Airport Weather Station 081123, July 2019 Monitoring Event



3.0 Groundwater and Leachate Monitoring Results

Copies of field notes are presented in **Attachment 2**. QAQC assessment is presented in **Attachment 3**. Laboratory reports are presented in **Attachment 4**. Tabulated historical monitoring records are presented in **Attachment 5**.

3.1 Data Quality

Ionic balances reported by the laboratories were acceptable (below 10%) in all samples except SD03 (11.7%). Comparisons between field EC and laboratory TDS were mostly consistent (TDS/EC generally around 0.6). The reported concentrations of TDS and sums of major ions (sodium, magnesium, calcium, potassium, chloride, sulphate and alkalinity) were generally consistent (TDS/ sum of Major Ions average of 0.92). TDS in stormwater exhibited higher ratio results in comparison to groundwater, leachate and surface water (TDS/EC between 0.8-1.3 and TDS/ sum of Major Ions between 1.4-2.1) which is likely the result of turbidity from the high rainfall event.

Samples were correctly preserved, chilled with ice and received at the primary laboratory at temperatures within the recommended range (≤6°C). Secondary laboratory noted that random sample temperature was 7°C. All samples were analysed within holding times.

Three rinsate blanks (QC04, QC05 and QC06) were collected during the July 2019 sampling event. All analytes were reported to be below the respective Limits of Reporting (LOR) (tabulated in **Attachment 3**) except for:

- QC05 for Bicarbonate Alkalinity as CaCO3 reported at 2 mg/L
- QC05 for Total Alkalinity as CaCO3 reported at 2 mg/L
- QC05 for Bicarbonate as HCO3 reported at 2 mg/L
- QC05 for Total Anions reported at 0.06 meq/L
- QC05 for Sulfate (as SO4-) (Filtered) reported at 1 mg/L
- QC06 for Sodium (Filtered) reported at 8 mg/L
- QC06 for Total Cations reported at 0.35 meq/L

One field blank (QC03) was sampled at a frequency of one in every 20 samples. All analytes were reported to be below the respective Limit of Reporting (LOR) (tabulated in **Attachment 3**) except for:

- QC03 for Bicarbonate Alkalinity as CaCO3 reported at 4 mg/L
- QC03 for Total Alkalinity as CaCO3 reported at 4 mg/L
- QC03 for Total Anions reported at 0.08 meq/L

One set of field duplicate samples was collected at MB07 (field triplicate analysed by the secondary laboratory Eurofins and field duplicate analysed by the primary laboratory ALS). The calculated Relative Percentage Difference (RPD) values for the duplicate and triplicate samples were assessed applying a widely used validation criteria, whereby high RPDs are not considered to be significant for sample concentrations less than 10 times the Limit of Reading (LOR); RPDs not exceeding 50% are acceptable for sample concentrations between 10 and 20 times the LOR; and RPDs of 30% is the compliance criterion for concentrations above 20 times the LOR.

The calculated RPDs are presented in **Attachment 3**.

Overall, the data was considered of a quality suitable for assessment.

3.2 Groundwater and Leachate Levels

Table 4 July 2019 Gauging Results

Location	Date	Reference Elevation TOC (mAHD)	Depth to Water (mbTOC)	Total Depth (mbTOC)	Water Elevation (mAHD)	Comments
LB01	10/07/2019	248.781	Dry	10.01	Dry	Not locked, stick up lid broken off, mud on probe
LB02	10/07/2019	249.215	13.32	15.22	235.90	Good condition, spiders, locked, leachate odour
LB03	10/07/2019	257.171	Dry	26.32	Dry	strong leachate odour, good condition, lock stiff, stick up wobbly, sediment on probe
LB04	10/07/2019	256.486	Dry	21.13	Dry	leachate odour, wobbly stick up, stiff lock
LS_1	10/07/2019	223.408	3.92	4.70	219.49	bailer ok
LS_2	10/07/2019	NKN	4.77	NM		can gauge only, no bailer access

Location	Date	Reference Elevation TOC (mAHD)	Depth to Water (mbTOC)	Total Depth (mbTOC)	Water Elevation (mAHD)	Comments
LS_3	10/07/2019	NKN	2.95	2.96		minor water, large PVC cap removed
MB02	12/07/2019	221.72	13.52	16.11	208.20	Lock broken off
MB03	12/07/2019	223.35	11.63	14.48	211.72	no gatic lid, hidden under rock
MB04	12/07/2019	236.82	5.77	22.56	231.05	
MB05	11/07/2019	249.338	23.01	35.12	226.33	PVC wobbly, No lock
MB06	10/07/2019	248.039	20.47	23.66	227.57	Good condition locked
MB07	10/07/2019	234.88	20.75	35.12	214.13	Good condition, locked, tubing in well
MB08	10/07/2019	247.161	21.02	35.86	226.14	Good condition, no well cap, locked
MB09	12/07/2019	222.417	14.97	36.29	207.45	Lock broken off, tubing stuck in well
MB10	11/07/2019	244.875	29.16	47.42	215.72	Good Condition, tubing left in well

Hydrographs for the site groundwater monitoring bores and leachate observation bores are illustrated in **Figure 2** (1993-2019) and **Figure 3** (recent 2015-2019 period). The hydrographs show that groundwater elevations in bores recovered in 2012 after a long-term decline and have remained generally stable.

Based on the July 2019 results, groundwater elevations in most of the bores have remained relatively unchanged, exhibiting a slight decline since February 2019 (average 0.43m). The trend is consistent across all monitoring groundwater locations except for bore MB10, which continued to rise (by about 1.3m since February 2019). The reason for this atypical behaviour is unclear (noting that in August 2019, groundwater is now present in LFG bore BH29 adjacent to MB10).

Consistent historical differences between groundwater elevations in bores MB07-MB09 and the shallower nearby bores MB02, MB03 and MB06, suggest that groundwater monitored by the deeper bores is not well connected to that monitored by the shallow bores. Historically groundwater elevations in the relatively paired bores MB06/MB08 and MB02/MB09 have indicated a potential downward gradient (groundwater elevations in the deeper bores MB08 and MB09 remained lower than in the shallow bores MB06 and MB02, respectively). Separate groundwater contours have therefore been produced for shallow and deep bores. Groundwater elevations reported for MB10 have been included with the deep bores, although its atypical behaviour suggests this bore may be monitoring separate hydrogeological conditions relative to the other site bores.

Groundwater elevations and inferred contours are included in **Attachment 1**, **Figure F5A** for shallow bores MB02-MB06, and groundwater elevations for the deeper bores MB07-MB10 are provided in **Attachment 1**, **Figure F5B**. The inferred groundwater flow direction for shallower and deeper portions of the aquifer system based on gauging data from July 2019, are anticipated to have remained generally to the west / south-west, consistent with the catchment topography. Inclusion of MB10 with the deep bores resulted in an inferred flow direction to the south and east, potentially reflecting mine dewatering along the New Chum anticline works.

Currently there are no finalised compliance target leachate elevations for assessment; these need to be confirmed by frequent gauging to account for potential seasonal variations. The EMP (Revision 2017) includes a requirement for monthly gauging of leachate bores LB01-LB04 for a period of one to

two years to capture seasonal variations (subject to review as part of the 6-mothly monitoring assessments).

All leachate bores except LB02 remained dry, in July 2019 only minor water level change at LB02 (<0.05m) was recorded. These results are consistent with previous monitoring; leachate head (1.9m) over the base of waste in this bore remained within the historical limits (0.9-2.8m). In absence of a maximum leachate elevation objective for this bore, the relatively stable hydrograph and lack of evidence of groundwater contamination by leachate, it is considered that the leachate level over the base of waste recorded in July 2019 (1.744m) in LB02 is acceptable.

In July 2019, groundwater was also detected in Landfill Gas monitoring bores BH29 (11.53 mbtoc, located adjacent to MB10) and at BH33 (11.803 mbtoc, located west of MB03). Depth to groundwater at BH33 is consistent with groundwater depth at MB03. Groundwater was also observed at BH33 in August 2018, the decline in water levels between 2018 and 2019 at BH33 is consistent with declines observed in other groundwater screened bores. Depth to groundwater at BH29 is significantly shallower than that observed in MB10, which is screened at a greater depth.

The results are consistent with the conclusions reached in February 2019. Based on data collected in July 2019, leachate levels in the landfill do not appear to have increased. Considering the low permeability of the underlying bedrock and depths to groundwater near Eaglehawk landfill (between 5-20 mbgl), it is considered that there remains a low potential for leachate migration to groundwater. It is anticipated that leachate levels, which are currently stable, may reduce in time with site closure.

Figure 2 Hydrographs – Historical

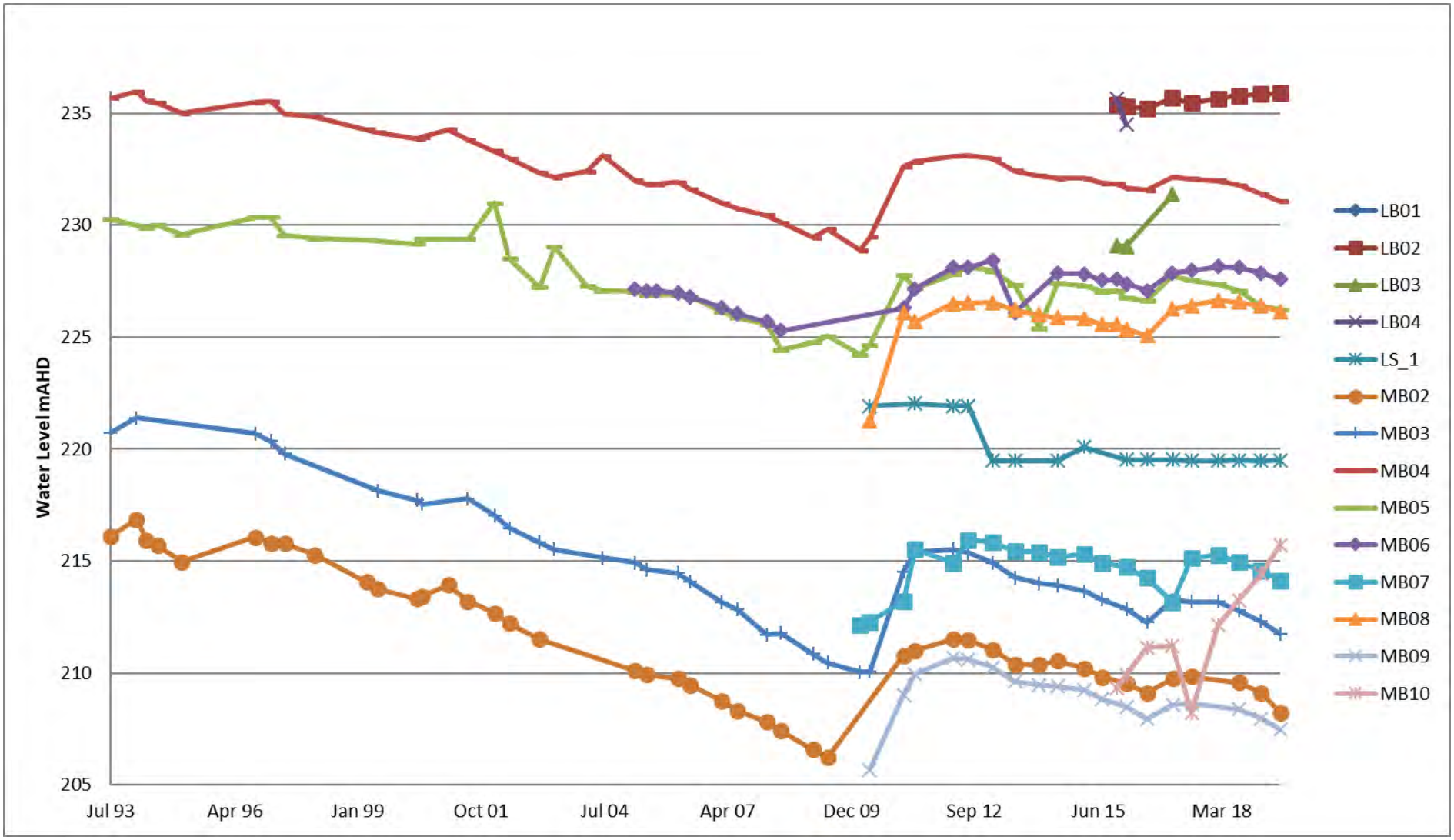
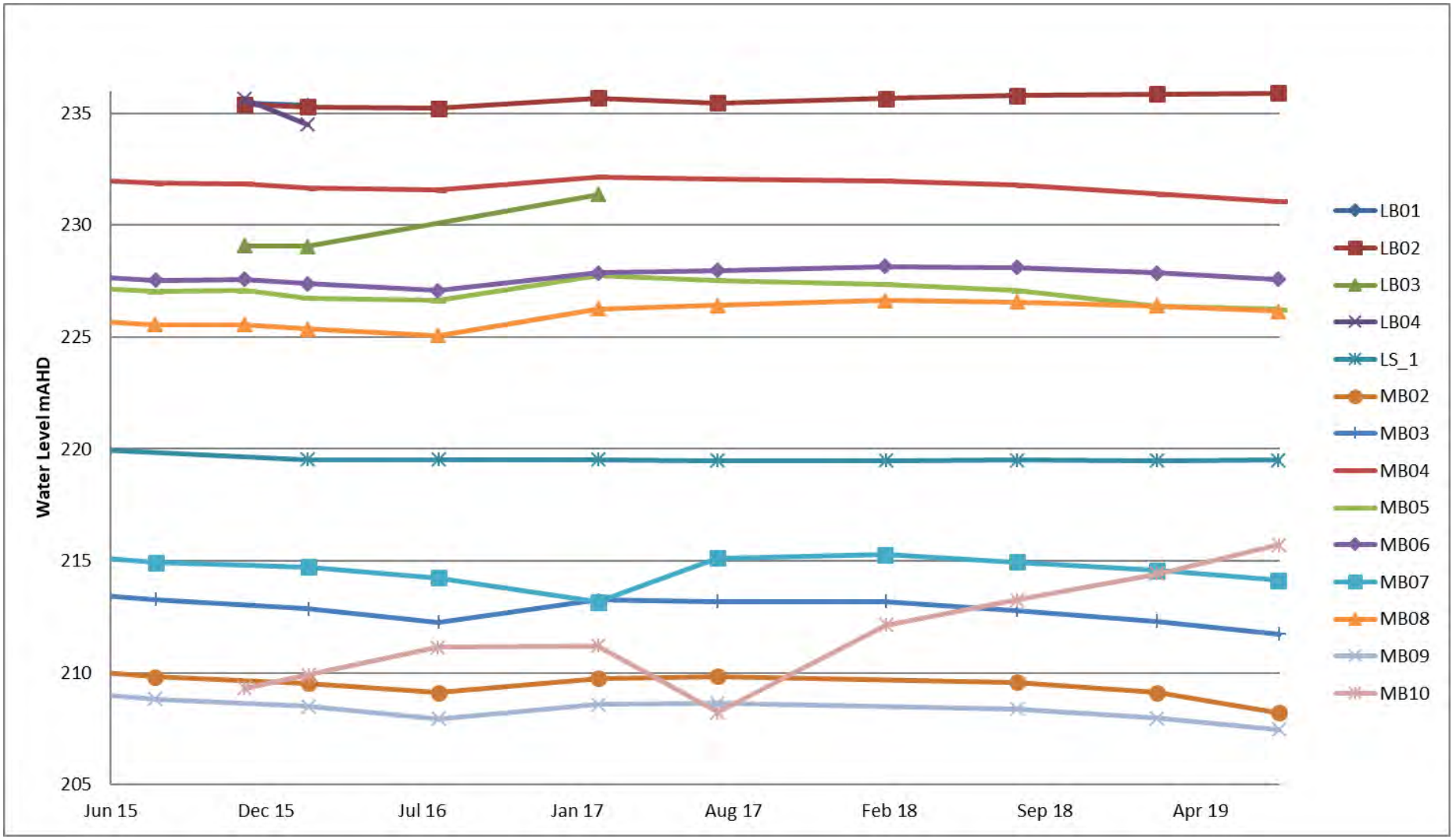


Figure 3 Hydrographs – June 2015 – July 2019



3.3 Water Chemistry

Tabulated results of the February 2019 monitoring event and historical results are presented in **Attachment 5**. Water quality charts are presented in **Attachment 6**.

Field Parameters

Based on July 2019 monitoring results, groundwater sampled from bores at Eaglehawk Landfill is characterised by generally neutral pH conditions (6.25 – 7.08), relatively high EC salinities (7,886 – 16,165 µS/cm) and generally oxidising conditions.

Field groundwater quality conditions appeared consistent with historical results for the respective bores. Previously anomalous pH result at MB09 (pH of 5.19 in February 2019) could not be confirmed as MB09 was unable to be sampled in July 2019.

A significant decrease in temperature at MB05 was observed in July 2019. Bore MB05 is located under the landfill and has historically had elevated temperatures (>25ºC) since 2003.

Leachate properties recorded for samples from Cell 1 (sump LS_1 and bore LB02) exhibited a neutral pH (7.02 – 7.04) and oxidising conditions. Salinity (as EC) was significantly lower at LB02 (of 2,713 µS/cm) compared to LS_1 (13,230 µS/cm). These results are consistent with historical measures, noting that LB02 leachate chemistry may be influenced by subsurface recharge in this area of the landfill.

Leachate flows into the leachate pond (locations LO_1 and LO_2) were unable to be measured in July 2019 as the level of the pond was above the pipe outlets. The leachate pond was sampled. Field collected water parameters from the Leachate Pond (LP) are notably different from leachate sump and bore results and were alkaline (pH 9.29) in July 2019.

Groundwater temperature in MB05 (16.5°C) decreased to be consistent with the remainder of the bores (14.1 – 17.8°C) which is a significant decrease from historical records (ranging from 25 - 38°C) since the bore casing extension. It is noted that decreased temperatures were recorded in all groundwater samples during July 2019 event.

Major Ions

As illustrated in the Piper plot in **Figure 4**, natural groundwater, leachate, stormwater and surface water samples exhibited generally a sodium+potassium – chloride major ion composition, with variable abundance of sulphate ions.

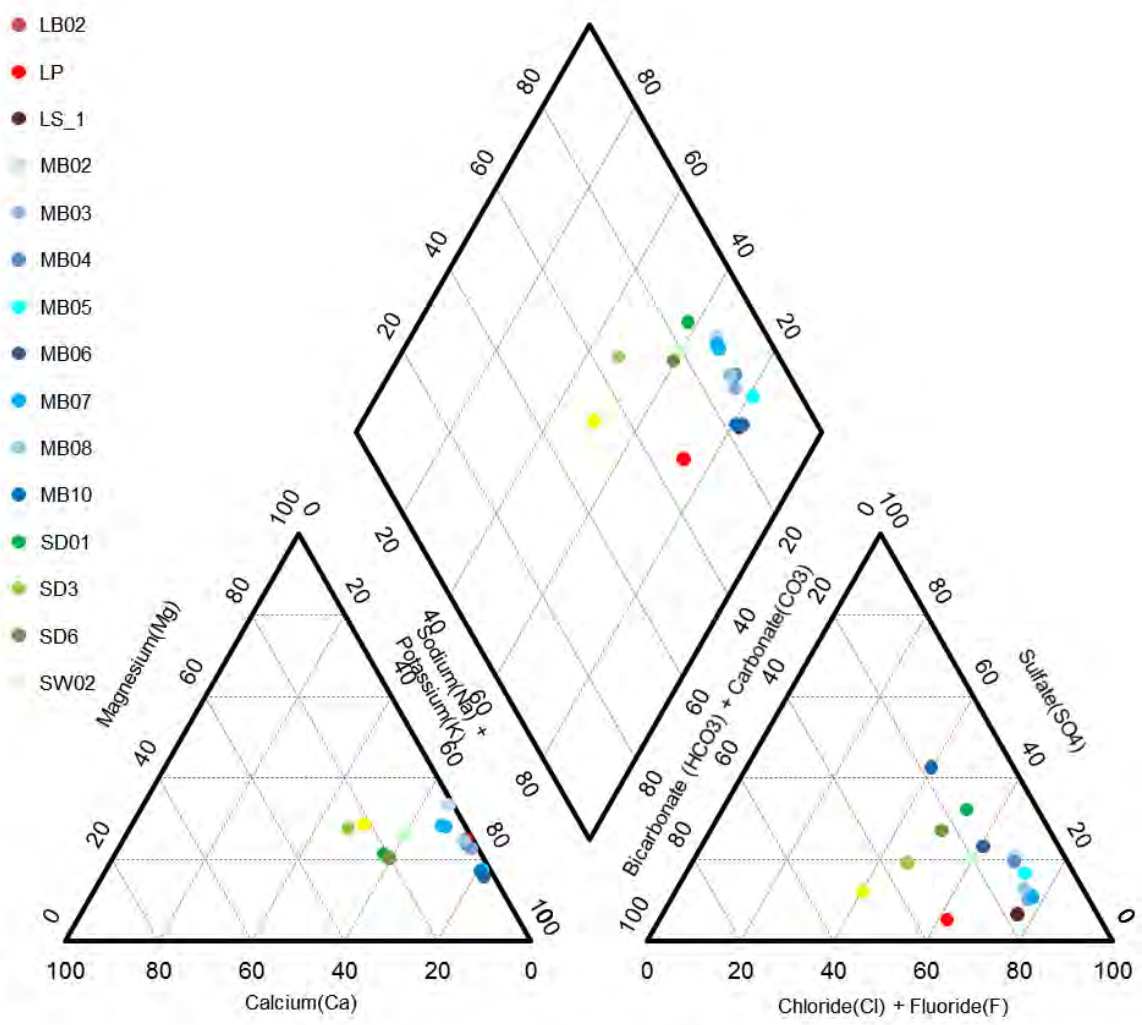
Surface water samples exhibit greater percentages of calcium and bicarbonate, which is indicative of young or surface waters.

The greatest relative abundance of sulphate ions is reported for MB10, suggesting different origin or mixing waters in the vicinity of this bore.

Leachate composition of the sump sample LS_1 was similar to groundwater. Leachate from LB02 continued to exhibit high relative abundance of bicarbonate ions, consistent with typical landfill leachate; however it also displays higher concentration of calcium, similar in abundance to surface water samples. In comparison with groundwater; these factors suggest mixing waters in the vicinity of this bore.

Overall, major ion chemistry in July 2019 was consistent with historical results for the respective locations. Landfill leachate impacts on groundwater are not apparent from the major ion chemistry.

Figure 4 Piper Plot, July 2019



Total Dissolved Solids

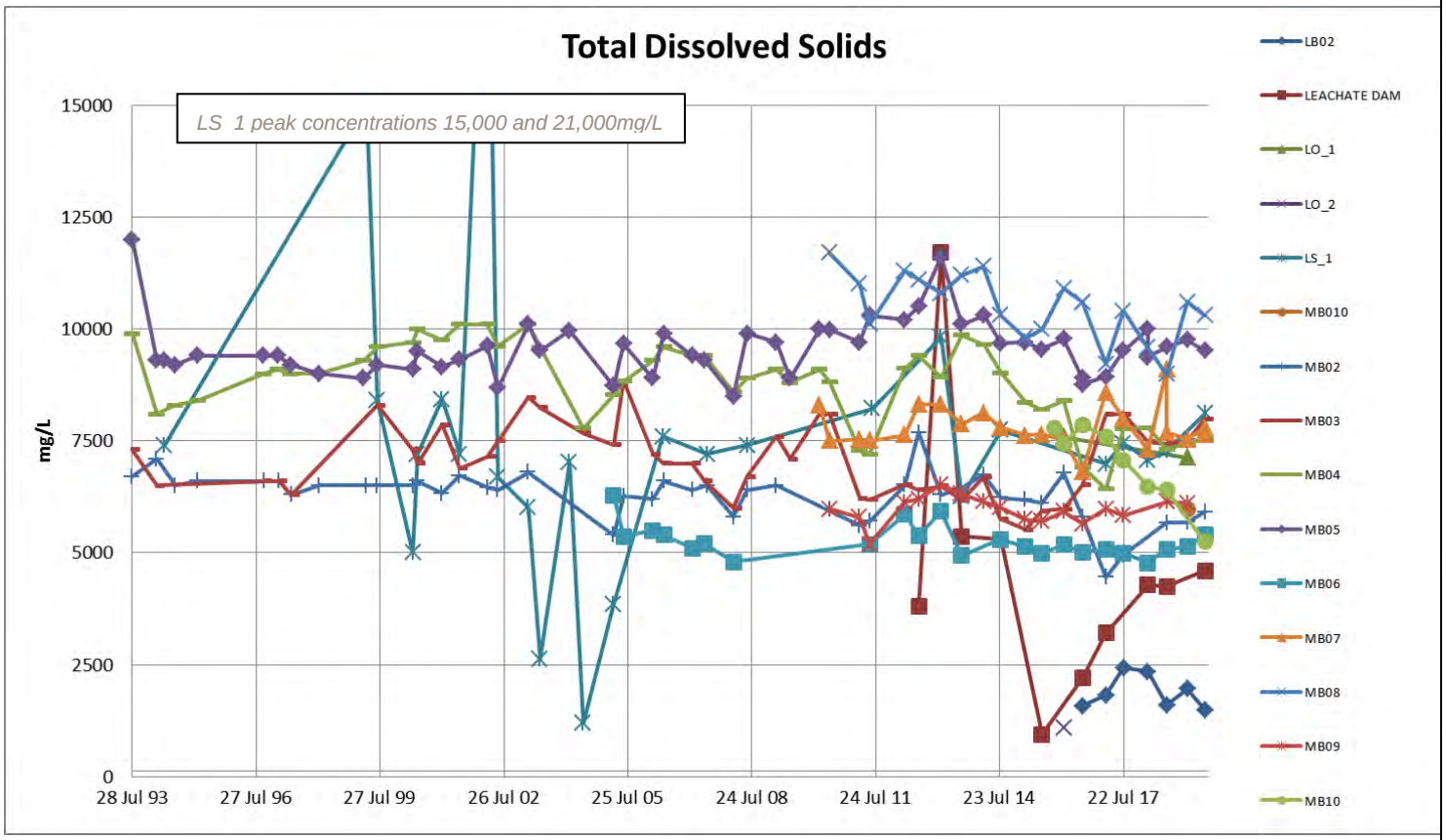
As illustrated in Figure 5, TDS concentrations in groundwater varied within the historical range, between 5,000 and 12,500 mg/L. No major changes are apparent.

A decreasing TDS trend at MB10 is apparent. The reason is unclear; however it could be associated with increasing groundwater elevations in this bore.

The highest TDS concentrations in groundwater continued to be reported for MB08 (10,300 mg/L) which continued to exhibit fluctuations over a narrow range (e.g.±300 mg/L between February 2019 and July 2019).

The TDS concentration of leachate from sump LS_1 was 8,110 mg/L and remained within the historical range for the sump. The TDS concentrations of leachate from LB02 (1,490 mg/L) remained lower than TDS of groundwaters; as discussed above in relation to EC, this could be indicative of mixing waters or offsite recharge.

Figure 5 TDS Concentrations



Bicarbonate as HCO_3

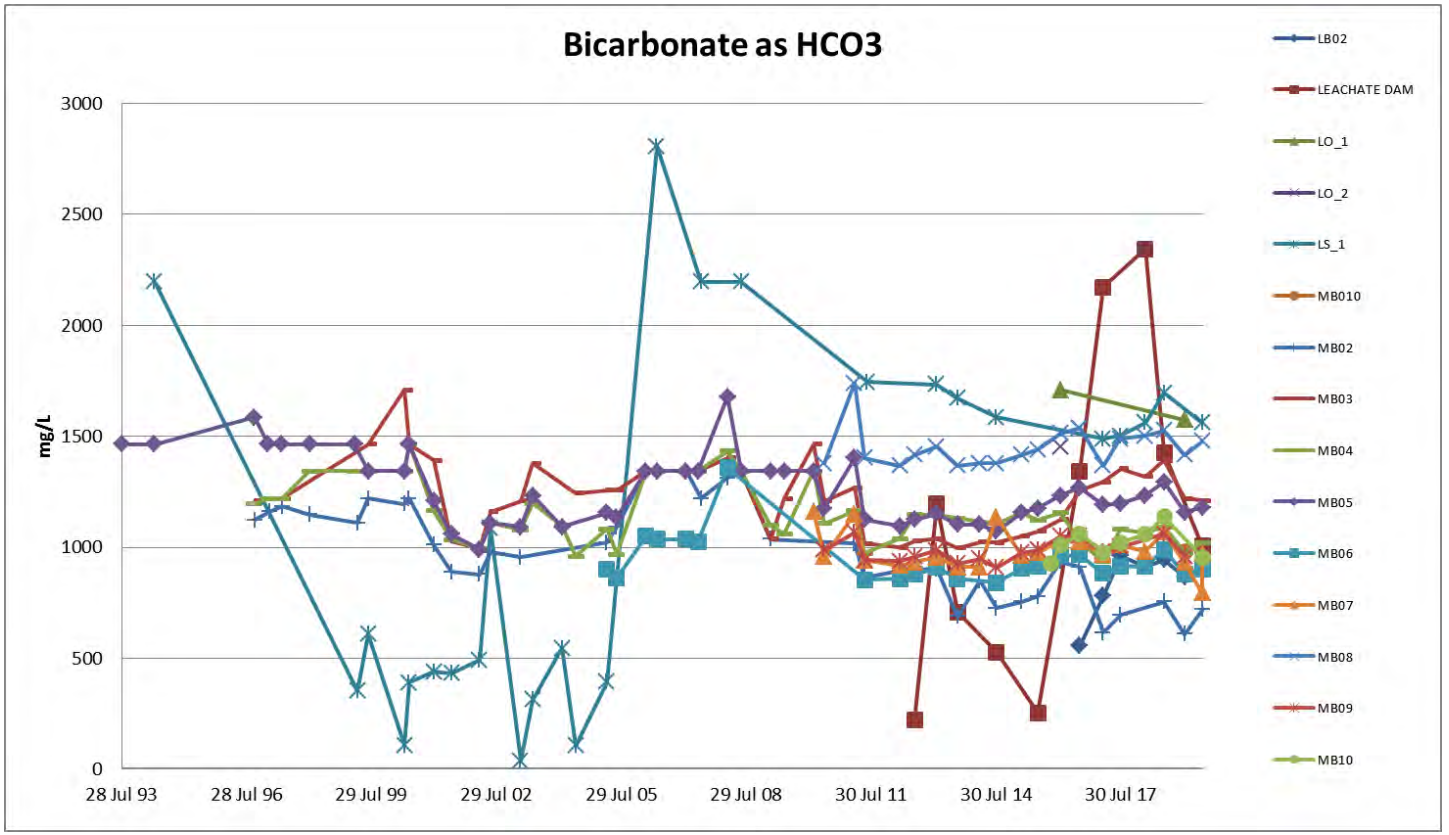
In July 2019, bicarbonate concentrations reported for most groundwater samples increased by about 20-60 mg/L in comparison with February 2019 monitoring results however remaining within the range of the historical results for the respective bores (refer Figure 6).

Groundwater from MB08 continued to report the highest bicarbonate (1,480 mg/L in July 2019).

In leachate sump LS_1 bicarbonate alkalinity remained relatively high and greater than concentrations reported for groundwater. Leachate bore LB02 concentration (898 mg/L) remained similar to concentrations for the lower range reported within groundwater).

Surface and storm water concentrations of bicarbonate alkalinity remained well below groundwater and leachate and within historical data range.

Figure 6 Bicarbonate as HCO_3 Concentrations

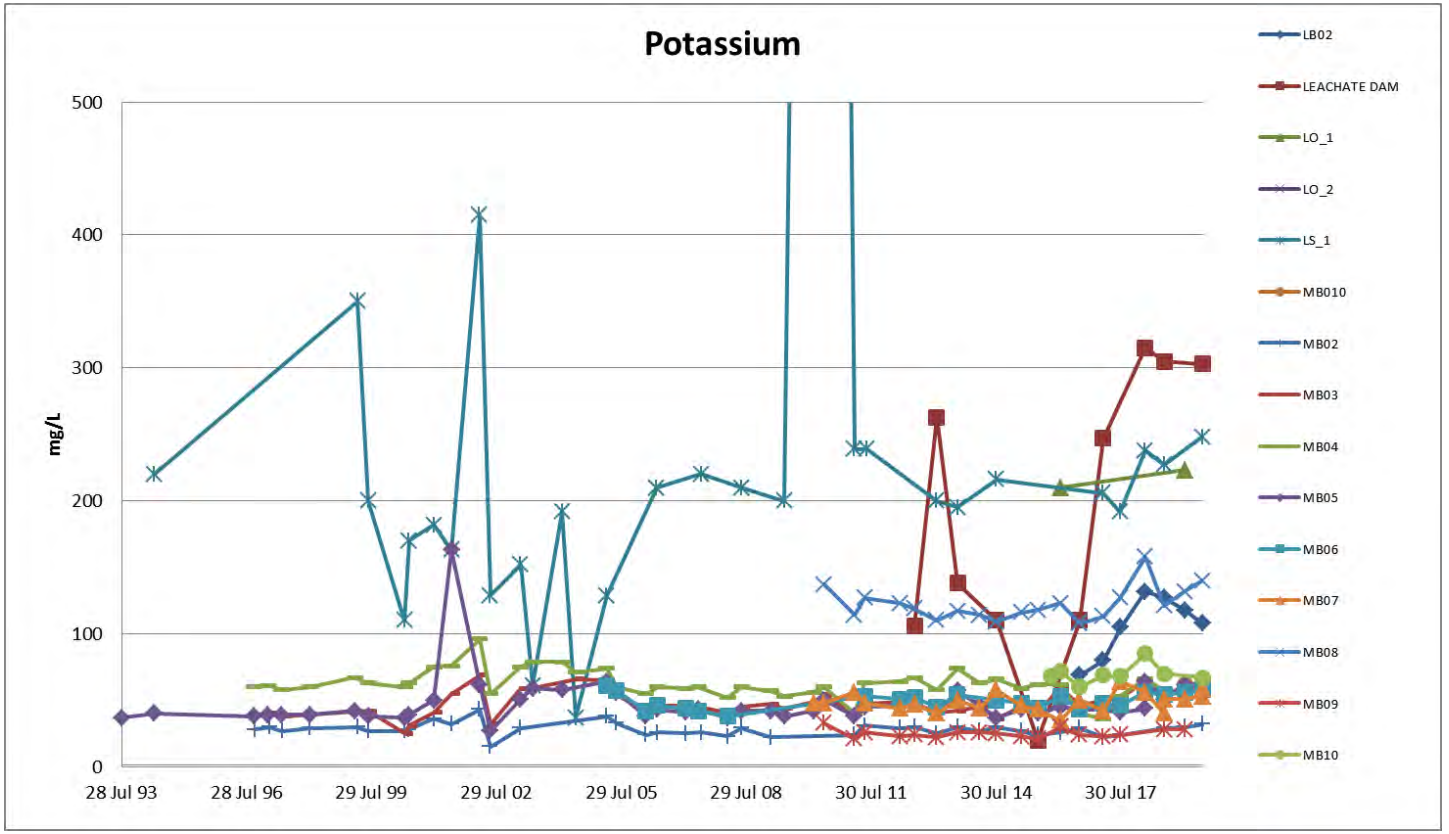


Potassium

The concentrations of potassium in groundwater (Figure 7) remained similar to those in February 2019. Concentrations in MB08 (140mg/L, July 2019) remain the elevated with respect to other groundwater samples at the site (varying within the range between 32 and 67 mg/L), and similar to leachate from LB02 (diluted waters, as shown by TDS).

Elevated concentrations of potassium are thought attributable to background groundwater quality in the area; there is no apparent impact on groundwater in the vicinity of Eaglehawk landfill based on concentrations of potassium as landfill leachate impact indicator.

Figure 7 Potassium Concentrations



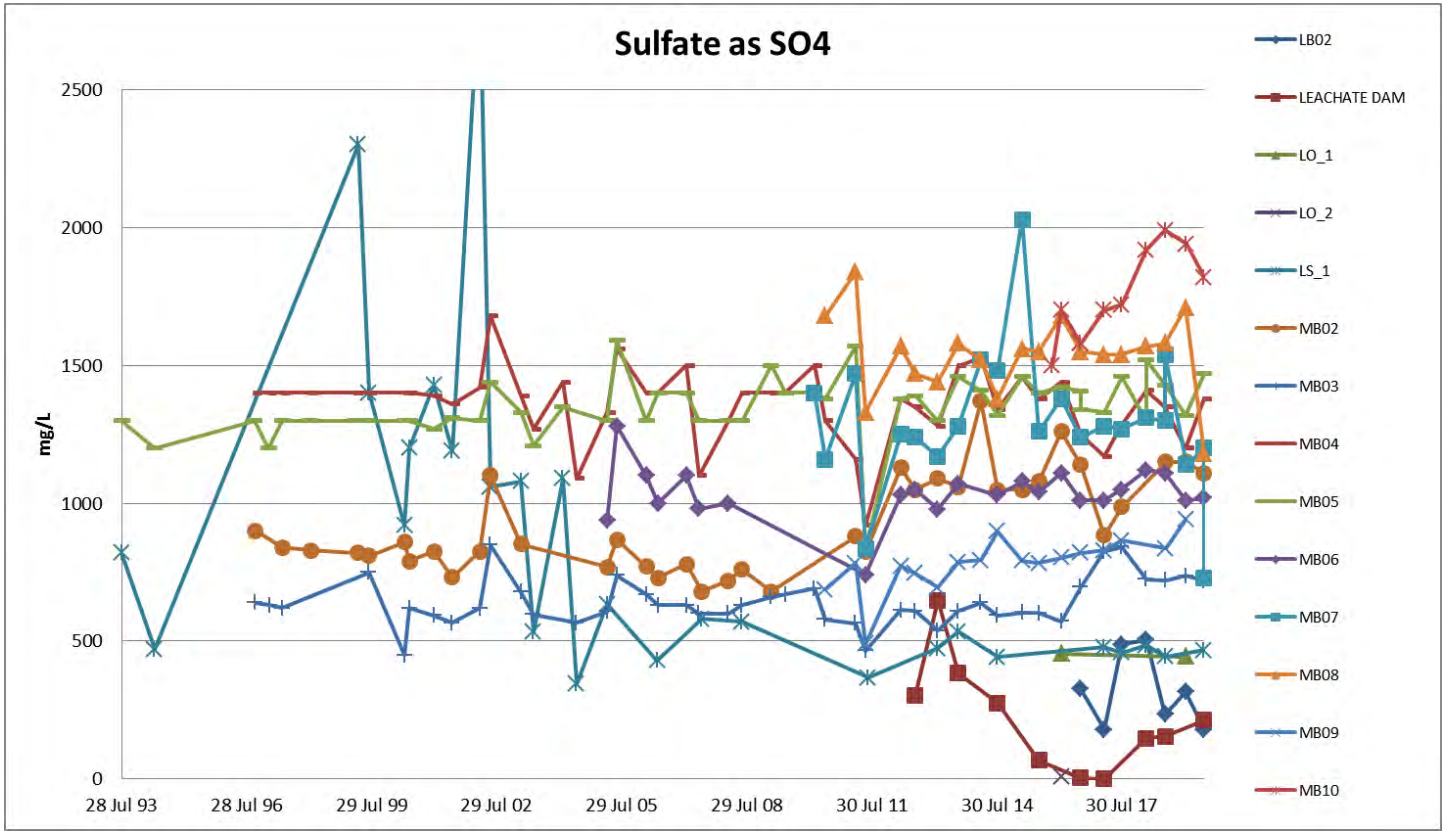
Sulfate

Concentrations of sulfate in groundwater exhibited variable fluctuations between the February 2019 and July 2019 results (Figure 8). For most of the bores, the reported concentrations of sulfate remained within the historical range (500-1,600 mg/L), with exception MB10 which appears elevated.

Sulphate concentrations in groundwater from MB10 remained the highest at the site (1,820 mg/L) and appear to be in a downward trend.

Sulphate concentrations reported for the leachate samples remained within historical ranges and were lower than sulphate in groundwaters.

Figure 8 Concentrations of Sulphate as SO_4



Nutrients and Bulk Organic Indicators

Ammonia (as N)

The concentrations of ammonia (as N) in groundwater remain within a low range between <0.01 and 1.0 mg/L, with most groundwaters containing concentrations below 0.2 mg/L; the highest concentrations continue to be reported for MB04 (1.00mg/L).

Ammonia as N concentrations in leachate remain elevated with respect to groundwater, with concentrations reported for leachate from the sump of Cell 1 an order of magnitude higher than those reported for leachate bore LB02.

July 2019 results were generally consistent with February 2019 results for most of the bores (Figure 9). There are no apparent long terms trends suggesting landfill leachate impact on groundwater.

Nitrate (as N)

Nitrate concentrations in groundwater from all bores except MB10 remained relatively low, varying from below LOR (0.01mg/L) to 0.34 mg/L (MB04). Nitrate concentration at MB10 continues to be elevated with respect to other groundwater and leachate samples.

Concentrations of nitrogen compounds in this bore are thought associated with mixing waters rather than attenuation of ammonia originating from leachate impact.

The leachate samples recorded low nitrate concentrations (below LOR-0.08mg/L), consistent with leachate chemistry.

Total Phosphorus (as P)

The concentrations of total phosphorus in groundwater remained mostly below 0.5 mg/L, including MB07 and MB10 where higher concentrations have been reported.

Recent increasing trends in total phosphorus since 2014/2015 can be seen in bores MB02, MB03, MB05 and MB08. However current concentrations reported remain within historical maximums.

Concentrations of total phosphorus in leachate are elevated with respect to groundwater.

Bulk Organics

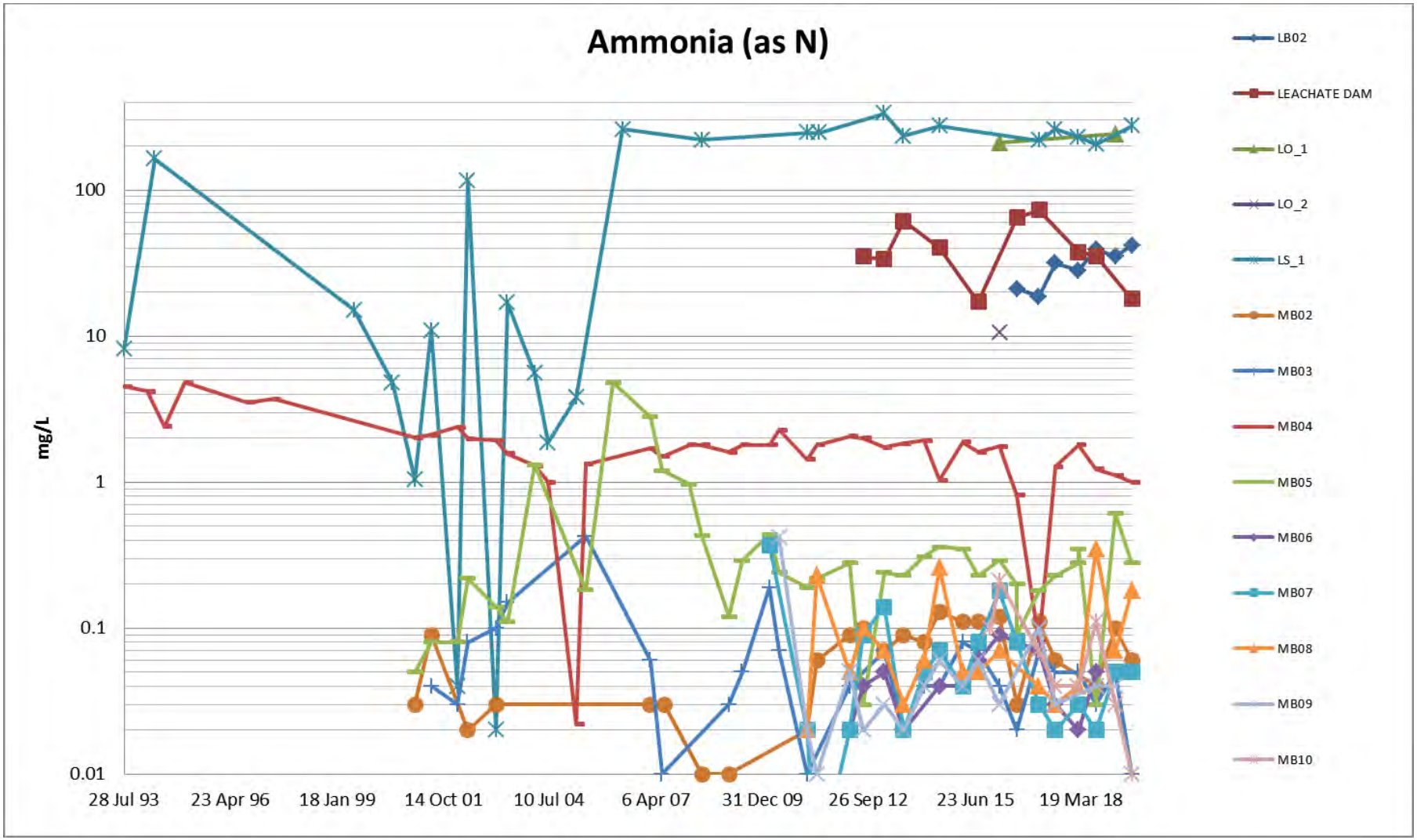
The reported concentrations of bulk organic indicators in groundwater have remained relatively low in comparison with leachate and are thought associated with background (relative to the landfill) rather than landfill leachate impact (see Table 5).

Groundwater in several bores in February 2019 reported relatively elevated TOC concentrations, however TOC concentrations reported in July 2019 are significantly lower and like the August 2018 event potentially exhibiting an annual cycle.

Table 5 Concentrations of Bulk Organic Indicators (July 2019)

Parameter	Groundwater:	Leachate:
BOD:	<1 - 3 mg/L	7 - 23 mg/L
COD:	<1 – 45 mg/L	69 - 436 mg/L
TOC:	<1 - 12 mg/L	15 - 120 mg/L

Figure 9 Concentrations of Ammonia as N



Metals and Cyanide

The reported concentrations of heavy metals and cyanide in groundwater at the site are thought to be attributed to historical activities associated with mining rather than landfill leachate. The concentrations of iron and manganese do not appear to indicate leachate impact in groundwater.

The reported concentrations of heavy metals varied, as summarised below:

- Arsenic – the reported concentrations in groundwater ranged between 1 to 21 µg/L. Groundwater sample results were generally within historical ranges for the respective bores. Leachate samples contained concentrations of arsenic 3-4 orders of magnitude higher than groundwater. Elevated arsenic at the site is associated with historical mining activities / deposits.
- Cadmium – concentrations in groundwater are generally at or below LOR (0.1 µg/L), except for MB04 (3.1µg/L). Typically, cadmium concentrations in groundwater from MB04 have been the highest at the site. Reportable concentrations were observed in MB06 (0.2 µg/L), MB07 (0.3 µg/L) and MB10 (0.1µg/L). Leachate samples did not report cadmium above LOR.
- Chromium –concentrations in groundwater were below LOR (1 µg/L) for all groundwater samples (except MB05 that reported 1 µg/L). Concentrations of 5 µg/L and 14 µg/L were reported for leachate sump (LS_1) and leachate dam (LP) respectively.
- Copper – the concentrations ranged from below LOR (<1 µg/L) to 7 µg/L (MB07), with majority of reported concentrations within the historical range for the respective bores. The increasing concentration trend observed recently in MB08 (41 µg/L in February 2019) was not supported in July 2019 with a below LOR result. Copper was not detected in leachate samples.
- Lead – concentrations in groundwater and leachate were near or below LOR (<1 µg/L to 1 µg/L).
- Nickel – concentrations in groundwater samples ranged from below LOR (<1 µg/L) to 129 µg/L in MB05. Recent concentrations fluctuate in most bores, an increasing trend is observed at MB07 since 2014). Nickel concentrations in leachate are similar in magnitude to those observed in groundwater.
- Zinc – concentrations in groundwater ranged between 8 – 156 µg/L and were generally within the historical ranges except for MB08 (156 mg/L, historical peak for this bore). Historical peak zinc concentrations reported for MB04 in February 2019 (124 µg/L) decreased by an order of magnitude in July 2019. Concentrations of zinc in leachate reported similar results to the lower concentrations of groundwater.
- Iron – concentrations of groundwater were below LOR (<50 µg/L) in bores MB04, MB06, MB07 and MB10. Reported concentrations ranged from 150 µg/L (MB05 and MB08) to 1,840 µg/L (MB02). The groundwater iron concentrations are within historical data ranges of each bore. The elevated concentration observed at MB02 appears relatively stable since 2014 and is below historical maximums observed in 2009. In leachate the reported concentrations were at generally an order of magnitude higher than the groundwater average. While concentrations of iron at MB02 may be suggestive of leachate impact, other indicators such as ammonia do not confirm this. Further monitoring is required to assess whether a trend in iron concentrations exists at the adjacent bore MB03 that may be indicative of leachate impact.
- Manganese –concentrations in groundwater varied between 7 and 1170 µg/L (MB02). Manganese concentration in MB02 is elevated with respect to groundwater and leachate. The groundwater manganese concentrations are within historical data ranges of each bore. Manganese concentration in leachate from bore LB02 remains an order of magnitude higher than in the sump LS_1 sample. Recent fluctuations in Manganese observed at MB05 are similar to that observed in LB02. The concentrations of manganese in groundwater are not thought associated with leachate impact.

Concentrations of free cyanide were below LOR (4 µg/L) in all leachate and groundwater samples. Total cyanide was detected in groundwater from MB02 (26 µg/L), MB04 (26 µg/L) and MB10 (8 µg/L) and leachate from in LB02 (6 µg/L) and LS_1 (20 µg/L).

Total cyanide includes free cyanide (un-ionised molecular HCN plus CN^-) and measurable cyanide from the breakdown of metallo-cyanide and organic complexes. ANZECC 2000 guideline trigger

values have been developed for free cyanide. The measured total cyanide in water samples at the site is not free cyanide in the HCN form (toxic).

Ionic Ratios

An important differentiator between natural groundwater and leachate is the ratio of cations (Sodium to Potassium and L/N ratios, illustrated in **Figure 10** and

Figure 11, respectively). Natural (N) groundwater exhibits elevated concentrations of the cations Mg^{2+}, Ca^{2+} and Na^{+} whereas leachate (L) is dominated by K^{+} and $NH4^{+}$. The addition of the dominant leachate cations divided by the sum of the dominant groundwater cations is the L/N ratio, commonly referred to as the Mulvey ratio (Mulvey and Brisbane, 1996):

$L/N = (K^{+} + NH4^{+})/(Mg^{2+} + Ca^{2+} + Na^{+})*100$

Leachate breakthrough during the anaerobic phase is evidenced by an increasing trend in L/N ratios (greater than 10 is common for landfill leachate), and a decreasing trend in Na/K ratios (less than 5 is common for landfill leachate) in groundwater.

The ionic ratios, illustrated below, indicate significant separation between the leachate bores and all the groundwater bores. Several bores exhibited a decrease in the Na/K ratio in 2018 however the trend did not continue to confirm the influence of leachate.

A slight increase in Mulvey ratios in groundwater sample MB07 increased to above 5 in July 2019 but is within historic data exhibited from other groundwater bores at Eaglehawk landfill. There have been no apparent long-term trends in any of the other groundwater bores indicative of leachate impact on groundwater.

Figure 10 Sodium to Potassium Ratios

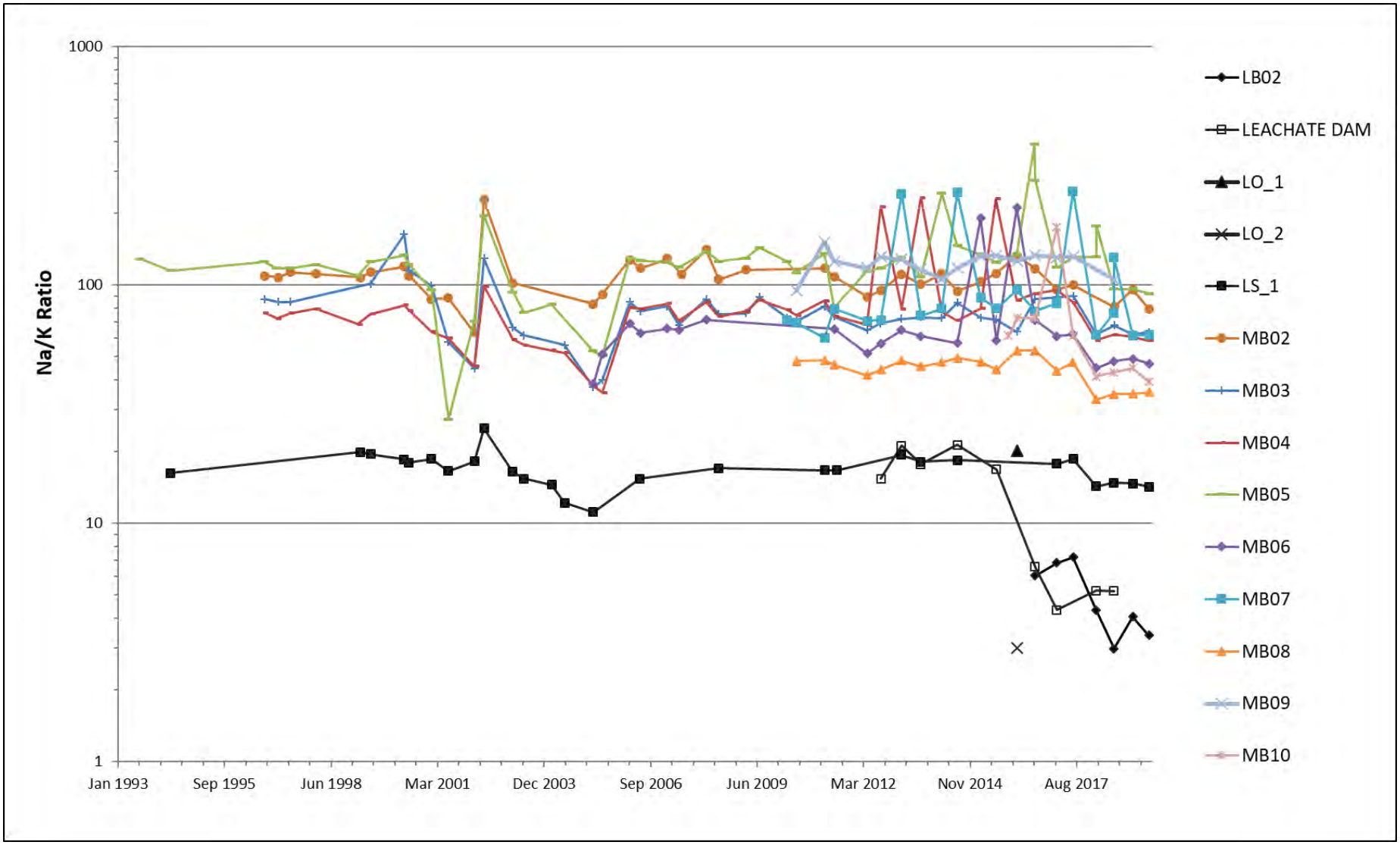
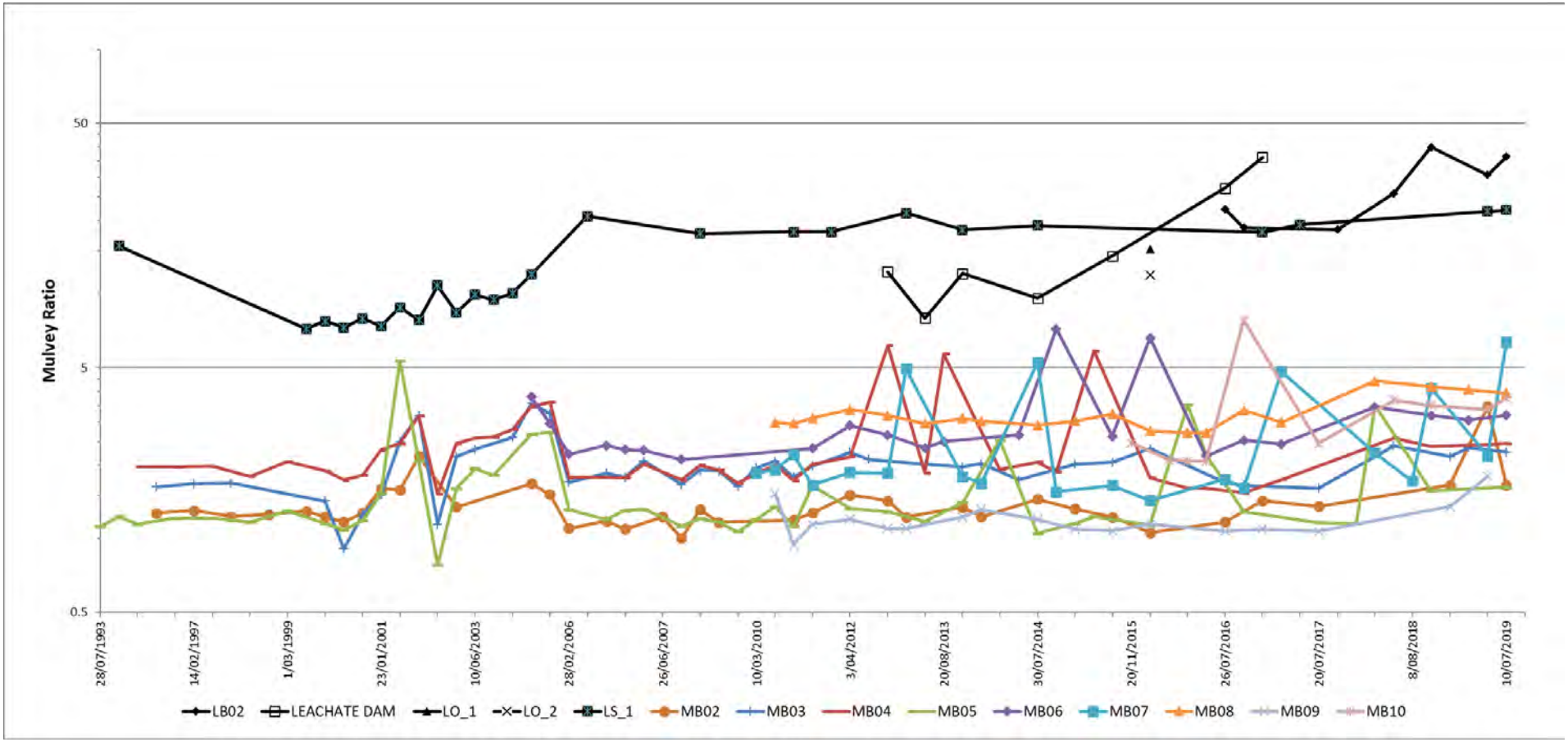


Figure 11 Leachate to Natural (Mulvey) Ratios



3.4 Water Quality Assessment

In accordance with the site-specific monitoring program (revision AECOM, 2017), groundwater beneficial uses (BU) protected under Segment C as per the now superseded SEPP (Groundwaters of Victoria). The new SEPP (Waters) was issued in October 2018 and provides different categorisation of Segments and protected beneficial uses. Under the new SEPP, groundwater at the site classifies within Segments D and E (TDS 5,401-7,100 mg/L and 7,101-10,000 mg/L, respectively).

The adopted Groundwater Quality Objectives (GWQOs) apply to protected beneficial uses under old Segment C / new Segments D & E and include water dependent ecosystems (ANZECC 2000[1], maintenance of aquatic ecosystems (moderately disturbed, freshwater)), stock watering, primary contact recreation, industrial use (restricted to Segment D) and buildings and structures.

A summary of the reported concentrations exceeding the adopted GWQOs (based on verified EMP revision 2017) is presented below. The exceedances are thought to be associated with background (relative to the site) conditions in groundwater rather than attributed to landfill leachate impact. MB05 is located under the landfill with casing extending through the waste and did not exhibit any elevated concentrations or trends suggesting worsening of groundwater quality due to landfill leachate impact.

Table 6 Summary of GWQOs Exceedances

Parameter	Location	Concentrations* Exceeding GWQO*	GWQO Exceeded	GWQO Value*
pH	MB02, MB07 and MB08	6.25-6.5	Industrial, Primary Contact Recreation	6.5-8.3
TDS	MB08	10,300	Livestock	10,000
Cadmium	MB04, MB06 and MB07	0.0002 - 0.0031	MOE Freshwater 95%	0.0002
Copper	MB05, MB07 and MB10	0.002 - 0.007	MOE Freshwater 95%	0.0014
Nickel	All bores except MB02 and MB06	0.015-0.129	MOE Freshwater 95%	0.011
Zinc	All bores	0.008 – 0.156	MOE Freshwater 95%	0.008
Bicarbonate Alkalinity as HCO_3	All bores	721 - 1476	Industrial Water	140
Ammonia as N	MB04	1.00	MOE Freshwater 95%	0.74
Sulfate as SO_4	MB07	1,200	Buildings & Structures	1,000
Cyanide Total	MB02, MB04 and MB10	0.008 – 0.026	MOE Freshwater 95%	0.007

**All concentrations are expressed in mg/L other than pH*

It is noted that these results are consistent with historical records. A mine dewatering report from the late 1980s in this area indicated a TDS range of 4,760-7,000 ppm (mg/L) and elevated K (35-55 mg/L), HCO3 (640-2,500 mg/L) and metals (As 0.2-0.8 mg/L, Fe 0.5-3 mg/L, Mn 0.7-1.5 mg/L). These elevated concentrations were recorded prior to landfilling and the results are therefore indicative of natural conditions.

[1] The Australian and New Zealand Guidelines for Fresh and Marine Water Quality have been revised in 2018. The 2017 EMP specifically refers to the ANZECC 2000 guidelines. Relevant water quality objectives under the new guidelines have been retained from the ANZECC 2000.

Groundwater chemistry reported for the site bores during July 2019 monitoring event continued to remain relatively consistent with historical results, with some minor changes thought reflective of groundwater conditions in the vicinity of the site rather than landfill leachate impact.

Increased / peak concentrations of several groundwater quality parameters, as discussed above, should be confirmed through further monitoring. If emerging trends indicative of groundwater quality deterioration are confirmed, the relevant risk assessment should be reviewed with monitoring and management requirements updated accordingly. This particularly relates to bore MB05 with casing extending through the waste mass and posing a risk of direct leachate pathway to groundwater; so far no increasing trends of the leachate impact indicators have been apparent in groundwater from MB05.

Water monitoring should continue in accordance with the auditor verified monitoring program (AECOM, 2017), with practical amendments to reflect encountered conditions and • new (recent) guideline amendments (SEPP and ANZECC). The low-flow sampling of groundwater bores should remain the preferred sampling method.

4.0 Surface Water Monitoring Results

The rainfall over Eaglehawk Landfill on 11 July facilitated enough flow at locations SD1, SD3 and SD6 for sampling during the July 2019 event. Field parameters of stormwater samples remained generally consistent with historical data. A summary of the EMP surface water quality objective exceedances is provided in Table 7 below.

The most significant exceedance is for turbidity, which is likely due to the operational nature of the site which has been cleared and has constant plant activity occurring.

In comparison, a turbidity value of <10 NTU is close to a clear stream, which is unlikely to occur in runoff being generated on site.

Table 7 Summary of SWQOs Exceedances

Parameter	Location	Concentrations* Exceeding SWQO*	SWQO Value*
Electrical conductivity	SD01, SD03 and SD06	603 – 1,324	500
TDS	SD01, SD03	1,020 - 1060	1,000
Manganese	SD03	226	100
Ammonia	SD01, SD03, SD06	0.11 – 0.26	0.1
Turbidity	SD01, SD03, SD06	3,410 – 13,900	10

**Metals concentrations in ug/L. All concentrations are expressed in mg/L other than pH*

5.0 LFG Monitoring Results

5.1 Subsurface Geology

The location of the LFG monitoring bores is shown in **Figure F2** in **Attachment 1**. Copies of field notes and equipment calibration certificates are presented in **Attachments 2**. Tabulated historical perimeter soil gas monitoring results are presented in **Attachment 7**.

As per EMP revision (AECOM, 2017), LFG conditions reported for bore MB06 were excluded from this assessment as groundwater was present in the bore at the time of the monitoring event. Note also that groundwater was also intercepted during drilling of BH22 and BH23 on the south-eastern boundary of Cell 1 and the bores had to be constructed at a shallower depth as a result (<5m).

In July 2019 groundwater was detected in bores BH29 and BH33 at 11.5 and 11.8 m below top of casing, respectively. In August 2018 BH29 was dry; however BH33 was reported to have a standing water level of 10.49 m below top of casing. The presence of groundwater detected BH29 may be indicative of localised recharge and in the case of BH33 is likely intercepting the groundwater table.

Final (stabilised) readings for each bore recorded in July 2019 are presented in Table 8 below. Readings highlighted in bold indicate concentrations exceeding Landfill BPEM (EPA Pub. 788.3, 2015) action levels for subsurface geology (1% v/v methane and 5% carbon dioxide (1.5%v/v above the adopted carbon dioxide background level of 3.5% v/v)).

In bores subject to monitoring by GA5000 in July 2019, methane was only reported at or above the instrument detection limit of 0.1%v/v in bores BH26 (5.5%v/v) and BH18 (0.2%v/v).

In 14 of the 26 bores sufficiently remote from the landfill to be subject to compliance assessment (bore ID highlighted in bold in the table), the concentrations of carbon dioxide were below the adopted action level (5%v/v). The highest reported exceedances were measured in bores BH21 (13.1%v/v), BH34 (9.6%v/v), BH09 (9.3%v/v).

The reported concentrations of carbon monoxide and hydrogen sulphide during the bore monitoring were at or below the instrument detections limit (1 ppm).

Elevated concentrations of methane and carbon dioxide and depleted concentrations of oxygen continued to be detected in BH26, at concentrations consistent with the historical record for this bore. A minor methane concentration was detected in BH18 (0.2%v/v).

Based on the gas monitoring results, it was concluded that fugitive LFG emissions detected in close proximity to the landfill appear to be controlled by natural attenuation processes, with methane being oxidised at rates exceeding migration.

Table 8 Final Gas Readings – Soil Gas Monitoring Bores, July 2019

Bore ID	Relative Pressure	Flow	CH_4	CO_2	O_2	%Balance	$\%Bal/O_2$	H_2S	CO
	mb	L/h	% v/v					ppm	
BH01	0.07	0.1	0	**5.4**	15.1	79.5	5.26	0	0
BH02	0.02	0	0	2.1	18.4	79.5	4.32	0	0
BH03	0.02	0	0	4	16.3	79.7	4.89	0	0
BH04	0.02	0	0	2.9	17.5	79.6	4.55	0	0
BH05	0.1	0	0	1.9	19.9	78.2	3.93	0	0
BH06	0.12	0	0	4.1	16.7	79.2	4.74	0	0
BH07	0.12	0	0	4.5	12.4	83.1	6.70	0	0
BH08	0.03	0	0	**7.4**	7	85.7	12.24	0	0
BH09	0.07	0.1	0	**9.3**	7.8	82.9	10.63	0	0
BH15	0	0	0	1.1	20.8	78.1	3.75	0	0
BH17	-0.02	0	0	3.7	17.7	78.6	4.44	0	0
BH18	-0.02	0	0.2	4.8	8.2	86.8	10.59	0	0
BH19	0.02	0	0	**9.6**	10.6	79.9	7.54	0	0
BH20	0.05	0	0	3.7	17	79.3	4.66	0	0
BH21	0.03	0	0	**13.1**	2.1	84.8	40.38	0	0
BH22	0.05	0	0	**10**	8.4	81.6	9.71	0	0
BH23	-0.03	0	0	3.5	17.9	78.6	4.39	0	0
BH24	0	0	0	2.3	19.3	78.4	4.06	0	0
BH25	0.07	0	0	**7.7**	12	80.2	6.68	0	0

Bore ID	Relative Pressure	Flow	CH_4	CO_2	O_2	%Balance	%Bal/O_2	H_2S	CO
	mb	L/h	% v/v					ppm	
BH26	0.05	0	**5.5**	**14.3**	1	79.1	79.10	0	0
BH27	0	0	0	4.6	15.1	80.3	5.32	0	0
BH28	0.07	0	0	**5.8**	16.3	78	4.79	0	0
BH29	0.09	0.1	0	**10.7**	6.3	83	13.17	0	0
BH30	-0.07	0	0	**6**	13.6	80.4	5.91	0	0
BH31	-0.22	0	0	**8**	10.3	81.7	7.93	0	0
BH32	-0.22	0	0	**8.8**	12.2	79	6.48	0	0
BH33	0	0	0	3.5	17.5	79	4.51	0	0
BH34	-0.09	0.1	0	**9.6**	13	77.5	5.96	0	0
BH35	-0.07	-0.1	0	**6.2**	16.7	77.2	4.62	0	0
BH36	0.12	-0.1	0	4.8	16.9	78.3	4.63	0	0
BH37	-0.1	-0.1	0	3.9	17.5	78.6	4.49	0	0
BH38	0.03	-0.1	0	4.7	16.6	78.7	4.74	0	0
BH39	-0.1	-0.1	0	**5.8**	11.6	82.6	7.12	0	0
BH40	Not Sampled - No gas cap on bore								

The recorded borehole flows were very low (– 0.1 to 0.1 L/h). The calculated Gas Screening Values (determined as peak flow multiplied by peak concentration, as per CIRIA (C665, 2007) were indicative of very low risk for carbon dioxide.

A typical composition of LFG is approximately 60%v/v methane and 40%v/v carbon dioxide however the following key factors may influence LFG composition:

- "**Water-washing**": carbon dioxide is significantly more soluble in comparison to methane and as such is preferentially removed resulting in a higher methane to carbon dioxide ratio in the LFG;
- **Methane oxidation**: in the presence of oxygen, methane is biologically degraded to form carbon dioxide; and
- **Dilution / Air Infiltration**: the composition of gas within the waste may be altered as a result of air entering the system due to pressure fluctuations. The occurrence of air infiltration suggests that the rate of LFG production is limited as sufficient LFG production precludes the occurrence of air infiltration.

Methane to carbon dioxide ratios in LFG is about 1.2, lower ratios are likely to indicate methane oxidation and higher ratios – water washing (depleted CO_2). Methane was detected in BH26, with a ratio of 0.38, consistent with methane oxidation.

In air, the % Balance / %Oxygen ratio is approximately 3.8; in soil gas this ratio is expected to increase as oxygen is consumed by the oxidation of methane; as seen in Table 8, the ratios in all bores with depleted oxygen confirm oxidation of methane.

Based on July 2019 monitoring results, it appears that subsurface methane oxidation is taking place in the vicinity of the landfill, with soil gas conditions in the perimeter monitoring bores suggesting oxidation rates exceeding those of lateral migration with exception of area north of cells 3a / 3b. Previous investigations (Tonkin Consulting, March 2016, *Landfill GAS Remediation Action Plan, Eaglehawk Landfill*) concluded that cell separation fill provided a preferential transport pathway in the

area of BH18 and BH26. Ongoing improvement of LFG extraction from these cells is expected to result in further reduction of methane concentrations in the subsurface geology in the vicinity of Cells 3a/3b.

5.2 Surface Emissions

The site plan with the results of the onsite surface emissions walkover conducted on 9th and 10th July 2019 is presented in **Figure F4A** in **Attachment 1**; copies of field notes and equipment calibration certificates are presented in **Attachments 2** and **4**, respectively; and tabulated results are presented in **Attachment 6**.

Surface emissions walkover excluded operational Cell 5. Methane emissions recorded at all the 179 landfill cover locations monitored in July 2019 were below the lowest EPA action levels (final capping – 100 ppm). At eight locations (ID 451-453, 485-487, 496-497) methane concentrations were greater than 10 ppm (11 – 44ppm). These locations are on the western slope of the capped area and it was noted that the wind was predominantly coming from the west during the walkover, potentially resulting in elevated readings.

Average methane concentration across the site was 3.2 ppm. Based on July 2019 monitoring results, the conditions reported for final cover were compliant with the EPA methane emissions objectives (a mean of 100 ppm with no individual result exceeding 200 ppm, EPA Pub. 1684 (2018)).

The results of the surface emissions walkover conducted in July 2019 suggest that the existing landfill cover effectively mitigates vertical gas emissions to atmosphere. The reported elevated methane concentrations occurred in an area of preferential LFG emission pathways, where landfill cover on the edges and slopes of the filled cells is least effective. Capping and LFG extraction from cells 3a and 3b are expected to contain LFG and reduce methane emissions.

5.3 Buildings, Services and Structures

Site plans with the results of the emissions monitoring at buildings and structures conducted on 10 July 2019 is provided in **Figures 3a** and **3b** in **Attachment 1**; the results are summarised below.

Table 9 Buildings and Structures LFG Monitoring, July 2018

Location	Description	Easting UTM Z55	Northing UTM Z55	CH_4 ppm	Comments
B1	Brick (Nth side)	254006	5931733	2.1	
B2	Brick (East side)	254023	5931734	3.9	
B3	Recycling centre (South side)	253884	5931640	2.0	
B4	1st aid room (Recycling centre South side)	253860	5931645	1.8	
B5	Inside site office/smoke room	254008	5931731	6.0	
B7	New portable (lunchroom/office)	-	-	1.8	
B8	New portable (toilets)	-	-	2.3	
Se1	SW drain (West of site office)	254010	5931737	30.2	
Se2	SW pit (Site entrance)	254007	5931747	1.8	
Se3	Telephone line (Nth-East corner brick building)	254007	5931745	2.1	
Se4	Drain gatic brick building (East side)	254025	5931739	9.6	
Se5	Water mains service pit	254024	5931726	71.3	

Location	Description	Easting UTM Z55	Northing UTM Z55	CH_4 ppm	Comments
Se6	Telstra pit (West of garages)	254011	5931719	16.3%	
Se7	Open steel gatic (West of garages)	253993	5931693	1.8	
Se8	SW pit (West of site building)	253982	5931705	213.0	
Se9	SW pit (SW of weighbridge / west roadside)	253982	5931712	421.0	
Se10	SW pit (SW of weighbridge / east curb near electric box)	253975	5931701	2.8	
Se11	SE downpipe (recycling shed)	253898	5931664	4000.0	
Se12	SW downpipe (recycling shed)	253868	5931643	2.2	
Se13	NW downpipe (recycling shed)	253868	5931688	16.5	
Se14	NE downpipe (recycling shed)	253873	5931688	1.0	
Se15	Pit next to wheel wash	253941	5931689	3.7	
Se22	Telstra Pit 2 (South of office, SE of wheel wash)	253951	5931657	122.0	
St1	Exit Weighbridge (North)	253976	5931724	1.3	
St2	Entry Weighbridge (North)	253998	5931730	1.9	
Recycling Ecocentre					
B6	Shed Site Office	254092	5931747	0.9	
Se16	SW drain entrance	254065	5931778	1.0	
Se17	SW drain carpark	254043	5931779	0.9	
Se18	SW pit exit	254030	5931757	1.5	
Se19	SW drain exit	254033	5931743	29.9	
Se20	SW drain (near timber frames)	254065	5931715	0.9	
Se21	Shed downpipe	254097	5931753	1.0	

B – buildings, Se – services, St - structures

Elevated methane concentrations have been consistently reported at the pit location Se6 (>10,000 ppm). Council rectification works have occurred at this service (in 2018) including Telstra analysing conduit to find breaks, attempting to seal area around the conduit, LMS expanding their collection network to include all areas in Cell 1 (adjacent to the pits) and monthly venting the pit for a 20-minute period. During the July 2019 event the methane concentration recorded Se6 was 16.3%v/v. No other methane concentrations exceeded the Landfill BPEM action levels for buildings/structures or subsurface services on and adjacent to the landfill site (5,000ppm and 10,000ppm respectively).

Most measured methane concentrations were consistent with ambient air concentrations (<6 ppm). Elevated methane concentrations were reported at the locations listed below.

Locations	Descriptions	CH_4 ppm
Se6	Onsite Telstra pit (West of garages)	16.3%v/v
Se11	SE downpipe (recycling shed)	4000.0
Se9	SW pit (SW of weighbridge / west roadside)	421.0
Se8	SW pit (West of site building)	213.0
Se22	Telstra Pit 2 (South of office, SE of wheel wash)	122.0

5.4 Off-site services walkover results

The offsite services emissions survey was completed 10th and 11th July 2019. Data is presented in **Figure F4B** in **Attachment 1**; copies of field notes and equipment calibration certificates are presented in **Attachments 2** and **4**, respectively; and tabulated results are presented in **Attachment 6**.

All monitored locations identified in the surrounding streets reported methane concentrations below 10 ppm.

Results from surveying Telstra pits in the streets adjacent to the eastern perimeter of the landfill present no indication that the elevated methane concentrations at onsite location Se6 is migrating through the pits

6.0 Conclusions and Recommendations

Based on the results of the July 2019 monitoring round at Eaglehawk landfill, it is concluded that:

- Groundwater elevations in all bores but MB10 decreased slightly in comparison with February 2019 monitoring event and remained overall stable. In MB10 a rising trend continues.
- The inferred groundwater flow direction for the shallower aquifer system remained generally to the west / south-west based on groundwater elevations across the site. Deeper aquifer system groundwater elevations suggest a more southerly groundwater flow direction.
- Leachate bores LB01, LB03 and LB04 remained dry. Leachate sumps LS_1 (Cells 1- Cell 2), LS_2 (Cell 3) and LS_3 (Cell 5) contained leachate. In bore LB02 (eastern portion of Cell 1) leachate head of 1.9m over the base of waste was reported which is within the historical range (0.9-2.8m). Leachate outflow pipes into the pond were submerged and flow measurements were unable to be taken. There was no apparent indication of rising leachate levels at the site.
- Groundwater chemistry has remained generally unchanged; fluctuations of groundwater quality parameters are considered reflective of variation in groundwater conditions at the site and do not suggest landfill leachate impact on groundwater.
- Based on decreasing salinity trend in groundwater from MB10 and low salinity uncharacteristic for mature municipal leachate reported for leachate from bore LB02, there is a potential source of fresh water recharge to the east of the landfill. The shallow water also detected in gas monitoring bore BH29 (in July 2019) may be indicative of recharge adjacent to the east of landfill cell, and further investigations would need to be conducted to confirm this.
- The concentrations of groundwater quality parameters exceeding the adopted GWQOs are generally attributed to the historical activities at and in the vicinity of the site and background conditions relative to the landfill rather than leachate impact, as evidenced by mine dewatering records.
- Based on July 2019 monitoring results, it appears that subsurface methane oxidation is taking place in the vicinity of the landfill, with soil gas conditions in the perimeter monitoring bores suggesting oxidation rates exceeding those of lateral migration with exception of area immediately north of cells 3a / 3b.

- In all bores subject to monitoring in July 2019, methane was only reported at BH26 (5.5%) and BH18 (0.2%) above the instrument detection limit of 0.1%v/v.
- Of the bores subject to compliance assessment, the concentrations of carbon dioxide exceeded the adopted action level (5%v/v) in 14 bores. The highest reported exceedances were measured in bores BH21 (13.1%v/v), BH34 (9.6%v/v), BH09 (9.3%v/v).
- Cap surface emissions recorded in July 2019 did not exceed EPA action levels. The results suggest that the existing landfill cover effectively mitigates vertical gas emissions to atmosphere. Relatively elevated methane concentrations were reported in an area of preferential LFG emission pathways, where landfill cover on the edges and slopes of the filled cells (3B, 2 and 5) is least effective until final capping is in place.
- Methane concentrations recorded during the monitoring of buildings, structures and services on and off site did not exceed the EPA action levels (5,000-10,000ppm) except for Telstra service pit Se6 which has consistently recorded elevated methane concentrations in the past and in which a concentration of 16.3% v/v was measured during this round.

6.1 Compliance Summary

Compliance with the site EPA licence conditions pertaining to periodic monitoring has been achieved during July 2019 monitoring event.

Condition **LI_L1** – Implementation of EMP:

- Compliant frequency
  - February 2019 event represented 1st biannual environmental monitoring event of 2019.

    July 2019 event represented 2nd biannual environmental monitoring event of 2019.
- Compliant scope, with minor deviations:
  - Additional soil gas monitoring locations were monitored 9 new perimeter bores, additional buildings and services).
  - Additional offsite CH_4 emissions survey has been undertaken.
- Compliant methodology –methodologies were mainly compliant with the requirements of the verified EMP (AECOM, 2017:

Condition **LI-L5** – management of LFG to prevent LFG emissions from exceeding the action levels specified in EPA Publication 788.3:

- Compliant, with exception of minor exceedances of CO2 (>5%v/v) reported for bores BH1 (5.4%v/v), BH08 (7.4% v/v), BH09 (9.3% v/v), BH21 (13.1% v/v) and BH28 (5.8% v/v).

Condition **LI_DL1.3** – impact on groundwater:

- Compliant – there are no apparent changes in groundwater chemistry indicative of worsening of groundwater quality, with exceedances of the adopted GWQOs attributed to the historical activities at and in the vicinity of the site and background conditions relative to the landfill.

Condition **LI-DW1** – impact on surface water

- Compliant, surface water chemistry sampled during July 2019 indicated no contamination from waste.

Recommendations

- It is recommended that the EMP be updated to incorporate new monitoring locations and incorporate/reflect new (recent) guideline amendments to the SEPP and ANZECC criteria.
- Environmental monitoring should continue at frequencies and in accordance with requirements specified by the auditor verified EMP (current revision - AECOM, 2017).
- Where practical, the cover on the edges and slopes of the filled cells Cell 3B / Cell 5 should continue to be rehabilitated in order to reduce surface emissions of methane.

- Details of the new gauge in the leachate pond should be included in the next EMP revision, including freeboard (water level) objective.
- Location and Easting and Northing of the groundwater monitoring bore MB05 should be confirmed and EMP site plan updated if required.

7.0 Standard Limitations

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Kind regards



Timothy Smith
Hydrogeologist
timothy.smith@aecom.com

Mobile: +61 401 911 967

David Ife
Technical Director Environment
david.ife@aecom.com

Mobile: 0418 172 847

encl: Attachment 1 Figures
Attachment 2 Field Records
Attachment 3 QAQC
Attachment 4 Laboratory Certificates
Attachment 5 Water Results
Attachment 6 Gas Results
Attachment 7 Plates

ATTACHMENT 1 FIGURES

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PROJECT ID 60563317
CREATED BY smitht7
LAST MODIFIED smitht7 24 SEP 2018

AECOM

www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 25 50 75 100
metres

1:2,500 when printed at A4

LEGEND

- Active groundwater bore
- Decommissioned
- Leachate bore
- Leachate
- Leachate Sump
- Stormwater discharge
- Surface water

Data sources:
Base Data: (c) 2014 (Nearmap)

GROUNDWATWER, LEACHATE AND SURFACE WATER MONITORING LOCATIONS

City of Greater Bendigo

Eaglehawk Landfill Environmental Monitoring

Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure

F1

Map Document: (P:\605X\60563317\4. Tech work area\4.99 GIS\02_Maps\60563317_F1_WATER_MONITORING.mxd)

A4 size

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CREATED BY TM
LAST MODIFIED smitht7 24 SEP 2018 www.aecom.com

AECOM

N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 40 80 120 160
metres

1:4,000 when printed at A4

LEGEND

- Licence boundary
- Leachate Sump

Soil-gas bores

- Active
- Destroyed

Data sources:
Base Data: Vicmap (c) 2017 (Imagery: Nearmap)

SUB SURFACE GAS MONITORING BORES AND

City of Greater Bendigo

Eaglehawk Landfill Environmental Monitoring

Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure

F2

Map Document: (P:\605X\60563317\4. Tech work area\4.99 GIS\02_Maps\60563317_F2_LFG MONITORING.mxd)

A4 size



PROJECT ID 43283856
CREATED BY WD
LAST MODIFIED RE 29 JUL 2019

AECOM
www.aecom.com

DATUM GDA 1994, PROJECTION MGA ZONE XX

0 5 10 20
metres
1:994 (when printed at A4)

LEGEND

Buildings, Services and Structures

Type

- Building
- Service
- Structure
- Buildings

Data sources:
Base Data: (c) 2014 (Nearmap)

LFG BUILDINGS, STRUCTURES AND SERVICES MONITORING LOCATIONS

City of Greater Bendigo

Eaglehawk Landfill Monitoring
February 2019
Eaglehawk Landfill
Upper California Gully Rd
Eaglehawk

Figure
F3a

A4 size

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Map Document: (\\AUMEL1FP001.AU.AECOMNET.COM\Projects\605X\60563317\4. Tech work area\4.99 GIS\02_Maps\Buildings and Structures\buildings and structures_ 3a.mxd)



PROJECT ID 43283856
CREATED BY WD
LAST MODIFIED RE 29 JUL 2019

AECOM
www.aecom.com

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 5 10 20
metres
1:800 (when printed at A4)

LEGEND

Type

- Building
- Service
- Structure
- Buildings

Data sources:
Base Data: (c) 2014 (Nearmap)

LFG BUILDINGS, SERVICES AND STRUCTURES SURVEY- RECYCLING CENTRE

City of Greater Bendigo

Environmental Monitoring
February 2019
Eaglehawk Landfill
Upper California Gully Rd

Figure
F3b

A4 size

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PROJECT ID 60563317
CREATED BY smitht7
LAST MODIFIED robert.essler 27 AUG 2019

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE XX

0 20 40 80
metres

1:2,000 (when printed at A3)

LEGEND

July 2019 LFG Walkover Data

CH4 (ppmv)

- <10
- 10 - 200
- 200 - 1000
- >1000

Data sources:
VicMap data:
Background Mapping Data Copyright The State of Victoria 2015. The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information
Imagery: Nearmap (2016)

July 2019 Methane Emissions Walkover Results

City of Bendigo

Eaglehawk Landfill

Upper California Gully, Eaglehawk, VIC

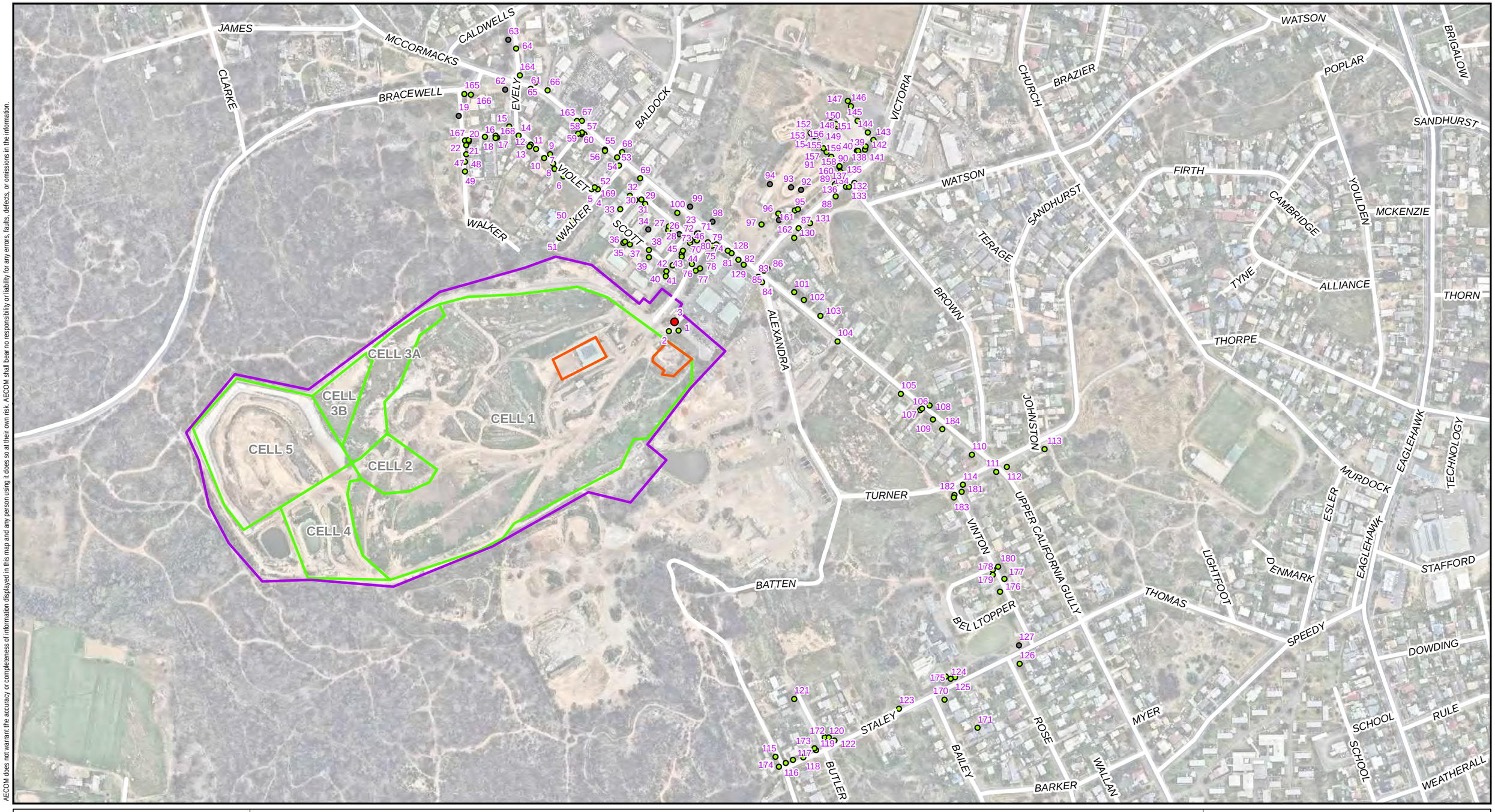
Figure

F4A

Map Document: (P:\605X\60563317\4. Tech work area\4.99 GIS\02_Maps\60563317_F4A_Onsite Gas Walkover.mxd)

A3 size

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PROJECT ID 60579200
CREATED BY TS
LAST MODIFIED smitht7 27 AUG 2019 www.aecom.com

AECOM

N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 60 120 180 240
metres

1:5,761 when printed at A4

LEGEND

- Licence boundary
- Cells
- Area not included in licence

2019_July_Offsite_Survey

- Not Measured / Unable to Locate
- < 10
- > 10

Data sources:
Base Data: Vicmap (c) 2017 (Imagery: Nearmap)

2019 OFF SITE SERVICES AND PITS WALKOVER RESULTS (METHANE)

City of Greater Bendigo

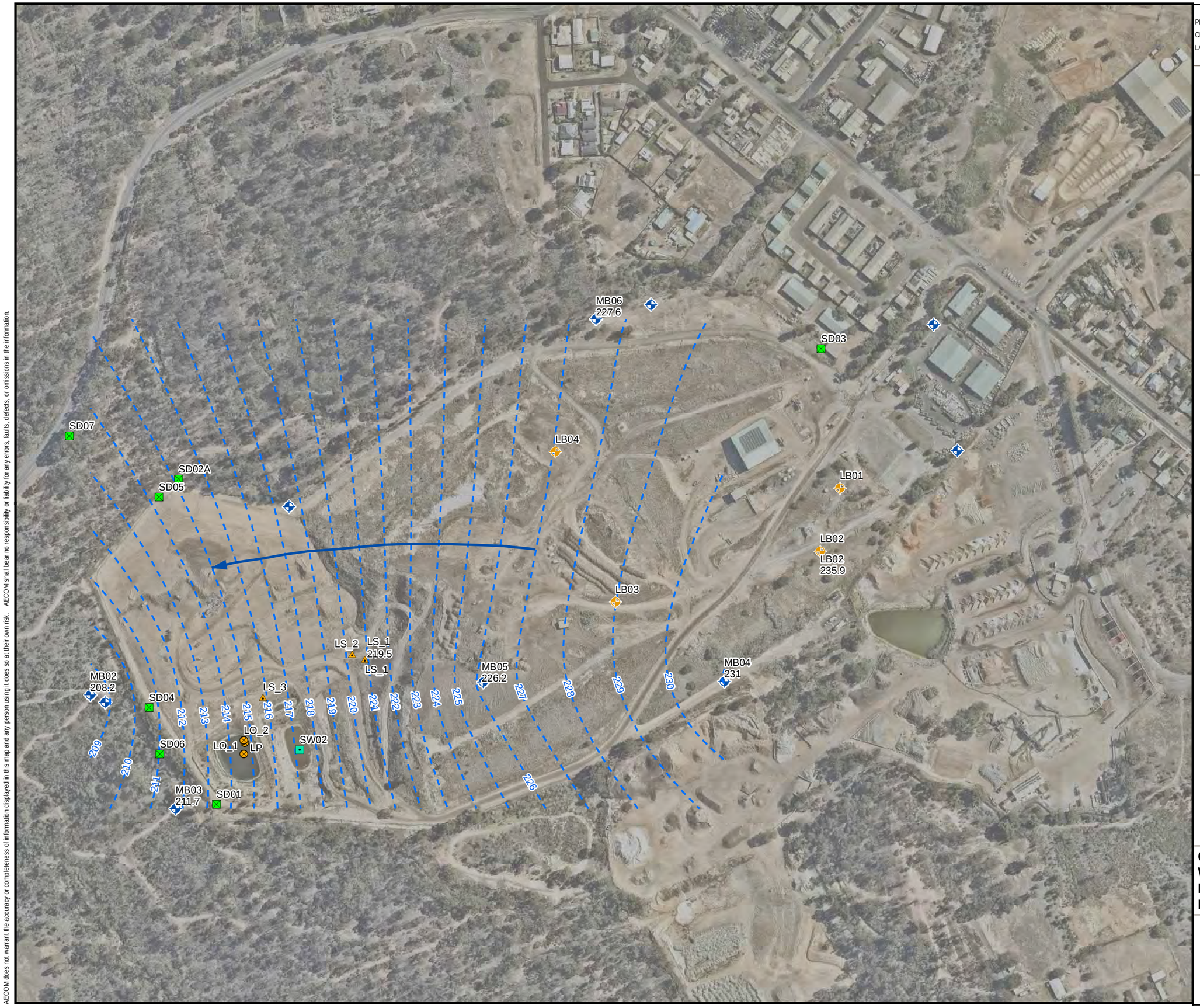
Eaglehawk Landfill Buffer Assessment

Eaglehawk Landfill
Upper California Gully Rd, Eaglehawk

Figure
F4B

Map Document: (P:\605X\60563317\4. Tech work area\4.99 GIS\02_Maps\60563317_F4B_OFFSITE WALKOVER.mxd)

A4 size



PROJECT ID 60563317
CREATED BY smitht7
LAST MODIFIED robert.essler 23 AUG 2019

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N

DATUM GDA 1994, PROJECTION MGA ZONE XX

0 40 80 160
metres

1:3,407 (when printed at A3)

LEGEND

- MB02-MB06 Contours
- Groundwater Bore

Type

- Leachate
- Leachate Sump
- Stormwater
- Surface water
- Inferred Groundwater Direction
- Leachate Bore

Data sources:
VicMap data:
Background Mapping Data Copyright The State of Victoria 2015. The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information
Imagery: Nearmap (2016)

GROUNDWATER RELATIVE WATER LEVELS AND INTERPOLATED CONTOURS MB02-MB06

City of Bendigo

Eaglehawk Landfill

Upper California Gully, Eaglehawk, VIC

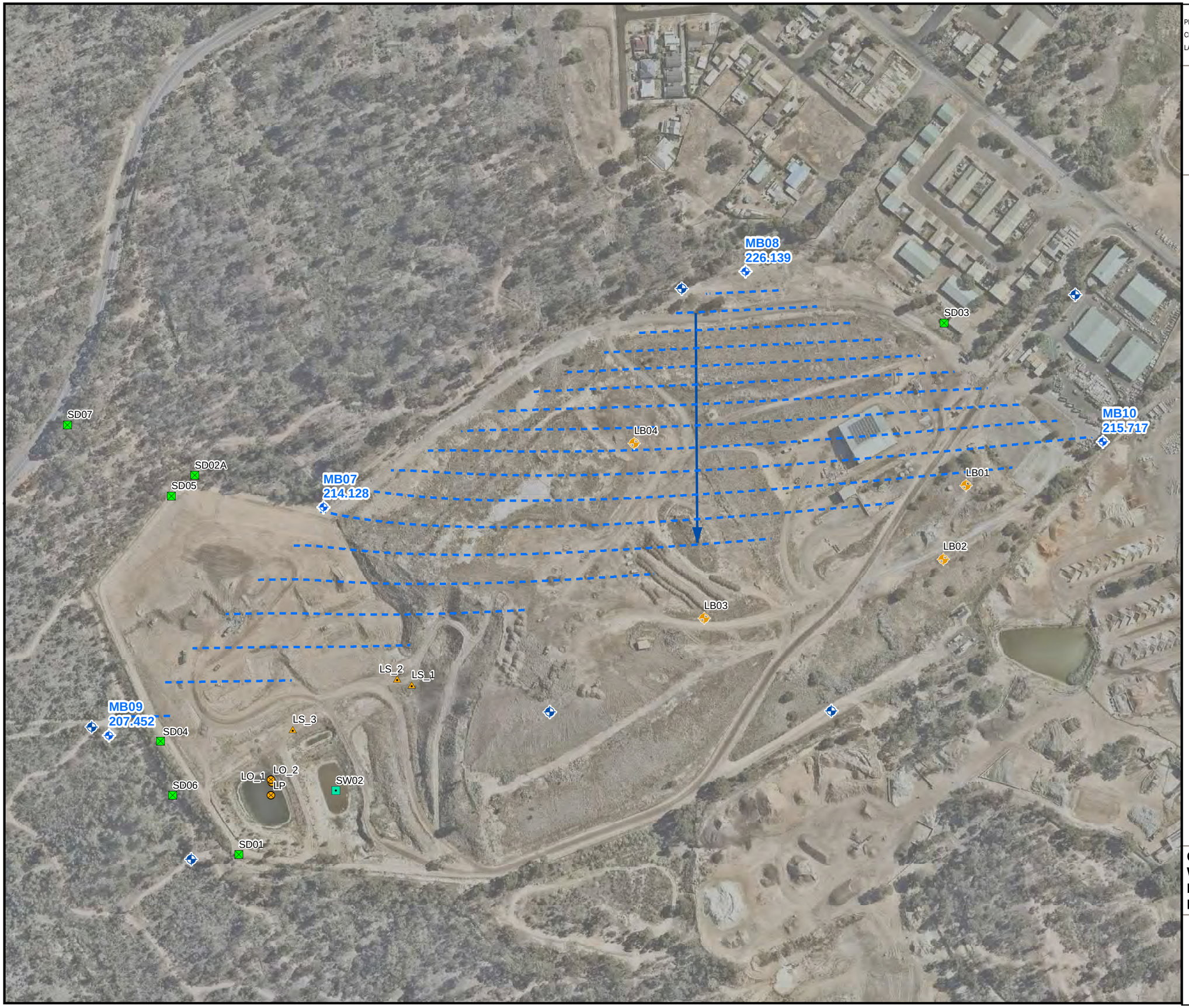
Figure

F5A

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Map Document: (P:\605X\60563317\4. Tech work area\4.7 July 2019 Monitoring Event\groundwater contours\60563317_F5A_Shallow GW Contours.mxd)

A3 size



PROJECT ID 60563317
CREATED BY smitht7
LAST MODIFIED robert.essler 23 AUG 2019

AECOM
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N

DATUM GDA 1994, PROJECTION MGA ZONE XX

0 30 60 120

metres

1:2,922 (when printed at A3)

LEGEND

- July 2019 Deep GW Contour
- Inferred Groundwater Direction
- Groundwater Bore

Type

- Leachate
- Leachate Sump
- Stormwater
- Surface water
- Leachate Bore

Data sources:
VicMap data:
Background Mapping Data Copyright The State of Victoria 2015. The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information
Imagery: Nearmap (2016)

GROUNDWATER RELATIVE WATER LEVELS AND INTERPOLATED CONTOURS MB07-MB10

City of Bendigo

Eaglehawk Landfill

Upper California Gully, Eaglehawk, VIC

Figure

F5B

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Map Document: (P:\605X\60563317\4. Tech work area\4.7 July 2019 Monitoring Event\groundwater contours\60563317_F5B_Deep GW Contours.mxd)

A3 size

ATTACHMENT 2 FIELD RECORDS

ANZ

FQM - NAPL and Groundwater Level Gauging Record

ECOM

Q4AN(EV)-414-FM1

Project Name:	Eaglehawk Landfill	**Project Location:**	Upper California Gully, Eaglehawk	**PM Name:**	Tim Smith
Project Number:	60563317	**Client:**	City of Bendigo	**Fieldwork Staff Name:**	~~TS~~/SW LS BM

Confirm NAPL and groundwater levels by repeat measurements. All columns must be completed. If NAPL is not present in a well write 'ND' (Not Detected) in the relevant column.

Field Data

Well ID	Date (dd/mm/yy)	Time (24hr:mm)	PID Reading (ppm)	Depth to LNAPL (mBTOC)	Depth to Groundwater (mBTOC)	LNAPL Thickness (m)	Depth to DNAPL (mBTOC)	Total Well Depth (mBTOC)	DNAPL Thickness (m)	Comments (well condition, odour, NAPL colour and viscosity)
LB02	10/7/19	9.35	-	-	13.316	-	-	15.06	-	GC, spiders, locked, leachate odour,
LB01		9.46	-	-	DRY	-	-	9.98	-	not locked, stickup lid broken off, probe
LB03		10.10	-	-	DRY	-	-	25.605	-	strong leachate odour, GC, locked, stiff
LB04		10.15	-	-	DRY	-	-	20.41	-	leachate odour, wobly stickup, stiff lock
LS_2					4.770			?		can gauge only no bailer access
LS_1				~~dry~~	3.92			~4.70		~~cannot access to gauge~~. Bailer ok
LS_3					~~2.980~~			2.960		Minor water, Large PVC they remove.
MB08		13.00			21.022			35.60		GC, no well cap, locked
MB06		14.00			20.466			23.76		GC, locked.
MB07	↓	14.45			20.752			35.00		GC, locked tubing in well.
MB02	12/7/19	12pm-12pm			13.251			15.95		Locks broken off
MB09					14.965			35.78		locks broken off
MB03	↓	↓			11.627			14.62		hidden under rock, no gatic lid.

stickup wobly, sediment on probe

Measurement Equipment

Make & Model:		**Supplier:**	Engip.
Serial No.:		**Calibration Report Provided?**	

Notes/Comments

(PID) - photo ionisation detector; (ppm) - parts per million; (LNAPL) - light non-aqueous phase liquids; (DNAPL) - dense light non-aqueous phase liquid; (mBTOC) - metres below top of casing

MB02 & MB09 labeled wrong on map

Approval and Distribution

Fieldwork Staff Signature	Date	Project Manager Signature	Date
[signature]	12/7/19		

Distribution: Project Central File

ANZ

FQM - Groundwater Sampling and Purging Record

Stormwater & surface waters (SP01, SD06, SD03)

Q4AN(EV)-405-FM1

Project Name:	Eaglehawk Landfill	**Project Number:**	60563317	**PM Name:**	Tim Smith	**Sample Date:**	12.7.19
Client:	City of Bendigo	**Project Location:**	Upper California Gully, Eaglehawk	**Fieldwork Staff:**	~~TS / SW~~ LS	**Well Development or Well Sampling Event? (circle)**	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level:	Bore Radius (mm):	Chem Kit Serial No.:	☐ Decontaminated	☐ Low Flow Pump rate:	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc):	Screen Interval (m):	Chem Kit Model:	☐ Dedicated	Intake depth:	Hydrasleeve Type:	
Bore Depth (m-pvc):	Casing Radius (mm):	Corrected Redox: Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc):	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m):	Bore Locked (YES/NO):	Parameter method: ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable):	☐ Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
12/7/19 10:08	SD03	flow 10L/min	–	9.12	1186	8.05	58.3	10.7	samples taken on 12.7.19
collected on 11/7/19	SD06	5L/min	–	9.91	603	8.11	71.6	9.1	samples taken on 11/7/19 parameters on 12.7.19
	SD01	10L/min	–	8.07	1324	8.07	106.6	9.5	"
11/7/19	SD04								dry, picture taken by RE
	SD02A								very low flow, not sampled picture ✓
	SD05								pictured
	SD07								not sweit picture taken.
10/7/19	SW01	surface water							pictures taken, not flowing.
	SW02	surface water							sampled on 10/7/19.
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information
Field Filtered:	**Unfiltered:**		x 40 mL Vial (HCl)		x 60 mL Ferrous	1	x 60 mL metals (HNO_3)	(4)
1	3	1	x 40 mL Vial (H_2SO_4)		x 100 mL Amber	1	x 250 mL Plastic 500	
		1	100 purple bottle					

Field Commets

Bore volume calculation, bore condition, fate of tubing, redox correction etc.

MB02 ~~→~~ 14.965 −35.78
MB09 ~~→~~ 13.251 −15.95
MB03 11.627 −14.62

MB02 is shallow & MB09 is deep figure is wrong

Approval and Distribution

Fieldwork Staff Signature	Date 12/7/19	Checker Name and Signature	Date
Project Manager Signature	Date	Distribution: Project Central File	

ANZ

FQM - Groundwater Sampling and Purging Record

Leachate Params

Q4AN(EV)-405-FM1

Project Name:	Eaglehawk Landfill	**Project Number:**	60563317	**PM Name:**	Tim Smith	**Sample Date:**	10/07/19
Client:	City of Bendigo	**Project Location:**	Upper California Gully, Eaglehawk	**Fieldwork Staff:**	~~TS~~ / ~~SW~~ L S B M	**Well Development or Well Sampling Event? (circle)**	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level:	Bore Radius (mm):	Chem Kit Serial No.:	☐ Decontaminated	☐ Low Flow Pump rate:	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc):	Screen Interval (m):	Chem Kit Model:	☐ Dedicated	Intake depth:	Hydrasleeve Type:	
Bore Depth (m-pvc):	Casing Radius (mm):	**Corrected Redox:** Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc):	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m):	Bore Locked (YES/NO):	**Parameter method:** ☐ Downhole		☐ Other (specify)	Sampling Start Time: 10:00	Hydrasleeve out
	Key Type (if applicable):	☐ Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

	Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
10:00am	LBO2		13.916	-	1.42	2713	7.02	-97.5	16.1	Leachate odour, clear - last
										bailer brown, Low turbidity -
										slight turbidity for the last bailer
10.55am	LS_1		3.92		0.96	13230	7.04	-87.2	14.6	Yellow/grey, medium turbidity leachate odour
	~~LS_3~~									Dry
	LP				16.85	7405	9.29	47.8	11.0	green, low turb, no odour,
	LO_1									submerged
	LO_2									submerged.
11:05am	SW02				15.56	1635	9.61	-9.4	11.2	green, low turbidity, no odour
	SW01									pictures taken, no flowing water.
	Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information
Field Filtered:	**Unfiltered:**		x 40 mL Vial (HCl)		x 60 mL Ferrous	1	x 60 mL metals (HNO_3)	
metals	vast	1	x 40 mL Vial (H_2SO_4)		x 100 mL Amber	1	x ~~250~~ 60 mL Plastic	
		1	60 Sulfate					
		1	60 NaOH					

Field Commets

Bore volume calculation, bore condition, fate of tubing, redox correction etc.

~~Lost water~~

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
Project Manager Signature	Date	**Distribution:** Project Central File	

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

MB02

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Sample Date:	12.7.19
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS/SW LS RE	Well Development or Well Sampling Event? (circle)	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 12.7.19	Bore Radius (mm):	Chem Kit Serial No.: YSI 20317	☐ Decontaminated	☐ Low Flow Pump rate:	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 13.251	Screen Interval (m):	Chem Kit Model: YSI	☐ Dedicated	Intake depth:	Hydrasleeve Type:	
Bore Depth (m-pvc): 14.62	Casing Radius (mm):	Corrected Redox: Y / (N)	☑ Disposable	☑ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): –	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve install time:	Hydrasleeve in
Product Thickness (m): –	Bore Locked (YES/NO):	Parameter method: ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable):	☑ Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or (mg/L))	E.C. (mS/cm or (µS/cm))	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
11:56	2.5			3.61	7165	6.141	-4.4	15.9	brow/grey, high turbidity,
11:58	5.5			2.07	7467	6.29	-0.8	16.7	"
12:00	8.0			2.07	7430	6.30	-13.0	17.0	"
12:03	10.5			1.92	7171	6.30	-17.5	17.0	"
12:05	12.5			3.19	9241	6.47	-22.5	16.9	"
12:11	13.5			2.90	9253	6.39	-25.1	16.8	"
		rested	at	13.5L.					
		and	sampled	@	12:45	on 12/7/19			
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Commets
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous	1	x 60 mL metals (HNO_3)		Bore volume calculation, bore condition, fate of tubing, redox correction etc.
metals	4	1	x 40 mL Vial (H_2SO_4)		x 100 mL Amber	1	x 250 mL Plastic 500		
		1	60 Sulfuric					(5)	
		1	60 NaOH						

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
[signature]	12/7/19		

Project Manager Signature — Date

Distribution: Project Central File

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

MB03

Project Name:	Eaglehawk Landfill	**Project Number:**	60563317	**PM Name:**	Tim Smith	**Sample Date:**	12-7-19
Client:	City of Bendigo	**Project Location:**	Upper California Gully, Eaglehawk	**Fieldwork Staff:**	TS / SW	**Well Development or Well Sampling Event? (circle)**	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 12.7.19	Bore Radius (mm): 50	Chem Kit Serial No.: YS1203	☑ Decontaminated	☑ Low Flow Pump rate: CPM1	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 11.627	Screen Interval (m):	Chem Kit Model:	☐ Dedicated	Intake depth:	Hydrasleeve Type:	
Bore Depth (m-pvc): 14.62	Casing Radius (mm):	Corrected Redox: Y / (N)	☑ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): –	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m): –	Bore Locked (YES/NO)	Parameter method: ☐ Downhole ☑ Retrieved		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable):					Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
11:15	0.5	11.91	CPM R2	0.66	12538	6.86	-145.9	16.9	clear, low turbidity, Sulfur odour
11:18	0.8	11.88	CPM1	0.56	12548	6.87	-148.8	16.4	"
11:21	1.2	11.86	CPM1	0.49	12556	6.87	-146.7	16.2	"
11:24	1.5	11.84	CPM1	0.41	12583	6.85	-143.1	16.4	"
11:27	1.8	11.84	CPM1	0.35	12583	6.85	-139.7	16.3	"
11:30	2.1	11.84	CPM1	0.37	12553	6.84	-137.3	16.4	"
	Stabilised	and sampled							
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information
Field Filtered:	**Unfiltered:**		x 40 mL Vial (HCl)		x 60 mL Ferrous	1	x 60 mL metals (HNO_3)	(5)
metals	4	1	x 40 mL Vial (H_2SO_4)		x 100 mL Amber	1	x 250 mL Plastic 500	
		1	60 Sulfuric					
		1	60 NaOH					

Field Commets

Bore volume calculation, bore condition, fate of tubing, redox correction etc.

Approval and Distribution

Fieldwork Staff Signature	Date: 12/7/19	Checker Name and Signature	Date
Project Manager Signature	Date	**Distribution:** Project Central File	

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

MB04

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Sample Date:	12.7.19
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS/SW L.S R.G	Well Development or Well Sampling Event? (circle)	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 12.7.19	Bore Radius (mm):	Chem Kit Serial No.: XSL 2031	☑ Decontaminated	☑ Low Flow Pump rate: CPM2	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 5.772	Screen Interval (m):	Chem Kit Model: YSI	☐ Dedicated	Intake depth:	Hydrasleeve Type:	
Bore Depth (m-pvc): 22.44	Casing Radius (mm):	Corrected Redox: Y / (N)	☑ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): —	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m): —	Bore Locked (YES/NO):	Parameter method: ☐ Downhole ☑ Retrieved		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable):					Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
08:50	0.5	5.71	CPM1	2.07	12177	6.91	1.7	17.0	clear, ~~no odour~~, no turbidity, slight odour
08:53	0.8	5.71	CPM1	0.84	12739	6.87	38.0	16.5	"
08:56	1.2	5.71	CPM1	0.86	12726	6.86	39.7	16.1	light brown., no odour, low turbidity
08:59	1.5	5.71	CPM2	0.93	12694	6.84	41.4	16.4	"
09:02	1.8	5.74	CPM2	0.70	13004	6.94	44.4	17.5	"
09:05	2.1	5.74	CPM2	0.42	12727	6.85	46.3	17.6	"
09:08	2.4	5.74	CPM2	0.31	12355	6.86	46.8	17.7	medium turbidity
09:11	2.7	5.74	CPM2	0.63	12188	6.86	49.6	17.7	"
09:14	3.0	5.74	CPM2	0.34	12175	6.86	51.1	17.7	"
09:17	3.3	5.74	CPM2	0.28	12212	6.86	53.4	17.8	"
09:20	3.6	5.74	CPM2	0.24	12222	6.86	54.7	17.8	"
		Stabilised and sampled							
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous	1	x 60 mL metals (HNO_3)	(5)
metals	4	1	x 40 mL Vial (H_2SO_4)		x 100 mL Amber	1	x 250 mL Plastic 500	
		1	60 sulfuric					
		1	60 NAOH					

Approval and Distribution

Fieldwork Staff Signature — Date: 12.7.19 — Checker Name and Signature — Date

Project Manager Signature — Date

Distribution: Project Central File

Field Commets

Bore volume calculation, bore condition, fate of tubing, redox correction etc.

144342 - low flow pump number

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

MB05

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Sample Date:	11/7/19
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS / ~~SW~~ L.S	Well Development or Well Sampling Event? (circle)	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 11/7/19	Bore Radius (mm): 50	Chem Kit Serial No.: YSI2031	☑ Decontaminated	☑ Low Flow Pump rate: CPM1	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 23.245	Screen Interval (m): 6m	Chem Kit Model: YSI	☐ Dedicated	Intake depth:	Hydrasleeve Type:	
Bore Depth (m-pvc):	Casing Radius (mm):	Corrected Redox: Y / (N)	☑ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): -	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m): -	Bore Locked (YES/NO):	Parameter method: ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable):	☑ Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
15:42	~~23.238~~	0.5	23.30	CPM1	0.80	15794	6.60	-48.0	18.3° leaf/bark odour, clear, no turbidity
15:45	0.8	23.30	CPM1	0.69	15316	6.58	-134.1	17.8	"
15:48	1.2	23.30	CPM1	0.67	15344	6.65	-128.8	17.9	"
15:51	1.5	23.30	CPM1	0.57	15321	6.57	-121.6	17.0	"
15:54	1.8	23.30	CPM1	0.67	15329	6.57	-109.6	16.7	"
15:57	2.1	23.30	CPM1	0.79	15233	6.56	-100.4	16.8	"
16:00	2.4	23.30	CPM1	0.61	15291	6.56	-96.5	17.0	"
15:03	2.7	23.30	CPM1	0.52	15295	6.57	-87.4	16.8	"
15:06	3.0	23.30	CPM1	0.51	15275	6.57	-86.0	16.5	"
		stabilised		and	sampled				
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous	1	x 60 mL metals (HNO_3)	(5)
metals	4	1	x 40 mL Vial (H_2SO_4)		x 100 mL Amber	1	x 250 mL Plastic 500	
		1	60 sulfuric					
		1	60 NaOH					

Field Commets

Bore volume calculation, bore condition, fate of tubing, redox correction etc.

initial swl with tubing in well 23.098
SWL without tubing = 23.245

3:28 start pump, 3:32 water up on CPM2 (aprox)

PVC wobbly / no lock ~~23.245~~

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
TS	11/7/19		
Project Manager Signature	**Date**	**Distribution:** Project Central File	

ANZ

FQM - Groundwater Sampling and Purging Record

MB06

Q4AN(EV)-405-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Sample Date:	10/7/19
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	~~TS / SW~~ BM/LS	Well Development or Well Sampling Event? (circle)	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 10/7/19	Bore Radius (mm):	Chem Kit Serial No.: 451	☐ Decontaminated	☐ Low Flow Pump rate: /	Hydrasleeve Size: /	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 20.466	Screen Interval (m):	Chem Kit Model: 2031	☐ Dedicated	Intake depth: /	Hydrasleeve Type: /	
Bore Depth (m-pvc): 23.760	Casing Radius (mm): 50	Corrected Redox: Y / (N)	☒ Disposable	☒ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc): /	Gauging
Depth to Product (m-pvc):	Cover Type ~~(gatic/stick up)~~:	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time: /	Hydrasleeve in
Product Thickness (m):	Bore Locked (YES/~~NO~~):	Parameter method: ☐ Downhole		☐ Other (specify)	Sampling Start Time: /	Hydrasleeve out
3.3 + 5	Key Type (if applicable):	☒ Retrieved				Parameters
Calculated bore volume (L): 16.0	Includes/ excludes bore annulus (circle)	# purge volumes removed: ~~3~~ 1		Total purged volume (L): 10L.		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or ~~mg/L~~)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
10/7/19 14 15	1.0	20.466		1.03	8433	7.10	36.0	17.1	no odour, clear, noturbidity
	5.0	23.02		1.99	8389	7.11	47.3	17.4	no odour, orange - brown, mod turb
	10.0	-		-	-	-	-	-	-
			baled dry @ 10L. Left overnight to sample tomorrow.						
11/7/19 09:30	-	20.488		1.50	8649	7.08	92.7	14.1	no odour, orange/brown, mod turb
			sampled on	11/7/19	at	9:30am			
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Commets
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous	1	x 60 mL metals (HNO_3)		Bore volume calculation, bore condition, fate of tubing, redox correction etc.
metals	4	1	x 40 mL Vial (H_2SO_4)		x 100 mL Amber	1	x ~~250~~ mL Plastic 500		1. Gauge WL
		1	60 Sulfuric					(5)	2. use bailer to take samples
		1	60 NaOH						3. use any leftover water to take parameters.

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
[signature]	11/7/19		
Project Manager Signature	**Date**	**Distribution:** Project Central File	

3m watercolum x 5 (50mL bail) = 1 bore volume | remove 3 borevolumes till baled dry. parameters taken every ½ borevolume.

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

MB07

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Sample Date:	10/7/19
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS / SW BM	Well Development or Well Sampling Event? (circle)	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 10/7/19	Bore Radius (mm): 188	Chem Kit Serial No.: 2031	[X] Decontaminated	[X] Low Flow Pump rate: CPM	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 20.752	Screen Interval (m): 29-35	Chem Kit Model: 451	[ ] Dedicated	Intake depth: 31	Hydrasleeve Type:	
Bore Depth (m-pvc): 35.00	Casing Radius (mm): 50	Corrected Redox: Y / (N)	[X] Disposable	[ ] Bailer [ ] Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc):	Cover Type ~~(gatic~~/stick up):	(The correction to apply is probe dependent)	[ ] Other (specify)	[ ] Peristaltic Pump [ ] Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m):	Bore Locked (YES/~~NO~~):	Parameter method: [ ] Downhole		[ ] Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable): Key	[X] Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
14 55	0·3	20·95	CPM2	4.05	11705	6·57	49·8	16·2	no odour, clear, no turbidity
14 58	0·9	21·15	CPM1	2·34	11910	6·50	74.0	16·2	" light greyish yellow, mod turb
15·01	2·2	21·12	CPM2 0/20	1·17	11928	6·50	87.9	15·6	" " low turb.
15·04	2·5	21.15	"	0·86	11905	6·50	97·0	16·2	
15·07	2·8	21·15	"	0·72	11938	6·50	102·2	16·3	
15·10	3·0	21·15	"	0·68	11934	6·50	104.9	16·2	
			Stable & sampled						
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Comments
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous	3	x 60 mL metals (HNO_3)	QC01 - duplicate	Bore volume calculation, bore condition, fate of tubing, redox correction etc.
Metals		3	x 40 mL Vial (H_2SO_4)		x 100 mL Amber	3	x ~~250~~ mL Plastic (500)	QC02 - ~~triplicate~~ 20.87	QC03 - Field blank
		3	60 sulfuric?						QC04 - rinsate blank
		3	60 NAOH P					(5)	

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
B McQuay	10/7/19		
Project Manager Signature	**Date**	**Distribution:** Project Central File	

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

MB08

Project Name:	Eaglehawk Landfill	**Project Number:**	60563317	**PM Name:**	Tim Smith	**Sample Date:**	10.7.19
Client:	City of Bendigo	**Project Location:**	Upper California Gully, Eaglehawk	**Fieldwork Staff:**	~~TS / SW~~ B.M L.S	**~~Well Development~~ or Well Sampling Event?** (circle)	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 10.7.19	Bore Radius (mm):	Chem Kit Serial No.: 2031	☑ Decontaminated	☑ Low Flow Pump rate:	Hydrasleeve Size:	**Monitoring sequence followed (number in order):**
Depth to GW (m-pvc): 21.07	Screen Interval (m): 29-35	Chem Kit Model: YSI	☐ Dedicated	Intake depth: 31 m	Hydrasleeve Type:	
Bore Depth (m-pvc): 35-60	Casing Radius (mm): 50	**Corrected Redox:** Y / (N)	☑ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): -	Cover Type ~~(gatic~~/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m): -	Bore Locked ~~(YES/NO)~~: key	**Parameter method:** ☐ Downhole		☐ Other (specify)	Sampling Start Time: 13.20	Hydrasleeve out
	Key Type (if applicable):	~~☑~~ Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
13:24	0.5	21.53	CPM2	2.85	15089	6.94	-85.6	16.3	clear, no turbidity, slight leachate odour.
13:27	0.8	21.63	CPM1	1.87	15957	6.90	-62.2	16.0	"
13:30	1.1	21.72	20/20	1.20	16362	6.82	-14.5	16.1	"
13:35	1.4	21.80	20/20	1.11	16480	6.76	-0.2	15.7	"
13:38	1.7	21.86	20/20	1.11	16430	6.64	14.6	15.5	"
13:41	1.9	21.90	"	1.14	16316	6.43	30.2	15.6	"
13:44	2.1	21.87	"	1.17	16296	6.31	40.2	15.5	"
13:47	2.3	21.90	"	1.00	16290	6.27	~~47~~.0	15.6	"
13:50	2.5	21.89	"	0.96	16165	6.25	52.2	15.7	"
				Stable & sampled.					
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Comments
Field Filtered:	**Unfiltered:**		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)		Bore volume calculation, bore condition, fate of tubing, redox correction etc.
metals	4 bottles		x 40 mL Vial (H_2SO_4)		x 100 mL Amber		x ~~250~~ mL Plastic 500		
			60 sulfuric					(5)	
			60 NaOH.						

Approval and Distribution

Fieldwork Staff Signature — Date: 10/7/19. — Checker Name and Signature — Date

Project Manager Signature — Date — **Distribution:** Project Central File

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FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

MBIO

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Sample Date:	11/7/19
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS / SW	Well Development or Well Sampling Event? (circle)	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 11/7/19	Bore Radius (mm):	Chem Kit Serial No.: YSI.2031	☑ Decontaminated	☑ Low Flow Pump rate:	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 29.158	Screen Interval (m):	Chem Kit Model: YSI	☐ Dedicated	Intake depth:	Hydrasleeve Type:	
Bore Depth (m-pvc): ~~31.847~~ 28.75	Casing Radius (mm):	Corrected Redox: Y / (N)	☑ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): —	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve install time:	Hydrasleeve in
Product Thickness (m): —	Bore Locked (YES/NO):	Parameter method: ☐ Downhole ☑ Retrieved		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable):					Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or (mg/L))	E.C. (mS/cm or (µS/cm))	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
~~10:47~~		~~29.22~~	~~CPM4~~						
12:10	0.5	29.32	CPM2	3.77	7554	7.13	96.7	15.6	yellow/orange, low turbidity, no odour
12:13	0.8	29.35	CPM2	3.14	8188	7.04	98.0	15.8	"
12:16	1.2	29.32	CPM1	2.97	8348	7.01	98.3	15.5	yellow/orange/medium turbidity, no odour
12:19	1.5	29.32	CPM1	2.52	8322	7.01	97.6	15.2	"
12:21	1.8	29.32	CPM1	2.30	8252	7.01	97.6	15.1	yellow/orange/brown/high turbidity, no odour
12:24	2.1	29.32	CPM1	2.08	8235	7.01	98.1	15.0	"
12:27	2.4	29.32	CPM1	1.86	8164	7.01	99.1	~~15.0~~ 15.0	"
12:30	2.7	29.32	CPM1	1.45	8016	7.03	99.4	15.3	"
12:33	3.0	29.32	CPM1	1.26	7927	7.03	99.1	15.6	"
12:36	3.3	29.32	CPM1	1.09	7886	7.04	98.7	15.6	"
		Stabilised	and sampled						
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Commets
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)		Bore volume calculation, bore condition, fate of tubing, redox correction etc.
metals	4	1	x 40 mL Vial (H_2SO_4)		x 100 mL Amber	1	x ~~250~~ 500 mL Plastic 500		tubing left in well, very deep well.
		1	60 sulfuric					(5)	
		1	60 NaOH						

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
[signature]	11/7/19		
Project Manager Signature	**Date**	**Distribution:** Project Central File	

28.75

11:44 Started pump CPM4 → CPM5
11:55 CPM3 - higher press-

AECOM

ANZ

FQM - Sample QAQC Tracking Sheet

Q4AN(EV)-011-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60563317
Project Location:	er California Gully, Eagleh	Client:	City of Bendigo
PM Name:	Tim Smith	Fieldwork Staff:	TS / SW

QAQC Information

QAQC ID	Primary Sample ID	Sample Type	Batch Number
QC01_10/7/19	MB07	Duplicate	
QC02_10/7/19	MB07	Triplicate	
QC03_10/7/19	-	Field Blank	4/7/19
QC04_10/7/19	-	Rinsate - Pump.	2/7/19
QC05_11/7/19	-	Rinsate - IP	5/7/19
QC06_12/7/19	-	Rinsate - Pump	5/7/19

QA\QC Project Requirements

QAQC	Required		Frequency		Method Used
Field Duplicates	☑ Yes	☐ No	☐ 1 in 10	☑ 1 in 20	
Field Triplicates	☑ Yes	☐ No	☐ 1 in 10	☑ 1 in 20	
Rinsate Blanks	☑ Yes	☐ No	☑ 1 per matrix/equipment/day		
Field Blanks	☑ Yes	☐ No	☑ 1 per ~~day~~	→	One per sampling round
Trip Blanks	☐ Yes	☑ No	☐ 1 per ice chest		
Trip Spikes	☐ Yes	☑ No	☐ 1 per ice chest		

Approval and Distribution

B Mitchell Cleary — Fieldwork Staff Signature

10/7/19 — Date

Project Manager Signature

Date

Distribution: Project Central File

Eaglehawk Landfill 2016 Monitoring

Number: 43283856

Client: City of Greater Bendigo

SITE: EAGLEHAWK LANDFILL

Monitoring Round:

Instrument: TDL-500 and GA5000

			UTM Zone 55				TDL	GA5000						
							CH_4	CH_4	CO_2	O_2	Balance	CO	H_2S	Pressure
Location ID	Type	Description	Easting	Northing	Date	Time	ppmv	% v/v	% v/v	% v/v	% v/v	ppmv	ppmv	Barometric (mb)
EPA Action Level - Subsurface services on and adjacent to the landfill site							5000-10000							
EPA Action Level - Buildings/structures on and adjacent to the landfill site														
	Ambient				10/7/19	9:40	1.6	0.0	0.1	21.2	78.8	0	0	986
					[illegible]	[illegible]	1.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
St1	Structure	Exit Weighbridge (North)	253976	5931724		11:33		0.0	0.1	20.9	79.0	0	0	984
St2	Structure	Entry Weighbridge (Nth)	253998	5931730	10/7/19	11:29	1.9	0.0	0.1	21.0	78.9	0	0	984
Se1	Service	SW drain (West of site office)	254010	5931737	10/7/19	11:31	30.2	0.0	0.1	21.0	79.0	0	0	984
Se2	Service	SW pit (Site entrance)	254007	5931747	10/7/19	12:08	1.8	0.0	0.1	21.2	78.7	0	0	985
B1	Building	Brick (Nth side)	254006	5931733	10/7/19	11:56	2.1	0.0	0.0	21.0	78.9	0	0	984
Se3	Service	Telephone line (Nth-East cnr brick building) full of leaves	254007	5931745	10/7/19	12:04	2.1	0.0	0.1	21.2	78.8	0	0	985
B2	Building	Brick (East side)	254023	5931734	10/7/19	11:48	3.9	0.0	0.1	20.7	79.2	0	0	985
Se4	Service	Drain gatic brick building (East side)	254025	5931739	10/7/19	11:55	9.6*	0.0	0.1	20.9	79.0	0	0	985
Se5	Service	Water mains service pit	254024	5931726	10/7/19	11:52	71.3*	0.6	0.2	20.7	78.6	0	0	985
Se6	Service	Telstra pit (West of garages)	254011	5931719	10/7/19	11:44	16.3%	16.0	4.5	6.2	73.5	0	0	985
Se7	Service	Open steel gatic (West of garages) full of water	253993	5931693	10/7/19	11:36	1.8	0.0	0.1	20.9	79.1	0	0	984
B3	Building	Recycling centre (Sth side)	253884	5931640	10/7/19	9:57	2.0	0.0	0.1	21.2	78.7	0	0	986
B4	Building	First aid room (Recycling centre Sth side)	253860	5931645	10/7/19	9:52	1.8	0.0	0.1	21.1	78.8	0	0	986
Se8	Service	SW pit (West of site building)	253982	5931705	10/7/19	11:35	213*	0.0	0.1	20.9	79.1	0	0	984
~~B6~~ B7	Building	NEW Inside site office/smoko room	~~254008~~	~~5931731~~	10/7/19	11:38	1.8	0.0	0.1	20.8	79.2	0	0	985
Se9	Service	SW pit (w of weighbridge)	253982	5931712	10/7/19	10:08	421*	0.0	0.1	21.4	78.6	0	0	987
Se10	Service	SW Pit (curb near electric box)	253975	5931701	10/7/19	10:05	2.8	0.0	0.1	21.3	78.6	0	0	986
Se11	Service	Recycling centre (cnr SE downpipe)	253898	5931664	10/7/19	9:55	[illegible]	[illegible]	0.1	21.2	78.8	0	0	986
Se12	Service	Recycling centre (cnr SW downpipe)	253868	5931643	10/7/19	9:54	2.2	0.0	0.1	21.2	78.8	0	0	986
Se13	Service	Recycling centre (cnr NW downpipe)	253868	5931688	10/7/19	9:49	16.5	0.0	0.1	21.1	78.8	0	0	986
Se14	Service	Recycling centre (cnr NE downpipe)	253873	5931688	10/7/19	9:44	1.0	0.0	0.1	21.2	78.7	0	0	986
Se15	Service	Pit next to wheelwash	253941	5931689	10/7/19	10:00	3.7	0.0	0.1	21.3	78.7	0	0	986

SE11: 4000+ ppm to ~300 won't stabilise

* Peak - unstable reading

Location ID	Type	Description	UTM Zone 55		Date	Time	CH_4		CO_2	O_2	Balance	CO	H_2S	Pressure
			Easting	Northing			ppmv	% v/v	% v/v	% v/v	% v/v	ppmv	ppmv	Barometric (mb)
EPA Action Level - Subsurface services on and adjacent to the landfill site								5000-10000						
Se22	Service	Telstra Pit 2 (South of office)	253951	5931657	10/7/19	10:03	122	0.0	0.1	21.3	78.6	0	0	987
B6	Building	New Portable (next to recycle centre)			10/7/19									
~~B5~~ B5	Building	~~New Portable~~ OLD (lunchroom/office)			10/7/19	11:59	6.0	0.0	0.1	21.1	78.9	0	0	↑84
B8	Building	New Portable (toilets)			10/7/19	12:01	2.3	0.0	0.1	21.1	78.8	0	0	984
Recycling Eco Centre														
Se16	Service	SW drain entrance	254065	5931778	10/7/19	13:11	1.0	0.0	0.1	20.9	79.0	0	0	982
Se17	Service	SW drain carpark	254043	5931779	10/7/19	13:13	0.9	0.0	0.1	21.0	78.9	0	0	982
Se18	Service	SW pit exit	254030	5931757	10/7/19	12:59	1.5	0.0	0.1	21.0	78.9	0	0	982
Se19	Service	SW drain exit	254033	5931743	10/7/19	12:57	29.9	0.0	0.1	21.0	78.9	0	0	982
Se20	Service	SW drain (near timber frames) clogged rubbish	254065	5931715	10/7/19	13:03	0.9	0.0	0.1	20.9	79.0	0	0	982
Se21	Service	Shed downpipe	254097	5931753	10/7/19	13:06	1.0	0.0	0.0	21.0	79.0	0	0	982
B6	Building	Shed Site office	254092	5931747	10/7/19	13:08	0.9	0.0	0.0	21.0	78.9	0	0	982
Leachate Sump														
St3	Structure	Leachate Sump 1	253502	5931466										
		Leachate Sump 2												

AECOM

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

Q4AN(EV)-703-FM1

SWL + TD

9/47/18

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Date:							
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS / SW LS	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH09	13:56	Ambient	0.0		0.1		20.7		79.2	0	0	0.1	991	0.07	GC,
		Pre-purge	0.0		8.8		15.7		78.3	0	0				
		1 min	0.0		9.1		8.6		82.4	0	0				
		2 min	0.0		9.2		8.0		82.7	0	0				
		3 min	0.0		9.3		7.8		82.9	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH08	14:18	Ambient	0.0		0.1		20.6		79.3	0	0	0.6	991	0.02	GC
		Pre-purge	0.0		0.1		20.5		80.4	0	0				
		1 min	0.0		0.1		20.5		79.5	0	0				
		2 min	0.0		0.1		20.5		79.4	0	0				
		3 min	0.0		0.1		20.5		79.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH08	14:40	Ambient	0.0		0.1		20.6		79.3	0	0	x			
		Pre-purge	0.0		6.7		9.6		84.3	0	0	0.0	992	0.03	
		1 min	0.0		6.7		8.4		84.9	0	0				
		2 min	0.0		6.9		7.8		85.2	0	0				
		3 min	0.0		7.2		7.4		85.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	0.0 0.0		7.2 7.4		7.3 7.6		85.5 85.7	0	0				

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													

1. ambient, no tube, 2. Relative (start) while slot 3. speed action flow (4) (blue)
4 gas reading (White)

AN

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

LS

9/7/19

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Date:	
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS / SW	Monitoring Instrument and Serial Number:	

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH07	14.50	Ambient	0 0		0 1		12.9		80.2	0	0	0.0	992	0 12	GC
		Pre-purge	0.0		0.1		18.9		80.4	0	0				ants in well
		1 min	0.0		4.3		12.9		82.8	0	0				
		2 min	0.0		4.4		12.6		83.0	0	0				
		3 min	0.0		4.5		12.4		83.1	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH06	15:05	Ambient	0.0		0.1		16.3		79.7	0	0	0.0	992	8.12	GC
		Pre-purge	0.0		0.2		21.1		75.5	0	0				
		1 min	0.0		4.0		16.7		79.3	0	0				
		2 min	0.0		4.1		16.7		79.2	0	0				
		3 min	0.0		4.1		16.7		79.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH05	15:15	Ambient	0.0		0.0		21.5		78.1	0	0	0.0	991	0.10	GC
		Pre-purge	0.0		1.8		20.1		78.3	0	0				
		1 min	0.0		1.8		19.9		78.3	0	0				
		2 min	0.0		1.8		19.9		78.3	0	0				
		3 min	0.0		1.9		19.9		78.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH03	15:32	Ambient	0.0		0.0		21.9		76.1	0	0	0.0	991	0.02	GC
		Pre-purge	0 0		3 2		19.3		78.7	0	0				met
		1 min	0.0		3.4		17.0		79.5	0	0				inside
		2 min	0.0		3.5		16 9		79.6	0	0				
		3 min	0.0		3.7		16.7		79.6	0	0				
			0.0		3.4		16 4		79.7	0	0				
			0.0		4.0		16.3		79.7	0	0				
			0.0		4 0		16.3		79.7	0	0				

AN

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet 4500852

AECOM

Q4AN(EV)-703-FM1

9/7/19

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Date:	
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS / SW Lia-S	Monitoring Instrument and Serial Number:	

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH04	15:48	Ambient	0.0		0.0		21.7		78.2	0	0	0.0	991	0.02	GC, ants infestation
		Pre-purge	0.0		2.8		17.7		79.5	0	0				
		1 min	0.0		2.9		17.6		79.6	0	0				
		2 min	0.0		2.9		17.6		79.6	0	0				
		3 min	0.0		2.9		17.65		79.6	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH02	15:56	Ambient	0.0		0.1		21.6		78.3	0	0	0.0	991	0.02	GC
		Pre-purge	0.0		2.0		20.2		78.4	0	0				
		1 min	0.0		2.1		18.4		79.5	0	0				
		2 min	0.0		2.1		18.4		79.5	0	0				
		3 min	0.0		2.1		18.4		79.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH01	16:04	Ambient	0.0		0.0		21.6		78.3	0	0	0.1	991	0.07	GC wet inside
		Pre-purge	0.0		4.8		18.6		78.0	0	0				
		1 min	0.0		4.9		15.7		79.4	0	0				
		2 min	0.0		5.4		15.1		79.5	0	0				
		3 min	0.0		5.4		15.1		79.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH17	16:17	Ambient	0.0		0.1		21.8		78.1	0	0	0.0	991	-0.02	GC - stickup - looks new
		Pre-purge	0.0		3.5		18.9		77.9	0	0				
		1 min	0.0		3.6		17.7		78.6	0	0				
		2 min	0.0		3.7		17.7		78.6	0	0				
		3 min													

AN

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

LS

9/7/19

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Date:							
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS / ~~SW~~	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH27	16:35	Ambient	0.0		0.1		21.6		75.2	0	0	0.0	991	0.00	GC ~~sunset~~ yellow
		Pre-purge	0.0		4.6		15.2		80.2	0	0				
		1 min	0.0		4.6		15.1		80.2	0	0				
		2 min	0.0		4.6		15.1		80.3	0	0				
		3 min	0.0		4.6		15.1		80.3	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH26	~~16:34~~ 16:40	Ambient	0.0		0.0		21.7		78.3	0	0	0.0	991	0.05	GC yellow water in well ~~stuck~~ TD = 13.053
		Pre-purge	0.0		0.2		21.5	60.9 ~~60.4~~	~~78.4~~	0	0				
		1 min	~~60.1~~ 5.1		14.2		1.3		79.4	0	0				
		2 min	5.2		14.2		1.2		79.4	0	0				
		3 min	5.3		14.2		1.1		79.3	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	5.5		14.3		1.0		79.1	0	0		taken on 10/7/19 - 9.09am		

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH25	8:42	Ambient	0.0		0.1		21.2		78.7	0	0	0.0	986	~~0.0~~ 0.07 ~~stuck~~	TD = 2.997 roots on prop GC/yellow. GCP✓
		Pre-purge	0.0		0.1		21.2		71.4	0	0				
		1 min	0.0		7.7		12.1		80.2	0	0				
		2 min	8.0		7.7		12.0		80.2	0	0				
		3 min	0.0		7.7		12.0		80.2	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

10/7/19 LS

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH19	14:49	Ambient	0.0		0.1		21.2		78.7	0	0	0.0	980	0.02	GC, GCP✓ ~~Stuck~~ TD = ~~6.6~~ 6.14
		Pre-purge	0.0		0.1		21.2		78.7	0	0				
		1 min	0.0		8.9		11.3		79.8	0	0				
		2 min	0.0		9.0		11.2		79.9	0	0				
		3 min	0.0		9.2		11.0		79.9	0	0				
		~~Unstable-~~ (Fluctuation or direction & rate of change in 10 secs)	0.0		9.6		10.6		79.9	0	0				grey Stuck up

~~Unstable-~~ Unchecked

GCP = gas cap present

Relative pressure - do while connected to bore?

AN

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

ECOM

Q4AN(EV)-703-FM1

10/7/19

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Date:							
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS/SWT L.S	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH18	15:20	Ambient	0.0		0.1		21.1		78.9	0	0	0.0	980	-0.02	~~SWL~~ =
		Pre-purge	0.1		0.3		21.0		74.6	0	0				TD = 13.94
		1 min	0.1		4.5		9.4		86.1	0	0				GC, lockable stiff
		2 min	0.1		4.5		9.3		86.2	0	0				grey
		3 min	0.1		4.6		8.8		86.5	0	0				stickup
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	0.1 0.2		4.7 4.8		8.5 8.2		86.7 86.8	0 0	0 0				GCP ✓ Rootson probe

CH4 uphill

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH20	15:00	Ambient	0.0		0.1		21.0		78.9	0	0	0.0	981	0.05	GCP ✓
		Pre-purge	0.0		3.4		20.8		79.0	0	0				GC
		1 min	0.0		3.5		17.3		79.2	0	0				~~SWL~~ =
		2 min	0.0		3.5		17.2		79.3	0	0				TD = 4.69
		3 min	0.0		3.6		17.1		79.3	0	0				roots on probe
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	0.0		3.7		17.0		79.3	0	0				grey stickup

next Corresdown

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH21	16:00	Ambient	0.0		0.4		20.7		66.6	~~6616~~ 160	0	0.0	982	~~0~~ 003	GCP ✓ GC
		Pre-purge	0.0		12.9		2.4		84.7	0	6				grey stickup
		1 min	0.0		12.9		2.3		84.8	0	6				location
		2 min	0.0		13.0		2.1		84.8	0	0				ground
		3 min	0.0		13.1		2.1		84.8	0	0				TD = 2.93
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH 22	16:10	Ambient	0.0		0.1		20.8		79.1	0	0	0.0	981	0.05	GCP ✓ GC
		Pre-purge	0.0		0.4		20.7		70.7	0	0				grey stickup
		1 min	0.0		9.9		8.6		81.6	0	0				
		2 min	0.0		9.9		8.5		81.6	0	0				TP 4.67
		3 min	0.0		~~9.9~~ 100		8.4		81.6	0	0				

GCP = gas cap present

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

11/7/19 GA500852

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Date:	
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	~~TS / SW~~ LS	Monitoring Instrument and Serial Number:	

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
~~BH13~~ BH24	08:20	Ambient	0.0		0.1		21.2		78.6	0	0	0.0	981	0.00	ac, grey stuff up ACP
		Pre-purge	0.0		2.3		21.2		78.6	0	0				TD = 8.67 roots & dry dust/clay on probe
		1 min	0.0		2.3		19.3		78.4	0	0				
		2 min	0.0		2.3		19.3		78.4	0	0				
		3 min	0.0		2.3		19.3		78.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

BH13 on map is consistent with locals who like its BH24

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH15	08:33	Ambient	0.0		0.1		21.2		78.6	0	0	0.0	981	0.0	-gas cap missing -old well
		Pre-purge	0.0		0.2		21.3		77.9	0	0				
		1 min	0.0		1.0		20.8		78.2	0	0				
		2 min	0.0		1.0		20.8		78.1	0	0				
		3 min	0.0		1.1		20.8		78.1						
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													

ACP = gas cap present

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Date:	11-7-2019
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS / SW	Monitoring Instrument and Serial Number:	GA5000

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH29	10:20	Ambient	0.0		0.1		21.2		78.7	0	0	0.1	981	0.09	GC
		Pre-purge	0.0		0.2		20.9		70.0	0	0				SWL=11.530
		1 min	0.0		10.7		6.4		82.9	0	0				TD=15.69
		2 min	0.0		10.7		6.4		83.0	0	0				
		3 min	0.0		10.7		6.3		83.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	0.0		10.7		6.3		83.0	0	0				

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH30	11:00	Ambient	0.0		0.1		21.0		78.9	0	0	0.0	981	-0.07	GC
		Pre-purge	0.6		5.9		19.3		76.9	0	0				SWL= —
		1 min	0.0		6.0		13.6		80.4	0	0				TD=15.72
		2 min	0.0		6.0		13.6		80.4	0	0				
		3 min	0.0		6.0		13.6		80.4	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH28	11:50	Ambient	0.0		0.1		21.1		78.8	0	0	0.0	983	0.07	GC
		Pre-purge	0.0		0.2		20.7		74.3	0	0				SWL= —
		1 min	0.0		5.9		16.3		77.8	0	0				TD=10.72
		2 min	0.0		5.9		16.3		77.9	0	0				
		3 min	0.0		5.8		16.3		77.9	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	0.0		5.8		16.3		78.0	0	0				

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH35	12:10	Ambient	0.0		0.1		20.8		79.1	0	0	-0.1	983	-0.07	GC
		Pre-purge	0.0		0.4		20.6		74.6	0	0				SWL= —
		1 min	0.0		6.3		16.6		77.2	0	0				TD=15.65
		2 min	0.0		6.2		16.6		77.2	0	0				
		3 min	0.0		6.2		16.7		77.2	0	0				

AN

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Date:	11-7-2019
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS / SW	Monitoring Instrument and Serial Number:	GA5000

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH37	12:25	Ambient	0.0		0.1		20.8		79.1	0	0	-0.1	982	-0.10	GC
		Pre-purge	0.0		0.6		20.7		75.8	0	0				SWL= —
		1 min	0.0		4.0		17.4		78.6	0	0				TD=15.69
		2 min	0.0		4.0		17.5		78.6	0	0				
		3 min	0.0		3.9		17.5		78.6	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH36	12:40	Ambient	0.0		0.1		21.0		78.9	0	0	-0.1	982	0.12	GC
		Pre-purge	0.0		0.6		20.9		74.0	0	0				SWL= —
		1 min	0.0		5.1		16.4		78.4	0	0				TD=15.69
		2 min	0.0		5.1		16.5		78.4	0	0				
		3 min	0.0		4.9		16.8		78.3	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	0.0 0.0		4.9 4.8		16.9 16.9		78.3 78.3	0 0	0 0				

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH38	13:00	Ambient	0.0		0.1		21.2		78.7	0	0	-0.1	980	0.03	GC
		Pre-purge	0.0		0.4		21.1		74.5	0	0				SWL= —
		1 min	0.0		4.7		16.6		78.7	0	0				TD=15.60
		2 min	0.0		4.7		16.6		78.7	0	0				
		3 min	0.0		4.7		16.6		78.7	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH39	13:10	Ambient	0.0		0.1		21.3		78.6	0	0	-0.1	980	-0.10	GC
		Pre-purge	0.0		0.5		21.2		73.5	0	0				SWL= —
		1 min	0.0		5.8		11.6		82.6	0	0				TD=15.63
		2 min	0.0		5.8		11.6		82.6	0	0				
		3 min	0.0		5.8		11.6		82.6	0	0				

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Date:							
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS / SW	Monitoring Instrument and Serial Number:							

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH40	13:20	Ambient	~~0.0~~		~~0.1~~		~~21.4~~		~~78.6~~	~~0~~	~~0~~		~~981~~		No cap
		Pre-purge													No lock
		1 min	No cap to connect GA5000 to												SWL = —
		2 min													TD = 15.60
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH34	14:25	Ambient	0.0		0.1		21.3		78.5	0	0	0.1	982	-0.09	GC
		Pre-purge	0.0		0.4		21.2		78.3	0	0				SWL = —
		1 min	0.0		9.6		13.0		77.4	0	0				TD = 15.68
		2 min	0.0		9.6		13.0		77.4	0	0				
		3 min	0.0		9.6		13.0		77.5	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH33	14:40	Ambient	0.0		0.1		21.4		78.5	0	0	0.0	983	0.00	GC
		Pre-purge	0.0		0.6		21.3		78.2	0	0				SWL = 11.803
		1 min	0.0		3.5		17.5		79.0	0	0				TD = 15.69
		2 min	0.0		3.5		17.5		79.0	0	0				
		3 min	0.0		3.5		17.5		79.0	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH32	15:05	Ambient	0.0		0.1		21.4		78.5	0	0	0.0	982	-0.22	GC
		Pre-purge	0.0		0.7		21.4		78.0	0	0				SWL = —
		1 min	0.0		8.9		12.2		79.0	0	0				TD = 15.72
		2 min	0.0		8.9		12.2		79.0	0	0				
		3 min	0.0		8.8		12.2		79.0	0	0				

AE

FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

AECOM

Q4AN(EV)-703-FM1

Project Name:	Eaglehawk Landfill	Project Number:	60563317	PM Name:	Tim Smith	Date:	11-7-2019
Client:	City of Bendigo	Project Location:	Upper California Gully, Eaglehawk	Fieldwork Staff:	TS / SW	Monitoring Instrument and Serial Number:	GA5000

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH71	16:30	Ambient	0.0		0.1		21.6		78.3	0	0	0.0	981	-0.22	GC
	11/7	Pre-purge	0.0		0.3		21.6		70.8	0	0				SWL= —
		1 min	0.0		8.0		10.3		81.7	0	0				TD=15.60
		2 min	0.0		8.0		10.2		81.8	0	0				
		3 min	0.0		8.0		10.3		81.7	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	0.0		8.0		10.3		81.7	0	0				

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
BH73	8:55	Ambient	0.0		0.1		21.2		78.7	0	0	0.0	981	-0.03	GC
	12/7	Pre-purge	0.0		0.1		21.1		76.2	0	0				SWL= —
		1 min	0.0		2.8		18.6		78.6	0	0				TD=3.76
		2 min	0.0		3.1		18.3		78.6	0	0				
		3 min	0.0		3.3		18.1		78.6	0	0				
		Unstable- (Fluctuation or direction & rate of change in 10 secs)	0.0		3.5		17.9		78.6	0	0				
			0.0		3.5		17.9		78.6	0	0				

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
		Ambient													
		Pre-purge													
		1 min													
		2 min													
		3 min													

ANZ

FQM - Landfill Cap Surveys Data Sheet

AECOM

Q4AN(EV)-702-FM1

Project Name:		Project Number:	
Project Location:		Client:	
PM Name:		Date:	
Monitoring Instrument and Serial Number:		Fieldwork Staff:	

Field Data

Point ID	Easting	* ~~Northing~~ South	CH4 (ppmv)	Comments/ Features
327	144.24438	36.72408	1.0	mud
328	24419	72798	1.0	"
329	397	792	1.61	"
330	374	786	1.2	grass
331	347	786	1.2	gravel
332	321	787	1.3	"
333	295	789	1.3	"
334	272	793	1.4	"
335	245	794	1.3	"
336	219	794	1.4	"
337	193	794	1.3	"
339	167	800	1.5	"
340	141	805	1.5	"
341	117	31813	1.6	"
342	094	821	1.5	"
343	072	830	1.6	"
344	051	842	1.8	"
345	031	856	1.6	"
346	014	867	1.5	"
347	3154	879	1.6	"
348	962	890	1.6	"
349	941	904	5.7	
350	923	916	2.3	"
351	898	930	1.7	"
352	912	944	1.9	"
353	935	932	2.0	"
354	954	922	8.5	clay cap
355	976	908	1.8	"
356	996	2899	4.5	"
357	4017	886	1.8	grass
358	4036	873	1.5	"
359	059	860	3.0	clay
360	078	848	5.0	gravel
361	100	836	1.5	grass
362	121	826	1.6	grass
363	147	819	2.5	clay.
364	174	813	1.5	grass
365	203	812	1.6	"
366	231	812	1.7	"
367	258	810	1.6	"
368	284	809	1.5	"
369	312	807	1.5	"
370	338	807	1.6	grass - clay
371	365	809	1.6	"
372	393	814	1.5	"

Approval and Distribution

Fieldwork Staff Signature _____ Date _____

Project Manager Signature _____ Date _____

Distribution: Project Central File

ANZ

FQM - Landfill Cap Surveys Data Sheet

AECOM

Q4AN(EV)-702-FM1

Project Name:		**Project Number:**	
Project Location:		**Client:**	
PM Name:		**Date:**	
Monitoring Instrument and Serial Number:		**Fieldwork Staff:**	

Field Data

Point ID	Easting	Northing	CH4 (ppmv)	Comments/ Features
373	144.24420	36.72820	1.6	mud.
374	402	835	1.4	mud road/track
375	377	840	1.5	"
376	352	849	1.6	"
377	327	853	1.4	"
378	301	858	1.3	"
379	281	863	1.4	"
380	254	871	1.4	"
381	232	886	1.5	"
382	211	896	1.5	"
383	187	910	1.6	"
384	161	901	9.20	grass
385	133	893	2.2	"
386	106	887	1.4	"
387	080	884	1.3	"
388	057	897	1.5	"
389	037	911	1.3	"
390	016	924	2.1	"
391	3994	935	2.2	"
392	975	950	1.7	"
393	953	963	2.0	"
394	973	976	1.9	"
395	3994	963	1.9	rocks
396	4019	954	1.9	dirt.
397	042	945	4.5	"
398	071	937	2.0	"
399	100	940	1.6	clay
400	129	950	1.6	"
401	158	942	2.2	"
402	185	936	1.8	cap
403	214	930	1.4	" grass
404	242	919	1.3	cap/gravel
405	240	896	1.4	grass
406	268	887	1.4	grass
407	287	901	1.3	"
408	271	931	1.4	"
409	245	950	1.3	"
410	223	965	1.2	"
411	161	968	1.7	dirt.
412	138	984	1.2	"
413	100	944	3.0	"
414	4065	994	2.4	"
415	045	3013	5.7	"
416	040	034	5.4	Grass
417	083	022	1.7	Clay

Approval and Distribution

Fieldwork Staff Signature _____ Date _____

Project Manager Signature _____ Date _____

Distribution: Project Central File

ANZ

FQM - Landfill Cap Surveys Data Sheet

Q4AN(EV)-702-FM1

Project Name:		Project Number:	
Project Location:		Client:	
PM Name:		Date:	
Monitoring Instrument and Serial Number:		Fieldwork Staff:	

Field Data

Point ID	Easting	Northing	CH4 (ppmv)	Comments/ Features
418	144.24129	36.73018	2.8	Dirt
419	168	008	4.1	"
420	211	009	1.8	Grass
421	254	012	1.8	"
422	294	006	1.5	Dirt Road
423	298	2977	1.4	Grass
424	348	982	1.6	Dirt
425	373	970	1.5	"
426	391	955	1.7	"
427	417	943	1.7	"
428	437	920	1.6	"
429	463	902	1.5	"
430	487	921	1.6	"
431	510	937	2.6	"
432	477	949	1.9	Grass
433	457	970	1.8	Dirt
434	432	985	1.8	Grass
435	402	996	2.1	"
436	379	3013	1.9	Dirt
437	353	028	2.2	Grass
438	333	044	2.1	"
439	310	064	1.9	"
440	280	079	2.8	"
441	263	101	2.8	"
442	240	127	1.9	Dirt Road
443	271	117	1.9	Grass
444	297	105	2.0	Grass / Dirt
445	326	092	1.9	"
446	355	079	1.8	"
447	382	063	2.5	Dirt
449	422	043	1.5	Grass
450	4030	3054	3.8	"
451	017	080	16.7	"
452	011	106	25.1	Grass / Bark
453	007	126	11.0	Grass / Clay
454	014	150	3.2	Grass
~~455~~ 454A	043	157	7.7	Clay
455	072	151	2.9	Grass
456	104	143	2.4	"
457	133	134	2.5	"
458	164	122	2.3	Bark
459	191	105	1.9	"
460	216	088	2.5	Grass
461	242	072	3.5	"
462	265	055	4.3	"

Approval and Distribution

Fieldwork Staff Signature _____ Date _____

Project Manager Signature _____ Date _____

Distribution: Project Central File

ANZ

FQM - Landfill Cap Surveys Data Sheet

Project Name:		Project Number:	
Project Location:		Client:	
PM Name:		Date:	
Monitoring Instrument and Serial Number:		Fieldwork Staff:	

Field Data

Point ID	Easting	Northing	CH4 (ppmv)	Comments/ Features
463	144.24228	36.73043	4.5	Grass
464	199	060	3.5	"
465	170	078	3.3	Dirt
466	136	093	3.5	"
467	106	108	3.1	"
468	075	117	3.9	Grass
469	037	107	5.6	Grass/Bark
470	069	093	3.8	"
471	107	075	2.3	Grass
472	139	063	4.3	Bark
473	161	039	3.6	Dirt
474	078	052	2.2	"
475	4199	3142	1.4	Dirt Road
476	168	154	2.0	"
477	136	162	2.2	"
478	104	170	1.4	"
479	072	179	1.3	"
480	042	189	1.3	"
481	014	185	1.2	"
482	3987	167	0.9	"
483	4034	2998	2.9	"
484	016	3021	2.4	Clay
485	001	041	20.9	"
486	3993	067	14.8	"
487	984	088	13.8	"
488	981	112	8.3	"
489	982	144	3.7	"
490	959	114	2.1	Dirt Road
491	956	088	2.7	"
492	961	066	6.7	Clay
493	964	046	5.4	"
494	976	024	2.7	"
495	990	3008	6.4	Grass
496	958	006	36.0	Clay
497	936	2986	44.0	"
498	923	962	1.4	"
499	4323	928	0.9	Grass
500	3847	915	1.0	Clay
501	376	905	1.3	"
502	406	896	2.5	"
503	423	868	1.2	"
504	396	859	1.3	Grass
505	373	870	1.4	Clay
506	327	893	1.3	"

Approval and Distribution

Fieldwork Staff Signature _____ Date _____

Project Manager Signature _____ Date _____

Distribution: Project Central File

Equipment Quality Report
Water Level Meter

Enqip #: 9469
Company: AECOM Australia Pty Ltd
Consultant: Tim Smith
PO #: 60563317/task 2
Certificate #: 13182

INSTRUMENT IDENTIFICATION

Model Number: 100/122
Serial Number: 237942
Instrument Type: Solinst Interface Meter

INSPECTION RECORD

Battery:	PASS	**Water Beeper:**	PASS
Tape Condition:	PASS	**Equipment Condition:**	PASS

Tested By: Mitch O'Grady **Test Date:** 8/07/2019

enqip
116 Thistlethwaite St, South Melbourne 3205
P 1300 218 987
E info@enqip.com.au | **W** www.enqip.com.au

Equipment Calibration Form
YSI ProPlus

Enqip #: 9469
Company: AECOM Australia Pty Ltd
Consultant: Tim Smith
PO #: 60563317/task 2
Certificate #: 13179

INSTRUMENT IDENTIFICATION

Model Number: 6050000
Serial Number: 18L102031
Instrument Type: YSI ProPlus

INSPECTION RECORD

Batteries Checked:	PASS	**Date & Time:**	PASS
Electrodes Cleaned/Checked:	PASS	**Temperature:**	PASS

CALIBRATION DETAILS

Sensor	Cal Solution	Value	Reading
pH	Buffer 4.00	4.00 pH	4.00 pH
	Buffer 7.00	7.00 pH	7.00 pH
Redox	Standard ORP	241 mV @ 15 °C	241 mV
O_2	Zero Dissolved Oxygen	0.0 %	0.0 %
	Air	100.0 %	100.0 %
Conductivity	Standard Conductivity	2.76 mS/cm	2.76 mS/cm

Calibration Successful: YES

Calibrated By: Mitch O'Grady **Test Date:** 8/07/2019

enqip
116 Thistlethwaite St, South Melbourne 3205
P 1300 218 987
E info@enqip.com.au | **W** www.enqip.com.au

Equipment Calibration Form
GA5000

Enqip #: 9469
Company: AECOM Australia Pty Ltd
Consultant: Tim Smith
PO #: 60563317/task 2
Certificate #: 13180

INSTRUMENT IDENTIFICATION

Model Number: GA5KA0F-100
Serial Number: GA500852
Instrument Type: GTI - GA5000

INSPECTION RECORD

Date & Time: PASS
Flow Rate: 619 mL/min

CALIBRATION DETAILS

Sensor	Standard	Reading	Traceability Lot #
CH_4	N_2 UHP	0 %	1009971
	2.5 %	2.5 %	987629
	60 %	60.0 %	1054211
CO_2	5 %	5.0 %	815306
	40 %	40.0 %	1054211
O_2	N_2 UHP	0 %	1009971
	20.9 %	20.9 %	N/A
CO	N_2 UHP	0 ppm	1009971
	100 ppm	100 ppm	987629
H_2S	N_2 UHP	0 ppm	1009971
	25 ppm	25 ppm	1092132

Calibration Successful: YES

Calibrated By: Mitch O'Grady **Test Date:** 8/07/2019

enqip
116 Thistlethwaite St, South Melbourne 3205
P 1300 218 987
E info@enqip.com.au | **W** www.enqip.com.au

Equipment Calibration Check
Inspectra Laser

Enqip #: 9469
Company: AECOM Australia Pty Ltd
Consultant: Tim Smith
PO #: 60563317/task 2
Certificate #: 13181

UNIT IDENTIFICATION

Model Number: Inspectra Laser
Serial Number: CH48921215
Unit Type: Methane Analyser

INSPECTION RECORD/CONDITION REPORT

Flow Rate: PASS
Alarms: PASS

CALIBRATION DETAILS

Gas	Reading	Traceability Lot #
Nitrogen UHP	0.0 ppm	1068301
Methane 100 ppm	96.4 ppm	1009971
Methane 2.5 %	2.4 %	977870

Calibration Successful: YES

Calibrated By: Kaz Svazas **Test Date:** 8/07/2019

enqip
423 City Road, South Melbourne 3205
P 1300 218 987
E info@enqip.com.au | **W** www.enqip.com.au

ATTACHMENT 3 QAQC

Table 3-1
Rinsate and Field Blanks
60563317
CGB - Eaglehawk Landfill
Field Blanks (water)
Filter: SDG in('ALSE-Melbourne 12-Jul-19','ALSE-Melbourne 11-Jul-1

SDG	ALSE-Melbourne 11-Jul-19	ALSE-Melbourne 11-Jul-19	ALSE-Melbourne 12-Jul-19	ALSE-Melbourne 12-Jul-19
Field ID	QC03_10/7/19	QC04_10/7/19	QC05_11/7/19	QC06_12/7/19
Sampled_Date/Time	10/07/2019 15:00	10/07/2019 15:00	11/07/2019 15:00	12/07/2019 15:00
Sample Type	Field_B	Rinsate	Rinsate	Rinsate

Chem_Group	**ChemName**	**Units**	**EQL**				
Alkalinity	Bicarbonate Alkalinity as CaCO3	mg/L	1	**4**	<1	**2**	<1
	Carbonate Alkalinity as CaCO3	mg/L	1	<1	<1	<1	<1
	Hydroxide Alkalinity as CaCO3	mg/L	1	<1	<1	<1	<1
	Total Alkalinity as CaCO3	mg/L	1	**4**	<1	**2**	<1
	Bicarbonate as HCO3	mg/L	1			**2**	<1
Bulk Organics	Biological Oxygen Demand	mg/L	2	<2	<2	<2	<2
	Chemical Oxygen Demand	mg/L	10	<10	<10	<10	<10
Cyanides	Cyanide (Free)	mg/L	0.004	<0.004	<0.004	<0.004	<0.004
	Cyanide Total	µg/L	4	<4	<4	<4	<4
Field	Turbidity	NTU	0.1				
Major Ions	Chloride	mg/L	1	<1	<1	<1	<1
	Calcium (Filtered)	mg/L	1	<1	<1	<1	<1
	Magnesium (Filtered)	mg/L	1	<1	<1	<1	<1
	Potassium (Filtered)	mg/L	1	<1	<1	<1	<1
	Sodium (Filtered)	mg/L	1	<1	<1	<1	**8**
	Sulfate as SO4 (Filtered)	mg/L	1	<1	<1	**1**	<1
	Total Anions	meq/L	0.01	**0.08**	<0.01	**0.06**	<0.01
	Total Cations	meq/L	0.01	<0.01	<0.01	<0.01	**0.35**
	Ionic Balance	%	0.01		<0.01		
Metals	Arsenic (Filtered)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
	Cadmium (Filtered)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Chromium (Filtered)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
	Copper (Filtered)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
	Iron (Filtered)	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
	Lead (Filtered)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
	Manganese (Filtered)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
	Nickel (Filtered)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
	Zinc (Filtered)	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Nutrients	Ammonia (as N)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
	Nitrate (as N)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
	Nitrite (as N)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
	Total Kjeldahl Nitrogen	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
	Nitrite + Nitrate as N	µg/L	10	<10	<10	<10	<10
	Total Phosphorus	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Organic Matter	Total Organic Carbon	mg/L	1	<1	<1	<1	<1
Physio-Chemical Parameters	Total Dissolved Solids	mg/L	10	<10	<10	<10	<10

Table 3-2
Field RPDs
60563317
CGB - Eaglehawk Landfill

Field Duplicates (water)
Filter: SDG in('ALSE-M

SDG	ALSE-Melbourne 11-Jul-19	ALSE-Melbourne 11-Jul-19		ALSE-Melbourne 11-Jul-19	10-Jul-19	
Field ID	MB07_10/7/19	QC01_10/7/19	**RPD**	MB07_10/7/19	QC02_10/7/19	**RPD**
Sampled Date/Time	10/07/2019 15:00	10/07/2019 15:00		10/07/2019 15:00	10/07/2019 15:00	
Chem_Gro	**ChemNam**	**Units**	**EQL**						
Organic Ma	Total Orga	mg/L	1 : 5 (Interlab)	<5	<5	0	<5	12	82
atter									
Physio-Che	Total Disso	mg/L	10	7590	7640	1	7590	7800	3
emical Parameters									
Metals	Arsenic (Fi	mg/L	0.001	0.005	0.004	22	0.005	0.001	133
	Cadmium (	mg/L	0.0001 : 0.0002 (Interlab)	0.0002	0.0003	40	0.0002	0.0003	40
	Chromium	mg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Copper (Fi	mg/L	0.001	0.007	0.007	0	0.007	0.006	15
	Iron (Filtere	mg/L	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Lead (Filte	mg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Manganese	mg/L	0.001 : 0.005 (Interlab)	0.033	0.033	0	0.033	0.035	6
	Nickel (Filt	mg/L	0.001	0.015	0.016	6	0.015	0.015	0
	Zinc (Filter	mg/L	0.005	0.02	0.02	0	0.02	0.021	5
Bulk Organ	Biological (	mg/L	2 : 5 (Interlab)	<2	<2	0	<2	<5	0
	Chemical (	mg/L	10 : 25 (Interlab)	<20	<20	0	<20	45	77
ics									
Alkalinity	Bicarbonat	mg/L	1 : 20 (Interlab)	798	798	0	798	650	20
	Carbonate	mg/L	1 : 10 (Interlab)	<1	<1	0	<1	<10	0
	Hydroxide A	mg/L	1	<1	<1	0	<1		
	Total Alkali	mg/L	1	798	798	0	798		
Nutrients	Ammonia (	mg/L	0.01	0.05	0.02	86	0.05	<0.01	133
	Nitrate (as	mg/L	0.01 : 0.02 (Interlab)	0.06	0.05	18	0.06	0.12	67
	Nitrite (as I	mg/L	0.01	<0.01	<0.01	0	<0.01		
	Total Kjeld	mg/L	0.1 : 0.2 (Interlab)	0.2	0.1	67	0.2	<0.2	0
	Nitrite + Ni	µg/L	10	60	50	18	60		
	Total Phos	mg/L	0.01	0.32	0.41	25	0.32		
Major Ions	Chloride	mg/L	1	3720	3690	1	3720	3300	12
	Calcium (F	mg/L	1	139	106	27	139		
	Magnesium	mg/L	1	494	450	9	494		
	Potassium	mg/L	1	57	59	3	57		
	Sodium (Fi	mg/L	1	2070	1940	6	2070		
	Sulfate as	mg/L	1	704	729	3	704		
	Total Anior	meq/L	0.01	136	135	1	136		
	Total Catio	meq/L	0.01	139	128	8	139		
	Ionic Balan	%	0.01	**1.29**	**2.65**	**69**	1.29		
Cyanides	Cyanide (F	mg/L	0.004 : 0.005 (Interlab)	<0.004	<0.004	0	<0.004	<0.005	0
	Cyanide To	µg/L	4	<4	<4	0	<4		

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 200 (1-10 x EQL); 50 (10-20 x EQL); 30 (> 20 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

ATTACHMENT 4 LABORATORY CERTIFICATES

FQM - Generic Chain of Custody Form

timothy.smith@aecom.com

CONSULTANT: AECOM	ADDRESS / OFFICE:	SAMPLER: Liq	Destination Laboratory: ALS
PROJECT MANAGER (PM): Tim Smith	SITE: Eaglehawk Landfill	MOBILE:	PHONE:
PROJECT NUMBER & TASK COI 60563317	P.O. NO.:	EMAIL REPORT TO: vera.levina@aecom.com	
RESULTS REQUIRED (Date):	QUOTE NO.:	ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)	

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:
All metals bottles have been field filtered.

Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water) | CONTAINER INFORMATION

ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles	TDS, major ions	Bicarb alkalinity	Ammonia, Nitrate	TKN, Phosphorus	TOC	CoD/BOD	total & free Cyanide.	Metals (Mn, Fe, As, Cd, Cu, Cr, Ni, Pb, Zn)	metals (Mn, Fe only)	Turbidity			HOLD
1	LBØ2_10/7/19	W	10/7/19		P, SP, VS, SH, N	5	X	X	X	X	X	X	X	X					
2	LS-1_10/7/19				"	5													
3	LP_10/7/19				"	5													
4	SWO2_10/7/19				P, SP, VS, N	4	X	X	X	X	X				X	X				
5	MB09_10/7/19				P, SP, VS, N, SH	5						X	X	X					
6	MB07_10/7/19					5													
7	QC01_10/7/19																		
→	QC02_10/7/19																		
8	QC03_10/7/19																		
9	QC04_10/7/19	↓	↓	↓	↓		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓			

Forward please →

Please send to Eurofins/mgt.

Forwarded to Secondary Lab
Initials Date 11/7

Environmental Division
Melbourne
Work Order Reference
EM1910906

Telephone : +61-3-8549 9600

RELINQUISHED BY:		RECEIVED BY		METHOD OF SHIPMENT
Name:	Date:	Name:	Date:	Con' Note No:
Of:	Time:	Of:	Time:	Transport Co:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

Soil Container Codes: Jar = Unpreserved glass jar

COC Page | of

KAnn (Am) 11/7, 9:30

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM1910906**

Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: MR TIMOTHY SMITH	Contact	: Peter Ravlic
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: timothy.smith@aecom.com	E-mail	: peter.ravlic@alsglobal.com
Telephone	: 6432 2000	Telephone	: +6138549 9645
Facsimile	: ----	Facsimile	: +61-3-8549 9626
Project	: 60563317	Page	: 1 of 3
Order number	: 60563317/1.0	Quote number	: EB2017AECOMAU0014 (EN/004/16)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: Eaglehawk Landfill		
Sampler	: Lia		

Dates

Date Samples Received	: 11-Jul-2019 09:30	Issue Date	: 11-Jul-2019
Client Requested Due Date	: 18-Jul-2019	Scheduled Reporting Date	: **18-Jul-2019**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 1.1°C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 9 / 9

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EG020F Dissolved Metals by ICP/MS	WATER - EK026SF Total Cyanide by Segmented Flow Analyser	WATER - EP005 Total Organic Carbon (TOC)	WATER - EP030 BOD	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity	WATER - NT-09 TKN, Total Phosphorus	WATER - W-01 7 Metals
EM1910906-001	10-Jul-2019 00:00	LB02_10/7/19	✓	✓	✓	✓	✓	✓	✓
EM1910906-002	10-Jul-2019 00:00	LS_1_10/7/19	✓	✓	✓	✓	✓	✓	✓
EM1910906-003	10-Jul-2019 00:00	LP_10/7/19	✓	✓	✓	✓	✓	✓	✓
EM1910906-004	10-Jul-2019 00:00	SW02_10/7/19	✓		✓		✓	✓	
EM1910906-005	10-Jul-2019 00:00	MB08_10/7/19	✓	✓	✓	✓	✓	✓	✓
EM1910906-006	10-Jul-2019 00:00	MB07_10/7/19	✓	✓	✓	✓	✓	✓	✓
EM1910906-007	10-Jul-2019 00:00	QC01_10/7/19	✓	✓	✓	✓	✓	✓	✓
EM1910906-008	10-Jul-2019 00:00	QC03_10/7/19	✓	✓	✓	✓	✓	✓	✓
EM1910906-009	10-Jul-2019 00:00	QC04_10/7/19	✓	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EA045 Turbidity	WATER - EK025SF Free CN By Segmented Flow Analyser	WATER - EK055G Ammonia as N By Discrete Analyser	WATER - EK058G Nitrate as N by Discrete Analyser	WATER - EP026SP Chemical Oxygen Demand (COD)
EM1910906-001	10-Jul-2019 00:00	LB02_10/7/19	✓		✓	✓	✓	✓
EM1910906-002	10-Jul-2019 00:00	LS_1_10/7/19	✓		✓	✓	✓	✓
EM1910906-003	10-Jul-2019 00:00	LP_10/7/19	✓		✓	✓	✓	✓
EM1910906-004	10-Jul-2019 00:00	SW02_10/7/19	✓	✓		✓	✓	
EM1910906-005	10-Jul-2019 00:00	MB08_10/7/19	✓		✓	✓	✓	✓
EM1910906-006	10-Jul-2019 00:00	MB07_10/7/19	✓		✓	✓	✓	✓
EM1910906-007	10-Jul-2019 00:00	QC01_10/7/19	✓		✓	✓	✓	✓
EM1910906-008	10-Jul-2019 00:00	QC03_10/7/19	✓		✓	✓	✓	✓
EM1910906-009	10-Jul-2019 00:00	QC04_10/7/19	✓		✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	AP_CustomerService.ANZ@aecom.com
- Chain of Custody (CoC) (COC)	Email	AP_CustomerService.ANZ@aecom.com

TIMOTHY SMITH

- *AU Certificate of Analysis - NATA (COA)	Email	timothy.smith@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	timothy.smith@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	timothy.smith@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	timothy.smith@aecom.com
- Chain of Custody (CoC) (COC)	Email	timothy.smith@aecom.com
- EDI Format - ENMRG (ENMRG)	Email	timothy.smith@aecom.com
- EDI Format - EQUIS V5 AECOM (EQUIS_V5_AECOM)	Email	timothy.smith@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	timothy.smith@aecom.com
- EDI Format - XTab (XTAB)	Email	timothy.smith@aecom.com
- Electronic SRN for EQuIS (ESRN_EQUIS)	Email	timothy.smith@aecom.com

VERA LEVINA

- *AU Certificate of Analysis - NATA (COA)	Email	vera.levina@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	vera.levina@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	vera.levina@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	vera.levina@aecom.com
- Chain of Custody (CoC) (COC)	Email	vera.levina@aecom.com
- EDI Format - ENMRG (ENMRG)	Email	vera.levina@aecom.com
- EDI Format - EQUIS V5 AECOM (EQUIS_V5_AECOM)	Email	vera.levina@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	vera.levina@aecom.com
- EDI Format - XTab (XTAB)	Email	vera.levina@aecom.com
- Electronic SRN for EQuIS (ESRN_EQUIS)	Email	vera.levina@aecom.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM1910906**	Page	: 1 of 6
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: MR TIMOTHY SMITH	Contact	: Peter Ravlic
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: 6432 2000	Telephone	: +6138549 9645
Project	: 60563317	Date Samples Received	: 11-Jul-2019 09:30
Order number	: 60563317/1.0	Date Analysis Commenced	: 11-Jul-2019
C-O-C number	: ----	Issue Date	: 19-Jul-2019 16:06
Sampler	: Lia		
Site	: Eaglehawk Landfill		
Quote number	: EN/004/16		
No. of samples received	: 9		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Arenie Vijayaratnam	Non-metals prep supervisor	Melbourne Inorganics, Springvale, VIC
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP026SP: EM1910906 #5 and 7, a dilution was required prior to the analysis of COD due to chloride interference, and the LOR has been adjusted accordingly.
- ED093F: EM1910906 #7, the results for Cations have been confirmed by re-preparation and re-analysis.
- EP005:EM1910906 #6-7 Particular samples required dilution prior to extraction due to matrix interferences. LOR values have been adjusted accordingly.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Ionic balances were calculated using: major anions - chloride, alkalinity, sulfate; and major cations - calcium, magnesium, potassium, sodium and ammonia for #1 and 2.
- ED045G: The presence of thiocyanate can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.
- ED045G: EM1910871 #33, Poor matrix spike recovery for chloride due to matrix effects.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	LB02_10/7/19	LS_1_10/7/19	LP_10/7/19	SW02_10/7/19	MB08_10/7/19
				Client sampling date / time	10-Jul-2019 00:00	10-Jul-2019 00:00	10-Jul-2019 00:00	10-Jul-2019 00:00	10-Jul-2019 00:00
Compound	CAS Number	LOR	Unit		EM1910906-001	EM1910906-002	EM1910906-003	EM1910906-004	EM1910906-005
					Result	Result	Result	Result	Result
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		1490	8110	4600	1050	10300
EA045: Turbidity									
Turbidity	----	0.1	NTU		----	----	----	35.9	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	577	77	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		736	1280	824	93	1210
Total Alkalinity as CaCO3	----	1	mg/L		736	1280	1400	170	1210
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		180	468	213	161	1180
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		441	4040	1860	358	5060
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		106	43	24	40	70
Magnesium	7439-95-4	1	mg/L		89	248	259	48	559
Sodium	7440-23-5	1	mg/L		216	2080	1210	185	2930
Potassium	7440-09-7	1	mg/L		108	248	303	23	140
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		10.0	47.5	12.4	----	0.015
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	0.005	0.014	----	<0.001
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	0.004	----	<0.001
Nickel	7440-02-0	0.001	mg/L		0.011	0.074	0.072	----	0.019
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	0.001	----	<0.001
Zinc	7440-66-6	0.005	mg/L		0.012	0.008	0.020	----	0.156
Manganese	7439-96-5	0.001	mg/L		0.400	0.035	0.065	0.011	0.087
Iron	7439-89-6	0.05	mg/L		8.19	3.56	0.06	<0.05	0.15
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.004	<0.004	<0.004	----	<0.004
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		0.006	0.020	<0.004	----	<0.004
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		41.9	275	18.0	0.24	0.18

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	LB02_10/7/19	LS_1_10/7/19	LP_10/7/19	SW02_10/7/19	MB08_10/7/19
				Client sampling date / time	10-Jul-2019 00:00	10-Jul-2019 00:00	10-Jul-2019 00:00	10-Jul-2019 00:00	10-Jul-2019 00:00
Compound	CAS Number	LOR	Unit		EM1910906-001	EM1910906-002	EM1910906-003	EM1910906-004	EM1910906-005
					Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	**0.90**	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	**0.08**	**0.03**	<0.01	**0.03**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	**0.08**	**0.93**	<0.01	**0.03**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**42.3**	**304**	**54.7**	**5.6**	**0.2**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**4.24**	**4.82**	**4.64**	**0.77**	**0.11**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**30.9**	**149**	**84.9**	**16.8**	**191**
ø Total Cations	----	0.01	meq/L		**27.8**	**139**	**----**	**----**	**----**
ø Total Cations	----	0.01	meq/L		**----**	**----**	**82.9**	**14.6**	**180**
ø Ionic Balance	----	0.01	%		**5.36**	**3.57**	**----**	**----**	**----**
ø Ionic Balance	----	0.01	%		**----**	**----**	**1.18**	**7.21**	**2.94**
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**15**	**120**	**121**	**22**	**7**
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		**69**	**436**	**640**	**----**	<20
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		**7**	**23**	**31**	**----**	<2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MB07_10/7/19	QC01_10/7/19	QC03_10/7/19	QC04_10/7/19	----
				Client sampling date / time	10-Jul-2019 00:00	10-Jul-2019 00:00	10-Jul-2019 00:00	10-Jul-2019 00:00	----
Compound	CAS Number	LOR	Unit		EM1910906-006	EM1910906-007	EM1910906-008	EM1910906-009	--------
					Result	Result	Result	Result	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**7590**	**7640**	<10	<10	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**798**	**798**	**4**	<1	----
Total Alkalinity as CaCO3	----	1	mg/L		**798**	**798**	**4**	<1	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**704**	**729**	<1	<1	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**3720**	**3690**	<1	<1	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**139**	**106**	<1	<1	----
Magnesium	7439-95-4	1	mg/L		**494**	**450**	<1	<1	----
Sodium	7440-23-5	1	mg/L		**2070**	**1940**	<1	<1	----
Potassium	7440-09-7	1	mg/L		**57**	**59**	<1	<1	----
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		**0.005**	**0.004**	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L		**0.0002**	**0.0003**	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L		**0.007**	**0.007**	<0.001	<0.001	----
Nickel	7440-02-0	0.001	mg/L		**0.015**	**0.016**	<0.001	<0.001	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Zinc	7440-66-6	0.005	mg/L		**0.020**	**0.020**	<0.005	<0.005	----
Manganese	7439-96-5	0.001	mg/L		**0.033**	**0.033**	<0.001	<0.001	----
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	----
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.004	<0.004	<0.004	<0.004	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	<0.004	<0.004	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.05**	**0.02**	<0.01	<0.01	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MB07_10/7/19	QC01_10/7/19	QC03_10/7/19	QC04_10/7/19	----
				Client sampling date / time	10-Jul-2019 00:00	10-Jul-2019 00:00	10-Jul-2019 00:00	10-Jul-2019 00:00	----
Compound	CAS Number	LOR	Unit		EM1910906-006	EM1910906-007	EM1910906-008	EM1910906-009	--------
					Result	Result	Result	Result	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.06**	**0.05**	<0.01	<0.01	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.06**	**0.05**	<0.01	<0.01	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.2**	**0.1**	<0.1	<0.1	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.32**	**0.41**	<0.01	<0.01	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**136**	**135**	**0.08**	<0.01	----
ø Total Cations	----	0.01	meq/L		**139**	**128**	<0.01	<0.01	----
ø Ionic Balance	----	0.01	%		**----**	**----**	**----**	<0.01	----
ø Ionic Balance	----	0.01	%		**1.29**	**2.65**	**----**	**----**	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		<5	<5	<1	<1	----
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		<20	<20	<10	<10	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	<2	<2	<2	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM1910906**	Page	: 1 of 7
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: MR TIMOTHY SMITH	Contact	: Peter Ravlic
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: 6432 2000	Telephone	: +6138549 9645
Project	: 60563317	Date Samples Received	: 11-Jul-2019
Order number	: 60563317/1.0	Date Analysis Commenced	: 11-Jul-2019
C-O-C number	: ----	Issue Date	: 19-Jul-2019
Sampler	: Lia		
Site	: Eaglehawk Landfill		
Quote number	: EN/004/16		
No. of samples received	: 9		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Arenie Vijayaratnam	Non-metals prep supervisor	Melbourne Inorganics, Springvale, VIC
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 2464099)									
EM1910888-003	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	4510	4660	3.23	0% - 20%
EM1910895-008	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	1060	1040	1.52	0% - 20%
EA045: Turbidity (QC Lot: 2461011)									
EM1910871-025	Anonymous	EA045: Turbidity	----	0.1	NTU	12.6	13.4	6.15	0% - 20%
EM1910871-035	Anonymous	EA045: Turbidity	----	0.1	NTU	11.7	11.9	1.69	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2461508)									
EM1910904-006	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	5	138	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	42	45	7.00	0% - 20%
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	3	<1	95.3	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	44	50	11.9	0% - 20%
EM1910895-007	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	535	536	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	535	536	0.00	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2461511)									
EM1910937-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	180	178	1.48	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	180	178	1.48	0% - 20%
EM1910953-003	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	206	203	1.40	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	206	203	1.40	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2461540)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2461540) - continued									
EM1910906-004	SW02_10/7/19	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	161	160	0.00	0% - 20%
EM1910871-035	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	365	361	1.15	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2461541)									
EM1910906-004	SW02_10/7/19	ED045G: Chloride	16887-00-6	1	mg/L	358	364	1.46	0% - 20%
EM1910871-035	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	255	260	1.87	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2460379)									
EM1910906-002	LS_1_10/7/19	ED093F: Calcium	7440-70-2	1	mg/L	43	42	0.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	248	248	0.00	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	2080	2090	0.637	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	248	248	0.00	0% - 20%
EM1910910-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	68	71	3.78	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	10	10	0.00	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	1040	1060	2.11	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	85	86	1.94	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2460378)									
EM1910883-006	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EM1910906-007	QC01_10/7/19	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0003	0.0002	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.004	0.003	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.007	0.007	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.033	0.031	4.39	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.016	0.014	13.5	0% - 50%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.020	0.019	0.00	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 2467437)									
EM1910906-001	LB02_10/7/19	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EM1910944-001	Anonymous	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2467436)									
EM1910906-001	LB02_10/7/19	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	0.006	0.005	0.00	No Limit
EM1910944-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	0.010	0.010	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2466299)									
EM1910906-001	LB02_10/7/19	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	41.9	43.2	3.14	0% - 20%
EM1910940-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.04	0.03	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2461539)									
EM1910906-004	SW02_10/7/19	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EM1910871-035	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.01	0.02	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2466300)									
EM1910906-001	LB02_10/7/19	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EM1910940-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	2.66	2.68	0.877	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2462727)									
EM1910733-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.6	0.6	0.00	No Limit
EM1910871-030	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	<0.1	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2462729)									
EM1910932-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	154	155	0.625	0% - 20%
EM1910906-005	MB08_10/7/19	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.2	0.2	0.00	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2462728)									
EM1910733-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EM1910871-030	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2462730)									
EM1910906-005	MB08_10/7/19	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.11	0.10	14.3	0% - 50%
EM1910957-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	6.97	7.30	4.63	0% - 20%
EP005: Total Organic Carbon (TOC) (QC Lot: 2461922)									
EM1910871-031	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	1	1	0.00	No Limit
EM1910906-004	SW02_10/7/19	EP005: Total Organic Carbon	----	1	mg/L	22	22	0.00	0% - 20%
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QC Lot: 2460281)									
EM1910798-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	<10	0.00	No Limit
EM1910906-009	QC04_10/7/19	EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	<10	0.00	No Limit
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QC Lot: 2465194)									
EM1910871-004	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	<10	0.00	No Limit
EM1910871-031	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	22	22	0.00	No Limit
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 2462490)									
EM1910901-001	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	3	3	0.00	No Limit
EM1910910-001	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	5700	5700	0.00	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 2464099)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	99.5	94	107
				<10	293 mg/L	98.6	90	110
EA045: Turbidity (QCLot: 2461011)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	103	88	110
ED037P: Alkalinity by PC Titrator (QCLot: 2461508)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	98.1	88	112
ED037P: Alkalinity by PC Titrator (QCLot: 2461511)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	102	88	112
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2461540)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	101	86	115
				<1	100 mg/L	106	86	115
ED045G: Chloride by Discrete Analyser (QCLot: 2461541)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	97.6	86	120
				<1	1000 mg/L	106	86	120
ED093F: Dissolved Major Cations (QCLot: 2460379)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	5 mg/L	102	92	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	5 mg/L	99.5	87	114
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	100	88	113
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	99.4	87	112
EG020F: Dissolved Metals by ICP-MS (QCLot: 2460378)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	95.0	91	107
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	94.0	84	104
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	86.5	83	103
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	87.2	82	103
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	91.6	83	105
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	90.1	83	105
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	86.4	82	106
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	94.5	85	109
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	102	94	106
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2467437)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	103	85	110
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2467436)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	94.7	75	109

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2466299)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	108	87	117
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2461539)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	98.6	92	111
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2466300)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	104	93	120
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2462727)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	5 mg/L	95.2	70	117
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2462729)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	5 mg/L	81.0	70	117
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2462728)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	2.21 mg/L	90.6	72	114
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2462730)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	2.21 mg/L	96.2	72	114
EP005: Total Organic Carbon (TOC) (QCLot: 2461922)								
EP005: Total Organic Carbon	----	1	mg/L	<1	100 mg/L	95.3	81	109
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 2460281)								
EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	25 mg/L	105	92	108
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 2465194)								
EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	5000 mg/L	101	92	108
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 2462490)								
EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	198 mg/L	93.4	78	120

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2461540)							
EM1910871-033	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	90.8	70	130
ED045G: Chloride by Discrete Analyser (QCLot: 2461541)							
EM1910871-033	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	# 67.2	70	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 2460378)							
EM1910883-006	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	88.3	85	131
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	91.0	81	133

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2460378) - continued							
EM1910883-006	Anonymous	EG020A-F: Chromium	7440-47-3	0.2 mg/L	90.2	71	135
		EG020A-F: Copper	7440-50-8	0.2 mg/L	82.7	76	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	84.6	75	133
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	92.0	64	134
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	84.8	73	131
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	86.8	75	131
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2467437)							
EM1910944-002	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	93.7	70	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2467436)							
EM1910906-002	LS_1_10/7/19	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	74.4	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2466299)							
EM1910906-002	LS_1_10/7/19	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2461539)							
EM1910871-033	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	96.7	80	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2466300)							
EM1910906-002	LS_1_10/7/19	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	83.6	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2462727)							
EM1910871-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	87.6	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2462729)							
EM1910906-006	MB07_10/7/19	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	78.3	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2462728)							
EM1910871-002	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	99.0	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2462730)							
EM1910906-006	MB07_10/7/19	EK067G: Total Phosphorus as P	----	1 mg/L	107	70	130
EP005: Total Organic Carbon (TOC) (QCLot: 2461922)							
EM1910871-033	Anonymous	EP005: Total Organic Carbon	----	100 mg/L	96.8	80	114
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 2460281)							
EM1910901-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	50 mg/L	107	70	130
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 2465194)							
EM1910871-002	Anonymous	EP026SP: Chemical Oxygen Demand	----	50 mg/L	102	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM1910906**	Page	: 1 of 10
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: MR TIMOTHY SMITH	Telephone	: +6138549 9645
Project	: 60563317	Date Samples Received	: 11-Jul-2019
Site	: Eaglehawk Landfill	Issue Date	: 19-Jul-2019
Sampler	: Lia	No. of samples received	: 9
Order number	: 60563317/1.0	No. of samples analysed	: 9

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED045G: Chloride by Discrete Analyser	EM1910871--033	Anonymous	**Chloride**	16887-00-6	67.2 %	70-130%	**Recovery less than lower data quality objective**
EK055G: Ammonia as N by Discrete Analyser	EM1910906--002	LS_1_10/7/19	**Ammonia as N**	7664-41-7	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**14-Jul-2019**	17-Jul-2019	✓
EA045: Turbidity							
Clear Plastic Bottle - Natural (EA045)							
SW02_10/7/19	**10-Jul-2019**	**----**	----	----	**11-Jul-2019**	12-Jul-2019	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**12-Jul-2019**	24-Jul-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**12-Jul-2019**	07-Aug-2019	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**12-Jul-2019**	07-Aug-2019	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**16-Jul-2019**	07-Aug-2019	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**12-Jul-2019**	06-Jan-2020	✓
EK025SF: Free CN by Segmented Flow Analyser							
White Plastic Bottle-NaOH (EK025SF)							
LS_1_10/7/19, LP_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**16-Jul-2019**	24-Jul-2019	✓
White Plastic Bottle-NaOH - Pb Acetate (EK025SF)							
LB02_10/7/19	**10-Jul-2019**	**----**	----	----	**16-Jul-2019**	24-Jul-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK026SF: Total CN by Segmented Flow Analyser							
White Plastic Bottle-NaOH (EK026SF)							
LS_1_10/7/19, LP_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**16-Jul-2019**	24-Jul-2019	✓
White Plastic Bottle-NaOH - Pb Acetate (EK026SF)							
LB02_10/7/19	**10-Jul-2019**	**----**	----	----	**16-Jul-2019**	24-Jul-2019	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**16-Jul-2019**	07-Aug-2019	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**12-Jul-2019**	12-Jul-2019	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**16-Jul-2019**	07-Aug-2019	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**12-Jul-2019**	07-Aug-2019	✓	**15-Jul-2019**	07-Aug-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**12-Jul-2019**	07-Aug-2019	✓	**15-Jul-2019**	07-Aug-2019	✓
EP005: Total Organic Carbon (TOC)							
Amber TOC Vial - Sulfuric Acid (EP005)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, SW02_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**12-Jul-2019**	07-Aug-2019	✓
EP026SP: Chemical Oxygen Demand (Spectrophotometric)							
Clear Plastic Bottle - Sulfuric Acid (EP026SP)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**11-Jul-2019**	07-Aug-2019	✓
EP030: Biochemical Oxygen Demand (BOD)							
Clear Plastic Bottle - Natural (EP030)							
LB02_10/7/19, LS_1_10/7/19, LP_10/7/19, MB08_10/7/19, MB07_10/7/19, QC01_10/7/19, QC03_10/7/19, QC04_10/7/19	**10-Jul-2019**	**----**	----	----	**11-Jul-2019**	12-Jul-2019	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	4	26	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	4	37	**10.81**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	37	**5.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	37	**5.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	37	**5.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Free CN by Segmented Flow Analyser	EK025SF	WATER	In house: Referenced to ASTM D7237: Using an automated segmented flow analyser, a sample at high pH (sodium hydroxide preserved) is buffered to pH 6.0. The hydrogen cyanide present passes across a gas dialysis membrane into an acceptor stream consisting of 0.01 M sodium hydroxide. The acceptor stream mixes with a buffer at pH 5.2 and reacts with chloramine-T to form cyanogen chloride. Cyanogen chloride reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour, measured at 600nm. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Total Organic Carbon	EP005	WATER	In house: Referenced to APHA 5310 B, The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM (2013) Schedule B(3)
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	WATER	In house: Referenced to APHA 5220 D. Samples are digested with a known excess of an acidic potassium dichromate solution using silver sulfate as a catalyst. The chromium is reduced from the Cr (VI) oxidation state to the Cr (III) state by the oxygen present in the organic material. Both of these chromium species are coloued and absorb in the visible region of (400nm & 600nm) the spectrum. The oxidisable organic matter can be calculated in terms of oxygen equivalents.
Biochemical Oxygen Demand (BOD)	EP030	WATER	In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)

ANZ

FQM - Generic Chain of Custody Form

Lia.Szokovski@aecom.com

Q4AN(EV)-007-FM1

CONSULTANT: AECOM	ADDRESS / OFFICE:	SAMPLER: Lia. S	**Destination Laboratory** ALS
PROJECT MANAGER (PM): Tim Smith	SITE: Eaglehawk Landfill	MOBILE:	PHONE:
PROJECT NUMBER & TASK CO: 60563317	P.O. NO.:	EMAIL REPORT TO: Vera.Leung@aecom.com	
RESULTS REQUIRED (Date):	QUOTE NO.:	ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)	

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL: All metal bottles have been filtered.

Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". Extra volume for QC or trace LORs etc.

ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles	TDS, major ions	Bicarb alkalinity	Ammonia, nitrate	TKN phosphorus	TOC	COD / BOD	total & free cyanide	metals (zinc/ferric/Cr/Cu/Ni/Pb/Zn)	metals (Mn/Fe only)	Turbidity			HOLD
1	MB06_11/7/19	W	11/7/19		P, SP, VS, SH, N	5													
2	MB10_11/7/19					5													
3	QC05_11/7/19					5													
4	SD01_11/7/19				P, SP, VS, N	4													
5	SD06_11/7/19				P, SP, VS, N	4													
6	MB05_11/7/19				P, SP, VS, SH, N	4													
7	QC06_12/7/19		12/7/19			5													
8	MB02_12/7/19					5													
9	MB03_12/7/19					5													
10	MB04_12/7/19					5													
11	SD03_12/7/19				P, SP, VS, N	4													

MW054

Environmental Division Melbourne
Work Order Reference
EM1911053

Telephone : +61-3-8549 9600

RELINQUISHED BY:		RECEIVED BY		RECEIVED BY		METHOD OF SHIPMENT
Name: V.L	Date: 12/7/19	Name:	Date:	Name:	Date: 12/7	Con' Note No:
Of:	Time:	Of:	Time:	Of:	Time: 16:55	Transport Co:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag. **Soil Container Codes:** Jar = Unpreserved glass jar

COC Page of

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM1911053**

Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: MR TIMOTHY SMITH	Contact	: Peter Ravlic
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: timothy.smith@aecom.com	E-mail	: peter.ravlic@alsglobal.com
Telephone	: 6432 2000	Telephone	: +6138549 9645
Facsimile	: ----	Facsimile	: +61-3-8549 9626
Project	: 60563317	Page	: 1 of 3
Order number	: 60563317/1.0	Quote number	: EB2017AECOMAU0014 (EN/004/16)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: Eaglehawk Landfill		
Sampler	: LS		

Dates

Date Samples Received	: 12-Jul-2019 16:55	Issue Date	: 15-Jul-2019
Client Requested Due Date	: 19-Jul-2019	Scheduled Reporting Date	: **19-Jul-2019**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Intact.
No. of coolers/boxes	: 2	Temperature	: 3.5°C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 11 / 11

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EG020F Dissolved Metals by ICP/MS	WATER - EK026SF Total Cyanide by Segmented Flow Analyser	WATER - EP005 Total Organic Carbon (TOC)	WATER - EP030 BOD	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity	WATER - NT-04 Nitrite and Nitrate	WATER - W-01 7 Metals
EM1911053-001	11-Jul-2019 00:00	MB06_11/7/19	✓	✓	✓	✓	✓	✓	✓
EM1911053-002	11-Jul-2019 00:00	MB10_11/7/19	✓	✓	✓	✓	✓	✓	✓
EM1911053-003	11-Jul-2019 00:00	QC05_11/7/19	✓	✓	✓	✓	✓	✓	✓
EM1911053-004	11-Jul-2019 00:00	SD01_11/7/19	✓		✓		✓	✓	
EM1911053-005	11-Jul-2019 00:00	SD06_11/7/19	✓		✓		✓	✓	
EM1911053-006	11-Jul-2019 00:00	MB05_11/7/19	✓		✓		✓	✓	
EM1911053-007	12-Jul-2019 00:00	QC06_12/7/19	✓	✓	✓	✓	✓	✓	✓
EM1911053-008	12-Jul-2019 00:00	MB02_12/7/19	✓	✓	✓	✓	✓	✓	✓
EM1911053-009	12-Jul-2019 00:00	MB03_12/7/19	✓	✓	✓	✓	✓	✓	✓
EM1911053-010	12-Jul-2019 00:00	MB04_12/7/19	✓	✓	✓	✓	✓	✓	✓
EM1911053-011	12-Jul-2019 00:00	SD03_12/7/19	✓		✓		✓	✓	

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EA045 Turbidity	WATER - ED037_CC Alkalinity by PC Titrator	WATER - EK025SF Free CN By Segmented Flow Analyser	WATER - EK055G Ammonia as N By Discrete Analyser	WATER - EP026SP Chemical Oxygen Demand (COD)	WATER - NT-09 TKN, Total Phosphorus
EM1911053-001	11-Jul-2019 00:00	MB06_11/7/19	✓		✓	✓	✓	✓	✓
EM1911053-002	11-Jul-2019 00:00	MB10_11/7/19	✓		✓	✓	✓	✓	✓
EM1911053-003	11-Jul-2019 00:00	QC05_11/7/19	✓		✓	✓	✓	✓	✓
EM1911053-004	11-Jul-2019 00:00	SD01_11/7/19	✓	✓	✓		✓		✓
EM1911053-005	11-Jul-2019 00:00	SD06_11/7/19	✓	✓	✓		✓		✓
EM1911053-006	11-Jul-2019 00:00	MB05_11/7/19	✓	✓	✓		✓		✓
EM1911053-007	12-Jul-2019 00:00	QC06_12/7/19	✓		✓	✓	✓	✓	✓
EM1911053-008	12-Jul-2019 00:00	MB02_12/7/19	✓		✓	✓	✓	✓	✓
EM1911053-009	12-Jul-2019 00:00	MB03_12/7/19	✓		✓	✓	✓	✓	✓
EM1911053-010	12-Jul-2019 00:00	MB04_12/7/19	✓		✓	✓	✓	✓	✓
EM1911053-011	12-Jul-2019 00:00	SD03_12/7/19	✓	✓	✓		✓		✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	AP_CustomerService.ANZ@aecom.com
- Chain of Custody (CoC) (COC)	Email	AP_CustomerService.ANZ@aecom.com

LIA SZOKOUSKI

- *AU Certificate of Analysis - NATA (COA)	Email	Lia.szokouski@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Lia.szokouski@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Lia.szokouski@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	Lia.szokouski@aecom.com
- Chain of Custody (CoC) (COC)	Email	Lia.szokouski@aecom.com
- EDI Format - ENMRG (ENMRG)	Email	Lia.szokouski@aecom.com
- EDI Format - EQUIS V5 AECOM (EQUIS_V5_AECOM)	Email	Lia.szokouski@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	Lia.szokouski@aecom.com
- EDI Format - XTab (XTAB)	Email	Lia.szokouski@aecom.com
- Electronic SRN for EQuIS (ESRN_EQUIS)	Email	Lia.szokouski@aecom.com

VERA LEVINA

- *AU Certificate of Analysis - NATA (COA)	Email	vera.levina@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	vera.levina@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	vera.levina@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	vera.levina@aecom.com
- Chain of Custody (CoC) (COC)	Email	vera.levina@aecom.com
- EDI Format - ENMRG (ENMRG)	Email	vera.levina@aecom.com
- EDI Format - EQUIS V5 AECOM (EQUIS_V5_AECOM)	Email	vera.levina@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	vera.levina@aecom.com
- EDI Format - XTab (XTAB)	Email	vera.levina@aecom.com
- Electronic SRN for EQuIS (ESRN_EQUIS)	Email	vera.levina@aecom.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM1911053**	Page	: 1 of 8
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: MR TIMOTHY SMITH	Contact	: Peter Ravlic
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: 6432 2000	Telephone	: +6138549 9645
Project	: 60563317	Date Samples Received	: 12-Jul-2019 16:55
Order number	: 60563317/1.0	Date Analysis Commenced	: 12-Jul-2019
C-O-C number	: ----	Issue Date	: 22-Jul-2019 18:34
Sampler	: LS		
Site	: Eaglehawk Landfill		
Quote number	: EN/004/16		
No. of samples received	: 11		
No. of samples analysed	: 11		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Arenie Vijayaratnam	Non-metals prep supervisor	Melbourne Inorganics, Springvale, VIC
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED037-P: EM1909253 #12 Poor duplicate precision for Alkalinity due to sample heterogeneity. Confirmed by re-preparation and re-analysis.
- ED093F: EM1911053 #11, the results for Cations have been confirmed by re-preparation and re-analysis.
- ED037-P: EM1911053 #7. Alkalinity has been confirmed via re-preparation and re-analysis
- While ALS is NATA accredited to report Alkalinity via method ED037P ALS is not NATA accredited to report analytes under method ED037CC which are calculations based on Alkalinity results from method ED037P.
- EP026SP: EM1911053-001, 006 & 008-010 samples required dilution prior to extraction due to matrix interferences. LOR values have been adjusted accordingly.
- ED041G: Results for EM1911053-003 have been confirmed by re-preparation and re-analysis.
- EA015: EM1911053 #4, 5 and 11: TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- Ionic Balance out of acceptable limits for sample #11 due to analytes not quantified in this report.
- EP005:EM1911053 #9-10 Particular samples required dilution prior to extraction due to matrix interferences. LOR values have been adjusted accordingly.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- ED045G: The presence of thiocyanate can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.
- ED041G and ED045: EM1911053 #5, sulfate and chloride result/s confirmed via sample repreparation and re-analysis.
- ED093F: EM1911053 #7, results confirmed for sodium via sample repreparation and re-analysis.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MB06_11/7/19	MB10_11/7/19	QC05_11/7/19	SD01_11/7/19	SD06_11/7/19
				Client sampling date / time	11-Jul-2019 00:00	11-Jul-2019 00:00	11-Jul-2019 00:00	11-Jul-2019 00:00	11-Jul-2019 00:00
Compound	CAS Number	LOR	Unit		EM1911053-001	EM1911053-002	EM1911053-003	EM1911053-004	EM1911053-005
					Result	Result	Result	Result	Result
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**5400**	**5250**	<10	**1060**	**764**
EA045: Turbidity									
Turbidity	----	0.1	NTU		**----**	**----**	**----**	**3410**	**7080**
ED037CC: Calculated Alkalinity Parameters									
ø Bicarbonate Alkalinity as Bicarbonate	----	1	mg/L		**901**	**952**	**2**	**113**	**83**
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**739**	**780**	**2**	**93**	**68**
Total Alkalinity as CaCO3	----	1	mg/L		**739**	**780**	**2**	**93**	**68**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**1020**	**1820**	**1**	**190**	**78**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**1960**	**1250**	<1	**229**	**105**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**38**	**40**	<1	**51**	**22**
Magnesium	7439-95-4	1	mg/L		**173**	**187**	<1	**33**	**14**
Sodium	7440-23-5	1	mg/L		**1600**	**1550**	<1	**132**	**64**
Potassium	7440-09-7	1	mg/L		**58**	**67**	<1	**51**	**17**
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		**0.002**	**0.004**	<0.001	**----**	**----**
Cadmium	7440-43-9	0.0001	mg/L		**0.0002**	**0.0001**	<0.0001	**----**	**----**
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	**----**	**----**
Copper	7440-50-8	0.001	mg/L		<0.001	**0.002**	<0.001	**----**	**----**
Nickel	7440-02-0	0.001	mg/L		<0.001	**0.026**	<0.001	**----**	**----**
Lead	7439-92-1	0.001	mg/L		**0.001**	<0.001	<0.001	**----**	**----**
Zinc	7440-66-6	0.005	mg/L		**0.008**	**0.018**	<0.005	**----**	**----**
Manganese	7439-96-5	0.001	mg/L		**0.007**	**0.040**	<0.001	**0.024**	**0.015**
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	<0.05	**0.15**	**0.24**
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.004	<0.004	<0.004	**----**	**----**
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	**0.008**	<0.004	**----**	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MB06_11/7/19	MB10_11/7/19	QC05_11/7/19	SD01_11/7/19	SD06_11/7/19
				Client sampling date / time	11-Jul-2019 00:00	11-Jul-2019 00:00	11-Jul-2019 00:00	11-Jul-2019 00:00	11-Jul-2019 00:00
Compound	CAS Number	LOR	Unit		EM1911053-001	EM1911053-002	EM1911053-003	EM1911053-004	EM1911053-005
					Result	Result	Result	Result	Result
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		<0.01	0.01	<0.01	0.26	0.10
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		0.01	0.04	<0.01	0.09	0.03
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.11	4.38	<0.01	2.14	0.71
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.12	4.42	<0.01	2.23	0.74
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.1	0.9	<0.1	8.2	6.8
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.22	0.70	<0.01	2.81	2.42
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		91.3	88.7	0.06	12.3	5.94
ø Total Cations	----	0.01	meq/L		87.2	86.5	<0.01	12.3	5.47
ø Ionic Balance	----	0.01	%		2.28	1.26	----	0.13	4.17
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		<1	2	<1	25	18
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		<20	11	<10	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	<2	<2	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MB05_11/7/19	QC06_12/7/19	MB02_12/7/19	MB03_12/7/19	MB04_12/7/19
				Client sampling date / time	11-Jul-2019 00:00	12-Jul-2019 00:00	12-Jul-2019 00:00	12-Jul-2019 00:00	12-Jul-2019 00:00
Compound	CAS Number	LOR	Unit		EM1911053-006	EM1911053-007	EM1911053-008	EM1911053-009	EM1911053-010
					Result	Result	Result	Result	Result
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		9510	<10	5910	7990	7560
ED037CC: Calculated Alkalinity Parameters									
ø Bicarbonate Alkalinity as Bicarbonate	----	1	mg/L		1180	<1	721	1210	1020
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		971	<1	591	996	841
Total Alkalinity as CaCO3	----	1	mg/L		971	<1	591	996	841
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		1470	<1	1110	720	1380
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		4750	<1	2710	4070	3620
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		61	<1	18	39	56
Magnesium	7439-95-4	1	mg/L		407	<1	425	397	408
Sodium	7440-23-5	1	mg/L		3360	8	1500	2390	2310
Potassium	7440-09-7	1	mg/L		62	<1	32	64	67
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		0.002	<0.001	0.021	0.004	0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	0.0031
Chromium	7440-47-3	0.001	mg/L		0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		0.004	<0.001	<0.001	<0.001	0.001
Nickel	7440-02-0	0.001	mg/L		0.129	<0.001	0.005	0.041	0.032
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		0.041	<0.005	0.064	0.020	0.033
Manganese	7439-96-5	0.001	mg/L		0.307	<0.001	1.17	0.062	0.061
Iron	7439-89-6	0.05	mg/L		0.15	<0.05	1.84	0.40	<0.05
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.004	<0.004	<0.004	<0.004	<0.004
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	0.026	<0.004	0.026
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.28	<0.01	0.06	0.01	1.00

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MB05_11/7/19	QC06_12/7/19	MB02_12/7/19	MB03_12/7/19	MB04_12/7/19
				Client sampling date / time	11-Jul-2019 00:00	12-Jul-2019 00:00	12-Jul-2019 00:00	12-Jul-2019 00:00	12-Jul-2019 00:00
Compound	CAS Number	LOR	Unit		EM1911053-006	EM1911053-007	EM1911053-008	EM1911053-009	EM1911053-010
					Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**0.34**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**0.34**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.5**	<0.1	**0.3**	<0.1	**1.0**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.17**	<0.01	**0.79**	**0.86**	**0.32**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**184**	<0.01	**111**	**150**	**148**
ø Total Cations	----	0.01	meq/L		**184**	**0.35**	**102**	**140**	**138**
ø Ionic Balance	----	0.01	%		**0.08**	**----**	**4.42**	**3.27**	**3.17**
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		<1	<1	**6**	<5	<5
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		<50	<10	**29**	**24**	<20
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	<2	**3**	<2	<2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SD03_12/7/19	----	----	----	----
				Client sampling date / time	12-Jul-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM1911053-011	--------	--------	--------	--------
					Result	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**1020**	----	----	----	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		**13900**	----	----	----	----
ED037CC: Calculated Alkalinity Parameters									
ø **Bicarbonate Alkalinity as Bicarbonate**	----	1	mg/L		**284**	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**233**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**233**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**125**	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**223**	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**54**	----	----	----	----
Magnesium	7439-95-4	1	mg/L		**37**	----	----	----	----
Sodium	7440-23-5	1	mg/L		**98**	----	----	----	----
Potassium	7440-09-7	1	mg/L		**28**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L		**0.226**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.12**	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.11**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.58**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.58**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**19.3**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SD03_12/7/19	----	----	----	----
				Client sampling date / time	12-Jul-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM1911053-011	--------	--------	--------	--------
					Result	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser - Continued									
Total Phosphorus as P	----	0.01	mg/L		**8.68**	----	----	----	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**13.5**	----	----	----	----
ø **Total Cations**	----	0.01	meq/L		**10.7**	----	----	----	----
ø **Ionic Balance**	----	0.01	%		**11.7**	----	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**50**	----	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM1911053**	Page	: 1 of 9
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: MR TIMOTHY SMITH	Contact	: Peter Ravlic
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: 6432 2000	Telephone	: +6138549 9645
Project	: 60563317	Date Samples Received	: 12-Jul-2019
Order number	: 60563317/1.0	Date Analysis Commenced	: 12-Jul-2019
C-O-C number	: ----	Issue Date	: 22-Jul-2019
Sampler	: LS		
Site	: Eaglehawk Landfill		
Quote number	: EN/004/16		
No. of samples received	: 11		
No. of samples analysed	: 11		

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Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Arenie Vijayaratnam	Non-metals prep supervisor	Melbourne Inorganics, Springvale, VIC
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 2467200)									
EM1910803-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	164	168	2.11	0% - 50%
EM1911049-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	6340	6310	0.537	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 2467202)									
EM1911053-007	QC06_12/7/19	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	<10	0.00	No Limit
EM1911122-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	3880	3910	0.744	0% - 20%
EA045: Turbidity (QC Lot: 2469057)									
EM1910803-001	Anonymous	EA045: Turbidity	----	0.1	NTU	0.9	1.0	12.9	No Limit
EM1911053-011	SD03_12/7/19	EA045: Turbidity	----	0.1	NTU	13900	13600	1.89	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2467527)									
EM1909253-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	756	757	0.239	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	756	757	0.239	0% - 20%
EM1909253-012	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	29	# 24	21.4	0% - 20%
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	354	362	2.13	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	383	385	0.499	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2467531)									
EM1911053-004	SD01_11/7/19	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	93	94	1.89	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	93	94	1.89	0% - 20%
EM1911113-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
ED037P: Alkalinity by PC Titrator (QC Lot: 2467531) - continued									
EM1911113-001	Anonymous	ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	847	801	5.62	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	847	801	5.62	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2465966)									
EM1909253-010	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	84	90	6.71	0% - 20%
EM1909253-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	170	174	2.47	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2465969)									
EM1911113-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	22	21	0.00	0% - 20%
EM1911053-004	SD01_11/7/19	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	190	197	3.86	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2465967)									
EM1909253-009	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	820	818	0.327	0% - 20%
EM1909253-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	2660	2610	1.84	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2465970)									
EM1911113-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	75	74	0.00	0% - 20%
EM1911053-004	SD01_11/7/19	ED045G: Chloride	16887-00-6	1	mg/L	229	228	0.807	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2467314)									
EM1911049-004	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	51	56	10.1	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	154	168	9.26	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	904	970	6.98	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	11	12	0.00	0% - 50%
EM1911053-008	MB02_12/7/19	ED093F: Calcium	7440-70-2	1	mg/L	18	18	0.00	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	425	419	1.54	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	1500	1490	0.886	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	32	33	0.00	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2467315)									
EM1911053-001	MB06_11/7/19	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0002	0.0002	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.007	0.007	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.008	0.007	0.00	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EM1911053-010	MB04_12/7/19	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0031	0.0030	0.00	0% - 20%
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.061	0.063	2.59	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2467315) - continued									
EM1911053-010	MB04_12/7/19	EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.032	0.032	0.00	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.033	0.032	4.06	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 2467437)									
EM1910906-001	Anonymous	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EM1910944-001	Anonymous	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 2470391)									
EM1911053-006	MB05_11/7/19	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2467439)									
EM1911042-002	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EM1911042-012	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2467441)									
EM1911053-003	QC05_11/7/19	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2470392)									
EM1911221-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EM1911053-006	MB05_11/7/19	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2473141)									
EM1911042-008	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.03	0.03	0.00	No Limit
EM1911053-003	QC05_11/7/19	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.01	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2465968)									
EM1911049-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EM1911053-005	SD06_11/7/19	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.03	0.03	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2473140)									
EM1911042-008	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EM1911053-003	QC05_11/7/19	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2468564)									
EM1911000-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.2	0.2	0.00	No Limit
EM1911053-003	QC05_11/7/19	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	<0.1	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2468566)									
EM1911053-005	SD06_11/7/19	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	6.8	6.9	0.00	0% - 20%
EM1911073-003	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.6	0.5	0.00	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2468565)									
EM1911000-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.04	0.02	42.5	No Limit
EM1911053-003	QC05_11/7/19	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	0.02	88.0	No Limit
EP005: Total Organic Carbon (TOC) (QC Lot: 2470799)									
EM1911000-001	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	2	2	0.00	No Limit
EM1911053-006	MB05_11/7/19	EP005: Total Organic Carbon	----	1	mg/L	<1	4	112	No Limit
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QC Lot: 2467671)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QC Lot: 2467671) - continued									
EM1910953-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	<10	0.00	No Limit
EM1910953-010	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	11	12	0.00	No Limit
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QC Lot: 2467672)									
EM1911053-002	MB10_11/7/19	EP026SP: Chemical Oxygen Demand	----	10	mg/L	11	12	9.52	No Limit
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QC Lot: 2472619)									
EM1911053-006	MB05_11/7/19	EP026SP: Chemical Oxygen Demand	----	10	mg/L	<50	<50	0.00	No Limit
EM1911209-003	Anonymous	EP026SP: Chemical Oxygen Demand	----	10	mg/L	166	170	2.38	0% - 50%
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 2465567)									
EM1911054-001	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	<2	0.00	No Limit
EM1911053-001	MB06_11/7/19	EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	<2	0.00	No Limit
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 2468350)									
EM1911120-001	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	2990	3090	3.28	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 2467200)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	100	94	107
				<10	293 mg/L	102	90	110
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 2467202)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	99.7	94	107
				<10	293 mg/L	100	90	110
EA045: Turbidity (QCLot: 2469057)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	103	88	110
ED037P: Alkalinity by PC Titrator (QCLot: 2467527)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	97.2	88	112
ED037P: Alkalinity by PC Titrator (QCLot: 2467531)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	101	88	112
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2465966)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	104	86	115
				<1	100 mg/L	104	86	115
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2465969)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	105	86	115
				<1	100 mg/L	105	86	115
ED045G: Chloride by Discrete Analyser (QCLot: 2465967)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	91.8	86	120
				<1	1000 mg/L	104	86	120
ED045G: Chloride by Discrete Analyser (QCLot: 2465970)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	93.4	86	120
				<1	1000 mg/L	103	86	120
ED093F: Dissolved Major Cations (QCLot: 2467314)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	5 mg/L	93.9	92	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	5 mg/L	99.7	87	114
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	104	88	113
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	104	87	112
EG020F: Dissolved Metals by ICP-MS (QCLot: 2467315)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	99.8	91	107
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	87.8	84	104
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	89.1	83	103
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	89.7	82	103

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2467315) - continued								
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	90.7	83	105
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	93.5	83	105
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	91.1	82	106
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	93.8	85	109
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	101	94	106
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2467437)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	103	85	110
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2470391)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	104	85	110
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2467439)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	103	75	109
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2467441)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	100	75	109
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2470392)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	107	75	109
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2473141)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	108	87	117
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2465968)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	96.1	92	111
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2473140)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	105	93	120
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2468564)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	5 mg/L	94.6	70	117
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2468566)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	5 mg/L	87.7	70	117
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2468565)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	2.21 mg/L	93.3	72	114
EP005: Total Organic Carbon (TOC) (QCLot: 2470799)								
EP005: Total Organic Carbon	----	1	mg/L	<1	100 mg/L	96.5	81	109
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 2467671)								
EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	500 mg/L	99.2	92	108
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 2467672)								
EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	500 mg/L	100	92	108
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 2472619)								
EP026SP: Chemical Oxygen Demand	----	10	mg/L	<10	500 mg/L	101	92	108
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 2465567)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 2465567) - continued								
EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	198 mg/L	86.7	78	120
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 2468350)								
EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	198 mg/L	89.3	78	120

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2465966)							
EM1909253-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2465969)							
EM1911053-005	SD06_11/7/19	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70	130
ED045G: Chloride by Discrete Analyser (QCLot: 2465967)							
EM1909253-002	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	# Not Determined	70	130
ED045G: Chloride by Discrete Analyser (QCLot: 2465970)							
EM1911053-005	SD06_11/7/19	ED045G: Chloride	16887-00-6	400 mg/L	93.1	70	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 2467315)							
EM1911053-001	MB06_11/7/19	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	89.2	85	131
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	82.2	81	133
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	85.0	71	135
		EG020A-F: Copper	7440-50-8	0.2 mg/L	85.5	76	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	84.4	75	133
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	87.1	64	134
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	87.1	73	131
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	85.6	75	131
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2467437)							
EM1910944-002	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	93.7	70	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2467439)							
EM1911042-003	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	91.9	70	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2467441)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2467441) - continued							
EM1911053-007	QC06_12/7/19	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	95.2	70	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2470392)							
EM1911168-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	86.5	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2473141)							
EM1911042-009	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	107	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2465968)							
EM1911049-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	94.9	80	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2473140)							
EM1911042-009	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	90.3	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2468564)							
EM1911036-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	92.6	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2468566)							
EM1911073-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	86.3	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2468565)							
EM1911036-001	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	108	70	130
EP005: Total Organic Carbon (TOC) (QCLot: 2470799)							
EM1911047-012	Anonymous	EP005: Total Organic Carbon	----	100 mg/L	101	80	114
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 2467671)							
EM1910953-002	Anonymous	EP026SP: Chemical Oxygen Demand	----	500 mg/L	101	70	130
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 2467672)							
EM1911053-003	QC05_11/7/19	EP026SP: Chemical Oxygen Demand	----	50 mg/L	100	70	130
EP026SP: Chemical Oxygen Demand (Spectrophotometric) (QCLot: 2472619)							
EM1911168-001	Anonymous	EP026SP: Chemical Oxygen Demand	----	500 mg/L	99.4	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM1911053**	Page	: 1 of 12
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: MR TIMOTHY SMITH	Telephone	: +6138549 9645
Project	: 60563317	Date Samples Received	: 12-Jul-2019
Site	: Eaglehawk Landfill	Issue Date	: 22-Jul-2019
Sampler	: LS	No. of samples received	: 11
Order number	: 60563317/1.0	No. of samples analysed	: 11

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Duplicate outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
ED037P: Alkalinity by PC Titrator	EM1909253--012	Anonymous	**Carbonate Alkalinity as CaCO3**	3812-32-6	21.4 %	0% - 20%	**RPD exceeds LOR based limits**
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EM1909253--002	Anonymous	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EM1911053--005	SD06_11/7/19	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
ED045G: Chloride by Discrete Analyser	EM1909253--002	Anonymous	**Chloride**	16887-00-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA045: Turbidity						
Clear Plastic Bottle - Natural						
SD03_12/7/19	----	----	----	16-Jul-2019	14-Jul-2019	**2**
EK057G: Nitrite as N by Discrete Analyser						
Clear Plastic Bottle - Natural						
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	----	----	----	15-Jul-2019	13-Jul-2019	**2**
Clear Plastic Bottle - Natural						
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	----	----	----	15-Jul-2019	14-Jul-2019	**1**
EP030: Biochemical Oxygen Demand (BOD)						
Clear Plastic Bottle - Natural						
MB05_11/7/19	----	----	----	15-Jul-2019	13-Jul-2019	**2**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**16-Jul-2019**	18-Jul-2019	✓
Clear Plastic Bottle - Natural (EA015H)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**----**	----	----	**16-Jul-2019**	19-Jul-2019	✓
EA045: Turbidity							
Clear Plastic Bottle - Natural (EA045)							
SD01_11/7/19, SD06_11/7/19	**11-Jul-2019**	**----**	----	----	**12-Jul-2019**	13-Jul-2019	✓
Clear Plastic Bottle - Natural (EA045)							
SD03_12/7/19	**12-Jul-2019**	**----**	----	----	**16-Jul-2019**	14-Jul-2019	×
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**16-Jul-2019**	25-Jul-2019	✓
Clear Plastic Bottle - Natural (ED037-P)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**----**	----	----	**16-Jul-2019**	26-Jul-2019	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**16-Jul-2019**	08-Aug-2019	✓
Clear Plastic Bottle - Natural (ED041G)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**----**	----	----	**16-Jul-2019**	09-Aug-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**16-Jul-2019**	08-Aug-2019	✓
Clear Plastic Bottle - Natural (ED045G)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**----**	----	----	**16-Jul-2019**	09-Aug-2019	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**18-Jul-2019**	08-Aug-2019	✓
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**----**	----	----	**18-Jul-2019**	09-Aug-2019	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**16-Jul-2019**	07-Jan-2020	✓
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**----**	----	----	**16-Jul-2019**	08-Jan-2020	✓
EK025SF: Free CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK025SF)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19	**11-Jul-2019**	**----**	----	----	**16-Jul-2019**	25-Jul-2019	✓
Opaque plastic bottle - NaOH (EK025SF)							
MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**17-Jul-2019**	25-Jul-2019	✓
Opaque plastic bottle - NaOH (EK025SF)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19	**12-Jul-2019**	**----**	----	----	**16-Jul-2019**	26-Jul-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19	**11-Jul-2019**	**----**	----	----	**16-Jul-2019**	25-Jul-2019	✓
Opaque plastic bottle - NaOH (EK026SF)							
MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**17-Jul-2019**	25-Jul-2019	✓
Opaque plastic bottle - NaOH (EK026SF)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19	**12-Jul-2019**	**----**	----	----	**16-Jul-2019**	26-Jul-2019	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**19-Jul-2019**	08-Aug-2019	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**----**	----	----	**19-Jul-2019**	09-Aug-2019	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**15-Jul-2019**	13-Jul-2019	×
Clear Plastic Bottle - Natural (EK057G)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**----**	----	----	**15-Jul-2019**	14-Jul-2019	×
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**19-Jul-2019**	08-Aug-2019	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**----**	----	----	**19-Jul-2019**	09-Aug-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**17-Jul-2019**	08-Aug-2019	✓	**17-Jul-2019**	08-Aug-2019	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**17-Jul-2019**	09-Aug-2019	✓	**17-Jul-2019**	09-Aug-2019	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**17-Jul-2019**	08-Aug-2019	✓	**17-Jul-2019**	08-Aug-2019	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**17-Jul-2019**	09-Aug-2019	✓	**17-Jul-2019**	09-Aug-2019	✓
EP005: Total Organic Carbon (TOC)							
Amber TOC Vial - Sulfuric Acid (EP005)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19, SD01_11/7/19, SD06_11/7/19, MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**17-Jul-2019**	08-Aug-2019	✓
Amber TOC Vial - Sulfuric Acid (EP005)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19, SD03_12/7/19	**12-Jul-2019**	**----**	----	----	**17-Jul-2019**	09-Aug-2019	✓
EP026SP: Chemical Oxygen Demand (Spectrophotometric)							
Clear Plastic Bottle - Sulfuric Acid (EP026SP)							
MB06_11/7/19, MB10_11/7/19, QC05_11/7/19	**11-Jul-2019**	**----**	----	----	**16-Jul-2019**	08-Aug-2019	✓
Clear Plastic Bottle - Sulfuric Acid (EP026SP)							
MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**18-Jul-2019**	08-Aug-2019	✓
Clear Plastic Bottle - Sulfuric Acid (EP026SP)							
QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19	**12-Jul-2019**	**----**	----	----	**16-Jul-2019**	09-Aug-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP030: Biochemical Oxygen Demand (BOD)							
Clear Plastic Bottle - Natural (EP030) MB06_11/7/19, MB10_11/7/19, QC05_11/7/19	**11-Jul-2019**	**----**	----	----	**12-Jul-2019**	13-Jul-2019	✓
Clear Plastic Bottle - Natural (EP030) MB05_11/7/19	**11-Jul-2019**	**----**	----	----	**15-Jul-2019**	13-Jul-2019	×
Clear Plastic Bottle - Natural (EP030) QC06_12/7/19, MB02_12/7/19, MB03_12/7/19, MB04_12/7/19	**12-Jul-2019**	**----**	----	----	**12-Jul-2019**	14-Jul-2019	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	4	39	**10.26**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	3	24	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	5	49	**10.20**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	33	**12.12**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	3	20	**15.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	33	**12.12**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	5	38	**13.16**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	4	35	**11.43**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	39	**5.13**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	3	49	**6.12**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	33	**12.12**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	2	20	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	33	**12.12**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	3	38	**7.89**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	4	35	**11.43**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	3	49	**6.12**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	2	20	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	3	38	**7.89**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	35	**5.71**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	3	49	**6.12**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	3	38	**7.89**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	* ED037 CC	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Free CN by Segmented Flow Analyser	EK025SF	WATER	In house: Referenced to ASTM D7237: Using an automated segmented flow analyser, a sample at high pH (sodium hydroxide preserved) is buffered to pH 6.0. The hydrogen cyanide present passes across a gas dialysis membrane into an acceptor stream consisting of 0.01 M sodium hydroxide. The acceptor stream mixes with a buffer at pH 5.2 and reacts with chloramine-T to form cyanogen chloride. Cyanogen chloride reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour, measured at 600nm. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Total Organic Carbon	EP005	WATER	In house: Referenced to APHA 5310 B, The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM (2013) Schedule B(3)
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	WATER	In house: Referenced to APHA 5220 D. Samples are digested with a known excess of an acidic potassium dichromate solution using silver sulfate as a catalyst. The chromium is reduced from the Cr (VI) oxidation state to the Cr (III) state by the oxygen present in the organic material. Both of these chromium species are coloued and absorb in the visible region of (400nm & 600nm) the spectrum. The oxidisable organic matter can be calculated in terms of oxygen equivalents.
Biochemical Oxygen Demand (BOD)	EP030	WATER	In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)

ANZ

FQM - Generic Chain of Custody Form

13

Q4AN(EV)-007-FM1

timothy.smith@aecom.com

CONSULTANT: AECOM	ADDRESS / OFFICE:	SAMPLER: Liq	**Destination Laboratory**
PROJECT MANAGER (PM): Tim Smith	SITE: Eaglehawk Landfill	MOBILE:	PHONE:
PROJECT NUMBER & TASK COI 60563317	P.O. NO.:	EMAIL REPORT TO: vera.levina@aecom.com	ALS
RESULTS REQUIRED (Date):	QUOTE NO.:	ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)	

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:
All metals bottles have been field filtered.

Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". Extra volume for QC or trace LORs etc.

ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles	TDS, major ions	Bicarb alkalinity	Ammonia, nitrate	TKN, phosphorus	TOC	CoD/BOD	total & free cyanide	metals (Mn, Fe, As, Cd, Cu, Cr, Ni, Pb, Zn)	metals (Mn, Fe only)	Turbidity			HOLD
1	LBØ2_10/7/19	W	10/7/19		P, SP, VS, SH, N	5	X	X	X	X	X	X	X	X					
2	LS-1_10/7/19				"	5	↓	↓	↓	↓	↓	↓	↓	↓					
3	LP_10/7/19				"	5	↓	↓	↓	↓	↓	↓	↓	↓					
4	SW02_10/7/19				P, SP, VS, N	4	X	X	X	X	X				X	X				
5	MB08_10/7/19				P, SP, VS, N, SH	5	↓	↓	↓	↓	↓	X	X	X						
6	MB07_10/7/19					5	↓	↓	↓	↓	↓	↓	↓	↓						
7	QC01_10/7/19						↓	↓	↓	↓	↓	↓	↓	↓						
→	QC02_10/7/19						↓	↓	↓	↓	↓	↓	↓	↓						Please send to Eurofins/Mgt.
8	QC03_10/7/19						↓	↓	↓	↓	↓	↓	↓	↓						
9	QC04_10/7/19	↓	↓	↓	↓	↓	X	↓	↓	↓	↓	↓	↓	↓						

Please send to Eurofins/Mgt.

665425

RELINQUISHED BY:		RECEIVED BY		RECEIVED BY		METHOD OF SHIPMENT
Name: Scott	Date: 11/7/19	Name:	Date:	Name:	Date:	Con' Note No:
Of: ALS	Time: 13:30	Of:	Time:	Of:	Time:	Transport Co:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag. **Soil Container Codes:** Jar = Unpreserved glass jar

COC Page 1 of

11/7, 9-30

Melbourne
6 Monterey Road
Dandenong South Vic 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name:	**AECOM Aust Pty Ltd Melbourne**
Contact name:	Tim Smith
Project name:	EAGLEHAWK LANDFILL
COC number:	Not provided
Turn around time:	5 Day
Date/Time received:	Jul 10, 2019 2:30 PM
Eurofins | mgt reference:	**665425**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 7 degrees Celsius.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☑ Sample containers for volatile analysis received with zero headspace.

☒ Split sample sent to requested external lab.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Michael Morrison on Phone : 03 8564 5933 or by e.mail: MichaelMorrison@eurofins.com

Results will be delivered electronically via e.mail to Tim Smith - tim.smith02@aecom.com.

Note: A copy of these results will also be delivered to the general AECOM Aust Pty Ltd Melbourne email address.

AECOM Aust Pty Ltd Melbourne
Collins Square, Tower 2, Level 11, 727 Collins Street
Docklands
VIC 3008

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Tim Smith**

Report **665425-W-V2**
Project name EAGLEHAWK LANDFILL
Project ID 60563317
Received Date Jul 10, 2019

Client Sample ID			**QC02_10/7/19**
Sample Matrix			**Water**
Eurofins Sample No.			**M19-Jl16474**
Date Sampled			**Jul 10, 2019**
Test/Reference	LOR	Unit	
Ammonia (as N)	0.01	mg/L	< 0.01
Biochemical Oxygen Demand (BOD-5 Day)	5	mg/L	< 5
Chemical Oxygen Demand (COD)	25	mg/L	45
Chloride	1	mg/L	3300
Cyanide (free)	0.005	mg/L	< 0.005
Nitrate (as N)	0.02	mg/L	0.10
Phosphate total (as P)	0.01	mg/L	0.34
Sulphate (as SO4)	5	mg/L	1200
Total Dissolved Solids Dried at 180°C ± 2°C	10	mg/L	7800
Total Kjeldahl Nitrogen (as N)*	0.2	mg/L	< 0.2
Total Organic Carbon	5	mg/L	12
Alkalinity (speciated)			
Bicarbonate Alkalinity (as HCO3)	20	mg/L	1000
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	830
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10
Alkali Metals			
Calcium	0.5	mg/L	150
Magnesium	0.5	mg/L	530
Potassium	0.5	mg/L	53
Sodium	0.5	mg/L	2100
Heavy Metals			
Arsenic (filtered)	0.001	mg/L	0.001
Cadmium (filtered)	0.0002	mg/L	0.0003
Chromium (filtered)	0.001	mg/L	< 0.001
Copper (filtered)	0.001	mg/L	0.006
Iron (filtered)	0.05	mg/L	< 0.05
Lead (filtered)	0.001	mg/L	< 0.001
Manganese (filtered)	0.005	mg/L	0.035
Nickel (filtered)	0.001	mg/L	0.015
Zinc (filtered)	0.005	mg/L	0.021

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Major Cations			
Ammonia (as N)	Melbourne	Jul 12, 2019	28 Days
- Method: LTM-INO-4200 Ammonia by Discrete Analyser			
Alkali Metals	Melbourne	Jul 12, 2019	180 Days
- Method: LTM-MET-3010 Alkali Metals S Si and P by ICP-AES			
Biochemical Oxygen Demand (BOD-5 Day)	Melbourne	Jul 12, 2019	2 Days
- Method: LTM-INO-4010 Biochemical Oxygen Demand (BOD5) in Water			
Chemical Oxygen Demand (COD)	Melbourne	Jul 12, 2019	28 Days
- Method: LTM-INO-4220 Determination of COD in Water			
Phosphate total (as P)	Melbourne	Jul 12, 2019	28 Days
- Method: APHA 4500-P E. Phosphorus			
Total Dissolved Solids Dried at 180°C ± 2°C	Melbourne	Jul 17, 2019	7 Days
- Method: LTM-INO-4170 Total Dissolved Solids in Water			
Total Kjeldahl Nitrogen (as N)*	Melbourne	Jul 12, 2019	7 Days
- Method: LTM-INO-4040 Phosphate and Nitrogen in waters by Continuous Flow Analysis (CFA)			
Total Organic Carbon	Melbourne	Jul 12, 2019	28 Days
- Method: LTM-INO-4060 Total Organic Carbon in water and soil			
Alkalinity (speciated)	Melbourne	Jul 12, 2019	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			
Heavy Metals (filtered)	Melbourne	Jul 12, 2019	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Major Anions			
Chloride	Melbourne	Jul 12, 2019	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Nitrate (as N)	Melbourne	Jul 12, 2019	28 Days
- Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA			
Sulphate (as SO4)	Melbourne	Jul 12, 2019	28 Days
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			

eurofins | mgt

ABN – 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name: AECOM Aust Pty Ltd Melbourne
Address: Collins Square, Tower 2, Level 11, 727 Collins Street
Docklands
VIC 3008

Project Name: EAGLEHAWK LANDFILL

Order No.:
Report #: 665425
Phone: 03 9653 1234
Fax: 03 9654 7117

Received: Jul 10, 2019 2:30 PM
Due: Jul 17, 2019
Priority: 5 Day
Contact Name: Tim Smith

Eurofins | mgt Analytical Services Manager : Michael Morrison

Sample Detail						Arsenic (filtered)	Bicarbonate Alkalinity (as HCO3)	Biochemical Oxygen Demand (BOD-5 Day)	Cadmium (filtered)	Chemical Oxygen Demand (COD)	Chromium (filtered)	Copper (filtered)	Cyanide (free)	Iron (filtered)	Lead (filtered)	Manganese (filtered)	Nickel (filtered)	Phosphate total (as P)	Total Dissolved Solids Dried at 180°C ± 2°C	Total Kjeldahl Nitrogen (as N)	Total Organic Carbon	Zinc (filtered)	Major Anions	Major Cations
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217																								
Brisbane Laboratory - NATA Site # 20794																								
Perth Laboratory - NATA Site # 23736																								
External Laboratory																								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**																			
1	QC02_10/7/19	Jul 10, 2019		Water	M19-Jl16474	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram | **mg/L:** milligrams per litre | **ug/L:** micrograms per litre

ppm: Parts per million | **ppb:** Parts per billion | **%:** Percentage

org/100mL: Organisms per 100 millilitres | **NTU:** Nephelometric Turbidity Units | **MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Biochemical Oxygen Demand (BOD-5 Day)	mg/L	< 5			5	Pass	
Chemical Oxygen Demand (COD)	mg/L	< 25			25	Pass	
Chloride	mg/L	< 1			1	Pass	
Cyanide (free)	mg/L	< 0.005			0.005	Pass	
Nitrate (as N)	mg/L	< 0.02			0.02	Pass	
Phosphate total (as P)	mg/L	< 0.01			0.01	Pass	
Sulphate (as SO4)	mg/L	< 5			5	Pass	
Total Dissolved Solids Dried at 180°C ± 2°C	mg/L	< 10			10	Pass	
Total Kjeldahl Nitrogen (as N)*	mg/L	< 0.2			0.2	Pass	
Method Blank							
Alkali Metals							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Heavy Metals							
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0002			0.0002	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Iron (filtered)	mg/L	< 0.05			0.05	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Manganese (filtered)	mg/L	< 0.005			0.005	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Ammonia (as N)	%	97			70-130	Pass	
Biochemical Oxygen Demand (BOD-5 Day)	%	116			70-130	Pass	
Chemical Oxygen Demand (COD)	%	86			70-130	Pass	
Chloride	%	125			70-130	Pass	
Cyanide (free)	%	91			70-130	Pass	
Nitrate (as N)	%	98			70-130	Pass	
Phosphate total (as P)	%	128			70-130	Pass	
Sulphate (as SO4)	%	105			70-130	Pass	
Total Dissolved Solids Dried at 180°C ± 2°C	%	99			70-130	Pass	
Total Kjeldahl Nitrogen (as N)*	%	121			70-130	Pass	
Total Organic Carbon	%	107			70-130	Pass	
LCS - % Recovery							
Alkalinity (speciated)							
Carbonate Alkalinity (as CaCO3)	%	90			70-130	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium	%	98			70-130	Pass	
Magnesium	%	96			70-130	Pass	
Potassium	%	109			70-130	Pass	
Sodium	%	107			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Ammonia (as N)	P19-Jl14538	NCP	%	94			70-130	Pass	
Chemical Oxygen Demand (COD)	S19-Jl15578	NCP	%	100			70-130	Pass	
Chloride	M19-Jl17800	NCP	%	89			70-130	Pass	
Nitrate (as N)	M19-Jl50152	NCP	%	93			70-130	Pass	
Phosphate total (as P)	M19-Jl18980	NCP	%	136			70-130	Fail	Q08
Sulphate (as SO4)	M19-Jl14290	NCP	%	74			70-130	Pass	
Total Kjeldahl Nitrogen (as N)*	M19-Jl13978	NCP	%	126			70-130	Pass	
Spike - % Recovery									
Alkalinity (speciated)				Result 1					
Bicarbonate Alkalinity (as CaCO3)	S19-Jl15309	NCP	%	92			70-130	Pass	
Carbonate Alkalinity (as CaCO3)	M19-Jl17616	NCP	%	101			70-130	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Calcium	M19-Jl19356	NCP	%	111			70-130	Pass	
Magnesium	M19-Jl19356	NCP	%	113			70-130	Pass	
Potassium	M19-Jl19356	NCP	%	111			70-130	Pass	
Sodium	M19-Jl19356	NCP	%	116			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic (filtered)	M19-Jl17678	NCP	%	94			70-130	Pass	
Cadmium (filtered)	M19-Jl17678	NCP	%	98			70-130	Pass	
Chromium (filtered)	M19-Jl17678	NCP	%	95			70-130	Pass	
Copper (filtered)	M19-Jl17678	NCP	%	94			70-130	Pass	
Iron (filtered)	M19-Jl17678	NCP	%	92			70-130	Pass	
Lead (filtered)	M19-Jl17678	NCP	%	98			70-130	Pass	
Manganese (filtered)	M19-Jl17678	NCP	%	96			70-130	Pass	
Nickel (filtered)	M19-Jl17678	NCP	%	94			70-130	Pass	
Zinc (filtered)	M19-Jl17678	NCP	%	95			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	P19-Jl14538	NCP	mg/L	0.38	0.33	14	30%	Pass	
Biochemical Oxygen Demand (BOD-5 Day)	S19-Jl15309	NCP	mg/L	< 5	< 5	<1	30%	Pass	
Chemical Oxygen Demand (COD)	M19-Jl13984	NCP	mg/L	120	130	4.0	30%	Pass	
Chloride	M19-Jl16498	NCP	mg/L	360	310	16	30%	Pass	
Nitrate (as N)	M19-Jl14290	NCP	mg/L	< 0.4	< 0.4	<1	30%	Pass	
Phosphate total (as P)	M19-Jl17675	NCP	mg/L	0.11	0.10	3.0	30%	Pass	
Sulphate (as SO4)	M19-Jl16498	NCP	mg/L	520	540	4.0	30%	Pass	
Total Dissolved Solids Dried at 180°C ± 2°C	M19-Jl16488	NCP	mg/L	8100	9200	13	30%	Pass	
Total Organic Carbon	M19-Jl17822	NCP	mg/L	28	29	1.0	30%	Pass	
Duplicate									
Alkalinity (speciated)				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as HCO3)	M19-Jl12683	NCP	mg/L	250	260	3.0	30%	Pass	
Bicarbonate Alkalinity (as CaCO3)	M19-Jl12683	NCP	mg/L	200	210	12	30%	Pass	
Carbonate Alkalinity (as CaCO3)	M19-Jl12683	NCP	mg/L	17	16	63	30%	Fail	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium	M19-Jl16040	NCP	mg/L	120	130	11	30%	Pass	
Magnesium	M19-Jl16040	NCP	mg/L	260	290	10	30%	Pass	
Potassium	M19-Jl16040	NCP	mg/L	67	73	9.0	30%	Pass	
Sodium	M19-Jl16040	NCP	mg/L	4200	4100	4.0	30%	Pass	

Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic (filtered)	M19-Jl17678	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	M19-Jl17678	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium (filtered)	M19-Jl17678	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper (filtered)	M19-Jl17678	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Iron (filtered)	M19-Jl17678	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Lead (filtered)	M19-Jl17678	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Manganese (filtered)	M19-Jl17678	NCP	mg/L	0.018	0.019	3.0	30%	Pass	
Nickel (filtered)	M19-Jl17678	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Zinc (filtered)	M19-Jl17678	NCP	mg/L	< 0.005	0.005	14	30%	Pass	

Comments

V2: This report has been amended with repeated results for carbonate alkalinity and ammonia for sample 19-Jl116474 as requested by RE 1/8/19

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q02	The duplicate %RPD is outside the recommended acceptance criteria. Further analysis indicates sample heterogeneity as the cause
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference

Authorised By

Michael Morrison	Analytical Services Manager
Emily Rosenberg	Senior Analyst-Metal (VIC)
Julie Kay	Senior Analyst-Inorganic (VIC)



Glenn Jackson

General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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ATTACHMENT 5 WATER RESULTS

Table T1
Analytical Results
60563317
City of Greater Bendigo - Eaglehawk Landfill

AECOM

									Location_Code	LB02	LP	LS_1	MB02	MB03	MB04	MB05	MB06	MB07	MB07	MB07	MB08	MB10
									Simple_Date	7/10/2019	7/10/2019	7/10/2019	7/12/2019	7/12/2019	7/12/2019	7/11/2019	7/11/2019	7/10/2019	7/10/2019	7/10/2019	7/10/2019	7/11/2019
									Sample_Type	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Field_D	Interlab_D	Normal	Normal
				Eaglehawk EMP - Buildings and Structures	Eaglehawk EMP - Industrial Water Use	Eaglehawk EMP - Maintenance of Ecosystems (Freshwater 95%)	Eaglehawk EMP - Primary Contact Recreation	Eaglehawk EMP - Stock Watering		Leachate			Groundwater										
Chem_Group	**ChemName**	**output unit**	**EQL**																				
NA	Bicarbonate	mg/L	20							-	-	-	-	-	-	-	-	-	-	800	-	-
Organic Matter	Total Organic Carbon	mg/L	1							15	121	120	6	<5	<5	<1	<1	<5	<5	12	7	2
Physio-Chemical Parameters	Total Dissolved Solids	mg/L	10		35000			10000		1490	4600	8110	5910	7990	7560	9510	5400	7590	7640	7800	10,300	5250
Metals	Arsenic (Filtered)	ug/L	1			24	70	500		10,000	12,400	47,500	21	4	1	2	2	5	4	1	15	4
	Cadmium (Filtered)	ug/L	0.1			0.2	20	10		<0.1	<0.1	<0.1	<0.1	<0.1	3.1	<0.1	0.2	0.2	0.3	0.3	<0.1	0.1
	Chromium (Filtered)	ug/L	1				500	1000		<1	14	5	<1	<1	<1	1	<1	<1	<1	<1	<1	<1
	Copper (Filtered)	ug/L	1			1.4	20000	500		<1	4	<1	<1	<1	1	4	<1	7	7	6	<1	2
	Iron (Filtered)	ug/L	50							8190	60	3560	1840	400	<50	150	<50	<50	<50	<50	150	<50
	Lead (Filtered)	ug/L	1			3.4	100	100		<1	1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1
	Manganese (Filtered)	ug/L	1			1900	5000			400	65	35	1170	62	61	307	7	33	33	35	87	40
	Nickel (Filtered)	ug/L	1			11	200	1000		11	72	74	5	41	32	129	<1	15	16	15	19	26
	Zinc (Filtered)	ug/L	5			8		20000		12	20	8	64	20	33	41	8	20	20	21	156	18
Bulk Organics	Biological Oxygen Demand	mg/L	2							7	31	23	3	<2	<2	<2	<2	<2	<2	<5	<2	<2
	Chemical Oxygen Demand	mg/L	10			75				69	640	436	29	24	<20	<50	<20	<20	<20	45	<20	11
Alkalinity	Bicarbonate Alkalinity as CaCO3	mg/L	1							736	824	1280	591	996	841	971	739	798	798	650	1210	780
	Carbonate Alkalinity as CaCO3	mg/L	1							<1	577	<1	<1	<1	<1	<1	<1	<1	<1	110	<1	<1
	Hydroxide Alkalinity as CaCO3	mg/L	1							<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1
	Total Alkalinity as CaCO3	mg/L	1							736	1400	1280	591	996	841	971	739	798	798	-	1210	780
	Bicarbonate as HCO3	mg/L	1		140					897.92	1005.28	1561.6	721	1210	1020	1180	901	973.56	973.56	-	1476.2	952
	Carbonate as CO3	mg/L								0.6	346.2	0.6	-	-	-	-	-	0.6	0.6	-	0.6	-
Nutrients	Ammonia (as N)	mg/L	0.01			0.74				41.9	18	275	0.06	0.01	1	0.28	<0.01	0.05	0.02	0.62	0.18	0.01
	Nitrate (as N)	mg/L	0.01			7.2	113	90.3		<0.01	0.03	0.08	<0.01	<0.01	0.34	<0.01	0.11	0.06	0.05	0.12	0.03	4.38
	Nitrite (as N)	mg/L	0.01			0.16	1	9.1		<0.01	0.9	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	-	<0.01	0.04
	Total Kjeldahl Nitrogen	mg/L	0.1							42.3	54.7	304	0.3	<0.1	1	0.5	<0.1	0.2	0.1	<0.2	0.2	0.9
	Total Phosphate (as P)	mg/L	0.01							-	-	-	-	-	-	-	-	-	-	0.34	-	-
	Total Phosphorus	mg/L	0.01							4.24	4.64	4.82	0.79	0.86	0.32	0.17	0.22	0.32	0.41	-	0.11	0.7
Major Ions	Chloride	mg/L	1	6000	19000					441	1860	4040	2710	4070	3620	4750	1960	3720	3690	3300	5060	1250
	Calcium	mg/L	0.5		420			1000		-	-	-	-	-	-	-	-	-	-	150	-	-
	Calcium (Filtered)	mg/L	1		420			1000		106	24	43	18	39	56	61	38	139	106	-	70	40
	Magnesium	mg/L	0.5							-	-	-	-	-	-	-	-	-	-	530	-	-
	Magnesium (Filtered)	mg/L	1							89	259	248	425	397	408	407	173	494	450	-	559	187
	Potassium	mg/L	0.5							-	-	-	-	-	-	-	-	-	-	53	-	-
	Potassium (Filtered)	mg/L	1							108	303	248	32	64	67	62	58	57	59	-	140	67
	Sodium	mg/L	0.5							-	-	-	-	-	-	-	-	-	-	2100	-	-
	Sodium (Filtered)	mg/L	1							216	1210	2080	1500	2390	2310	3360	1600	2070	1940	-	2930	1550
	Sulfate as SO4	mg/L	5	1000	2700		5000	1000		-	-	-	-	-	-	-	-	-	-	1200	-	-
	Total Anions	meq/L	0.01							30.9	84.9	149	111	150	148	184	91.3	136	135	-	191	88.7
	Total Cations	meq/L	0.01							27.8	82.9	139	102	140	138	184	87.2	139	128	-	180	86.5
	Sulfate (as SO4-) (Filtered)	mg/L	1							180	213	468	1110	720	1380	1470	1020	704	729	-	1180	1820
	Ionic Balance	%	0.01							5.36	1.18	3.57	4.42	3.27	3.17	0.08	2.28	1.29	2.65	-	2.94	1.26
Cyanides	Cyanide Total	µg/L	4			7	800	80		6	<4	20	26	<4	26	<4	<4	<4	<4	-	<4	8
	Cyanide (Free)	mg/L	0.004							<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005	<0.004	<0.004
Field	Purge Volume	L								-	-	-	13.5	2.1	3.6	3	10	3	-	-	2.5	3.3
	pH (Field)	pH Units		5.5-	6.5-8.3		6.5-8.5			7.02	9.29	7.04	6.39	6.84	6.86	6.57	7.08	6.5	-	-	6.25	7.04
	Temperature	°C								16.1	11	19.6	16.8	16.4	17.8	16.5	14.1	16.2	-	-	15.7	15.6
	Electrical conductivity (field)	µS/cm								2713	7405	13,230	9253	12,553	12,222	15,275	8649	11,934	-	-	16,165	7886
	TDS (Field)	mg/L								1817.71	4961.35	8864.1	6199.51	8410.51	8188.74	10,234	5794.83	7995.78	-	-	10,831	5283.62
	DO	mg/L								1.42	16.85	0.96	2.9	0.37	0.24	0.51	1.5	0.68	-	-	0.96	1.09
	Redox Potential (Field)	mV								-97.5	47.8	-87.2	-25.1	-137.3	54.7	-86	92.7	104.4	-	-	52.2	98.7
	Redox Potential (Corrected)	mV								115.49677	264.5927	123.19172	187.37576	75.47348	266.43146	126.69905	307.18537	317.32234	-	-	265.49449	312.06892
	Turbidity	NTU	0.1							-	-	-	-	-	-	-	-	-	-	-	-	-

Table T2
Analytical Results
60563317
City of Greater Bendigo - Eaglehawk Landfill

							Location_Code	SD01	SD03	SD06	SW02
							Simple_Date	7/11/2019	7/12/2019	7/11/2019	7/10/2019
							Sample_Type	Normal	Normal	Normal	Normal
				Eaglehawk EMP - Surface Water Objectives	Eaglehawk EMP - Surface Water Objectives (MOE)	Eaglehawk EMP - Surface Water Objectives (PCR)	Stormwater			Surface water
Chem_Group	**ChemName**	**output unit**	**EQL**							
NA	Bicarbonate	mg/L	20				-	-	-	-
Organic Matter	Total Organic Carbon	mg/L	1				25	50	18	22
Physio-Chemical Parameters	Total Dissolved Solids	mg/L	10	1000			1060	1020	764	1050
Metals	Arsenic (Filtered)	ug/L	1				-	-	-	-
	Cadmium (Filtered)	ug/L	0.1				-	-	-	-
	Chromium (Filtered)	ug/L	1				-	-	-	-
	Copper (Filtered)	ug/L	1				-	-	-	-
	Iron (Filtered)	ug/L	50			300	150	120	240	<50
	Lead (Filtered)	ug/L	1				-	-	-	-
	Manganese (Filtered)	ug/L	1		1900	100	24	226	15	11
	Nickel (Filtered)	ug/L	1				-	-	-	-
	Zinc (Filtered)	ug/L	5				-	-	-	-
Bulk Organics	Biological Oxygen Demand	mg/L	2				-	-	-	-
	Chemical Oxygen Demand	mg/L	10				-	-	-	-
Alkalinity	Bicarbonate Alkalinity as CaCO3	mg/L	1				93	233	68	93
	Carbonate Alkalinity as CaCO3	mg/L	1				<1	<1	<1	77
	Hydroxide Alkalinity as CaCO3	mg/L	1				<1	<1	<1	<1
	Total Alkalinity as CaCO3	mg/L	1				93	233	68	170
	Bicarbonate as HCO3	mg/L	1	500			113	284	83	113.46
	Carbonate as CO3	mg/L					-	-	-	46.2
Nutrients	Ammonia (as N)	mg/L	0.01	0.1			0.26	0.11	0.1	0.24
	Nitrate (as N)	mg/L	0.01		7.2	10	2.14	0.58	0.71	<0.01
	Nitrite (as N)	mg/L	0.01		0.16	1	0.09	<0.01	0.03	<0.01
	Total Kjeldahl Nitrogen	mg/L	0.1				8.2	19.3	6.8	5.6
	Total Phosphate (as P)	mg/L	0.01				-	-	-	-
	Total Phosphorus	mg/L	0.01	0.025			2.81	8.68	2.42	0.77
Major Ions	Chloride	mg/L	1	400			229	223	105	358
	Calcium	mg/L	0.5				-	-	-	-
	Calcium (Filtered)	mg/L	1				51	54	22	40
	Magnesium	mg/L	0.5				-	-	-	-
	Magnesium (Filtered)	mg/L	1				33	37	14	48
	Potassium	mg/L	0.5				-	-	-	-
	Potassium (Filtered)	mg/L	1				51	28	17	23
	Sodium	mg/L	0.5	300			-	-	-	-
	Sodium (Filtered)	mg/L	1	300			132	98	64	185
	Sulfate as SO4	mg/L	5	400			-	-	-	-
	Total Anions	meq/L	0.01				12.3	13.5	5.94	16.8
	Total Cations	meq/L	0.01				12.3	10.7	5.47	14.6
	Sulfate (as SO4-) (Filtered)	mg/L	1				190	125	78	161
	Ionic Balance	%	0.01				0.13	11.7	4.17	7.21
Cyanides	Cyanide Total	µg/L	4				-	-	-	-
	Cyanide (Free)	mg/L	0.004				-	-	-	-
Field	Purge Volume	L					-	-	-	-
	pH (Field)	pH Units		6.5-8.3		6.5-8.5	8.07	8.05	8.11	9.61
	Temperature	°C					9.5	10.7	9.1	11.2
	Electrical conductivity (field)	µS/cm		500			1324	1186	603	1635
	TDS (Field)	mg/L					887.08	794.62	404.01	1095.45
	DO	mg/L					8.07	9.12	9.91	15.56
	Redox Potential (Field)	mV					106.6	78.3	71.6	-9.4
	Redox Potential (Corrected)	mV					324.50915	295.31599	289.80687	207.24384
	Turbidity	NTU	0.1	10			3410	13,900	7080	35.9

Table T3 - Historical Gauging

Location	Date	Reference Elevation (mAHD)	SWL (mbTOC)	Total Depth (mbTOC)	Elevation (mAHD)	Comments
LB01	20/11/2015	248.781	13.354	15.5	235.43	Good condition, yellow stickup. Strong leachate odour
	9/02/2016	248.781	13.438	15.55	235.34	Yellow stickup, locked. Leachate odour
	26/07/2016	248.781		1.12		Damaged by vehicle
	16/02/2017	248.781				Well damaged, blocked at 1.28m
	20/07/2017	248.781	Dry	9.82		Yellow stickup, Gatic lid rusted
	21/02/2018	248.781	Dry	9.88		Monument lid hinge broken
	8/08/2018	248.781	Dry	9.79		Good condition
	5/02/2019	248.781	Dry	10.01		Good condition
	10/07/2019	248.781	Dry	9.98		Not locked, stick up lid broken off, mud on probe
LB02	20/11/2015	249.215	13.825	16.6	235.39	Good condition, yellow stickup. Strong leachate odour, no cap
	9/02/2016	249.215	13.926	16.43	235.29	Yellow stickup, locked. Leachate odour, no cap
	26/07/2016	249.215	13.99	14.88	235.23	Odourous, good condition
	16/02/2017	249.215	13.528	14.88	235.69	Good condition, leachate odour
	20/07/2017	249.215	13.758	14.88	235.46	Good condition
	21/02/2018	249.215	13.558	14.97	235.66	Good condition, very strong odour
	8/08/2018	249.215	13.428	15.03	235.79	Good condition
	5/02/2019	249.215	13.35	15.22	235.87	Good condition
	10/07/2019	249.215	13.316	15.06	235.90	Good condition, spiders, locked, leachate odour
LB03	20/11/2015	257.171	28.088	29.65	229.08	New yellow stickup, black silt on dipper
	9/02/2016	257.171	28.111	29.66	229.06	Yellow stickup, locked. Leachate odour
	26/07/2016	257.171		25.83		Odorous, good condition
	16/02/2017	257.171	25.808	25.83	231.36	Good condition
	20/07/2017	257.171	Dry	25.77		GC, wet silt at base
	21/02/2018	257.171	Dry	25.68		Good condition
	8/08/2018	257.171	Dry	26.15		Good condition, lock rusted
	5/02/2019	257.171	Dry	26.32		Good condition
	10/07/2019	257.171	Dry	25.65		strong leachate odour, good condition, lock stiff, stick up wobbly, sediment on probe
LB04	20/11/2015	256.486	20.845	22.71	235.64	New yellow stickup, odourous
	9/02/2016	256.486	21.993	22.89	234.49	Yellow stickup, locked. Leachate odour
	26/07/2016	256.486		20.68		Odourous, good condition
	16/02/2017	256.486	Dry	21.1		Good condition
	20/07/2017	256.486	Dry	20.62		Good condition
	21/02/2018	256.486	Dry	20.59		Good condition, very strong odour
	8/08/2018	256.486	Dry	20.44		Good condition
	5/02/2019	256.486	Dry	21.13		Good condition
	10/07/2019	256.486	Dry	20.41		leachate odour, wobbly stick up, stiff lock
LS_1	29/07/2015		3.91			ToS riser (concrete)
	1/06/2010	223.408	1.49		221.92	
	1/06/2011	223.408	1.38		222.03	
	3/04/2012	223.408	1.48		221.93	
	8/08/2012	223.408	1.48		221.93	
	19/02/2013	223.408	3.93		219.48	Access through hole in side
	21/08/2013	223.408	3.93		219.48	
	30/07/2014	223.408	3.93		219.48	From top of sump
	4/03/2015	223.408	3.32		220.09	Gauged from top of concrete riser
	9/02/2016	223.408	3.89		219.52	Top of sump
	26/07/2016	223.408	3.88		219.53	Measured from top of sump
	17/02/2017	223.408	3.89		219.52	Good condition, lid hard to get off
	20/07/2017	223.408	3.94		219.47	ToS
	21/02/2018	223.408	3.92		219.49	Good condition
	8/08/2018	223.408	3.903		219.51	Good condition
	5/02/2019	223.408	3.94		219.47	
	10/07/2019	223.408	3.92		219.49	bailer ok
LS_2	26/07/2016			5.8		Measured from top of sump, brown solids on probe
	17/02/2017		Dry			Good condition
	20/07/2017		Dry	4.84		ToS silt on base
	21/02/2018		4.76	5.84		Good condition
	8/08/2018		Dry	4.79		
	5/02/2019		Dry	4.77		Good condition, silt on base
	10/07/2019		4.77			can gauge only, no bailer access
LS_3	21/07/2017		2.97	3.02		ToS (black HDPE Stickup)
	8/08/2018		Dry	2.95		ToS (black HDPE Stickup)
	5/02/2019		Dry			HDPE stickup broken
	10/07/2019		2.95	2.96		minor water, large PVC they removed
MB02	28/07/1993	221.72	5.61	16	216.11	
	20/02/1994	221.72	4.85	16	216.87	
	10/05/1994	221.72	5.78	16	215.94	
	11/08/1994	221.72	6.03	16	215.69	
	21/02/1995	221.72	6.75	16	214.97	
	9/10/1996	221.72	5.66	16	216.06	
	14/02/1997	221.72	5.94	16	215.78	
	4/06/1997	221.72	6.45	16	215.27	
	5/02/1998	221.72	6.668	16	215.05	
	29/03/1999	221.72	7.66	16	214.06	
	30/06/1999	221.72	7.96	16	213.76	
	11/05/2000	221.72	8.4	16	213.32	
	23/06/2000	221.72	8.3	16	213.42	
	23/01/2001	221.72	7.78	16	213.94	
	28/06/2001	221.72	8.52	16	213.20	
	1/02/2002	221.72	9.04	16	212.68	
	1/06/2002	221.72	9.5	16	212.22	
	1/02/2003	221.72	10.22	16	211.50	
	1/06/2003	221.72	Dry	16		
	16/03/2005	221.72	11.61	16	210.11	
	16/06/2005	221.72	11.802	16	209.92	
	9/09/2005	221.72	Dry	16		
	28/02/2006	221.72	11.96	16	209.76	
	1/06/2006	221.72	12.255	16	209.47	
	13/02/2007	221.72	12.971	16	208.75	
	26/06/2007	221.72	13.405	16	208.32	
	14/02/2008	221.72	13.91	16	207.81	

Table T3 - Historical Gauging

Location	Date	Reference Elevation (mAHD)	SWL (mbTOC)	Total Depth (mbTOC)	Elevation (mAHD)	Comments
	12/06/2008	221.72	14.31	16	207.41	
	23/02/2009	221.72	15.13	16	206.59	
	24/06/2009	221.72	15.501	16	206.22	
	10/03/2010	221.72	Dry	16		
	1/06/2010	221.72	Dry	16		
	1/03/2011	221.72	10.93	16	210.79	
	1/06/2011	221.72	10.72	16	211.00	
	3/04/2012	221.72	10.2	16	211.52	
	8/08/2012	221.72	10.246	16	211.47	
	19/02/2013	221.72	10.674	15.51	211.05	
	20/08/2013	221.72	11.327	15.49	210.39	
	4/03/2014	221.72	11.365	15.57	210.36	Good Condition
	29/07/2014	221.72	11.17	15.53	210.55	Good Condition. No odour. Padlock
	4/03/2015	221.72	11.503	15.49	210.22	Good condition
	28/07/2015	221.72	11.894	15.56	209.83	Good condition
	10/02/2016	221.72	12.18	15.55	209.54	Bailer
	26/07/2016	221.72	12.617	15.55	209.10	Good condition, Bailers, cuts in PVC
	17/02/2017	221.72	11.976	15.54	209.74	Good condition
	20/07/2017	221.72	11.892	15.53	209.83	Good condition, Ants nest
	20/02/2018	221.72	-	-		Well vandalised and inaccessable
	8/08/2018	221.72	12.143	15.97	209.58	Good condition, 2 iron locks
	5/02/2019	221.72	12.619	16.11	209.10	Recorded as MB09; tubing in well
	12/07/2019	221.72	13.521	15.95	208.20	Good condition, Lock broken off
MB03	28/07/1993	223.35	2.61	16	220.74	
	20/02/1994	223.35	1.95	16	221.40	
	10/05/1994	223.35		16		
	11/08/1994	223.35		16		
	21/02/1995	223.35		16		
	9/10/1996	223.35	2.67	16	220.68	
	14/02/1997	223.35	2.99	16	220.36	
	4/06/1997	223.35	3.57	16	219.78	
	5/02/1998	223.35		16		
	29/03/1999	223.35		16		
	30/06/1999	223.35	5.21	16	218.14	
	11/05/2000	223.35	5.62	16	217.73	
	23/06/2000	223.35	5.8	16	217.55	
	23/01/2001	223.35		16		
	28/06/2001	223.35	5.55	16	217.80	
	1/02/2002	223.35	6.31	16	217.04	
	1/06/2002	223.35	6.89	16	216.46	
	1/02/2003	223.35	7.52	16	215.83	
	1/06/2003	223.35	7.83	16	215.52	
	24/02/2004	223.35		16		
	24/06/2004	223.35	8.21	16	215.14	
	16/03/2005	223.35	8.43	16	214.92	
	16/06/2005	223.35	8.73	16	214.62	
	9/09/2005	223.35		16		
	28/02/2006	223.35	8.88	16	214.47	
	1/06/2006	223.35	9.247	16	214.10	
	13/02/2007	223.35	10.17	16	213.18	
	26/06/2007	223.35	10.515	16	212.84	
	14/02/2008	223.35	11.63	16	211.72	
	12/06/2008	223.35	11.57	16	211.78	
	23/02/2009	223.35	12.5	16	210.85	
	24/06/2009	223.35	12.89	16	210.46	
	10/03/2010	223.35	13.3	16	210.05	
	1/06/2010	223.35	13.29	16	210.06	
	1/03/2011	223.35	8.821	16	214.53	
	1/06/2011	223.35	7.92	16	215.43	
	3/04/2012	223.35	7.82	16	215.53	
	8/08/2012	223.35	7.97	16	215.38	
	19/02/2013	223.35	8.419	14.61	214.93	
	21/08/2013	223.35	9.082	14.52	214.27	
	4/03/2014	223.35	9.353	14.71	214.00	Flush
	29/07/2014	223.35	9.431	14.66	213.92	No odour. Flush, no lock or bolts
	5/03/2015	223.35	9.703	14.65	213.65	Flush, no bolts
	29/07/2015	223.35	10.087	14.66	213.26	Flush, no lock/bolts
	10/02/2016	223.35	10.505	14.58	212.85	No bolts, flush
	26/07/2016	223.35	11.082	14.61	212.27	Flush, no bolts
	16/02/2017	223.35	10.09	14.53	213.26	Good condition
	20/07/2017	223.35	10.169	14.61	213.18	No Gatic Lid, well cap removed, bailer in well
	21/02/2018	223.35	10.156	14.6	213.19	No Gatic Lid
	8/08/2018	223.35	10.564	14.74	212.79	Good Condition
	4/02/2019	223.35	11.053	14.48	212.30	Not Gatic, using a stone
	12/07/2019	223.35	11.627	14.62	211.72	no gatic lid, hidden under rock
	28/07/1993	236.82	1.13	22	235.69	
	20/02/1994	236.82	0.85	22	235.97	
	10/05/1994	236.82	1.28	22	235.54	
	11/08/1994	236.82	1.37	22	235.45	
	21/02/1995	236.82	1.82	22	235.00	
	9/10/1996	236.82	1.34	22	235.48	
	14/02/1997	236.82	1.29	22	235.53	
	4/06/1997	236.82	1.85	22	234.97	
	5/02/1998	236.82	1.982	22	234.84	
	29/03/1999	236.82	2.55	22	234.27	
	30/06/1999	236.82	2.69	22	234.13	
	11/05/2000	236.82	2.97	22	233.85	
	23/06/2000	236.82	2.88	22	233.94	
	23/01/2001	236.82	2.54	22	234.28	
	28/06/2001	236.82	3.01	22	233.81	
	1/02/2002	236.82	3.51	22	233.31	
	1/06/2002	236.82	3.84	22	232.98	
	1/02/2003	236.82	4.49	22	232.33	

Table T3 - Historical Gauging

Location	Date	Reference Elevation (mAHD)	SWL (mbTOC)	Total Depth (mbTOC)	Elevation (mAHD)	Comments
MB04	1/06/2003	236.82	4.69	22	232.13	
	24/02/2004	236.82	4.41	22	232.41	
	24/06/2004	236.82	3.71	22	233.11	
	16/03/2005	236.82	4.84	22	231.98	
	16/06/2005	236.82	4.995	22	231.83	
	9/09/2005	236.82	5	22	231.82	
	28/02/2006	236.82	4.9	22	231.92	
	1/06/2006	236.82	5.212	22	231.61	
	13/02/2007	236.82	5.827	22	230.99	
	26/06/2007	236.82	6.088	22	230.73	
	14/02/2008	236.82	6.38	22	230.44	
	12/06/2008	236.82	6.7	22	230.12	
	23/02/2009	236.82	7.36	22	229.46	
	24/06/2009	236.82	6.992	22	229.83	
	10/03/2010	236.82	7.94	22	228.88	
	1/06/2010	236.82	7.357	22	229.46	
	1/03/2011	236.82	4.205	22	232.62	
	1/06/2011	236.82	3.97	22	232.85	
	3/04/2012	236.82	3.73	22	233.09	
	8/08/2012	236.82	3.715	22	233.11	
	19/02/2013	236.82	3.839	22.09	232.98	Lock rusted
	20/08/2013	236.82	4.406	22.07	232.41	
	5/03/2014	236.82	4.625	22.17	232.20	OK condition, lock jammed
	30/07/2014	236.82	4.718	12.24	232.10	Good Condition. No odour. Padlock
	4/03/2015	236.82	4.724	22.12	232.10	Good condition. Lock rusted.
	28/07/2015	236.82	4.95	22.11	231.87	Rusty stickup and cap
	20/11/2015	236.82	4.96	22.12	231.86	Rusty stickup
	10/02/2016	236.82	5.175	22.12	231.65	Rusted, lid detached. Waterra tubing
	25/07/2016	236.82	5.265	22.24	231.56	Good condition, lock not locked, waterra tubing
	16/02/2017	236.82	4.66	22.21	232.16	Good condition
	19/07/2017	236.82	4.757	22.24	232.06	Good condition
	21/02/2018	236.82	4.837	22.3	231.98	Good condition
	8/08/2018	236.82	5.045	22.15	231.78	Good Condition, low flow tubing
	4/02/2019	236.82	5.443	22.56	231.38	Good condition
	12/07/2019	236.82	5.772	22.41	231.05	
MB05	28/07/1993	249.338	0.05	35.4	230.26	
	20/02/1994	249.338		35.4		
	10/05/1994	249.338	0.41	35.4	229.90	
	11/08/1994	249.338	0.3	35.4	230.01	
	21/02/1995	249.338	0.73	35.4	229.58	
	9/10/1996	249.338	-0.05	35.4	230.36	
	14/02/1997	249.338	-0.04	35.4	230.35	
	4/06/1997	249.338	0.77	35.4	229.54	
	5/02/1998	249.338	0.901	35.4	229.41	
	29/03/1999	249.338	0.97	35.4	229.34	
	30/06/1999	249.338		35.4		
	11/05/2000	249.338	5.44	35.4	229.16	
	23/06/2000	249.338	5.22	35.4	229.38	
	23/01/2001	249.338		35.4		
	28/06/2001	249.338	11.9	35.4	229.39	
	1/02/2002	249.338	15.32	35.4	231.00	
	1/06/2002	249.338	17.81	35.4	228.51	
	1/02/2003	249.338	22.12	35.4	227.22	
	1/06/2003	249.338	20.3	35.4	229.04	
	24/02/2004	249.338	22.06	35.4	227.28	
	24/06/2004	249.338	22.26	35.4	227.08	
	16/03/2005	249.338	22.31	35.4	227.03	
	16/06/2005	249.338	22.455	35.4	226.88	
	9/09/2005	249.338		35.4		
	28/02/2006	249.338	22.45	35.4	226.89	
	1/06/2006	249.338	22.529	35.4	226.81	
	13/02/2007	249.338	23.194	35.4	226.14	
	26/06/2007	249.338	23.487	35.4	225.85	
	14/02/2008	249.338	23.77	35.4	225.57	
	12/06/2008	249.338	24.9	35.4	224.44	
	23/02/2009	249.338	24.58	35.4	224.76	
	24/06/2009	249.338	24.3	35.4	225.04	
	10/03/2010	249.338	25.135	35.4	224.20	
	1/06/2010	249.338	24.68	35.4	224.66	
	1/03/2011	249.338	21.592	35.4	227.75	
	1/06/2011	249.338	22.15	35.4	227.19	
	3/04/2012	249.338	21.545	35.4	227.79	
	8/08/2012	249.338	21.195	35.4	228.14	
	19/02/2013	249.338	21.395	34.56	227.94	Rusted
	21/08/2013	249.338	22.027	34.53	227.31	Misplaced location on map. Waterra tube fell deep down bore
	5/03/2014	249.338	23.936	34.58	225.40	OK condition, added new tubing
	30/07/2014	249.338	21.943	34.6	227.40	Good Condition. No odour. Padlock
	3/03/2015	249.338	22.049	34.54	227.29	Loose PVC within monument. PVC slightly broken. Gatic cover does not fit securely- cannot be locked. 21%v/v CH4, 14% v/v CO2, 0 ppm H2S
	28/07/2015	249.338	22.315	34.57	227.02	PVC wobbly, broken at top
	20/11/2015	249.338	22.265	34.58	227.07	Odourous, bailer
	10/02/2016	249.338	22.592	34.51	226.75	CH4: 1.3%, CO2: 1.0%, O2: 20.2%, H2S: 0, CO: 0, Cracked PVC
	25/07/2016	249.338	22.704	34.57	226.63	Leachate odour, casing wobbly, bailers
	16/02/2017	249.338	21.58	34.57	227.76	Covered in mulch, pile needs to be moved, posts damaged
	20/07/2017	249.338	21.814	34.56	227.52	Good condition
	20/02/2018	249.338	21.973	-	227.37	Good condition
	8/08/2018	249.338	22.273	35.07	227.07	Good Condition, low flow tubing
	5/02/2019	249.338	22.961	35.12	226.38	
	11/07/2019	249.338	23.098		226.24	PVC wobbly, No lock
	16/03/2005	248.039	20.87	22.5	227.17	
	16/06/2005	248.039	20.968	22.5	227.07	
	9/09/2005	248.039	20.97	22.5	227.07	

Table T3 - Historical Gauging

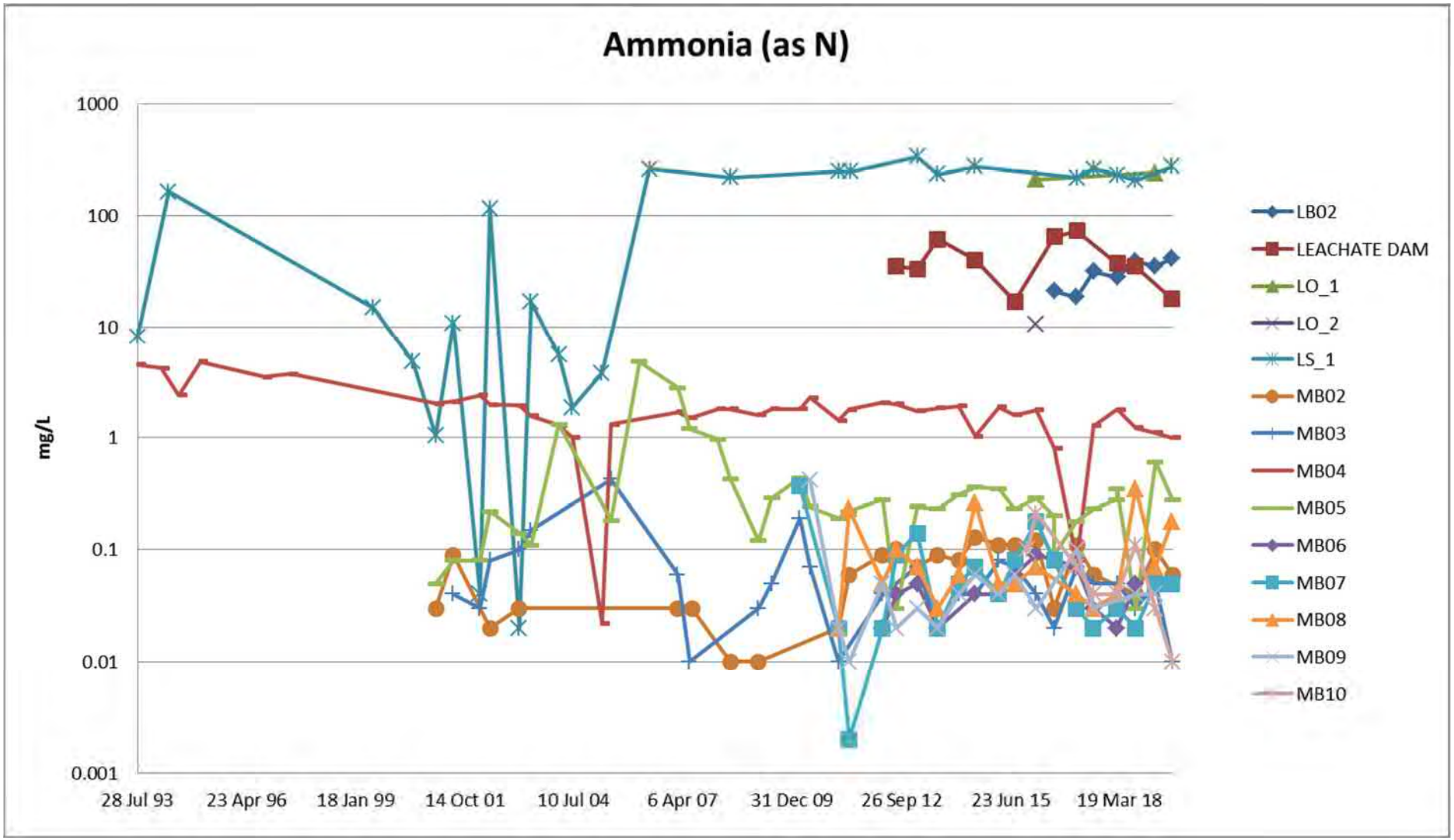
Location	Date	Reference Elevation (mAHD)	SWL (mbTOC)	Total Depth (mbTOC)	Elevation (mAHD)	Comments
MB06	28/02/2006	248.039	21.083	22.5	226.96	
	1/06/2006	248.039	21.234	22.5	226.81	
	13/02/2007	248.039	21.711	22.5	226.33	
	26/06/2007	248.039	21.995	22.5	226.04	
	14/02/2008	248.039	22.35	22.5	225.69	
	12/06/2008	248.039	22.76	22.5	225.28	
	23/02/2009	248.039	Dry	22.5		
	24/06/2009	248.039	Dry	22.5		
	10/03/2010	248.039	Dry	22.5		
	1/06/2010	248.039	Dry	22.5		
	1/03/2011	248.039	21.73	22.5	226.31	
	1/06/2011	248.039	20.87	22.5	227.17	
	3/04/2012	248.039	19.935	22.5	228.10	
	8/08/2012	248.039	19.937	22.5	228.10	
	19/02/2013	248.039	19.607	23.29	228.43	
	20/08/2013	248.039	21.925	23.33	226.11	
	4/03/2014	248.039	Dry	10.85		Dry
	29/07/2014	248.039	20.205	23.36	227.83	Good Condition. No odour. Padlock
	4/03/2015	248.039	20.225	23.34	227.81	Good condition
	29/07/2015	248.039	20.498	23.37	227.54	Good condition
	20/11/2015	248.039	20.471	23.37	227.57	Good condition, bailer
	9/02/2016	248.039	20.655	23.37	227.38	Bailer
	25/07/2016	248.039	20.969	23.35	227.07	Good condition
	16/02/2017	248.039	20.185	23.35	227.85	Good condition
	19/07/2017	248.039	20.066	23.35	227.97	Good condition, Gas Cap
	20/02/2018	248.039	19.881	23.41	228.16	Good condition
	8/08/2018	248.039	19.926	23.56	228.11	Good condition, low flow tubing
	5/02/2019	248.039	20.169	23.66	227.87	Good condition, no odour
	10/07/2019	248.039	20.466	23.76	227.57	Good condition, locked
MB07	10/03/2010	234.88	22.75	35	212.13	
	1/06/2010	234.88	22.59	35	212.29	
	1/03/2011	234.88	21.68	35	213.20	
	1/06/2011	234.88	19.37	35	215.51	
	3/04/2012	234.88	19.96	35	214.92	
	8/08/2012	234.88	18.937	35	215.94	
	19/02/2013	234.88	19.029	34.83	215.85	Thin Tubing
	21/08/2013	234.88	19.461	35.2	215.42	
	4/03/2014	234.88	19.466	34.76	215.41	
	30/07/2014	234.88		31.45		Good Condition. Minor S odour. Padlock
	31/07/2014	234.88	19.708	34.78	215.17	Good Condition. No odour. Padlock
	4/03/2015	234.88	19.56	34.73	215.32	Good condition. No lock
	29/07/2015	234.88	19.952	34.65	214.93	good condition, not locked
	10/02/2016	234.88	20.163	34.66	214.72	Good Condition. Waterra tubing
	26/07/2016	234.88	20.644	34.75	214.24	Good condition, locked, tubing
	16/02/2017	234.88	21.727	34.74	213.15	Good condition
	19/07/2017	234.88	19.761	34.83	215.12	Good condition
	20/02/2018	234.88	19.602	-	215.28	Good condition
	8/08/2018	234.88	19.94	35.15	214.94	Good Condition, low flow tubing
	5/02/2019	234.88	20.321	35.12	214.56	Good condition, impeded access
	10/07/2019	234.88	20.752	35.00	214.13	Good conditon, locked, tubing in well
MB08	1/06/2010	247.161	25.93	35.8	221.23	
	1/03/2011	247.161	21.08	35.8	226.08	
	1/06/2011	247.161	21.48	35.8	225.68	
	3/04/2012	247.161	20.65	35.8	226.51	
	8/08/2012	247.161	20.63	35.8	226.53	
	19/02/2013	247.161	20.612	35.01	226.55	
	20/08/2013	247.161	20.94	28.36	226.22	No foot valve on waterra tube
	4/03/2014	247.161	21.171	30.67	225.99	Good Condition
	30/07/2014	247.161	21.3	35.32	225.86	Good Condition. No odour. Padlock
	4/03/2015	247.161	21.316	35.35	225.85	Good condition
	28/07/2015	247.161	21.608	35.35	225.55	Installed Waterra tubing. Located between green waste stockpiles
	20/11/2015	247.161	21.598	35.35	225.56	Good condition, bailer
	9/02/2016	247.161	21.802	35.37	225.36	Bailer
	25/07/2016	247.161	22.082	35.33	225.08	Good condition, locked, bailer
	16/02/2017	247.161	20.905	35.39	226.26	Good condition
	19/07/2017	247.161	20.745	35.04	226.42	Good condition
	20/02/2018	247.161	20.52	35.65	226.64	Good condition
	8/08/2018	247.161	20.588	35.95	226.57	Good Condition, low flow tubing
	5/02/2019	247.161	20.779	35.86	226.38	Good condition, no bore cap, tubing on ground
	10/07/2019	247.161	21.022	35.6	226.14	Good condition, no well cap, locked
MB09	1/06/2010	222.417	16.75	35.9	205.67	
	1/03/2011	222.417	13.395	35.9	209.02	
	1/06/2011	222.417	12.48	35.9	209.94	
	3/04/2012	222.417	11.735	35.9	210.68	
	8/08/2012	222.417	11.8	35.9	210.62	
	19/02/2013	222.417	12.164	33.34	210.25	
	20/08/2013	222.417	12.795	35.73	209.62	
	4/03/2014	222.417	12.964	32.7	209.45	Good Condition
	30/07/2014	222.417	13.022	32.15	209.40	Good Condition. No odour. Padlock
	4/03/2015	222.417	13.175	32.16	209.24	Good condition
	28/07/2015	222.417	13.585	33.63	208.83	Good condition
	10/02/2016	222.417	13.928	35.72	208.49	Waterra tubing
	26/07/2016	222.417	14.469	35.86	207.95	Good condition, waterra tubing
	17/02/2017	222.417	13.83	35.84	208.59	Cap destroyed and taken, well in good condition
	20/07/2017	222.417	13.8	35.87	208.62	Stick up lid missing, Duct tape over PVC
	20/02/2018	222.417	-	-	-	Well vandalised and inaccessable
	8/08/2018	222.417	14.025	36.31	208.39	Good condition, 2 iron locks
	5/02/2019	222.417	14.449	36.29	207.97	Recorded as MB02; good condition, tubing in well
	12/07/2019	222.417	14.965	35.78	207.45	Lock broken off, tubing stuck in well
	20/11/2015	244.875	35.555	47.38	209.32	Good condition. New yellow stickup
	10/02/2016	244.875	34.962	47.37	209.91	Good condition
	25/07/2016	244.875	33.747	47.12	211.13	Good condition, locked

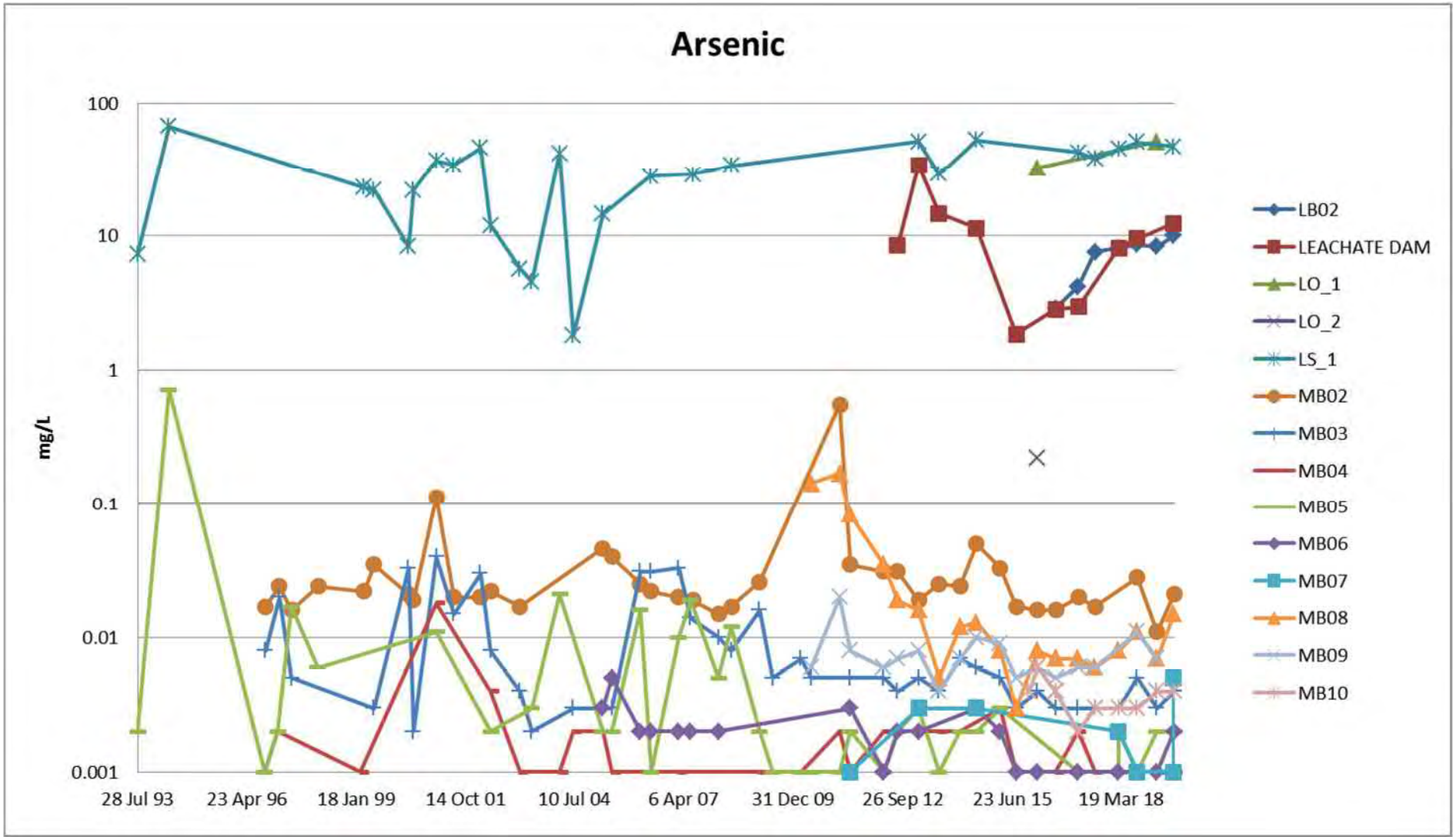
Table T3 - Historical Gauging

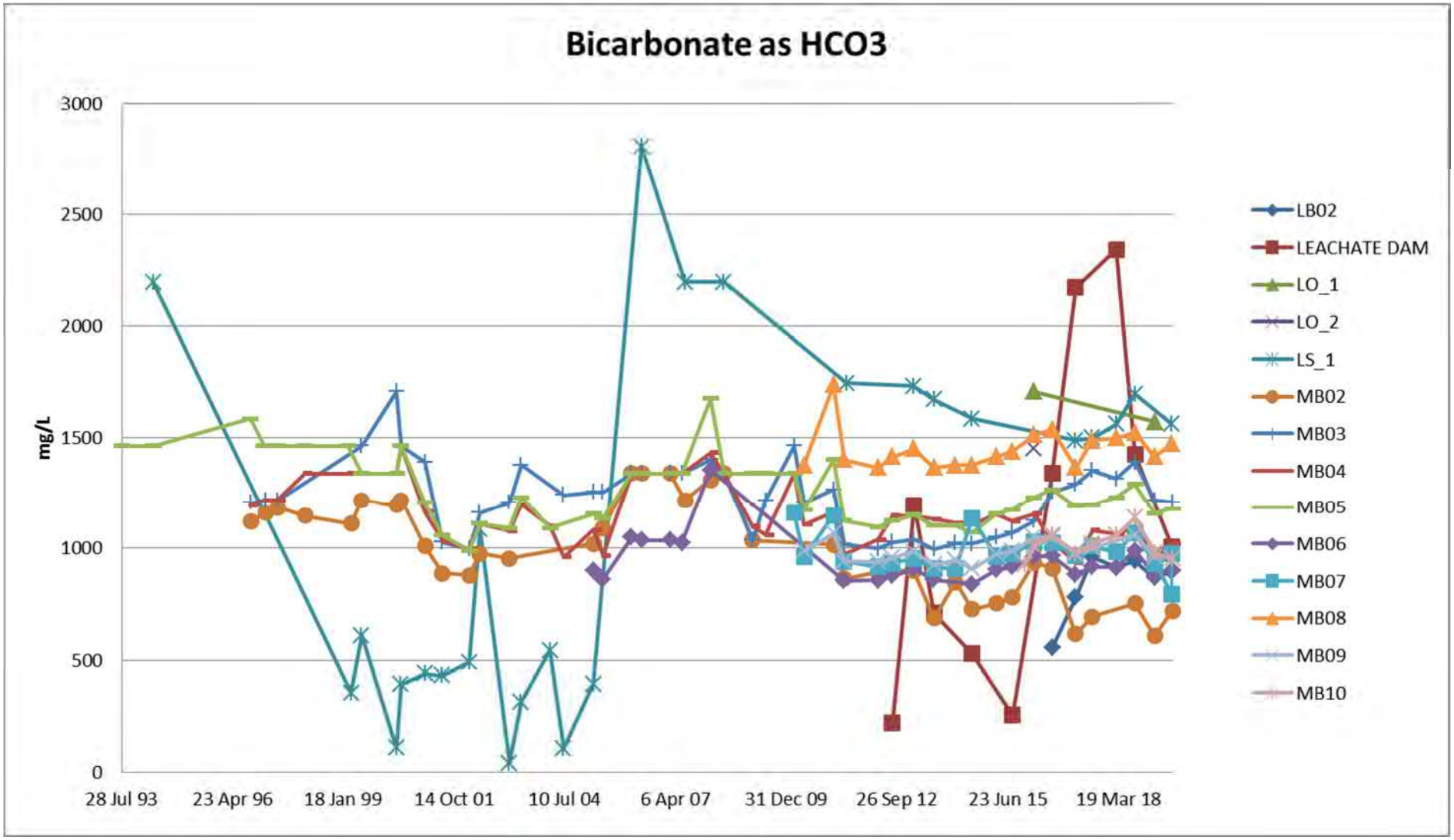
Location	Date	Reference Elevation (mAHD)	SWL (mbTOC)	Total Depth (mbTOC)	Elevation (mAHD)	Comments
MB10	16/02/2017	244.875	33.68	47.05	211.20	Good condition, hidden behind tyre pile
	20/07/2017	244.875	36.65	47.97	208.23	Good condition
	21/02/2018	244.875	32.746	47.4	212.13	Good condition
	8/08/2018	244.875	31.625	47.2	213.25	Good Condition, low flow tubing
	5/02/2019	244.875	30.464	47.42	214.41	Good condition
	11/07/2019	244.875	29.158	47.58	215.72	Good condition, tubing left in well

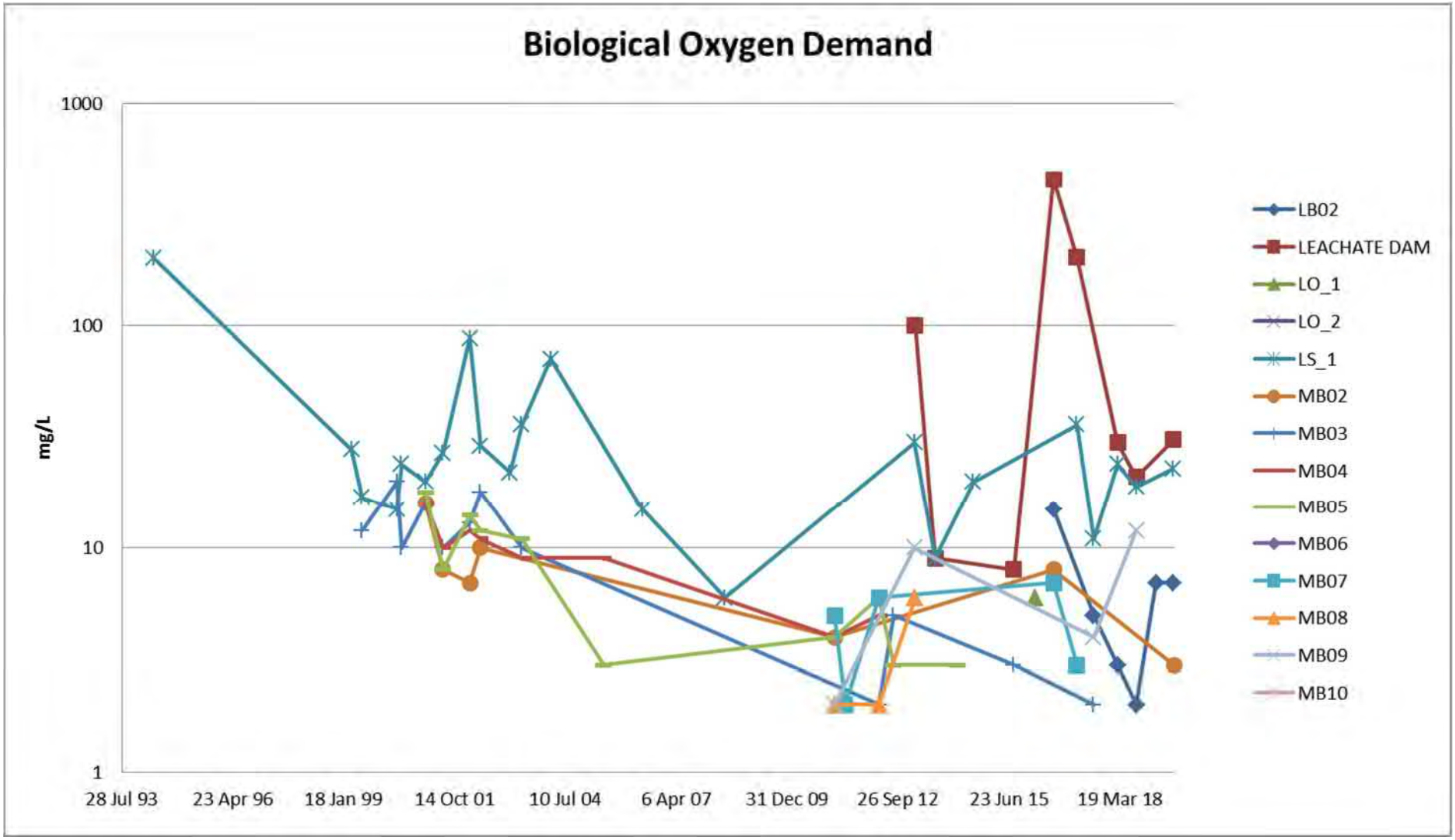
ATTACHMENT 6 WATER QUALITY CHARTS

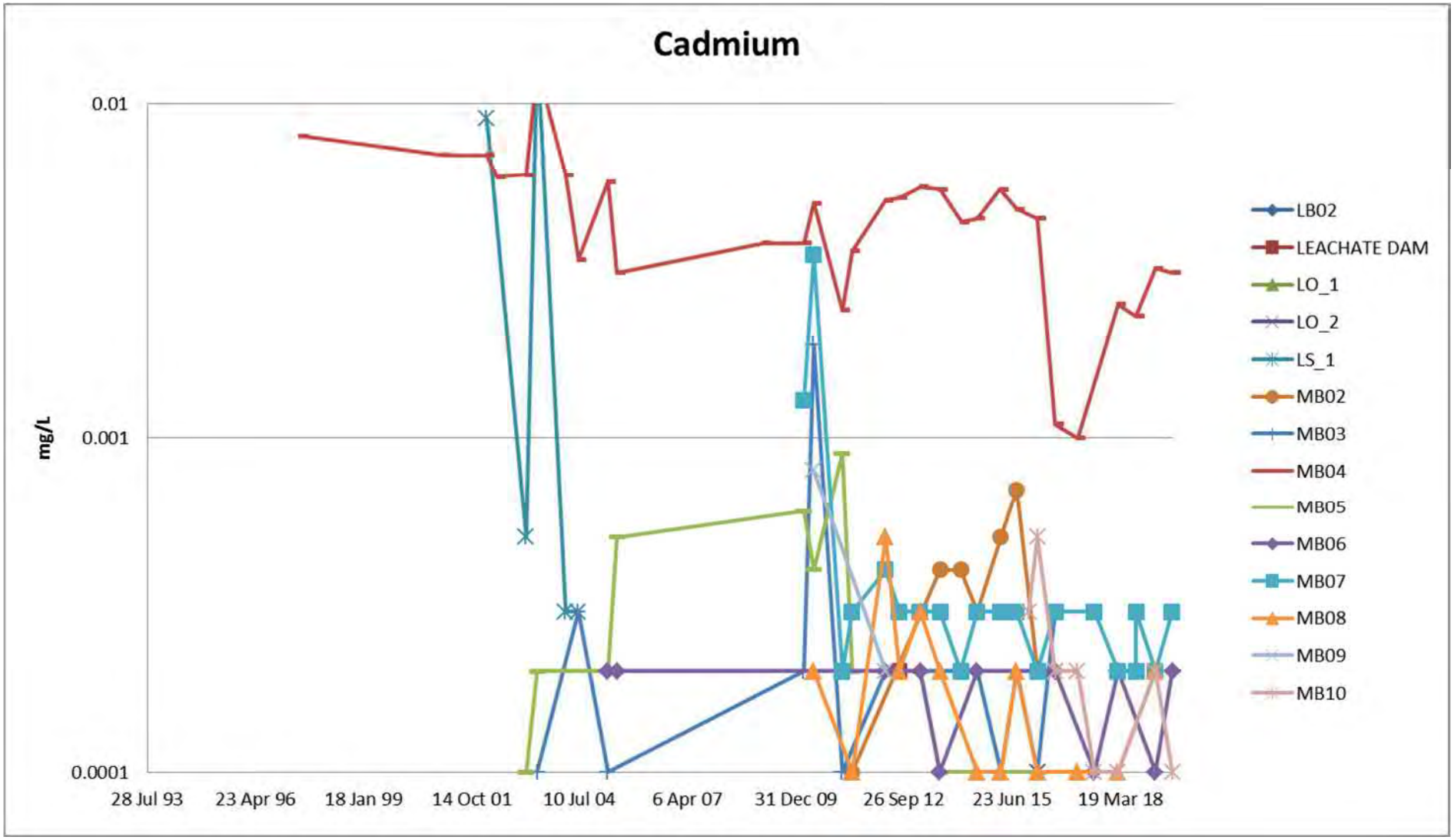
Attachment 6 – Water Quality Charts

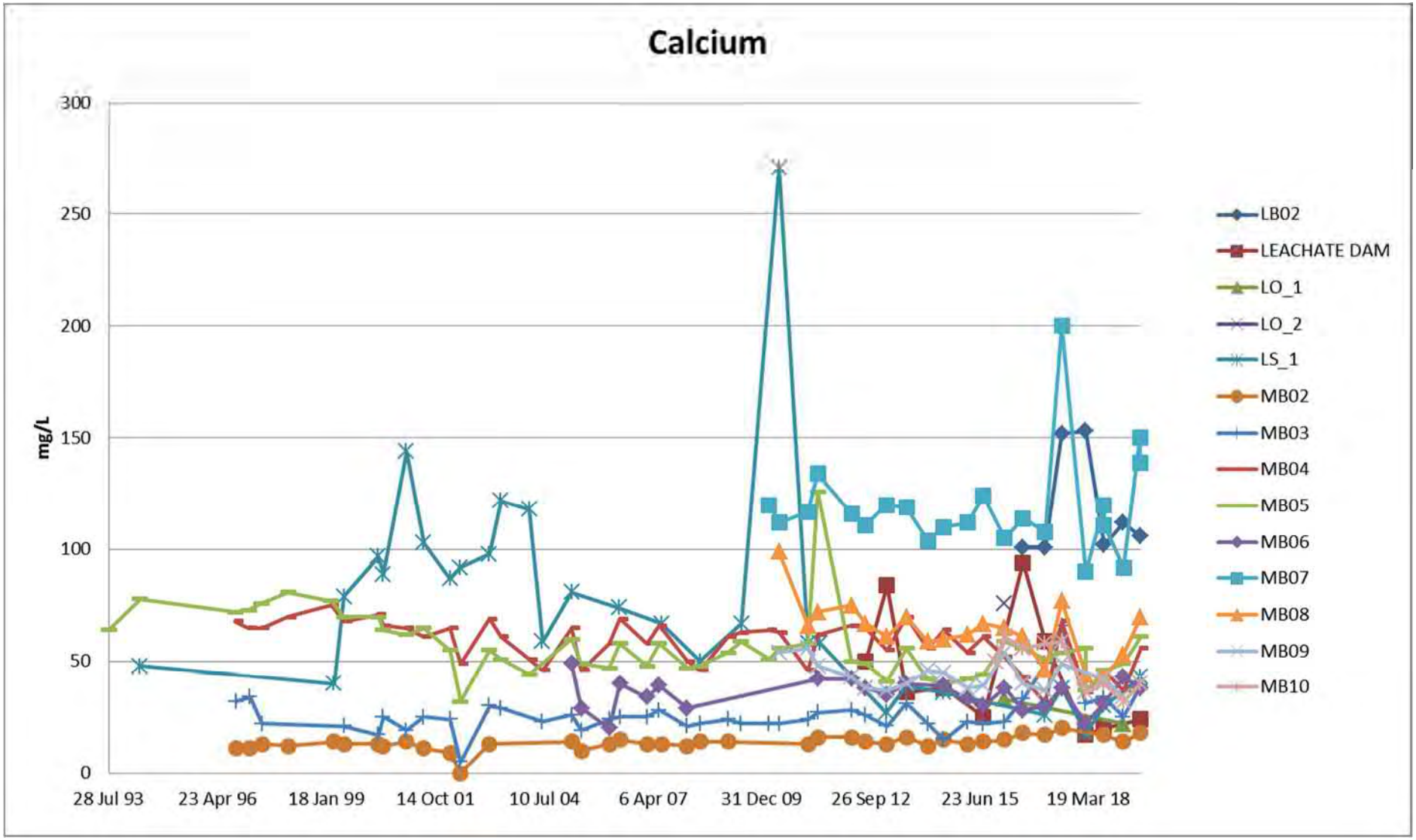


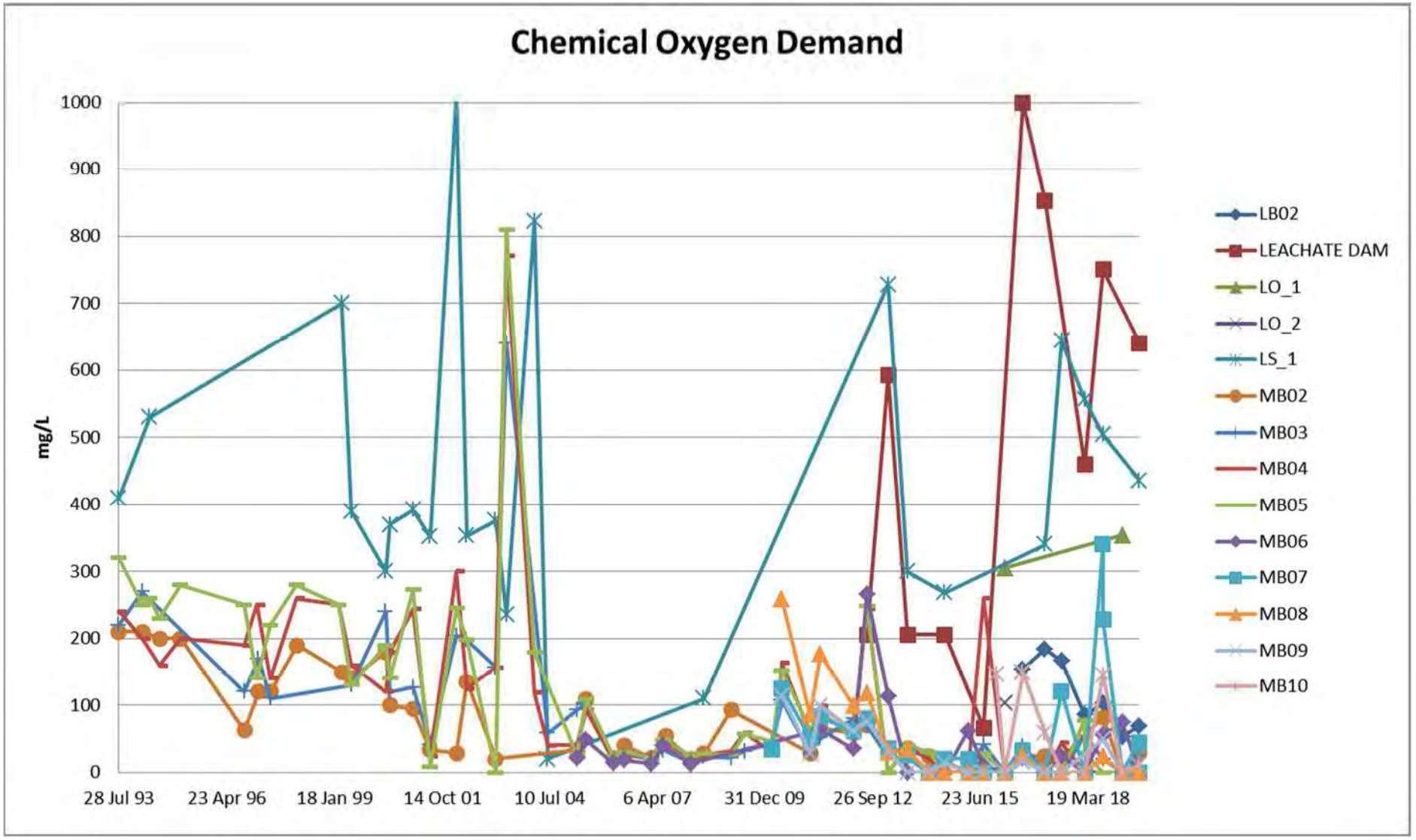

Arsenic
100
10
1
0.1
0.01
0.001
mg/L
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

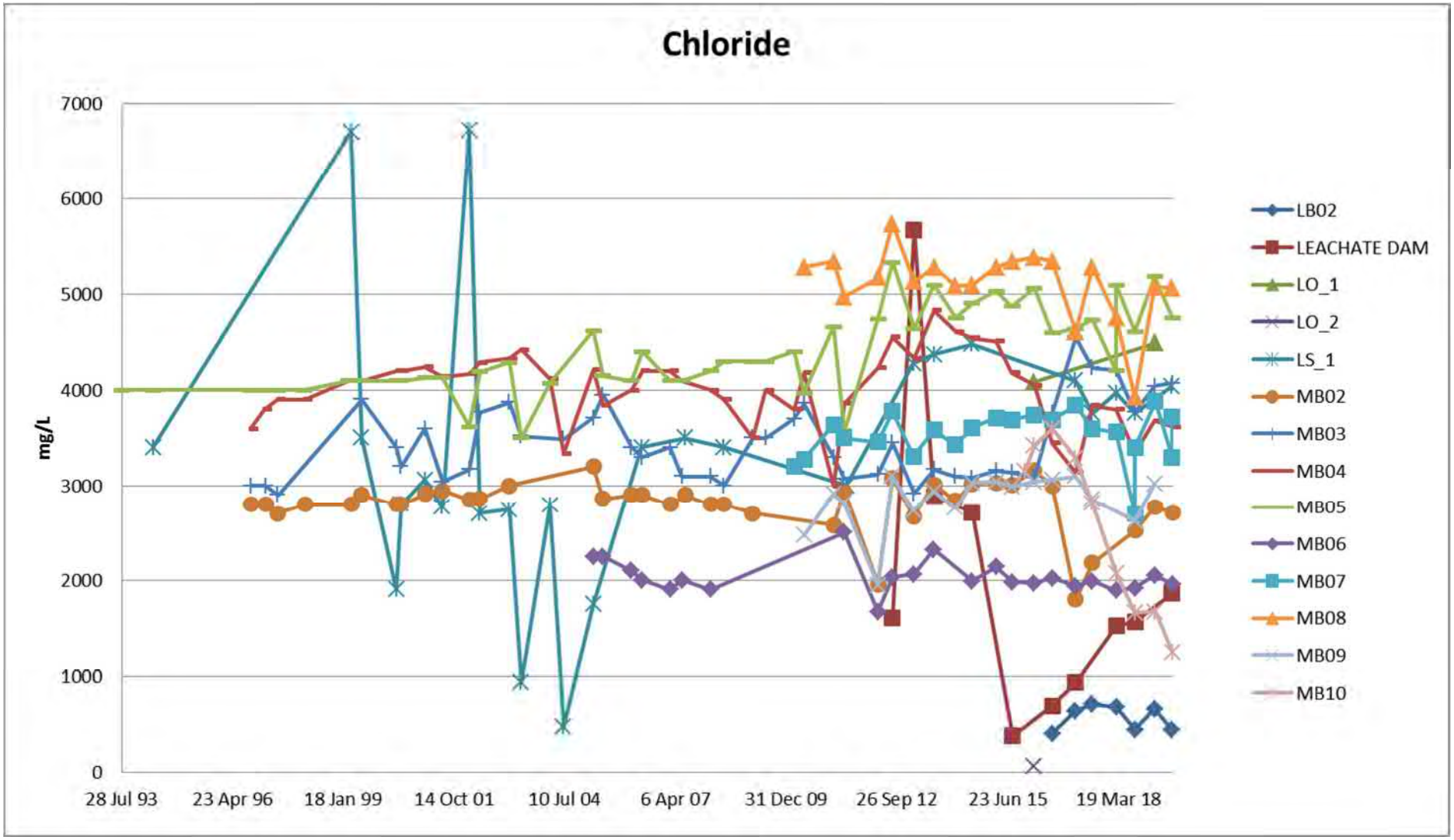

Bicarbonate as HCO3
mg/L
3000
2500
2000
1500
1000
500
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

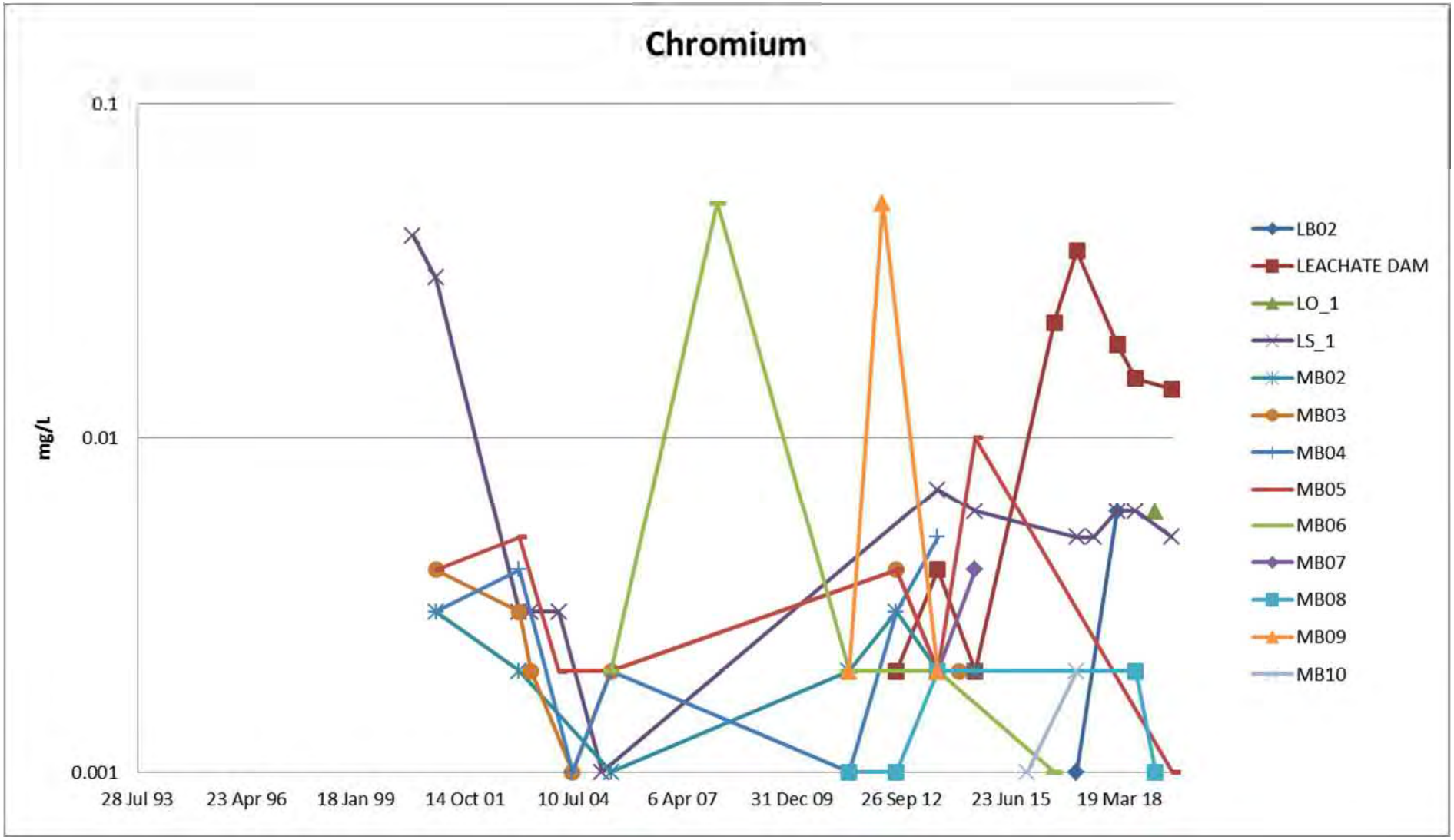

Biological Oxygen Demand
1000
100
10
1
mg/L
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

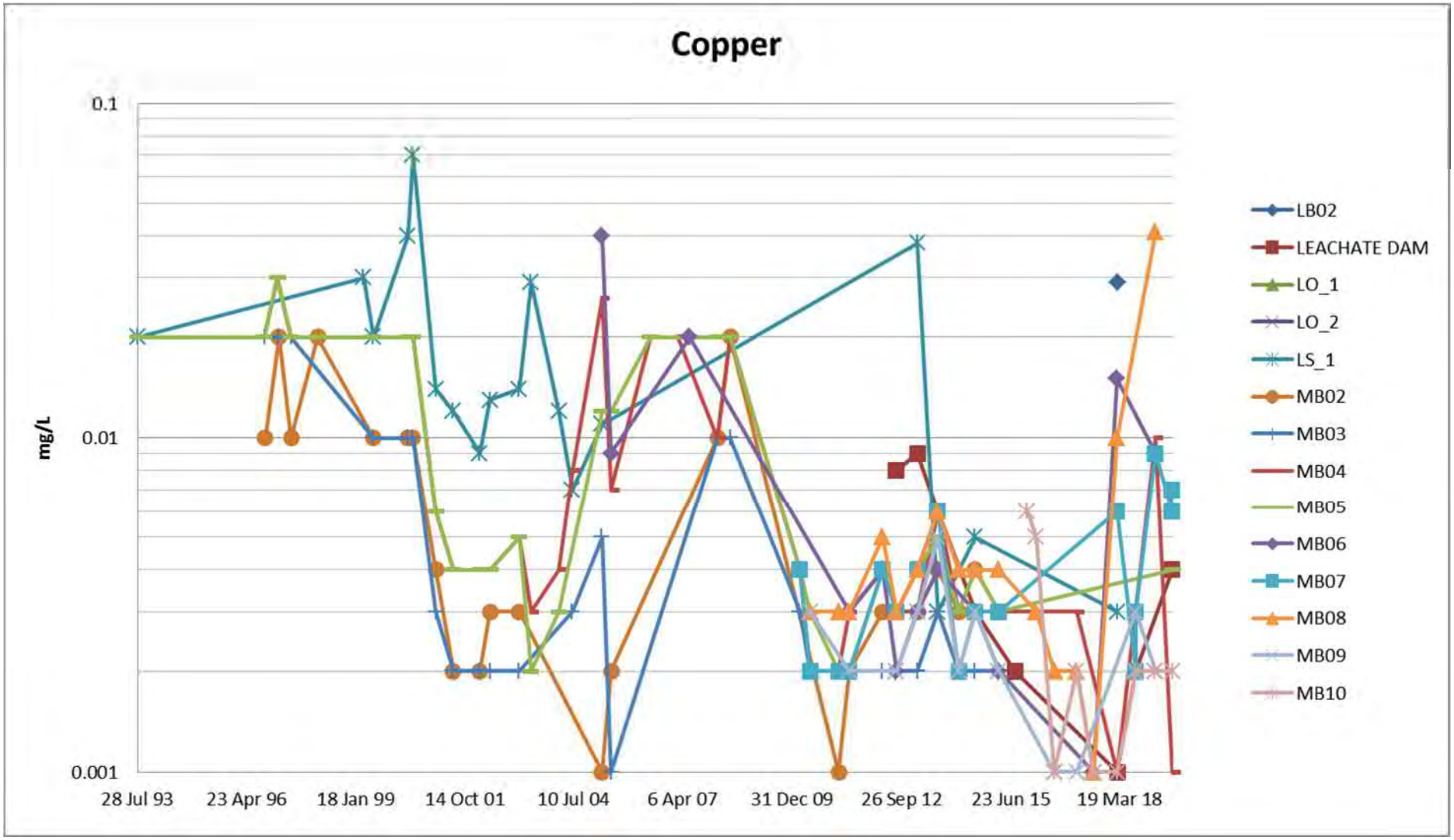

Cadmium
0.01
0.001
0.0001
mg/L
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

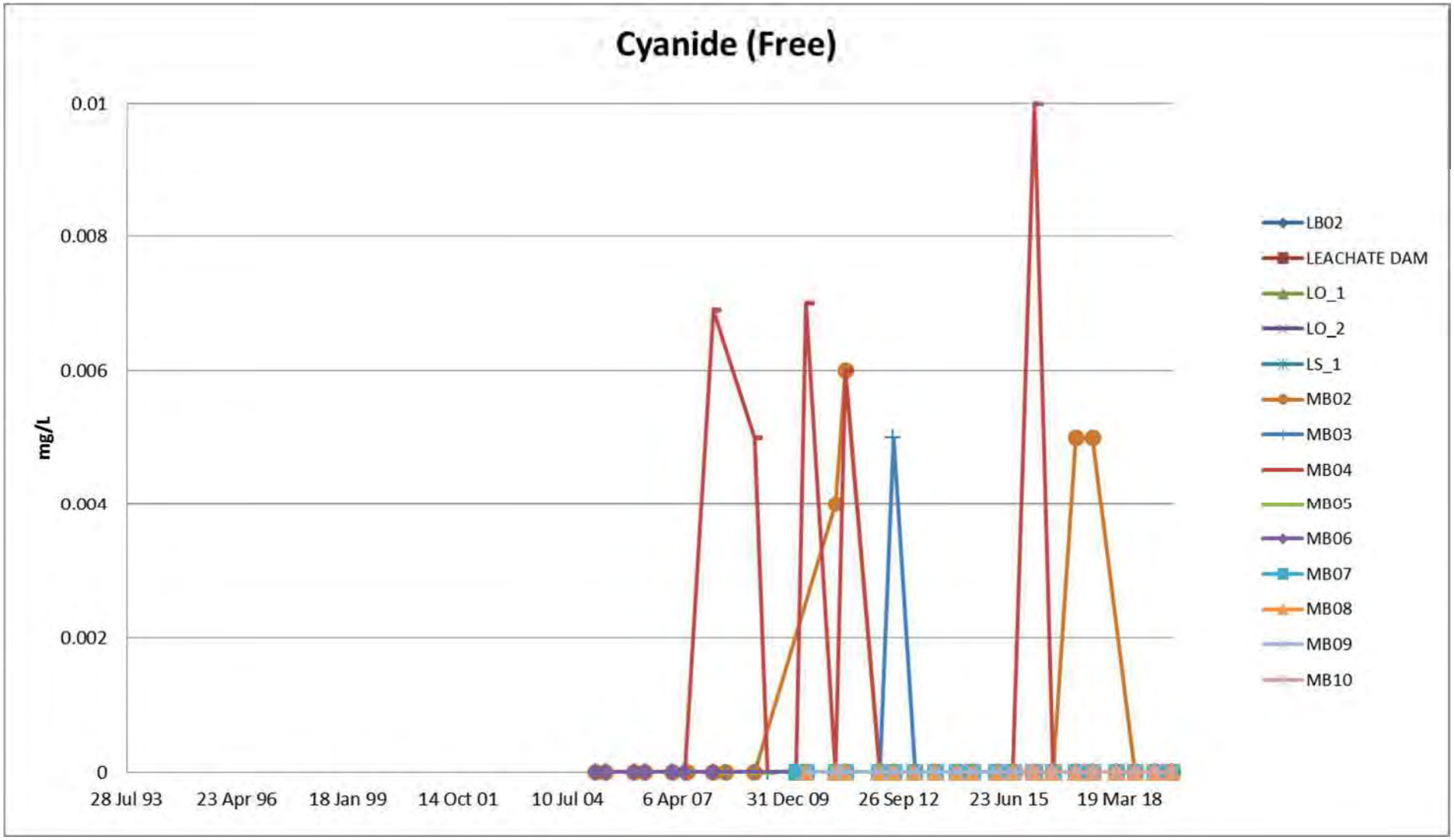

Calcium
mg/L
300
250
200
150
100
50
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

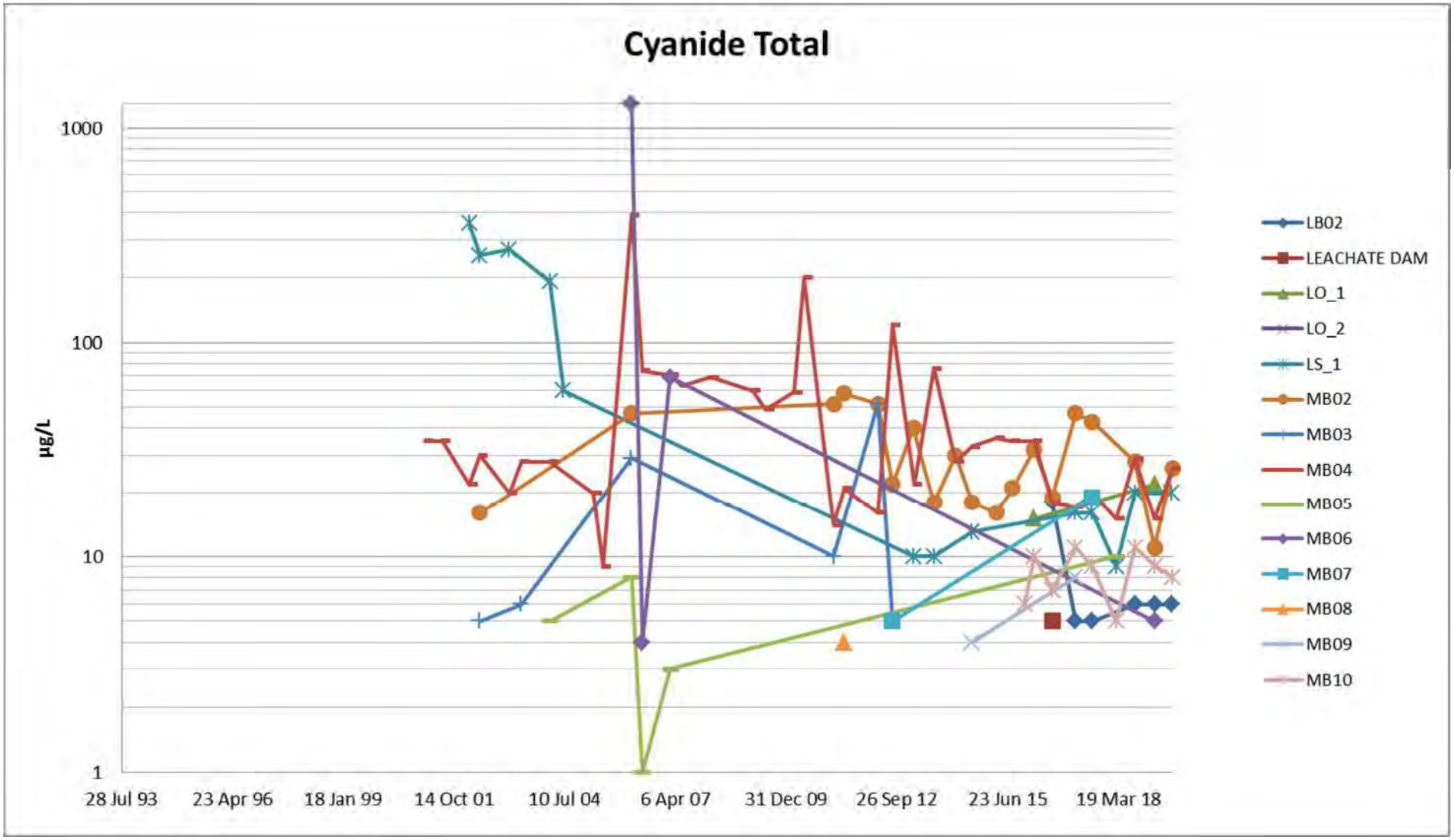

Chemical Oxygen Demand
mg/L
1000
900
800
700
600
500
400
300
200
100
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

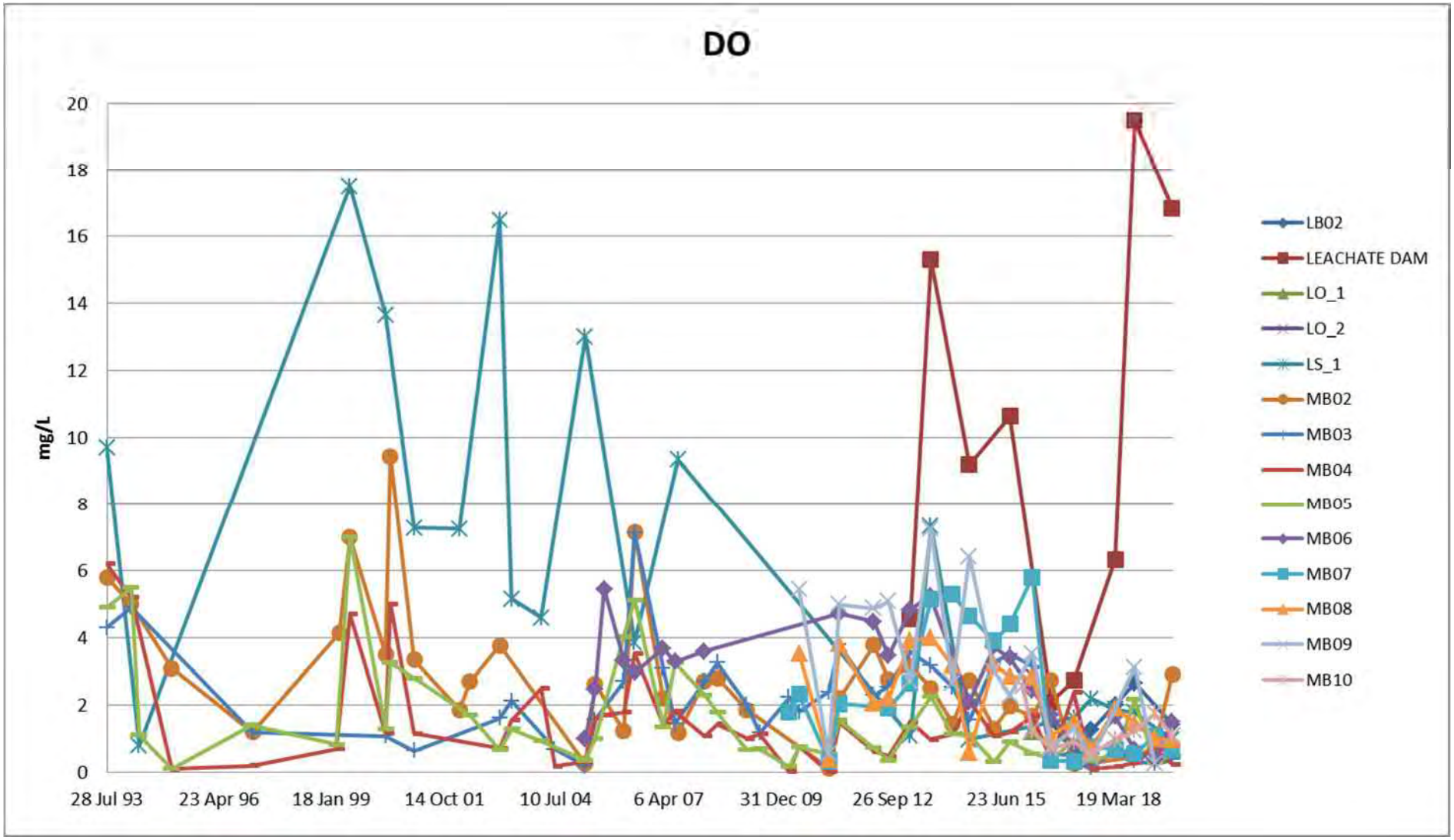

Chloride
7000
6000
5000
4000
3000
2000
1000
0
mg/L
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

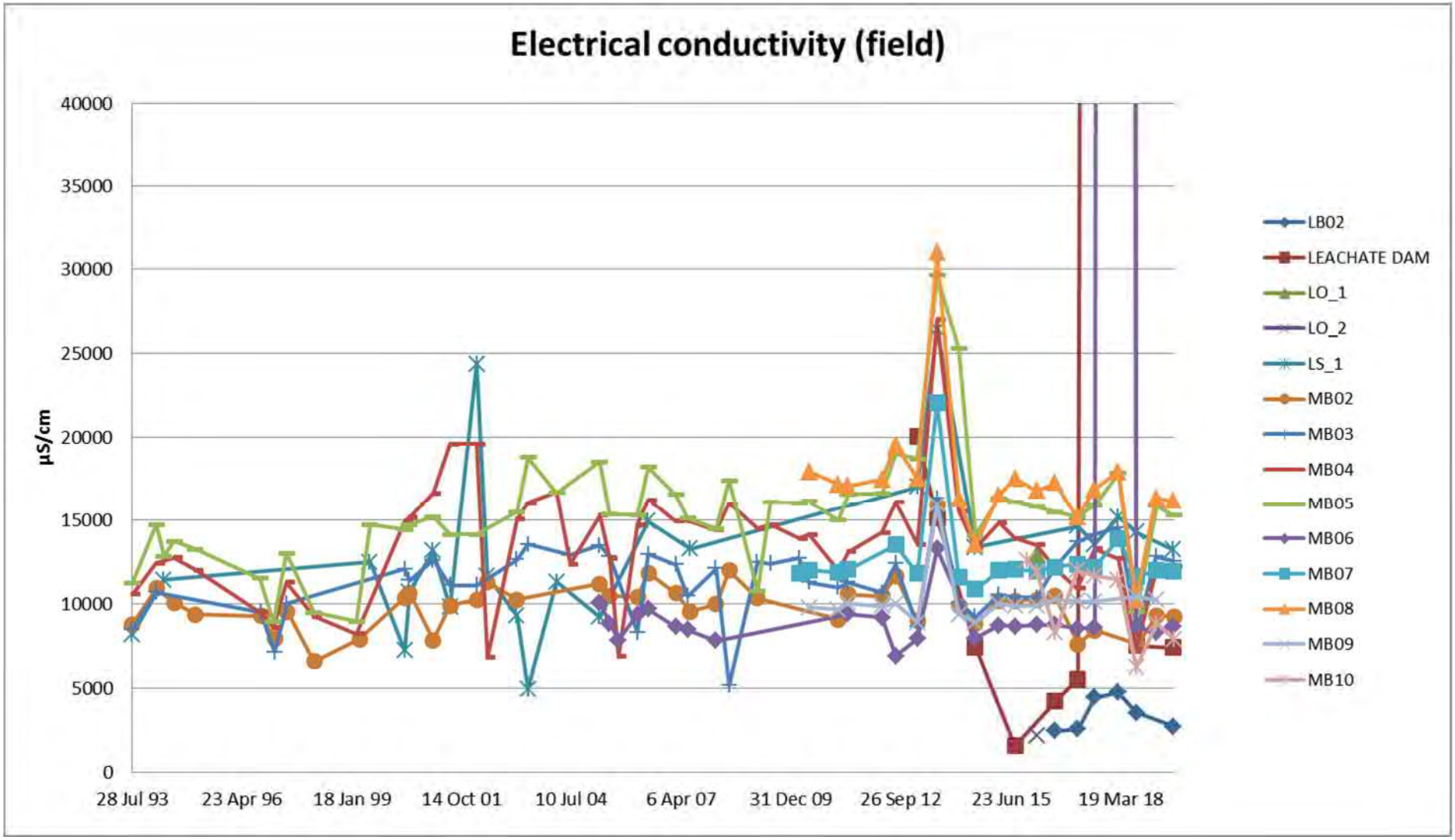

Chromium
0.1
0.01
0.001
mg/L
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

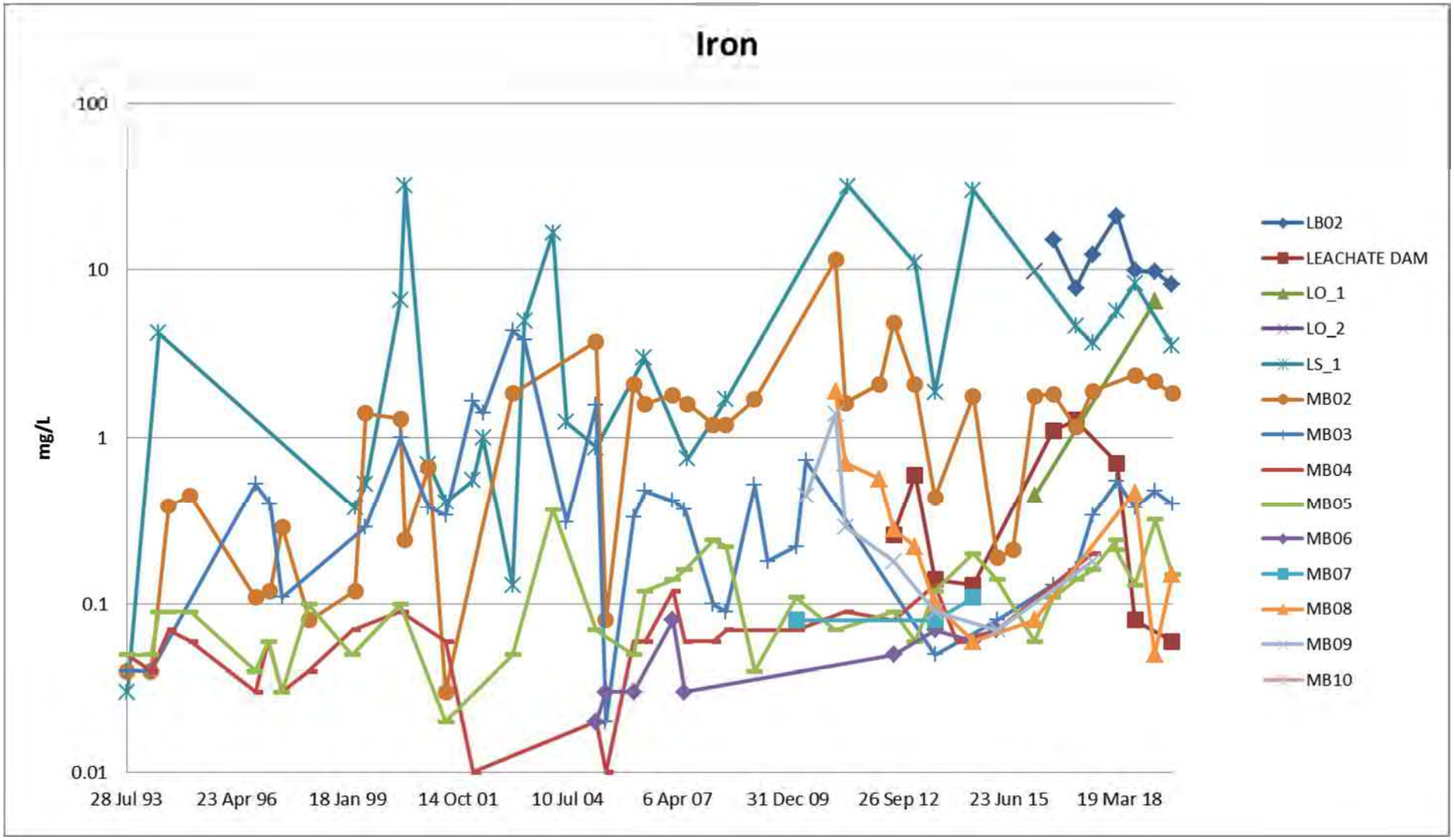

Copper
0.1
0.01
0.001
mg/L
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

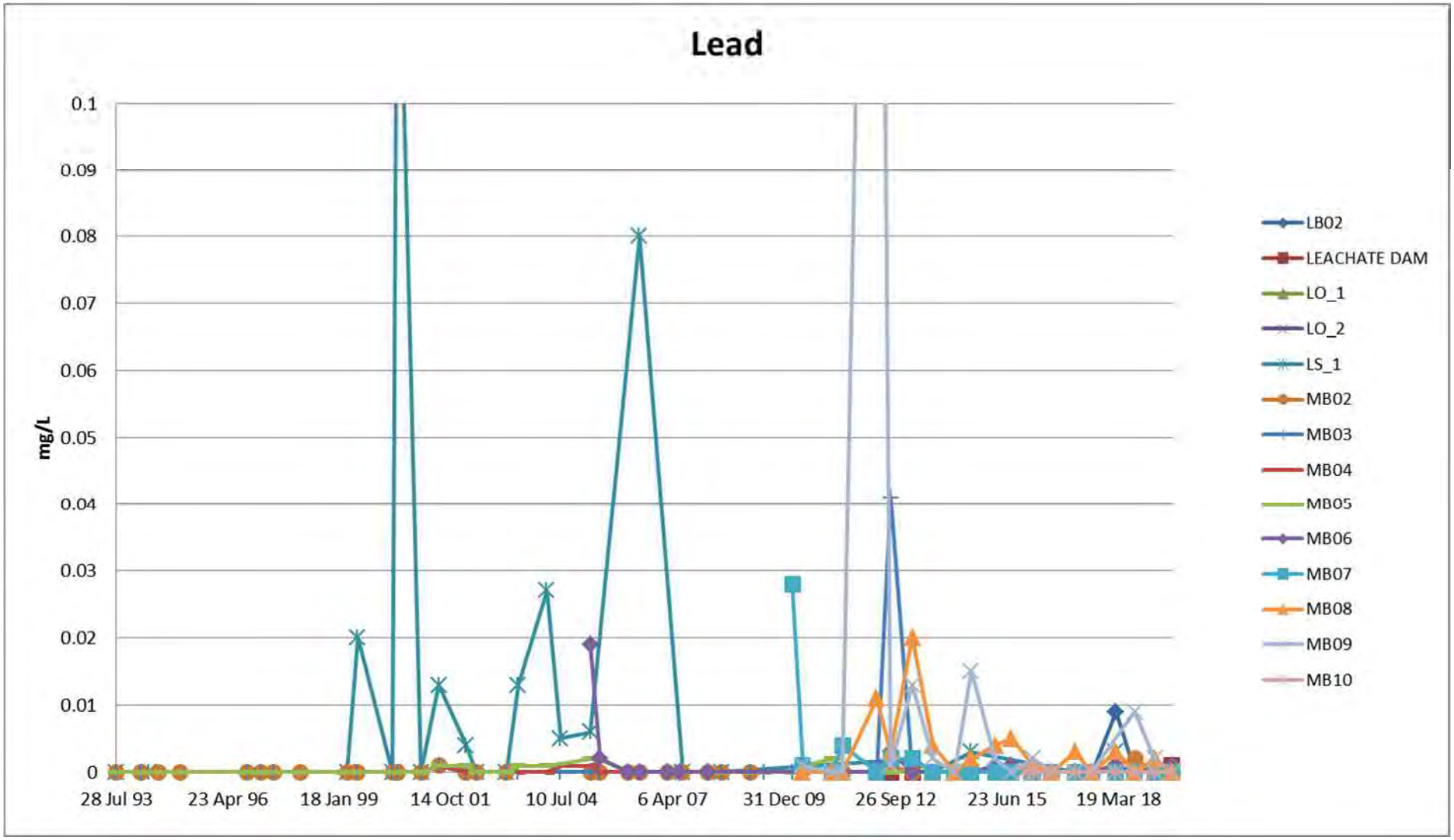

Cyanide (Free)
0.01
0.008
0.006
0.004
0.002
0
mg/L
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

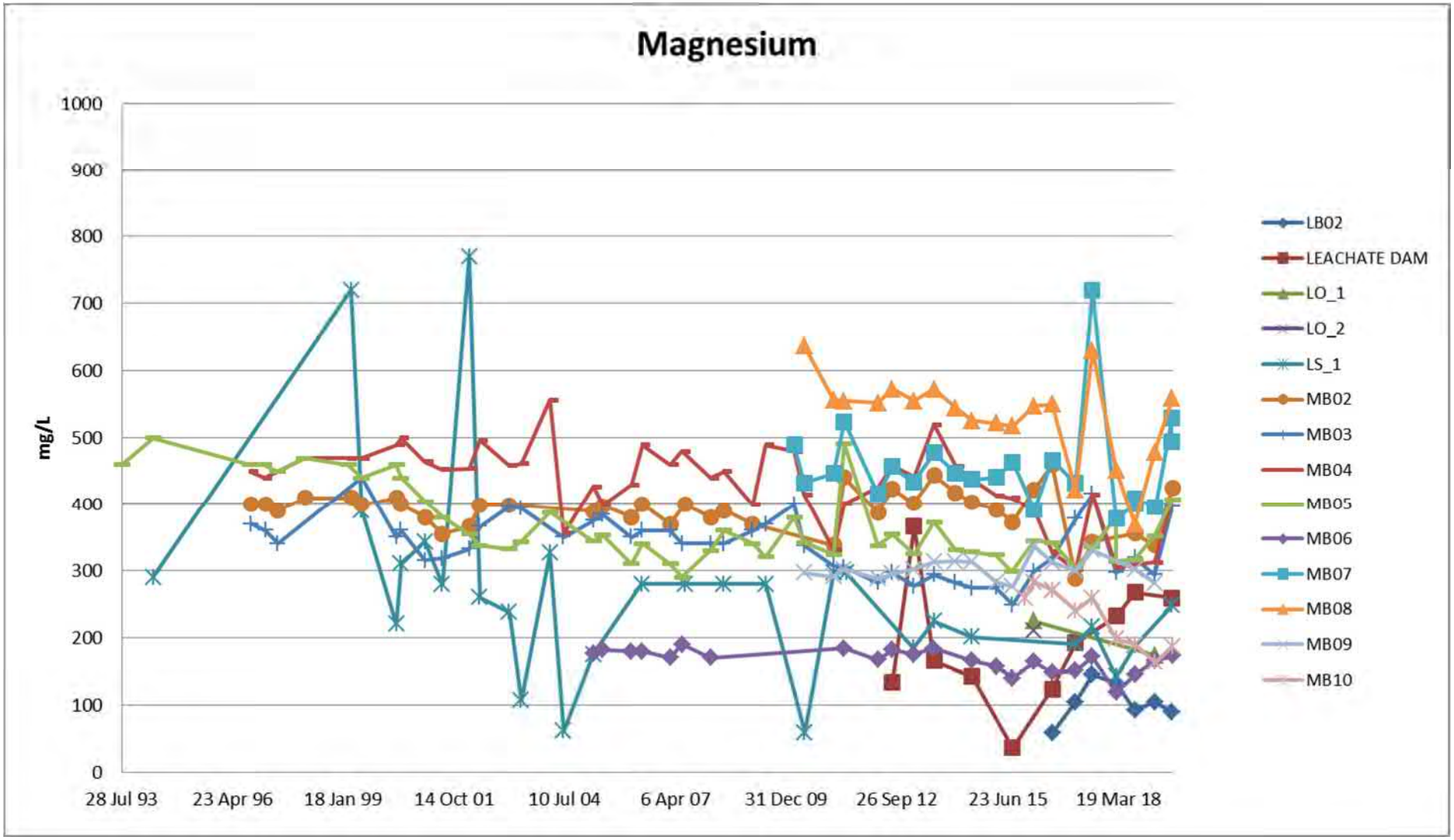

Cyanide Total
µg/L
1000
100
10
1
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

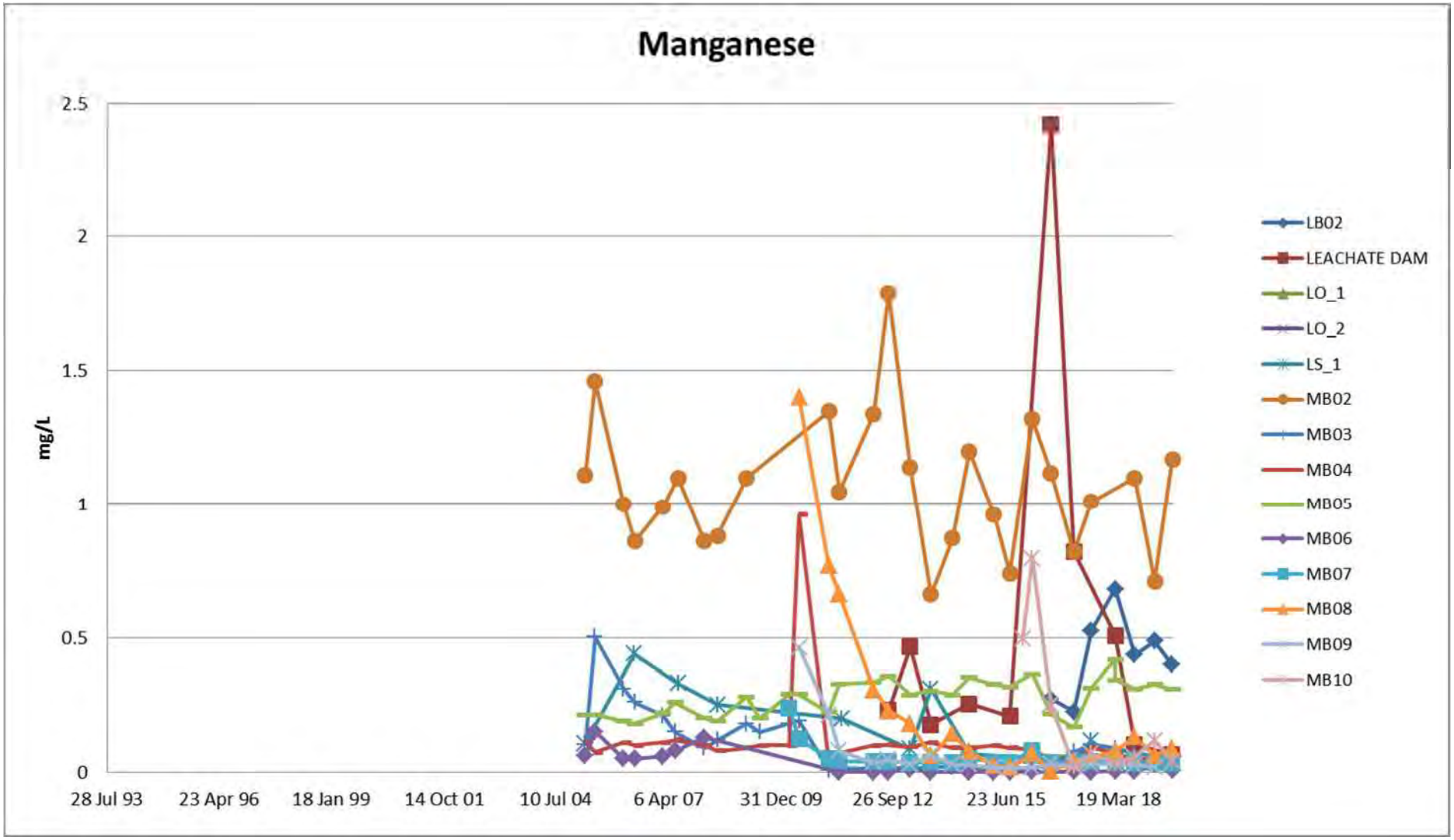

DO
mg/L
20
18
16
14
12
10
8
6
4
2
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

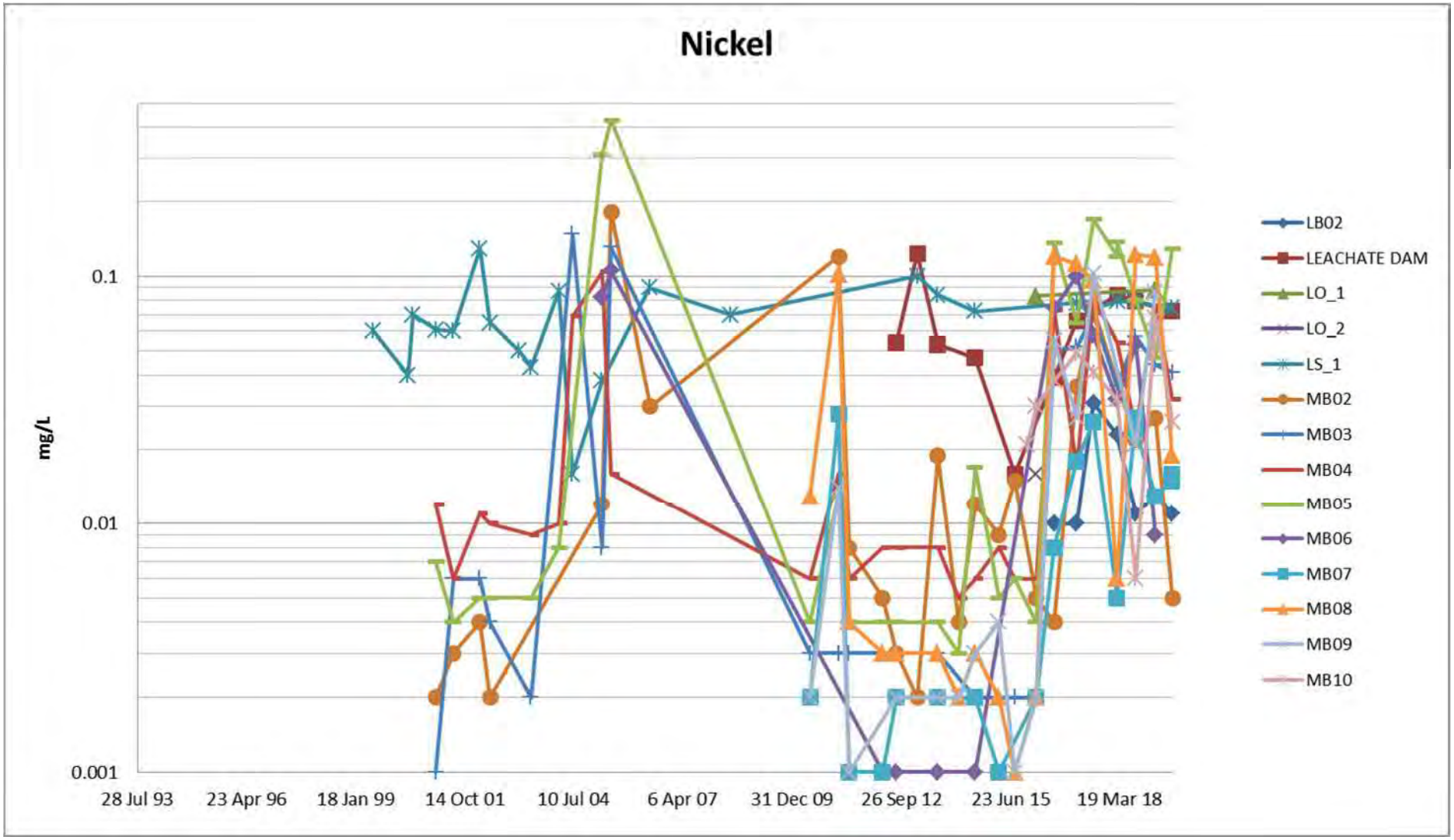

Electrical conductivity (field)
µS/cm
40000
35000
30000
25000
20000
15000
10000
5000
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

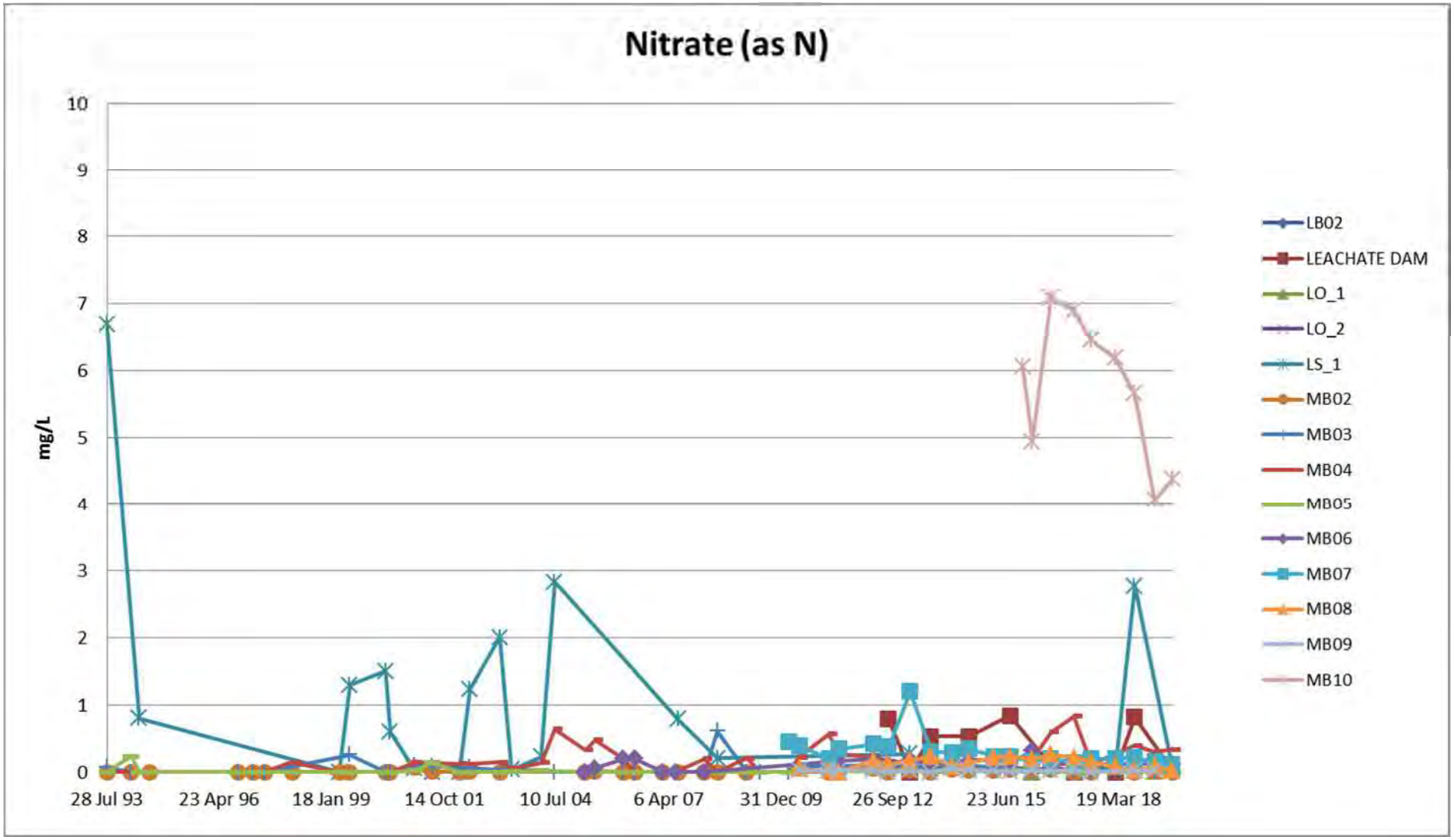

Iron
100
10
1
0.1
0.01
mg/L
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

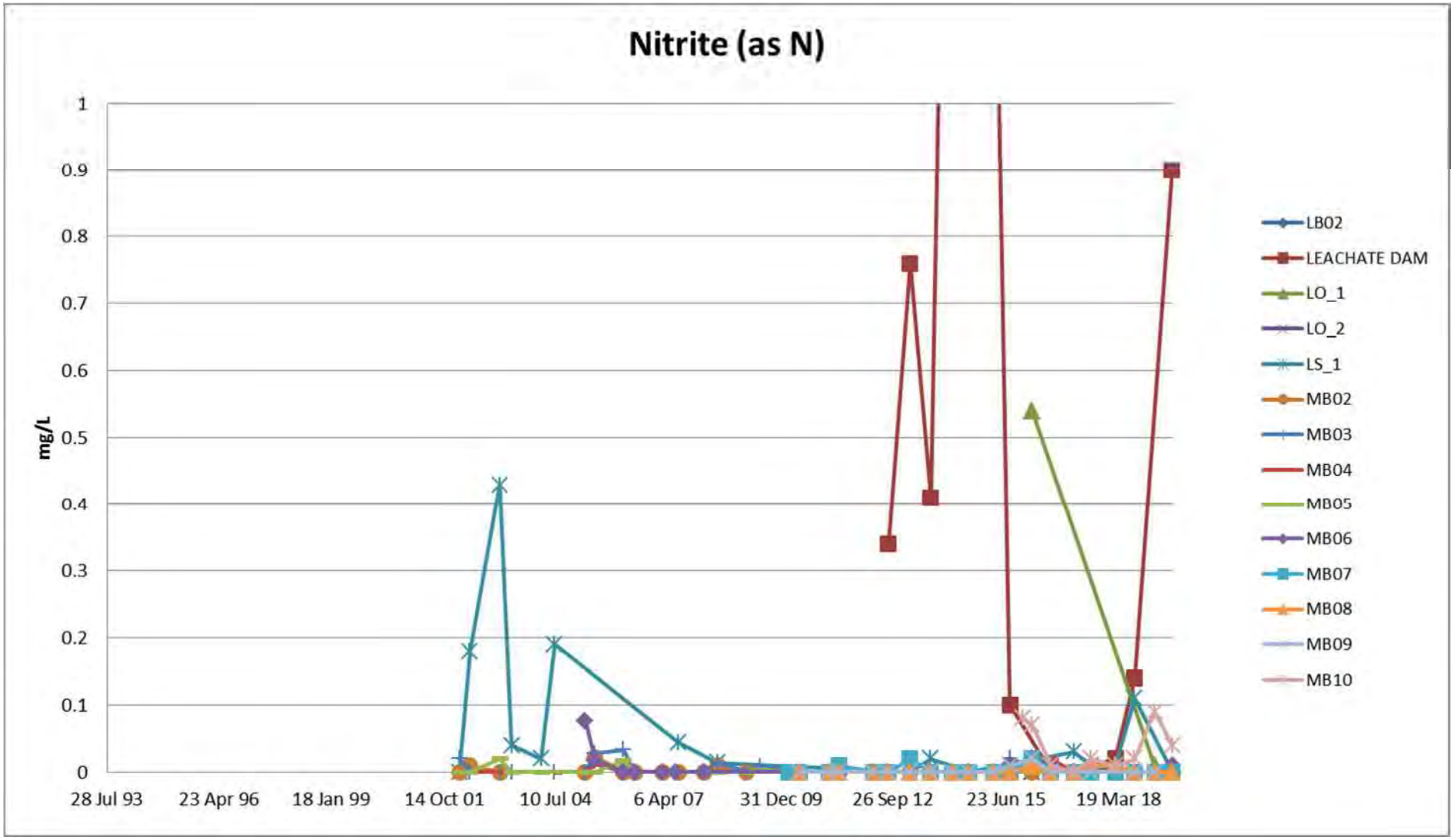

Lead
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
mg/L
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

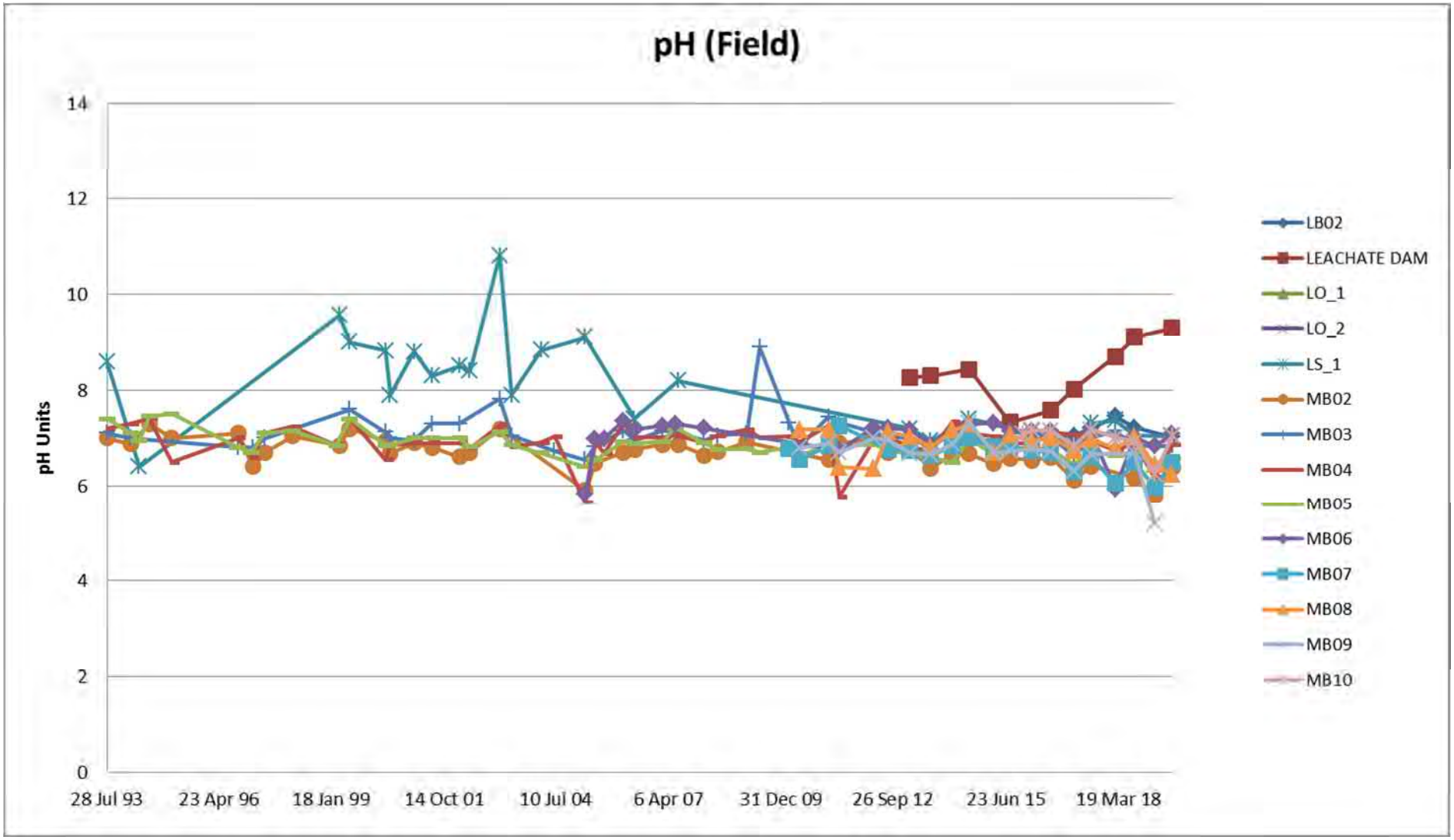

Magnesium
mg/L
1000
900
800
700
600
500
400
300
200
100
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

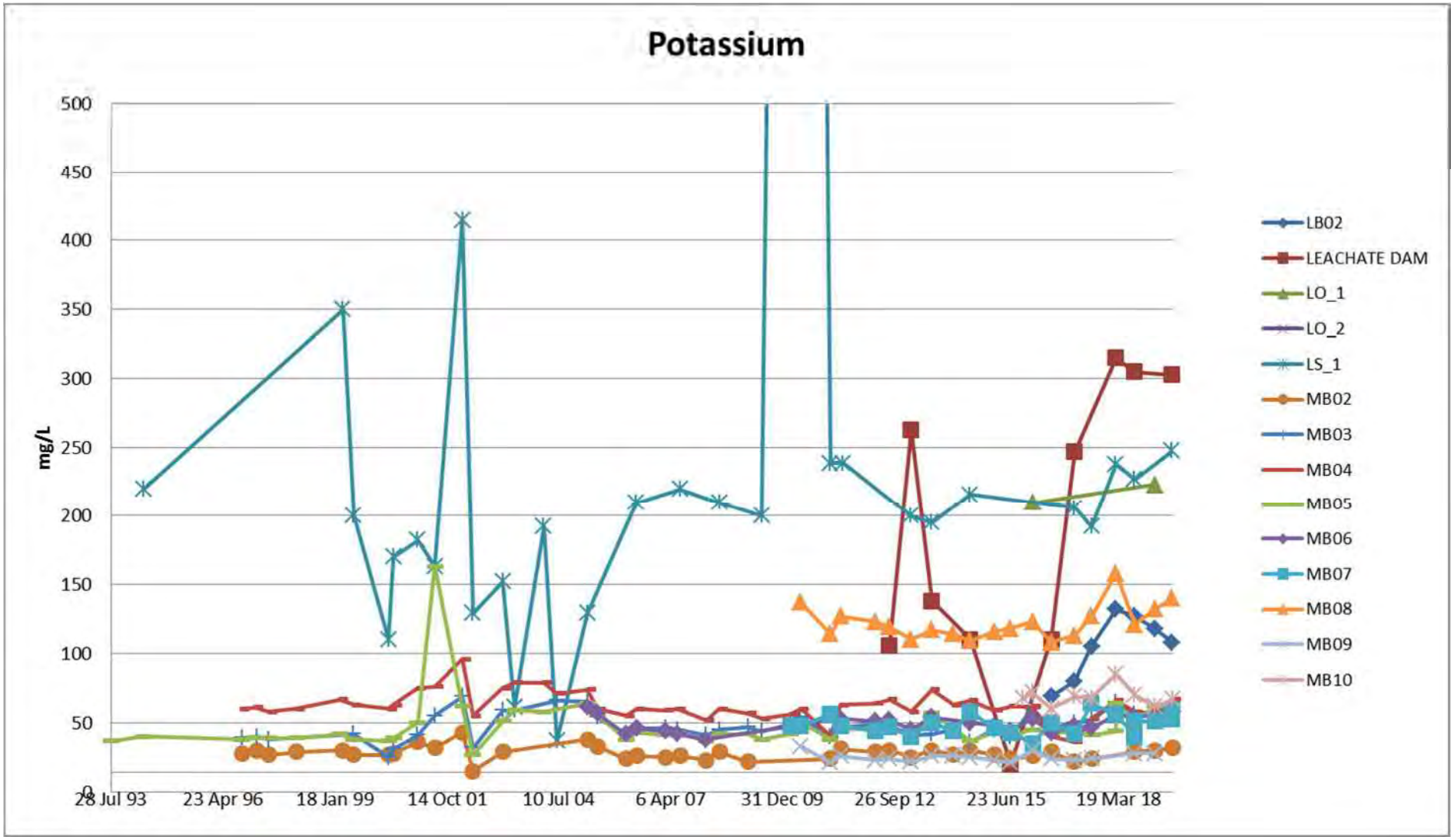

Manganese
2.5
2
1.5
1
0.5
0
mg/L
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

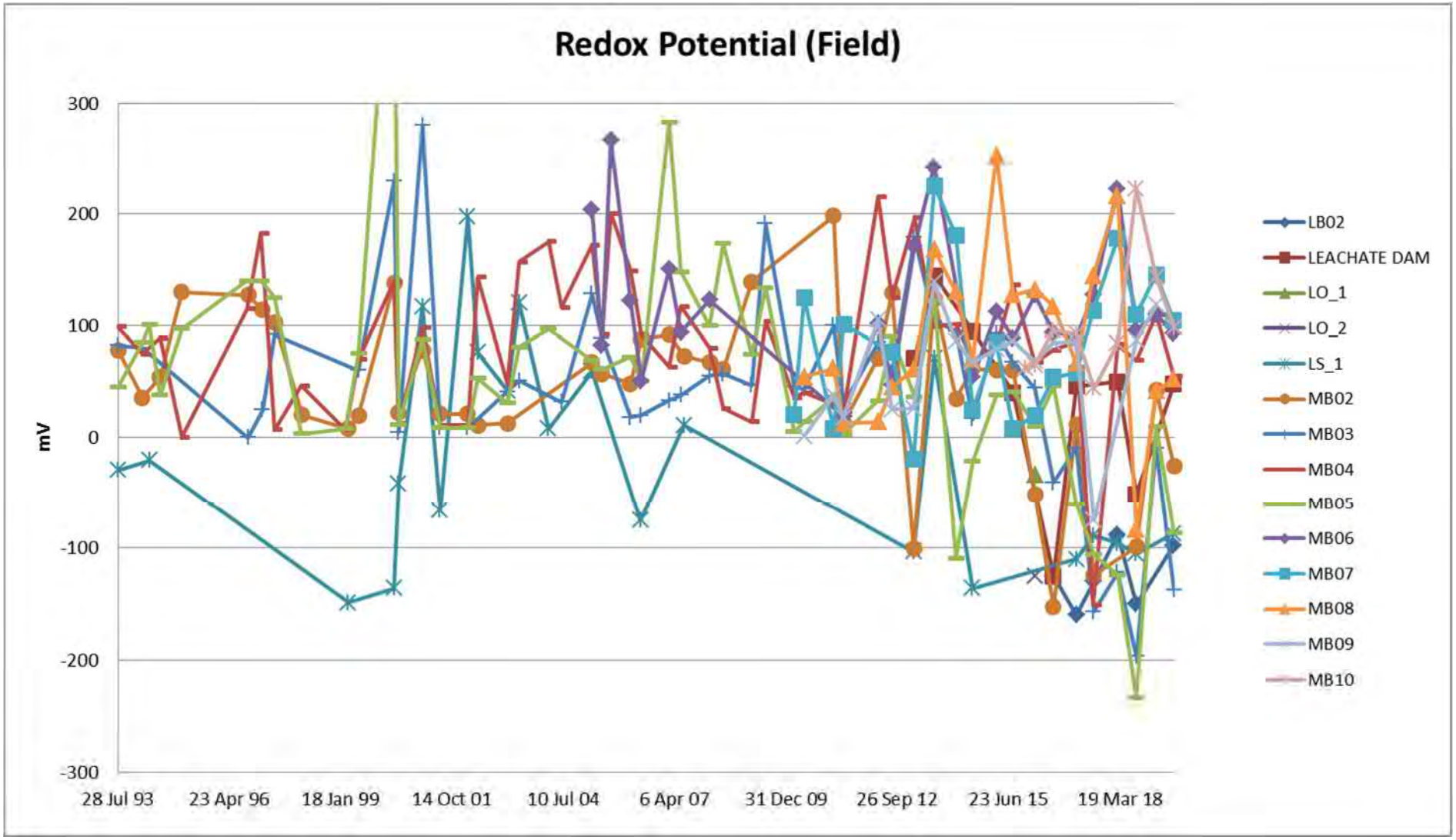

Nickel
mg/L
0.1
0.01
0.001
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

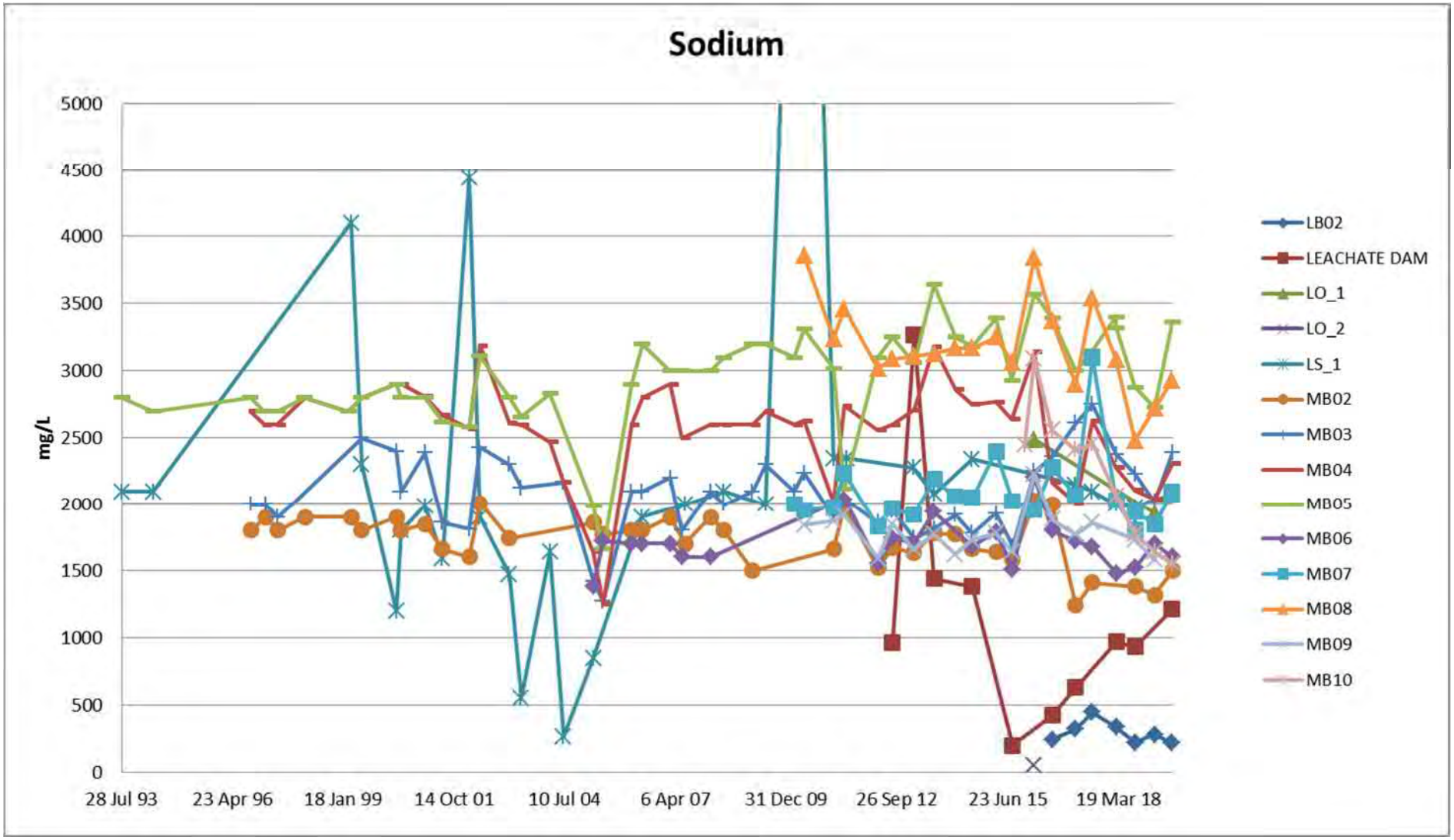

Nitrate (as N)
mg/L
10
9
8
7
6
5
4
3
2
1
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

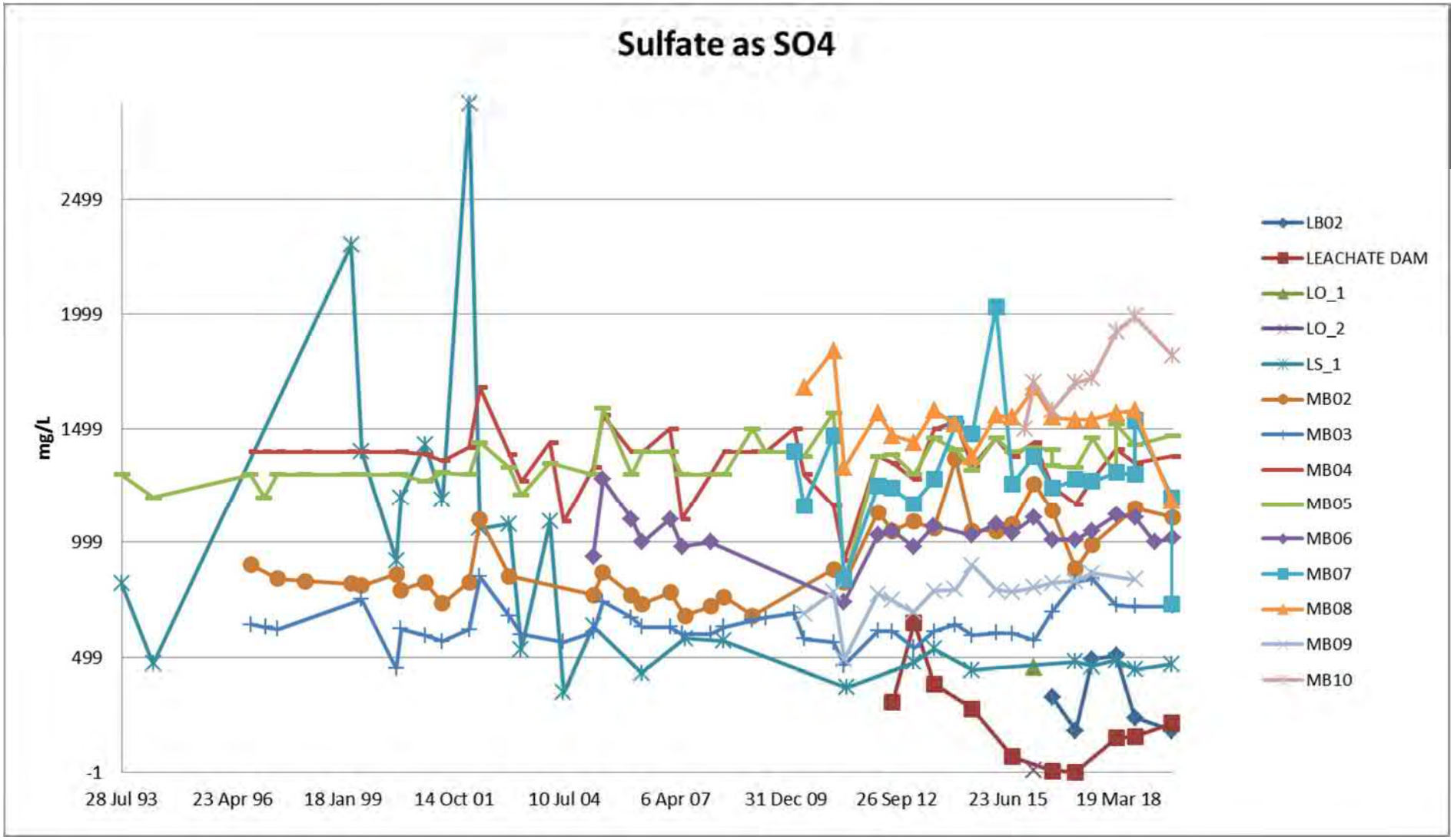

Nitrite (as N)
mg/L
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

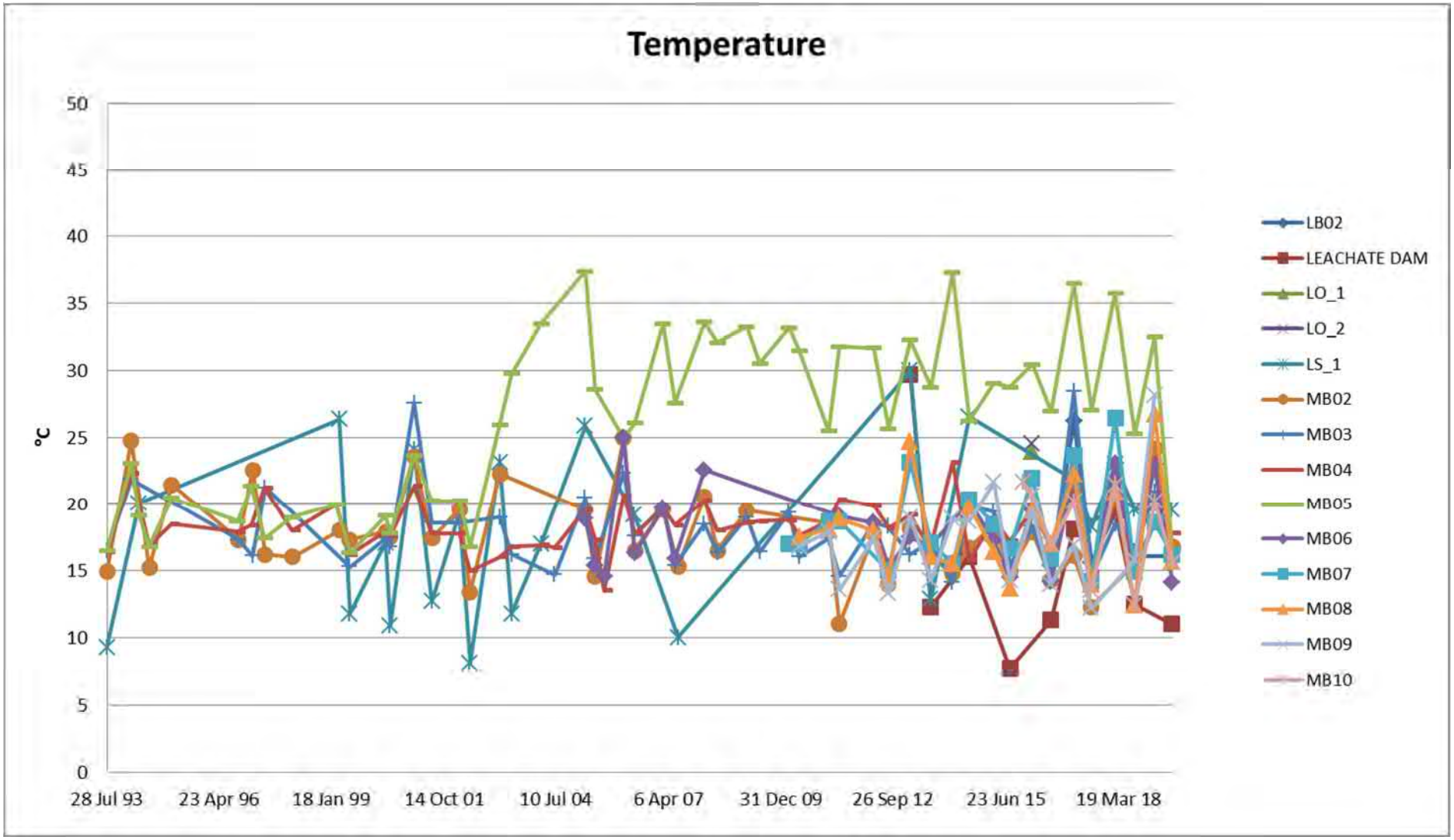

pH (Field)
pH Units
14
12
10
8
6
4
2
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

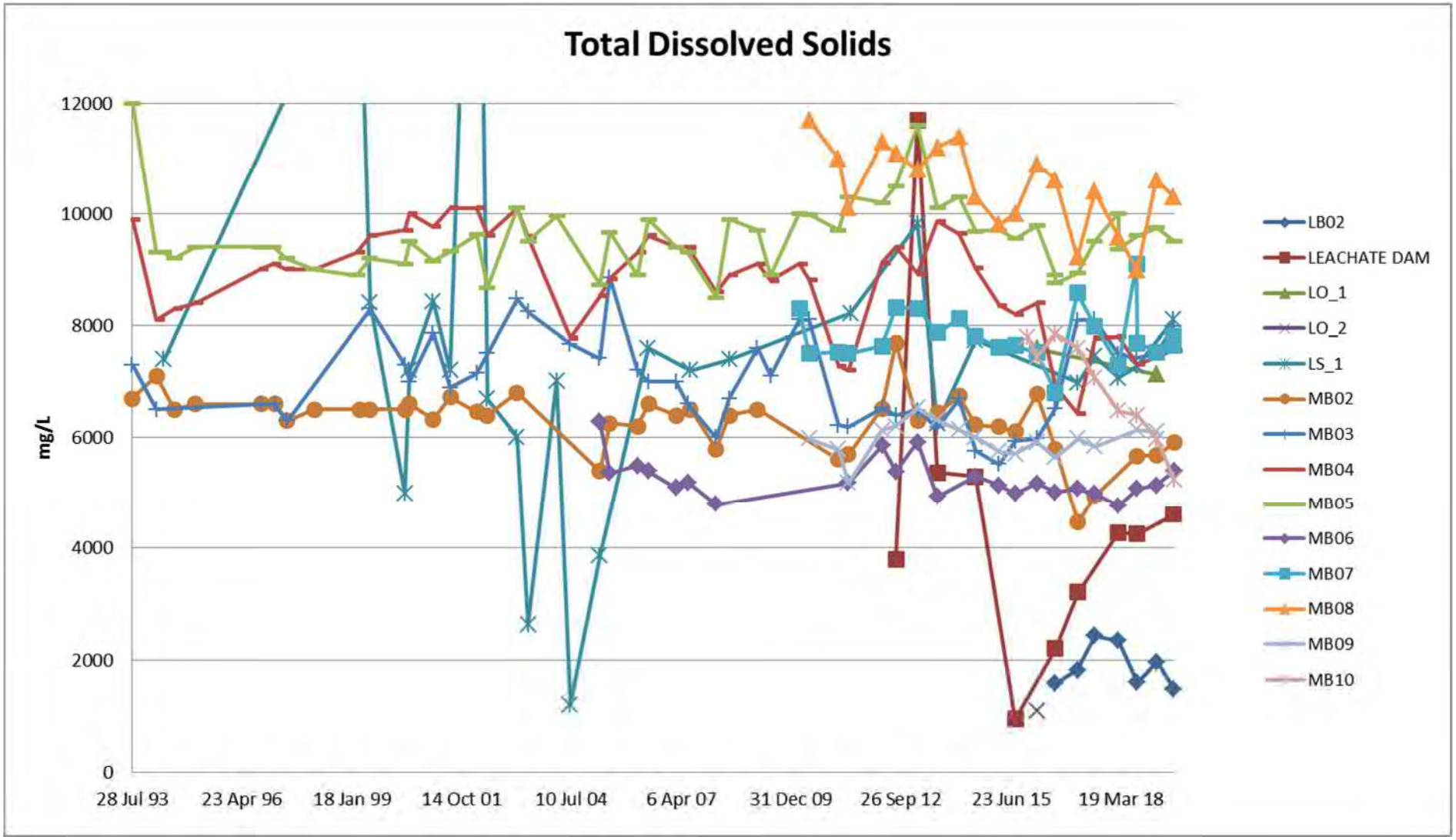

Potassium
mg/L
500
450
400
350
300
250
200
150
100
50
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

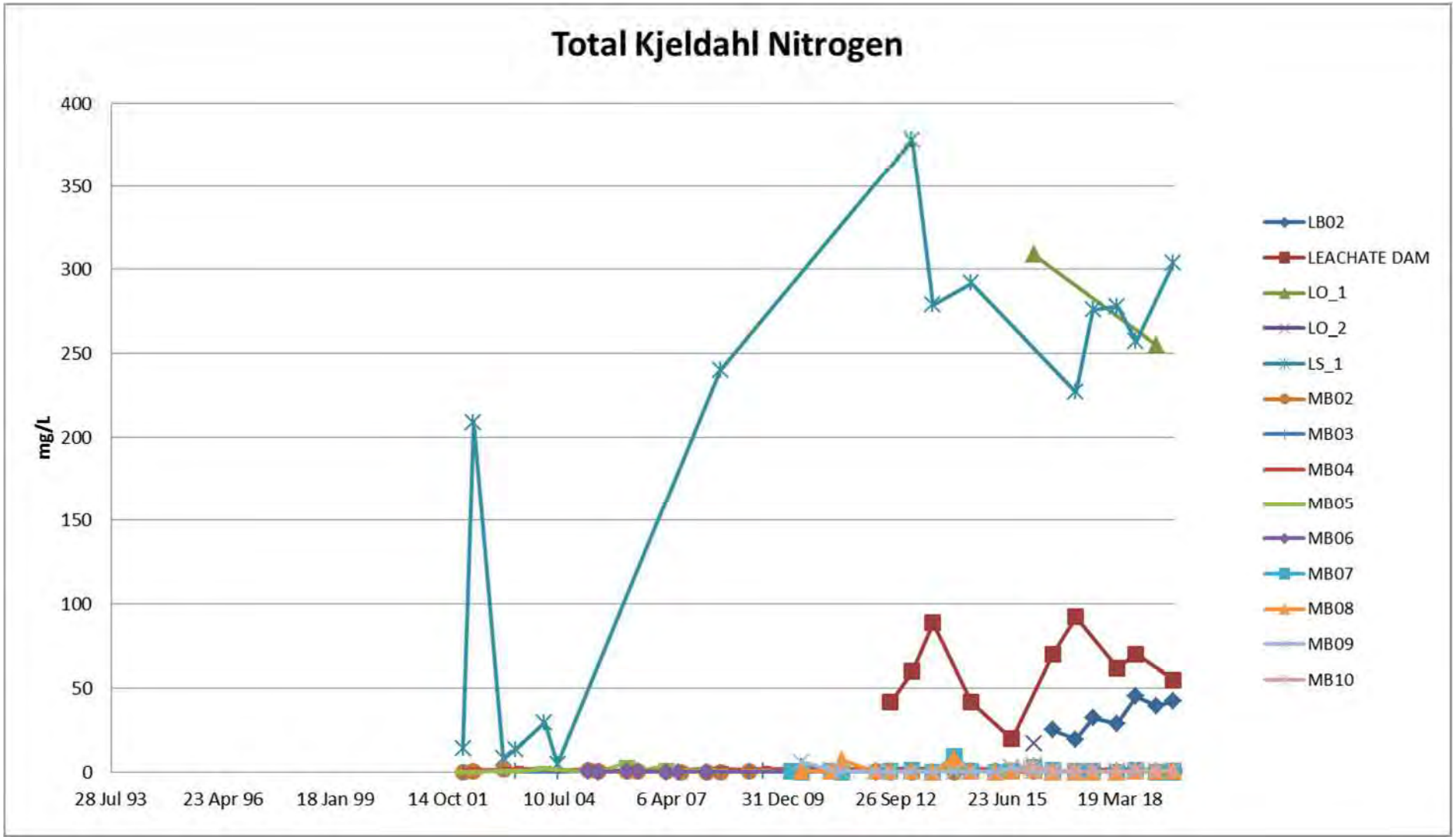

Redox Potential (Field)
mV
300
200
100
0
-100
-200
-300
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

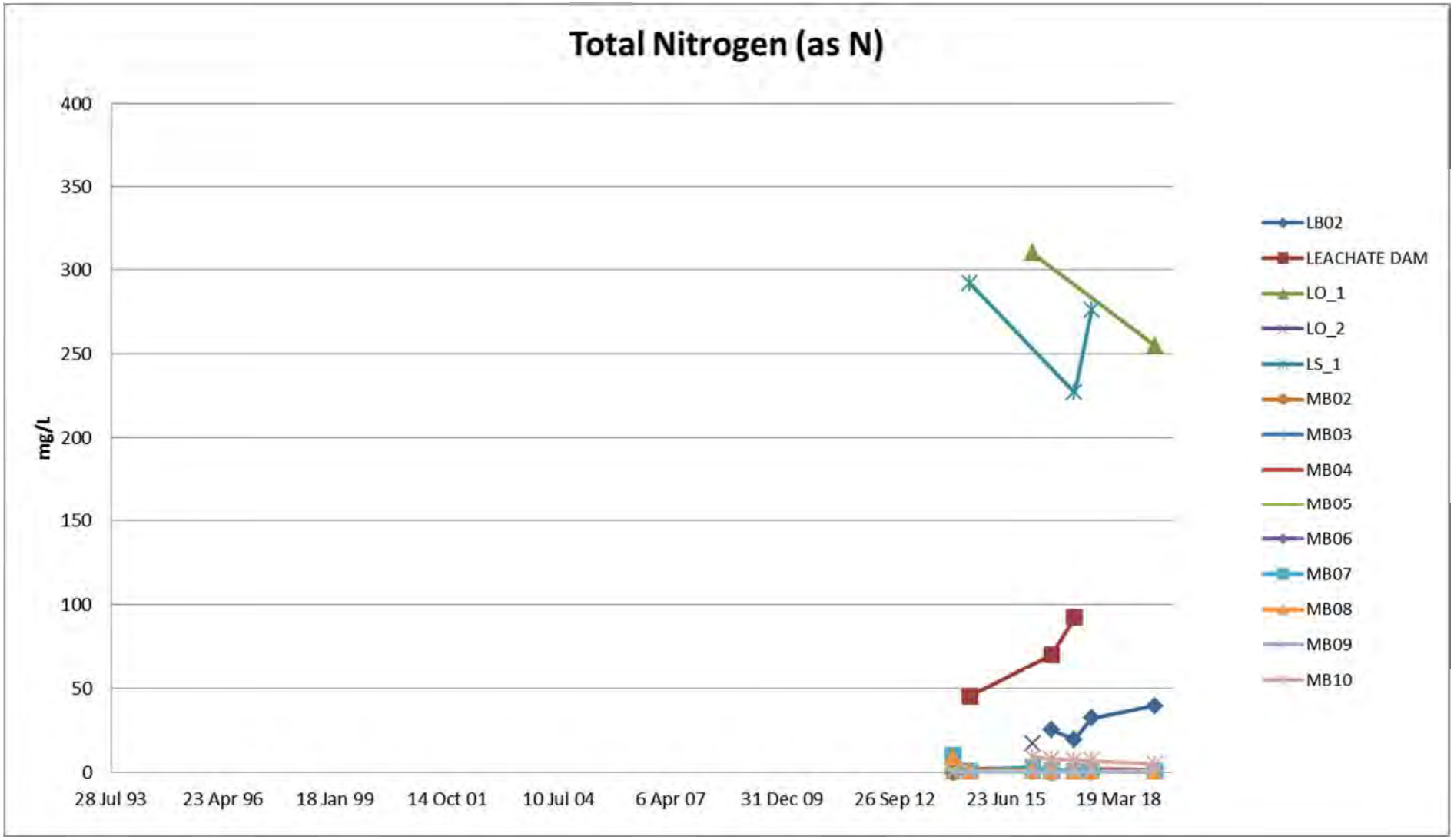

Sodium
mg/L
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

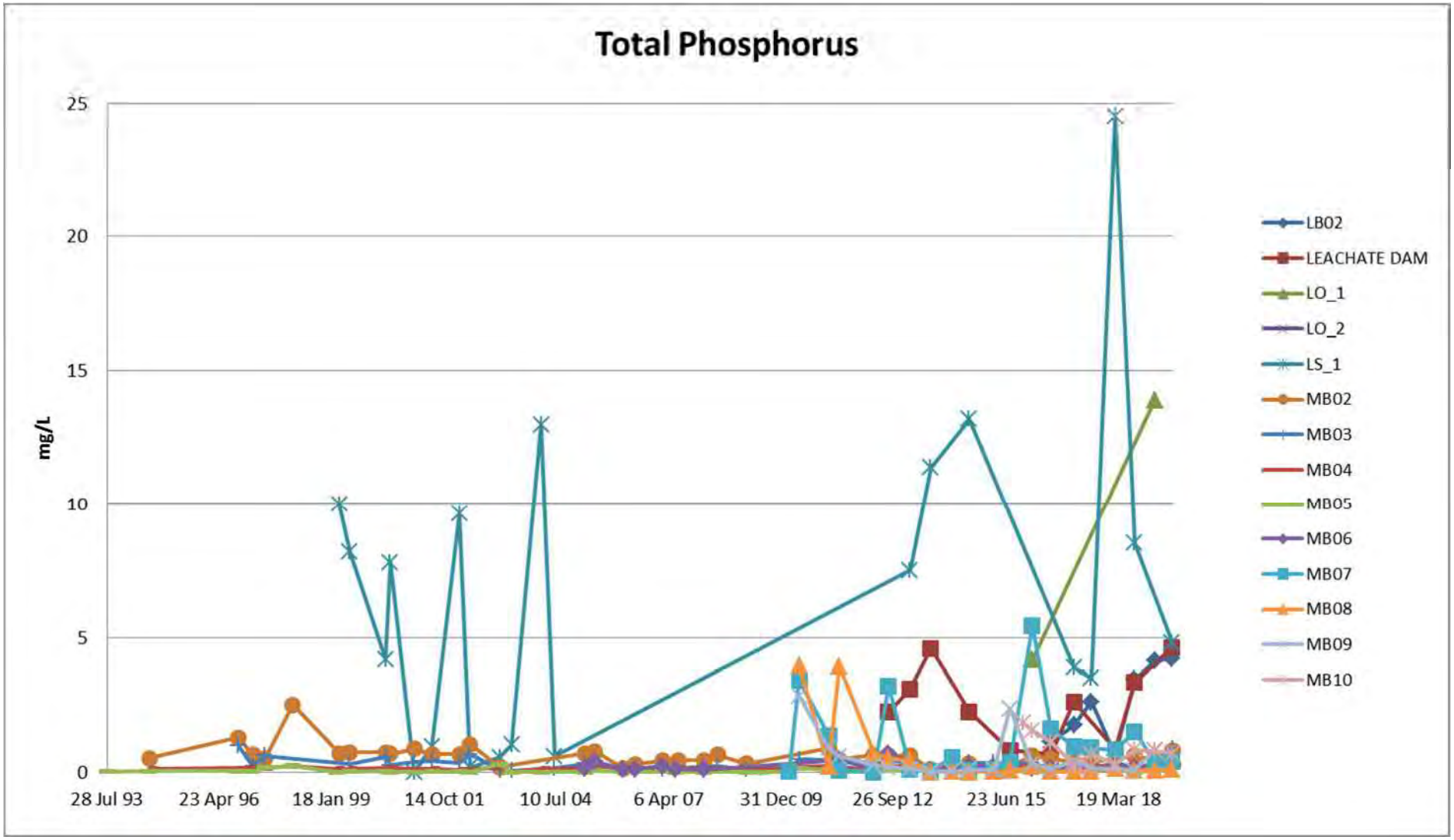

Sulfate as SO4
mg/L
2499
1999
1499
999
499
-1
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

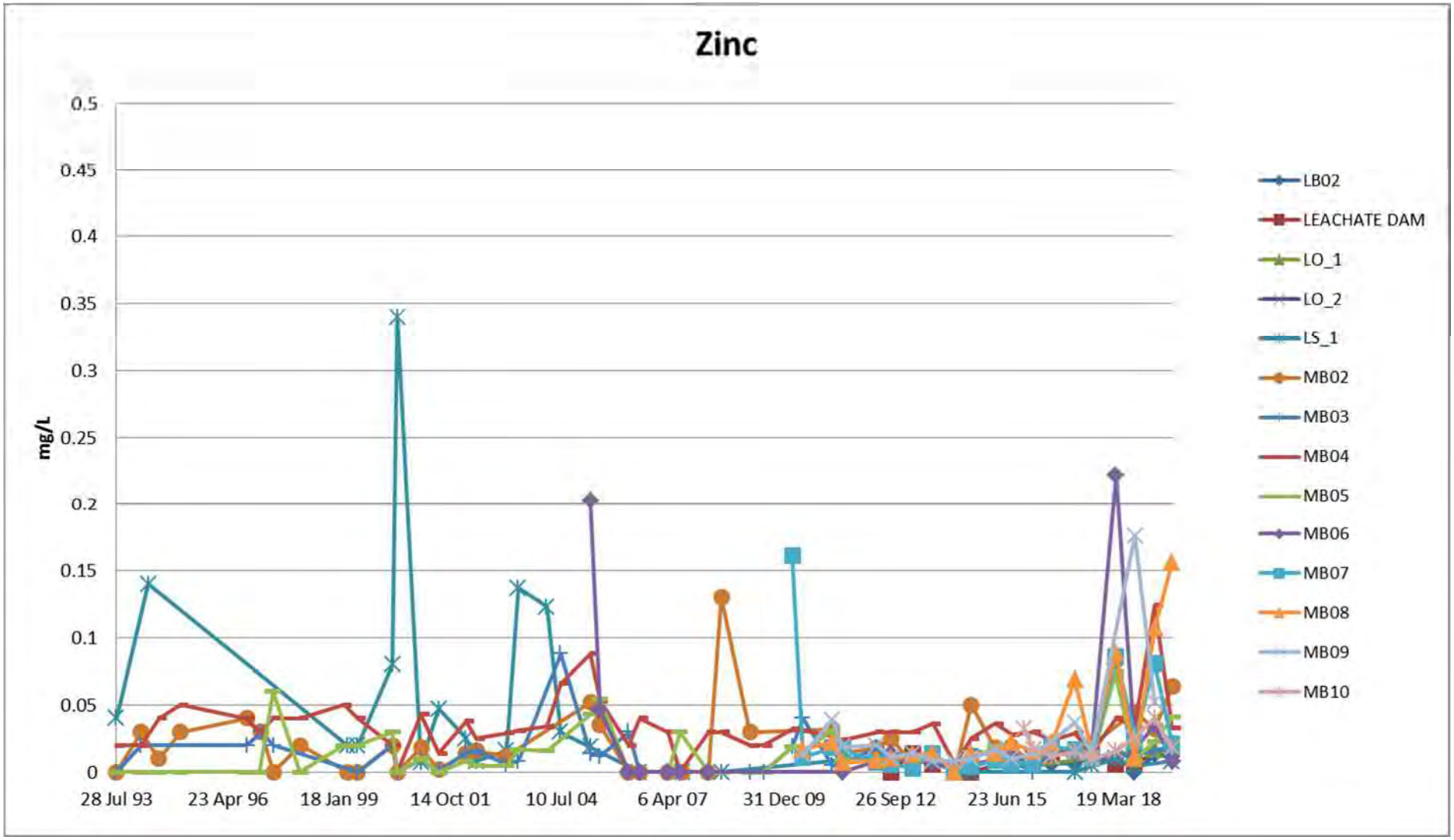

Temperature
°C
50
45
40
35
30
25
20
15
10
5
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10


Total Dissolved Solids
12000
10000
8000
6000
4000
2000
0
mg/L
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10


Total Kjeldahl Nitrogen
mg/L
400
350
300
250
200
150
100
50
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10


Total Nitrogen (as N)
mg/L
400
350
300
250
200
150
100
50
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10


Total Phosphorus
mg/L
25
20
15
10
5
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10


Zinc
mg/L
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
28 Jul 93
23 Apr 96
18 Jan 99
14 Oct 01
10 Jul 04
6 Apr 07
31 Dec 09
26 Sep 12
23 Jun 15
19 Mar 18
LB02
LEACHATE DAM
LO_1
LO_2
LS_1
MB02
MB03
MB04
MB05
MB06
MB07
MB08
MB09
MB10

ATTACHMENT 7 GAS RESULTS

Historical LFG Results
60563317 Eaglehawk

Balance to Oxygen (3.8); >3.8 in soils with oxidation as O2 is consumed CH4/CO2 0.8 in LFG GA detection limit 0.1 L/hr (if no detectable flow)

Bore ID	Date	Flow l/hr	Relative Pressure mb	CH4 %v/v	CO2 %v/v	O2 %v/v	%Balance	%bal/O2	GSV CH4%*flow	GSV CO2%*flow
BH01	Aug-01			0	0	18.9				
	Oct-01			0	0	17.9				
	Nov-01			0	0	16.1				
	Dec-01			0	0	19.1				
	Feb-02			0	0	18.3				
	Mar-02			0	0	19.5				
	Apr-02			0	0	19.1				
	May-02			0	0	19.9				
	Jun-02			0	0	19.3				
	Jul-02			0	0	19.8				
	Nov-03			0	0	18				
	Nov-04			0	0	19.1				
	Mar-05			0	0	19.5				
	Sep-05			0	0	19				
	Feb-09			0	0	18.3				
	Jun-09			0	0	20.6				
	Sep-09			0	0	19.3				
	Dec-09			0	0	16.9				
	Mar-10			0.1	0.1	16.2				
	Jun-10			0	0	18.5				
	Mar-11			0	0	12.3				
	Jun-11			0	0	19.3				
	Apr-12			0.4	0.4	18				
	Aug-12			0	0	20.2				
	Feb-13			0	0	19.1	78.8	4.13		
	Aug-13			0	0	18.9	79.1	4.19		
	Mar-14			0	0	16.4	80.4	4.90		
	Jul-14			0	0	18.6	78.9	4.24		
	Mar-15			0	0	15.5	80.7	5.21		
	Jul-15	0	0.07	0	0	19.8	78.7	3.97	0.00	0.00
	Feb-16	-0.1	0.05	0	0	18.3	79.2	4.33	0.00	0.00
	Jul-16	0	0.37	0	0	17	77.9	4.58	0.00	0.00
	Aug-16			0	0	17	77.5	4.56		
	Sep-16			0	0	11.8	80.3	6.81		
	Feb-17	0	0.07	0	0	17.2	79.5	4.62	0.00	0.00
	Jul-17	0	0.02	0	0	19.1	77.8	4.07	0.00	0.00
	Feb-18	0	0	0	0	17.9	80.2	4.48	0.00	0.00
	Aug-18	0.1	0	0	2.6	19	78.3	4.12	0.00	0.00
	Oct-18	0	0.07	0	1.6	18.9	79.5	4.21	0.00	0.00
	Feb-19	0	-0.1	0	1.5	20.4	78.0	3.82	0.00	0.00
	Jul-19	0.1	0.07	0	5.4	15.1	79.5	5.26	0.00	0.01
BH02	Aug-01			0	1.9	18.4				
	Oct-01			0	2.3	19				
	Nov-01			0	2.3	18.6				
	Dec-01			2.4	1	19.4				
	Feb-02				3.2	16.8				
	Mar-02			0	1.6	19.4				
	Apr-02			0.1	1.6	19.6				
	May-02			0	1.3	19.5				
	Jun-02			0	1.2	19.2				
	Jul-02			0	1.7	19				
	Aug-02			0	1.2	19.6				
	Feb-03			0	2.3	15.5				
	Jun-03			0	2	18.9				
	Sep-03			0	4.3	16.5				
	Nov-03			0	2.4	18.5				
	Feb-04			0	2.2	18.9				
	Jun-04			0.1	2.3	17.5				
	Sep-04			0	2.4	18.8				
	Nov-04			0	2	20.1				
	Mar-05			0	2.1	19.5				
	Sep-05			0	2.4	18.3				
	Feb-09			0	2.2	18.3				
	Jun-09			0	1.3	20.6				
	Sep-09			0	1.4	19.3				
	Dec-09			0	2	16.9				
	Mar-10			0	2.1	16.2				
	Jun-10			0	1.8	18.5				
	Mar-11			0	5.6	12.3				
	Jun-11			0	2	19.3				
	Apr-12			0.4	3.4	18				
	Aug-12			0	1.1	20.2				
	Feb-13			0	2.2	19.1	78.7	4.12		
	Aug-13			0	2	18.9	79.1	4.19		
	Mar-14			0	3.3	16.4	80.3	4.90		
	Jul-14			0	2.4	18.6	79	4.25		
	Mar-15			0	2.9	15.5	81.6	5.26		
	Jul-15	0	-0.12	0	0.1	19.8	78.8	3.98	0.00	0.00
	Feb-16	0	0.03	0	2.4	18.3	79.3	4.33	0.00	0.00
	Jul-16	0	0.05	0	3.1	17	79.9	4.70	0.00	0.00
	Aug-16			0	3	17	80	4.71	0.00	0.00
	Sep-16			0	3.3	11.8	84.9	7.19	0.00	0.00
	Feb-17	0	0.02	0	3	17.2	79.8	4.64	0.00	0.00
	Jul-17	0	0.05	0	2.3	19.1	78.6	4.12	0.00	0.00
	Feb-18	0	0.02	0	2.3	17.9	79.7	4.45	0.00	0.00
	Aug-18	0.1	0.09	0	1.8	18.8	79.4	4.22	0.00	0.00
	Oct-18	0	0.05	0	1.3	18.9	79.8	4.22	0.00	0.00
	Feb-19	0	0.1	0	2.6	19.6	77.7	3.96	0.00	0.00
	Jul-19	0	0.02	0	2.1	18.4	79.5	4.32	0.00	0.00

GSV legend	CIRIA C665 (2007)
0.07	Very low risk GSV <0.07
0.7	Low risk GSV <0.7
3.5	Moderate risk GSV <3.5
15	Moderate to high risk GSV<15
70	High risk GSV <70
71	Very high risk GSV >70

Historical LFG Results
60563317 Eaglehawk

Balance to Oxygen (3.8); >3.8 in soils with oxidation as O2 is consumed CH4/CO2 0.8 in LFG GA detection limit 0.1 L/hr (if no detectable flow)

Bore ID	Date	Flow l/hr	Relative Pressure mb	CH4 %v/v	CO2 %v/v	O2 %v/v	%Balance	%bal/O2	GSV CH4%*flow	GSV CO2%*flow	GSV legend	CIRIA C665 (2007)
BH03	Aug-01			0	9.4	8.6						
	Oct-01			0	13	5						
	Nov-01			0	0	20.5						
	Dec-01			0	9.9	12.3						
	Feb-02			0	15	6.4						
	Mar-02			0	5.6	15						
	Apr-02			0	10	10.4						
	May-02			0	6.4	14.2						
	Jun-02			0	8.9	10.8						
	Jul-02			0	10.8	10.3						
	Aug-02			0	9.2	10.8						
	Feb-03			0	14	7.1						
	Jun-03			0	12	9.1						
	Sep-03			0	16.6	2.3						
	Nov-03			0	13.1	9.3						
	Feb-04			0	13.4	10.2						
	Jun-04			0	10.1	8.7						
	Sep-04			0	12.3	8.8						
	Nov-04			0	10	12.7						
	Mar-05			0	7.2	15.1						
	Sep-05			0	10.7	6.1						
	Mar-06			-	7.5	12.9						
	Jun-06			0.1	7.5	14.6						
	Feb-07			0.3	5.6	15.6						
	Jun-07			0.2	11.1	6.4						
	Feb-08			0	6.6	12.7						
	Jun-08			0	6.8	14.8						
	Feb-09			0	5.5	16.2						
	Jun-09			0	6.6	12.8						
	Sep-09			0	8.8	10.7						
	Dec-09			0	9.1	8.4						
	Mar-10			0.1	7.7	10.1						
	Jun-10			0.1	9.1	10.7						
	Mar-11			0	13.1	3.6						
	Jun-11			0	6.4	15.9						
	Apr-12			0.3	7.9	14						
	Aug-12			0	7	12.2						
	Feb-13			0	2.4	18.6	79	4.25				
	Aug-13			0	4.9	14	81.1	5.79				
	Mar-14			0	2.5	16.7	80.8	4.84				
	Jul-14			0	6.3	12.3	81.4	6.62				
	Mar-15			0	4.7	16.2	80.2	4.95				
	Jul-15	0	0.07	0	3.2	17.5	79.2	4.53	0.00	0.00		
	Feb-16	0	-0.07	0	3.2	17.7	79.1	4.47	0.00	0.00		
	Jul-16	0	0.03	0	6.1	13.9	80	5.76	0.00	0.01		
	Aug-16			0	5.7	12.8	81.5	6.37	0.00	0.01		
	Sep-16			0	7.2	8.2	84.6	10.32	0.00	0.01		
	Feb-17			0	3.5	16.1	80.4	4.99	0.00	0.00		
	Jul-17	0.1	0.24	0	4.7	16.3	74	4.54	0.00	0.00		
	Feb-18	0	-0.02	0	1.9	17.8	80.2	4.51	0.00	0.00		
	Oct-18	0	0.08	0	2.3	18.1	79.4	4.39	0.00	0.00		
	Feb-19	0	-0.12	0	3.5	18.2	78.3	4.30	0.00	0.00		
	Jul-19	0	0.02	0	4	16.3	79.7	4.89	0.00	0.00		
BH04	Aug-01			0	12	6.2						
	Oct-01			0	14	7.4						
	Nov-01			0	0	20.2						
	Dec-01			0	11	8.1						
	Feb-02			0	7.4	15						
	Mar-02			0	11	9						
	Apr-02				30	10.3						
	May-02			0	8.7	11.8						
	Jun-02			0	8.7	10.1						
	Jul-02			0	8.8	12						
	Aug-02			0	9	10.6						
	Feb-03			0	15	6.2						
	Jun-03			0	11.6	9.6						
	Sep-03			0	18.2	2.2						
	Nov-03			0.1	13	9.7						
	Feb-04			0	13.6	9.9						
	Jun-04			0	10.3	8.4						
	Sep-04			0	12.6	8.4						
	Nov-04			0	10.8	11.8						
	Mar-05			0	8.2	13.8						
	Sep-05			0	11.4	7.8						
	Mar-06			-	6.5	14.6						
	Jun-06			0.1	6.5	14.7						
	Feb-07			0.4	6.3	15.3						
	Jun-07			0.1	13.5	5.8						
	Feb-08			0	4.5	13.2						
	Jun-08			0.1	5.8	15.5						
	Feb-09			0	6.8	14.6						
	Jun-09			0	6.3	13.2						
	Sep-09			0	9	10.8						
	Dec-09			0	10.1	7.3						
	Mar-10			0	9.6	8.9						
	Jun-10			0	9.7	10.8						
	Mar-11			0	19	3						
	Jun-11			0	8	14.5						
	Apr-12			0.4	7.5	14						
	Aug-12			0	7	12.1						
	Feb-13			0	2.4	18.5	79.1	4.28				
	Aug-13			0	4.9	14	81.1	5.79				

Historical LFG Results
60563317 Eaglehawk

Balance to Oxygen (3.8); >3.8 in soils with oxidation as O2 is consumed CH4/CO2 0.8 in LFG GA detection limit 0.1 L/hr (if no detectable flow)

Bore ID	Date	Flow l/hr	Relative Pressure mb	CH4 %v/v	CO2 %v/v	O2 %v/v	%Balance	%bal/O2	GSV CH4%*flow	GSV CO2%*flow	GSV legend	CIRIA C665 (2007)
BH04 cont	Mar-14			0	3	16.5	80.5	4.88				
	Jul-14			0	6.1	12.7	81.2	6.39				
	Mar-15			0	5.2	15.6	79.2	5.08				
	Jul-15	0	-0.15	0	0.1	21.3	78.7	3.69	0.00	0.00		
	Feb-16	0.1	0	0	3.6	17.3	79.2	4.58	0.00	0.00		
	Jul-16	0	0.17	0	6.4	13.2	80.4	6.09	0.00	0.01		
	Aug-16			0	5.7	12.4	81.9	6.60	0.00	0.01		
	Sep-16			0	8.2	6.9	84.9	12.30	0.00	0.01		
	Feb-17			0	3.6	17.4	79	4.54	0.00	0.00		
	Jul-17	0	0	0	5.3	15.9	78.8	4.96	0.00	0.01		
	Feb-18	0	-0.05	0	0.1	16.7	79.1	4.74	0.00	0.00		
	Aug-18	0.1	0.09	0	3.6	17.4	79.2	4.55	0.00	0.00		
	Oct-18	0	0.1	0	2.7	18	79	4.39	0.00	0.00		
	Feb-19	0	0.1	0	3.5	18.2	78.3	4.30	0.00	0.00		
	Jul-19	0	0.02	0	2.9	17.5	79.6	4.55	0.00	0.00		
BH05	Aug-01			0	0.7	20.2						
	Oct-01			0	1.7	18.5						
	Nov-01			0	0	20.5						
	Dec-01			0	0.3	20						
	Feb-02			0	1.5	18.8						
	Mar-02			0	0.6	11						
	Apr-02				1.6	20.4						
	May-02			0	0.3	20.6						
	Jun-02			0	0.8	20.2						
	Jul-02			0	0.9	20.7						
	Nov-03			0.1	1.2	19.3						
	Nov-04			0	1.3	20.4						
	Mar-05			0	0.3	19.9						
	Sep-05			0.1	1.2	20.1						
	Feb-09			0	0.2	20.2						
	Jun-09			0	1.4	20.2						
	Sep-09			0	1.8	20.2						
	Dec-09			0	1.3	17.7						
	Mar-10			0	1	19.4						
	Jun-10			0	2	19.8						
	Mar-11			0.1	2.8	17						
	Jun-11			0	0.6	20.9						
	Apr-12			0.1	1.7	17.8						
	Aug-12			0	1.6	19.3						
	Feb-13			0	0.5	20.7	78.8	3.81				
	Aug-13			0	0.3	21.1	78.6	3.73				
	Mar-14			0	0.9	18.1	81	4.48				
	Jul-14			0	2.6	18.8	78.6	4.18				
	Mar-15			0	0.8	19.5	79.7	4.09				
	Jul-15	0	0.05	0	1	20.6	78.4	3.81	0.00	0.00		
	Feb-16	0	0.12	0	0.7	19.6	79.6	4.06	0.00	0.00		
	Jul-16	0	0.05	0	0.3	21.6	78.1	3.62	0.00	0.00		
	Feb-17	0	0.07	0	6	15.1	78.9	5.23	0.00	0.01		
	Jul-17	0	0.07	0	1.8	20.2	78	3.86	0.00	0.00		
	Feb-18	0	0.02	0	0.3	19.5	80.2	4.11	0.00	0.00		
	Aug-18	0.1	0.15	0	1.2	19.6	79.2	4.04	0.00	0.00		
	Oct-18	0	0.08	0	1.3	18.5	80	4.32	0.00	0.00		
	Feb-19	0	0.09	0	0.5	20.6	78.9	3.83	0.00	0.00		
	Jul-19	0	0.1	0	1.9	19.9	78.2	3.93	0.00	0.00		
BH06	Aug-01			0	0	20.6						
	Oct-01			0	0.4	19.9						
	Nov-01			0	0.5	19.7						
	Dec-01			0	0.5	19.8						
	Feb-02			0	0.4	20						
	Mar-02			0	0.4	20.1						
	Apr-02			0	0.5	19.4						
	May-02			0	0.6	20.3						
	Jun-02			0	0.2	20.4						
	Jul-02			0	0.3	20.8						
	Nov-03			0	0.7	19.7						
	Nov-04			0	0.5	21						
	Mar-05			0	0.4	20.7						
	Sep-05			0	0.3	21						
	Jun-09			0	0.6	21						
	Sep-09			0	1.4	18.7						
	Dec-09			0	1.1	17.7						
	Mar-10			0.1	0	20.2						
	Jun-10			0	1.3	19.1						
	Mar-11			0.1	2.4	16.7						
	Jun-11			0	0.7	20.2						
	Apr-12			0.1	1.8	18.1						
	Aug-12			0	0.2	21.5						
	Feb-13			0	0.4	20.8	78.8	3.79				
	Aug-13			0	1.4	18.1	80.5	4.45				
	Mar-14			0	0.8	18.1	81.1	4.48				
	Jul-14			0	4.5	16.5	81.9	4.96				
	Mar-15			0	4.5	16.1	79.4	4.93				
	Jul-15	0	-0.21	0	4.4	17.3	78.4	4.53	0.00	0.00		
	Feb-16	0	0.02	0	6.5	14	79.5	5.68	0.00	0.01		
	Jul-16	0	0.04	0	3.4	19.3	77.3	4.01	0.00	0.00		
	Feb-17	0	0.03	0	5.7	15.2	79.1	5.20	0.00	0.01		
	Jul-17	0	0.02	0	6.3	15.4	78.3	5.08	0.00	0.01		
	Feb-18	0	-0.03	0	2.9	17.7	79.3	4.48	0.00	0.00		
	Aug-18	0.2	0.22	0	6.5	14.9	78.6	5.28	0.00	0.01		
	Oct-18	0	0.13	0	4.6	16.2	79.3	4.90	0.00	0.00		
	Feb-19	0	0.05	0	4.8	17.3	77.9	4.50	0.00	0.00		
	Jul-19	0	0.12	0	4.1	16.7	79.2	4.74	0.00	0.00		

Historical LFG Results
60563317 Eaglehawk

Balance to Oxygen (3.8); >3.8 in soils with oxidation as O2 is consumed CH4/CO2 0.8 in LFG GA detection limit 0.1 L/hr (if no detectable flow)

Bore ID	Date	Flow l/hr	Relative Pressure mb	CH4 %v/v	CO2 %v/v	O2 %v/v	%Balance	%bal/O2	GSV CH4%*flow	GSV CO2%*flow	GSV legend	CIRIA C665 (2007)
BH07	Oct-01			0	4.2	8.5						
	Nov-01			0	4.4	10.5						
	Dec-01			0	3.6	14.5						
	Feb-02			0	5	10.2						
	Mar-02			0	1.9	18.2						
	Apr-02			0	4	14.8						
	May-02			0	2.5	16.9						
	Jun-02			0	4.3	10.9						
	Jul-02			0	4.7	12.2						
	Aug-02			0	4	13.2						
	Nov-03			0.1	4.5	11.3						
	Nov-04			0	3.8	13						
	Mar-05			0	5.5	11.9						
	Mar-06			0	3.3	13.4						
	Jun-09			0	1.4	20.2						
	Sep-09			0	0.7	19.9						
	Dec-09			0	2.9	12.5						
	Mar-10			0	1.9	18.6						
	Jun-10			0	1.2	19.3						
	Mar-11											
	Jun-11			0.3	1.7	18.7						
	Apr-12			0.1	5.1	8						
	Aug-12			0	2.2	17.9						
	Feb-13			0	2.1	17.8	80.1	4.50				
	Aug-13			0	2.1	18.5	79.4	4.29				
	Mar-14			0	4.7	12.7	82.7	6.51				
	Jul-14			0	5.7	10.6	83.6	7.89				
	Mar-15			0	2.5	15.9	81.6	5.13				
	Jul-15	0	0.12	0	1	19.8	79.2	4.00	0.00	0.00		
	Feb-16	0	0.02	0	2.9	17.6	79.5	4.52	0.00	0.00		
	Jul-16	0	-0.14	0	2	13	85	6.54	0.00	0.00		
	Aug-16			0								
	Sep-16			0								
	Feb-17	0	0	0	10.5	11.7	77.8	6.65	0.00	0.01		
	Jul-17	0	0.09	0	3.1	16.8	80.1	4.77	0.00	0.00		
	Feb-18	0	-0.02	0	5.6	15.6	78.8	5.05	0.00	0.01		
	Aug-18	0.1	0.28	0	1.1	19.5	79.4	4.07	0.00	0.00		
	Oct-18	0	0	0	2.1	20	79	3.95	0.00	0.00		
	Feb-19	0	-0.03	0	2.7	18	79.2	4.40	0.00	0.00		
	Jul-19	0	0.12	0	4.5	12.4	83.1	6.70	0.00	0.00		
BH08	Aug-01			0.4	7.5	3.1						
	Oct-01			0	6.2	7.8						
	Nov-01			0.1	7.6	8.1						
	Dec-01			0	3.1	16.6						
	Feb-02			0	10.1	8						
	Mar-02			0	3	17						
	Apr-02			0	4.6	13.4						
	May-02			0	9.3	16.4						
	Jun-02			0	4.4	11.4						
	Jul-02			0	4.1	13.1						
	Aug-02			0	3.8	14.3						
	Feb-03			0	7.8	10.6						
	Jun-03			0	5.8	11.5						
	Sep-03			0	6.7	8.2						
	Nov-03			0.1	8.2	7.8						
	Feb-04			0	7	14						
	Jun-04			0	5.3	11.4						
	Sep-04			0	3.7	14						
	Nov-04			0	4.7	15						
	Mar-05			0	6.0	13.9						
	Sep-05			0.1	6.1	6.5						
	Jun-09			0	3.9	15.7						
	Sep-09			0	0.5	20.7						
	Dec-09			0.1	5	11.8						
	Mar-10			0.1	0	20.6						
	Jun-10			0	4.3	15.2						
	Mar-11											
	Jun-11			0	0	20.6						
	Apr-12			0.1	5.5	5.5						
	Aug-12			0	2.3	20						
	Feb-13			0	1.3	19.3	79.4	4.11				
	Aug-13			0	0.2	21.4	78.4	3.66				
	Mar-14			0	6.5	10.7	82.8	7.74				
	Jul-14			0	3.2	15.7	81	5.16				
	Mar-15			0	4.5	12.2	83.3	6.83				
	Jul-15	0	0.02	0	0.3	20.5	79.2	3.86	0.00	0.00		
	Feb-16	-0.1	-0.02	0	2.3	18.6	79.1	4.25	0.00	0.00		
	Jul-16	0	0.03	0	0.4	21.2	78.4	3.70	0.00	0.00		
	Aug-16			0								
	Sep-16			0								
	Feb-17	0	0.05	0	1.2	19	79.8	4.20	0.00	0.00		
	Jul-17	0	-0.14	0	0.2	21.4	78.4	3.66	0.00	0.00		
	Feb-18	0	-0.07	0	0.7	19.2	80.1	4.17	0.00	0.00		
	Aug-18	0.1	0.27	0	0.3	20.3	79.4	3.91	0.00	0.00		
	Oct-18	0	0	0	1.4	18.8	80	4.26	0.00	0.00		
	Feb-19	0	0.1	0	2	19.5	78.5	4.03	0.00	0.00		
	Jul-19	0	0.03	0	7.4	7	85.7	12.24	0.00	0.01		

Historical LFG Results
60563317 Eaglehawk

Balance to Oxygen (3.8); >3.8 in soils with oxidation as O2 is consumed CH4/CO2 0.8 in LFG GA detection limit 0.1 L/hr (if no detectable flow)

Bore ID	Date	Flow l/hr	Relative Pressure mb	CH4 %v/v	CO2 %v/v	O2 %v/v	%Balance	%bal/O2	GSV CH4%*flow	GSV CO2%*flow	GSV legend	CIRIA C665 (2007)
BH09	Aug-01			0	4.4	14.7						
	Oct-01			0.1	10	0.1						
	Nov-01			0	8.8	2.6						
	Dec-01			0	5	10						
	Feb-02			0	11	2.6						
	Mar-02			0	0.5	19.9						
	Apr-02			0	7.1	7.1						
	May-02			0	20	10						
	Jun-02			0	11	1.2						
	Jul-02			0	10.9	1						
	Aug-02			0	8.9	1.9						
	Feb-03			0	11	3.5						
	Jun-03			0	9.8	4.1						
	Sep-03			0	8.4	5.6						
	Nov-03			0.1	7.6	5						
	Feb-04			0	5.4	10						
	Jun-04			0	6.5	8.6						
	Sep-04			0	5.5	10						
	Nov-04			0	1.9	19.4						
	Mar-05			0	7.4	8.8						
	Sep-05			0.1	7.1	6.4						
	Feb-09				2.6	16.9						
	Jun-09			0	1.8	20.7						
	Sep-09			0	1.3	19.6						
	Dec-09			0	5.3	3.5						
	Mar-10			0.1	3.4	7.6						
	Jun-10			0	1.9	19.1						
	Mar-11			0	0	20.6						
	Jun-11			0	0.9	19.8						
	Apr-12			0.1	9.1	4						
	Aug-12			0	5.7	13						
	Feb-13			0	0.8	20.3	78.9	3.89				
	Aug-13			0	0.1	21.4	78.5	3.67				
	Mar-14			0	8.1	8.8	83.1	9.44				
	Jul-14			0	3.4	16.5	80.1	4.85				
	Mar-15			0	4.8	12.5	82.7	6.62				
	Jul-15	0	0	0	1	20.4	78.6	3.85	0.00	0.00		
	Feb-16	0.1	0.12	0	3.1	18	78.9	4.38	0.00	0.00		
	Jul-16	0	-0.04	0	2.3	20.5	77.2	3.77	0.00	0.00		
	Aug-16											
	Sep-16											
	Feb-17	0	0.09	0	2.1	18.1	79.7	4.40	0.00	0.00		
	Jul-17	-0.1	-0.27	0	2.5	19.9	77.6	3.90	0.00	0.00		
	Feb-18	0	-0.05	0	0.9	19	80.1	4.22	0.00	0.00		
	Aug-18	0	-0.05	0	2.2	19.4	78.4	4.04	0.00	0.00		
	Oct-18	0	0	0	0.3	19.8	80	4.04	0.00	0.00		
	Feb-19	0	0.26	0	3	18.2	78.8	4.33	0.00	0.00		
	Jul-19	0.1	0.07	0	9.3	7.8	82.9	10.63	0.00	0.01		
BH15	Aug-01			0	0	21.1						
	Oct-01			0	6.7	16.4						
	Nov-01			0	7.2	12.6						
	Dec-01			0	5.4	13.9						
	Feb-02			0	9.1	12.1						
	Mar-02			0	5.2	16.1						
	Apr-02			0	6.2	13.6						
	May-02			0	3.2	18						
	Jun-02			0	7.7	12.2						
	Jul-02			0	7.6	12						
	Aug-02			0	6.4	10.9						
	Feb-03			0	7.3	11.5						
	Jun-03			0	7	14.5						
	Sep-03			0	4	18						
	Nov-03			0.1	6.8	14						
	Feb-04			0	7.4	13						
	Jun-04			0.1	5.4	16.7						
	Sep-04			0	5.9	15.8						
	Nov-04			0	7	14.1						
	Mar-05			0	7.1	14.8						
	Sep-05			0	6.7	14.7						
	Sep-09			0	3	17.3						
	Dec-09			0	3.7	13.5						
	Mar-10			0.1	1.2	19.7						
	Jun-10			0	2.2	19						
	Mar-11			0.1	4.4	13.3						
	Jun-11			0	1	19.7						
	Apr-12			0.1	4.2	13.2						
	Aug-12			0	3.3	17.7						
	Feb-13			0	2	16.8	81.2	4.83				
	Aug-13			0	3	17.5	79.5	4.54				
	Mar-14			0	3.3	16.2	80.5	4.97				
	Jul-14			0	2.6	19.6	77.6	3.96				
	Mar-15			0	3.5	14.5	82	5.66				
	Jul-15	0	0.09	0	0.9	20.9	78.2	3.74	0.00	0.00		
	Feb-16	0	0.02	0	2.9	14.5	82.6	5.70	0.00	0.00		
	Jul-16	0	-0.12	0	1.7	20.5	77.8	3.80	0.00	0.00		
	Feb-17	0	0.03	0	3.9	16.3	79.3	4.87	0.00	0.00		
	Jul-17	0	-0.07	0	0.9	21.1	78	3.70	0.00	0.00		
	Feb-18	0	0.02	0	2.6	16.4	81	4.94	0.00	0.00		
	Aug-18	0.1	0.1	0	1.5	20.8	77.7	3.74	0.00	0.00		
	Oct-18	0	0.04	0	0.9	19.5	79.1	4.06	0.00	0.00		
	Feb-19	0	0.11	0	2.4	18.2	79.4	4.36	0.00	0.00		
	Sep-19	0	0	0	1.1	20.8	78.1	3.75	0.00	0.00		

Historical LFG Results
60563317 Eaglehawk

Balance to Oxygen (3.8); >3.8 in soils with oxidation as O2 is consumed CH4/CO2 0.8 in LFG GA detection limit 0.1 L/hr (if no detectable flow)

Bore ID	Date	Flow l/hr	Relative Pressure mb	CH4 %v/v	CO2 %v/v	O2 %v/v	%Balance	%bal/O2	GSV CH4%*flow	GSV CO2%*flow	GSV legend	CIRIA C665 (2007)
BH17	Feb-13			0	2.1	19	78.9	4.15				
	Aug-13			0	6.5	12.2	81.3	6.66				
	Mar-14			0	3.8	16.7	79.5	4.76				
	Jul-14			0	5.7	14.5	79.8	5.50				
	Mar-15			0	7.2	11.4	81.4	7.14				
	Jul-15	0	-0.02	0	3.7	17.4	78.9	4.53	0.00	0.00		
	Feb-16	0	0.02	0	4.1	14.5	81.4	5.61	0.00	0.00		
	Jul-16	0	0.1	0	6.9	13.7	79.4	5.80	0.00	0.01		
	Aug-16			0	4.6	16.2	79.2	4.89				
	Sep-16			0	5.7	3.7	90.6	24.49				
	Feb-17	0	0.07	0	7.9	13.4	78.7	5.87	0.00	0.01		
	Jul-17	0	0.08	0	6.3	15.2	78.5	5.16	0.00	0.01		
	Feb-18	0	0.36	0	5.8	15.5	78.8	5.08	0.00	0.01		
	Aug-18	0.1	0.12	0	1.6	17.4	80.9	4.65	0.00	0.00		
	Oct-18	0.1	0.1	0	3.4	17.3	79.3	4.58	0.00	0.00		
	Feb-19	0	0.04	0	5.2	17	77.8	4.58	0.00	0.01		
	Jul-19	0	-0.02	0	3.7	17.7	78.6	4.44	0.00	0.00		
BH18	Feb-13			0	2.1	19	78.9	4.15	0.00	0.00		
	Aug-13			5.6	10.6	10.5	73.3	6.98	0.01	0.01		
	Mar-14			0	5.9	15.8	78.3	4.96	0.00	0.01		
	Jul-14			15.6	16.5	3.2	64.7	20.22	0.02	0.02		
	Mar-15			0	7.6	13	79.4	6.11	0.00	0.01		
	Jul-15	0	-0.03	1.6	6.7	14.7	77.1	5.24	0.00	0.01		
	Feb-16	0	0.05	0	5.2	16.7	78.1	4.68	0.00	0.01		
	Jul-16	0	0.1	11.4	15.3	4.5	68.8	15.29	0.01	0.02		
	Aug-16			7.9	13.3	6.1	72.7	11.92	0.01	0.01		
	Sep-16			15.3	17.6	3.3	63.8	19.33	0.02	0.02		
	Feb-17	0	0.07	0	9.7	11.3	78.9	6.98	0.00	0.01		
	Jul-17	0	-0.14	1.8	8	7.8	82.4	10.56	0.00	0.01		
	Feb-18	0	0.1	0.2	5.3	16	78.7	4.92	0.00	0.01		
	Jun-18	0.4		0	3.4	17.8	78.8	4.43	0.00	0.01		
	Jun-18	0.3		0	2.5	19.4	78.2	4.03	0.00	0.01		
	Jul-18	0	0.03	0	3.5	16.6	79.9	4.81	0.00	0.00		
	Aug-18	0.1	0.12	0	4.3	14.1	81.6	5.79	0.00	0.00		
	Oct-18	0	0.06	0	4.4	16.1	79.5	4.94	0.00	0.00		
	Feb-19	-0.10	-0.05	0	5.8	17	77.2	4.54	0.00	-0.01		
	Jul-19	0.00	-0.02	0.2	4.8	8.2	86.8	10.59	0.00	0.00		
BH19	Feb-13			**0**	1.7	19.1	79.2	4.15				
	Aug-13			0	8.8	9.3	81.9	8.81				
	Mar-14			0	3.7	17.1	79.1	4.63				
	Jul-14			0	NM	NM						
	Mar-15			NM	3.7	18.2	78.2	4.30				
	Jul-15	0	-0.09	0	3.2	17.7	79	4.46	0.00	0.00		
	Feb-16	0	0.03	0	2.8	17.8	79.4	4.46	0.00	0.00		
	Jul-16	0	0.1	0	10.9	5.3	83.9	15.83	0.00	0.01		
	Aug-16			0	8.6	8.9	82.6	9.28				
	Sep-16			0	12.5	2.7	84.8	31.41				
	Feb-17	0	0.1	0	6.8	14.4	78.8	5.47	0.00	0.01		
	Jul-17	0	0.03	0	5	16	79	4.94	0.00	0.01		
	Feb-18	0	-0.03	0	3	16.6	80.4	4.84	0.00	0.00		
	Jun-18	0.6		0	3.0	18	79	4.39				
	Jul-18	0.1	0.03	0	3.2	17.7	79.1	4.47	0.00	0.00		
	Aug-18	0.1	0.13	0	4.6	16.6	78.9	4.75	0.00	0.00		
	Oct-18	0	0.08	0	3.4	18	78.6	4.37	0.00	0.00		
	Feb-19	0	0.05	0	4	17.6	78	4.43	0.00	0.00		
	Jul-19	0	0.02	0	9.6	10.6	79.9	7.54	0.00	0.01		
BH20	Feb-13			0	2.3	18.7	79	4.22				
	Aug-13			0	5.6	14.9	79.5	5.34				
	Mar-14			0	4.6	17.1	78.4	4.58				
	Jul-14			NM	5.8	14.5	79.6	5.49				
	Mar-15			0	5.2	14.3	80.5	5.63				
	Jul-15	0	-0.03	0	3.6	17.8	78.6	4.42	0.00	0.00		
	Feb-16	0.1	-0.03	0	3.7	17.1	79.2	4.63	0.00	0.00		
	Jul-16	0	0.07	0	4.9	15.7	79.4	5.06	0.00	0.00		
	Aug-16			0	4	17.1	78.9	4.61				
	Sep-16			0	4.3	15.2	80.5	5.30				
	Feb-17	0	0.1	0	4.9	16.4	78.7	4.80	0.00	0.00		
	Jul-17	0	0.1	0	3.9	17.4	78.7	4.52	0.00	0.00		
	Feb-18	0	0.1	0	3.9	16	80.1	5.01	0.00	0.00		
	Aug-18	0	0.11	0	3.3	17.9	78.8	4.40	0.00	0.00		
	Oct-18	0	0.09	3	3	18	79	4.39	0.00	0.00		
	Feb-19	0	0.08	0	4	17.8	78.2	4.39	0.00	0.00		
	Jul-19	0	0.05	0	3.7	17	79.3	4.66	0.00	0.00		
BH21	Feb-13			0	1.4	19.8	78.8	3.98				
	Aug-13			0	6.5	10.5	82.9	7.90				
	Mar-14			0	13.3	1.3	85.4	65.69				
	Jul-14			0	5.5	8.2	86.2	10.51				
	Mar-15			0	8.2	11.6	80.2	6.91				
	Jul-15			0	2.2	19.9	77.9	3.91				
	Feb-16			0	4.4	16.6	79	4.76				
	Jul-16	0	0.07	0	6.5	9.4	84.1	8.95	0.00	0.01		
	Aug-16	0	-0.02	0	6.5	6.8	86.8	12.76	0.00	0.01		
	Sep-16	0	0.02	0	3.5	8.7	87.8	10.09	0.00	0.00		
	Feb-17			0	3.7	18.4	77.9	4.23				
	Jul-17			0	3.7	18.5	77.8	4.21				
	Feb-18	0.1	0.33	0	3.2	16.5	80.4	4.87	0.00	0.00		
	Jun-18	0.4	0.09	0	3.8	17.6	78.7	4.47	0.00	0.02		
	Jun-18	0.5	0.03	0	2.5	19.4	78.2	4.03	0.00	0.01		
	Jul-18	0.1	0.24	0	2.9	19.1	78	4.08	0.00	0.00		
	Aug-18	0	0.14	0	2.7	19.8	77.5	3.91	0.00	0.00		
	Oct-18	0	0.05	0	4.8	16.2	79	4.88	0.00	0.00		
	Feb-19	0.1	0.09	0	4.6	18.1	77.2	4.27	0.00	0.00		
	Jul-19	0	0.03	0	13.1	2.1	84.8	40.38	0.00	0.01		

Historical LFG Results
60563317 Eaglehawk

Balance to Oxygen (3.8); >3.8 in soils with oxidation as O2 is consumed CH4/CO2 0.8 in LFG GA detection limit 0.1 L/hr (if no detectable flow)

Bore ID	Date	Flow l/hr	Relative Pressure mb	CH4 %v/v	CO2 %v/v	O2 %v/v	%Balance	%bal/O2	GSV CH4%*flow	GSV CO2%*flow	GSV legend	CIRIA C665 (2007)
BH22	Feb-13			0	1	20.2	78.8	3.90				
	Aug-13			0	2.5	17.7	79.8	4.51				
	Mar-14			0	9.2	12.2	78.6	6.44				
	Jul-14			0	9.8	5.3	84.9	16.02				
	Mar-15			0	15.2	5.6	79.2	14.14				
	Jul-15			0	3.3	19.1	77.7	4.07				
	Feb-16			0	2.6	18	79.4	4.41				
	Jul-16	0	0.03	0	6.2	8.5	85.3	10.04	0.00	0.01		
	Aug-16	0	0.03	0	6.9	3.1	90	29.03	0.00	0.01		
	Sep-16	0	0	0	8	1.8	90.2	50.11	0.00	0.01		
	Feb-17			0	6.5	15.3	77.9	5.09				
	Jul-17			0	4.1	17.1	78.8	4.61				
	Feb-18	0	0.09	0	9.8	10.6	79.6		0.00	0.01		
	Jun-18	0.5	-0.12	0	4.1	16	79.9	4.99	0.00	0.02		
	Jun-18	0.6	0.02	0	7.6	12.4	79.9	6.44	0.00	0.05		
	Jul-18	0.1	0.15	0.1	0.3	20.4	79.2	3.88	0.00	0.00		
	Aug-18	0.1	0.14	0	9.9	7.4	82.6	11.16	0.00	0.01		
	Oct-18	0	0.08	0	5.7	14.4	79.9	5.55	0.00	0.01		
	Feb-19	0	0.05	0	6.3	16.1	77.6	4.82	0.00	0.01		
	Jul-19	0	0.05	0	10	8.4	81.6	9.71	0.00	0.01		
BH23	Feb-13			0	1.1	20.1	78.8	3.92				
	Aug-13			0	2.9	19.4	77.7	4.01				
	Mar-14			0	3.6	18.6	78.4	4.22				
	Jul-14			0	3.2	17.6	78.3	4.45				
	Mar-15			0	4	15	81	5.40				
	Jul-15	0	-0.02	0	2.2	19.8	78	3.94	0.00	0.00		
	Feb-16	0.1	0.05	0	3.1	16.1	80.9	5.02	0.00	0.00		
	Jul-16	0	0.09	0	3.2	19.2	77.6	4.04	0.00	0.00		
	Aug-16											
	Sep-16											
	Feb-17	0	0.07	0	4.2	16.2	79.6	4.91	0.00	0.00		
	Jul-17	0	0.05	0	3.6	17.8	78.6	4.42	0.00	0.00		
	Feb-18	0	-0.05	0	3.8	16.1	80.1	4.98	0.00	0.00		
	Jun-18	0.6		0	3.3	16	79.2	4.95	0.00	0.02		
	Jun-18	0.4		0	1.7	18.6	79.6	4.28	0.00	0.01		
	Jul-18	0.1		0.1	0.4	20.3	79.2	3.90	0.00	0.00		
	Aug-18	0.1	0.08	0	1.2	20.3	78.5	3.87	0.00	0.00		
	Oct-18	0	0.1	0	2.3	17.9	79.8	4.46	0.00	0.00		
	Feb-19	0	-0.03	0	2	19.7	78.3	3.97	0.00	0.00		
	Jul-19	0	-0.03	0	3.5	17.9	78.6	4.39	0.00	0.00		
BH24	Feb-13			0	1	21.6	79	3.66	0.00	0.00		
	Aug-13			0	3.5	15.9	80.6	5.07	0.00	0.00		
	Mar-14			0	3.5	17.1	79.3	4.64	0.00	0.00		
	Jul-14			0	3.8	20.8	78.6	3.78	0.00	0.00		
	Mar-15			0	4.2	14.3	81.5	5.70	0.00	0.00		
	Jul-15	0	0.02	0	2.2	19.2	78.5	4.09	0.00	0.00		
	Feb-16	0	0.05	0	2.9	14.8	82.3	5.56	0.00	0.00		
	Jul-16	0	-0.29	0	4.4	17	78.6	4.62	0.00	0.00		
	Aug-16											
	Sep-16											
	Feb-17	0	0.09	0	4.8	16.4	78.8	4.80	0.00	0.00		
	Jul-17	0	-0.12	0	2.9	19.2	77.9	4.06	0.00	0.00		
	Feb-18			0	3.2	16.4	80.4	4.90	0.00	0.00		
	Aug-18	0	0	0	1.7	20.6	77.7	3.77	0.00	0.00		
	Oct-18	0	0.05	0	2.1	19.1	78.7	4.12	0.00	0.00		
	Feb-19	0	0.08	0	2.6	18.5	78.9	4.26	0.00	0.00		
	Jul-19	0	0	0	2.3	19.3	78.4	4.06	0.00	0.00		
BH25	Jul-16	0.1	0.38	0	9.5	8.4	82.1	9.77	0.00	0.01		
	Aug-16			0	7.2	9.3	83.5	8.98				
	Sep-16			0	9.1	5.0	85.9	17.18				
	Feb-17	0.1	0.51	0	3.5	17.2	79.3	4.61	0.00	0.00		
	Jul-17	0	-0.03	0	2.5	20.1	77.4	3.85	0.00	0.00		
	Feb-18	0	0	0	1.6	17.9	80.5	4.50	0.00	0.00		
	Jun-18	0.4		0	2.8	18.6	78.7	4.23	0.00	0.01		
	Jun-18	0.5		0	2.0	19.9	78.1	3.92	0.00	0.01		
	Jul-18	0	-0.01	0	1.7	19.8	78.4	3.96	0.00	0.00		
	Aug-18	0.1	0.11	0	1.5	20.1	78.4	3.90	0.00	0.00		
	Oct-18	0	0.09	0	2.6	17.9	79.5	4.44	0.00	0.00		
	Feb-19	0	0.1	0	2.6	19	78.4	4.13	0.00	0.00		
	Jul-19	0	0.07	0	7.7	12	80.2	6.68	0.00	0.01		
BH26	Jul-16	0	0.14	0.2	1.1	20.2	78.5	3.89	0.00	0.00		
	Aug-16			5.8	10.6	7	76.7	10.96				
	Sep-16			13.2	10.7	0.1	76.0	760.0				
	Feb-17	0	0.01	2.5	15.7	3.9	77.9	19.97	0.00	0.02		
	Jul-17	0	0.02	11.9	15.3	1.3	71.5	55.00	0.01	0.02		
	Feb-18	0	0.07	1.3	14.8	7.5	76.4	10.19	0.00	0.01		
	Jun-18	0		0.7	11.8	6.9	80.6	11.68	0.00	0.01		
	Jun-18	0.5		0.4	9.6	10.2	79.8	7.82	0.00	0.05		
	Jul-18	0	0.09	4.3	11.5	9.6	74.5	7.76	0.00	0.01		
	Aug-18	0.1	0.09	8.5	14.4	5.6	71.5	12.77	0.01	0.01		
	Oct-18	0	0.07	2.8	10.8	7.4	78.9	10.66216	0.00	0.01		
GasClam	Feb-19	NR		2-10	15-20	2-10						
	Jul-19	0	0.05	5.5	14.3	1	79.1	79.1	0.01	0.01		

Historical LFG Results
60563317 Eaglehawk

Balance to Oxygen (3.8); >3.8 in soils with oxidation as O2 is consumed CH4/CO2 0.8 in LFG GA detection limit 0.1 L/hr (if no detectable flow)

Bore ID	Date	Flow l/hr	Relative Pressure mb	CH4 %v/v	CO2 %v/v	O2 %v/v	%Balance	%bal/O2	GSV CH4%*flow	GSV CO2%*flow	GSV legend	CIRIA C665 (2007)
BH27	Jul-16	0	0.07	0	4.5	14.2	81.3	5.73	0.00	0.00		
	Aug-16			0	0.1	21	78.9	3.76				
	Sep-16			0	6.6	10.8	82.6	7.65				
	Feb-17	0	0.14	0	7.1	13.2	79.7	6.04	0.00	0.01		
	Jul-17	0	0.02	0	3.6	17.4	79.0	4.54	0.00	0.00		
	Feb-18	0.1	0.1	0	4.9	16.4	78.7	4.80	0.00	0.00		
	Jun-18	0.3		0	3.0	18.4	78.7	4.28	0.00	0.01		
	Jun-18	0.6		0	3.1	18.4	78.5	4.27	0.00	0.02		
	Jul-18	0	0.22	0	3.4	18.3	78.3	4.28	0.00	0.00		
	Aug-18	0.1	0.22	0	3.6	17.4	79	4.54	0.00	0.00		
	Oct-18	0	0.09	0	3.7	17.4	78.9	4.53	0.00	0.00		
	Feb-19	0	-0.07	0	5.6	17.5	76.9	4.39	0.00	0.01		
	Jul-19	0	0	0	4.6	15.1	80.3	5.32	0.00	0.00		
BH28	Jul-16	0	0.04	0	5.4	15.8	78.8	4.99	0.00	0.01		
	Aug-16			0	4.6	17.1	78.3	4.58				
	Sep-16			0	3.8	17.2	79.0	4.59				
	Feb-17	0	0.02	0	3.3	18.2	78.5	4.31	0.00	0.00		
	Jul-17	0	0.1	0	3.3	18.5	78.2	4.23	0.00	0.00		
	Feb-18	0	0.05	0.1	3.0	18.8	78.1	4.15	0.00	0.00		
	Jul-18	0		0.0	0.1	21.2	78.7	3.71	0.00	0.00		
	Aug-18	0.1	0.04	0	2.5	19.6	77.9	3.97	0.00	0.00		
	Oct-18	0	0.03	0	3.3	17.8	78.9	4.43	0.00	0.00		
	Feb-19	0	0.09	0	3.1	18.2	78.6	4.32	0.00	0.00		
	Jul-19	0	0.07	0	5.8	16.3	78	4.79	0.00	0.01		
BH29	Jun-18	0.7	0.07	0	9.7	7.3	83.1	11.38	0.00	0.07		
	Jun-18	0.3	0.14	0	9.9	7.1	83.0	11.69	0.00	0.03		
	Jul-18	0	0.09	0	9.8	7.8	82.3	10.55	0.00	0.01		
	Aug-18	0	0.16	0	9.9	7.5	82.6	11.01	0.00	0.01		
	Oct-18	0.01	0.03	0	11.8	6.8	81.5	11.99	0.00	0.00		
GasClam	Feb-19	NR		0	0-22	4-22						
	Jul-19	0.1	0.09	0	10.7	6.3	83.0	13.17	0.00	0.01		
BH30	Jun-18	0.1	-0.02	0	2.5	18.2	79.3	4.36	0.00	0.00		
	Jul-18	0.1	989	0	3.7	17.6	78.7	4.47	0.00	0.00		
	Aug-18	0.1	0.17	0	3.9	17.7	78.3	4.42	0.00	0.00		
	Oct-18	0	0.07	0	3.5	17.0	79.5	4.68	0.00	0.00		
GasClam	Feb-19	NR		0	4-6	14-18						
	Jul-19	0	-0.07	0	6.0	13.6	80.4	5.91	0.00	0.01		
BH31	Jun-18	0	0.03	0	1.9	18.9	79.1	4.19	0.00	0.00		
	Jul-18	0	0.07	0	5.5	15.1	79.3	5.25	0.00	0.01		
	Aug-18	0	0.1	0	6.0	15.0	79.1	5.27	0.00	0.01		
	Oct-18	0	0.1	0	5.3	14.7	80.0	5.44	0.00	0.01		
	Feb-19	0.1	0.12	0	5.5	16.6	77.8	4.69	0.00	0.01		
	Jul-19	0	-0.22	0	8.0	10.3	81.7	7.93	0.00	0.01		
BH32	Jun-18	0.5	-0.02	0	2.6	19.8	77.6	3.92	0.00	0.01		
	Jun-18	0.1	-0.03	0	0.7	21.1	78.2	3.71	0.00	0.00		
	Jul-18	0.1	0.03	0	4.1	19.5	76.4	3.92	0.00	0.00		
	Aug-18	0	0	0	4.4	19.5	76.2	3.91	0.00	0.00		
	Oct-18	0.1	0.11	0	3.5	18.3	78.1	4.27	0.00	0.00		
	Feb-19	0.1	0.16	0	4.3	17.5	78.1	4.46	0.00	0.00		
	Jul-19	0	-0.22	0	8.8	12.2	79.0	6.48	0.00	0.01		
BH33	Jun-18	0.5	0.1	0	2.3	19.3	78.8	4.08	0.00	0.01		
	Jun-18	0	0.14	0	1.8	19.6	78.6	4.01	0.00	0.00		
	Jul-18	0	0.11	0	2.6	19.3	78.1	4.05	0.00	0.00		
	Aug-18	0	0.05	0	2.6	19.3	78.1	4.05	0.00	0.00		
	Oct-18	0	0.04	0	2.9	18.1	79.1	4.37	0.00	0.00		
	Feb-19	0	0.11	0	4.4	17.4	78.2	4.49	0.00	0.00		
	Jul-19	0	0	0	3.5	17.5	79.0	4.51	0.00	0.00		
BH34	Jun-18	0.3	0.1	0	2.6	19.2	78.3	4.08	0.00	0.01		
	Jun-18	0.1	-0.03	0	2.4	19.6	78.0	3.98	0.00	0.00		
	Jul-18	0	0.07	0	0.1	21.6	78.4	3.63	0.00	0.00		
	Aug-18	0	0.04	0	5.4	18.6	76.0	4.09	0.00	0.01		
	Oct-18	0	0.05	0	5.5	16.4	78.1	4.76	0.00	0.01		
	Feb-19	0.1	0.15	0	5.9	16.5	77.5	4.70	0.00	0.01		
	Jul-19	0.1	-0.09	0	9.6	13.0	77.5	5.96	0.00	0.01		

Historical LFG Results
60563317 Eaglehawk

Balance to Oxygen (3.8); >3.8 in soils with oxidation as O2 is consumed CH4/CO2 0.8 in LFG GA detection limit 0.1 L/hr (if no detectable flow)

Bore ID	Date	Flow l/hr	Relative Pressure mb	CH4 %v/v	CO2 %v/v	O2 %v/v	%Balance	%bal/O2	GSV CH4%*flow	GSV CO2%*flow	GSV legend	CIRIA C665 (2007)
BH35	Jun-18	0.7	0.47	0	2.1	19.6	78.2	3.99	0.00	0.01		
	Jun-18	0	-0.02	0	1.5	19.6	78.9	4.03	0.00	0.00		
	Jul-18	0.1	0.09	0	3.0	19.5	77.5	3.97	0.00	0.00		
	Aug-18	0	0.02	0	3.4	20.0	76.6	3.83	0.00	0.00		
	Jan-18	0.1	0.09	0	3.5	17.9	78.6	4.39	0.00	0.00		
	Feb-19	0	0.06	0	2.9	18.7	78.4	4.19	0.00	0.00		
	Jul-19	-0.1	-0.07	0	6.2	16.7	77.2	4.62	0.00	-0.01		
BH36	Jun-18	0.5	0.14	0	1.5	20.4	78.1	3.83	0.00	0.01		
	Jun-18	0.8	-0.02	0	1.0	20.9	78.2	3.74	0.00	0.01		
	Jul-18	0	0	0	1.8	20.3	77.9	3.84	0.00	0.00		
	Aug-18	0.1	0.02	0	1.7	20.6	77.7	3.77	0.00	0.00		
	Oct-18	0	0.09	0	2.7	18.3	79.0	4.32	0.00	0.00		
	Feb-19	0	-0.09	0	3.6	18.4	78.1	4.24	0.00	0.00		
	Jul-19	-0.1	0.12	0	4.8	16.9	78.3	4.63	0.00	0.00		
BH37	Jun-18	1.2	-0.03	0	1.9	19.2	78.9	4.11	0.00	0.02		
	Jul-18	0	0.12	0	1.1	20.0	78.9	3.95	0.00	0.00		
	Aug-18	0.1	0.17	0	1.2	20.7	78.1	3.77	0.00	0.00		
	Oct-18	0	0.13	0	2.3	18.2	79.5	4.37	0.00	0.00		
	Feb-19	0	0.07	0	2.5	18.3	79.1	4.32	0.00	0.00		
	Jul-19	-0.1	-0.1	0	3.9	17.5	78.6	4.49	0.00	0.00		
BH38	Jun-18	0	-0.03	0	0.7	21.2	78.1	3.68	0.00	0.00		
	Jul-18	0.1	0.15	0	1.8	20.0	78.3	3.92	0.00	0.00		
	Aug-18	0.1	0.08	0	2.9	19.0	78.1	4.11	0.00	0.00		
	Oct-18	0	0.08	0	2.8	18.1	79.1	4.37	0.00	0.00		
	Feb-19	0	0.11	0	3.8	18.3	77.9	4.26	0.00	0.00		
	Jul-19	-0.1	0.03	0	4.7	16.6	78.7	4.74	0.00	0.00		
BH39	Jun-18	0	-0.03	0	1.6	20.0	78.4	3.92	0.00	0.00		
	Jul-18	0.1	0.07	0	0.1	21.4	78.5	3.67	0.00	0.00		
	Aug-18	0	0.05	0	4.7	15.5	79.7	5.14	0.00	0.00		
	Oct-18	0	0.1	0	3.7	17.1	79.2	4.63	0.00	0.00		
	Feb-19	0.1	0.13	0	4.7	16.8	78.5	4.67	0.00	0.00		
	Jul-19	-0.1	-0.1	0	5.8	11.6	82.6	7.12	0.00	-0.01		
BH40	Jun-18	0		0	1.5	20.1	78.4	3.90	0.00	0.00		
	Jul-18	0.1	0.07	0	0.1	21.4	78.5	3.67	0.00	0.00		
	Aug-18	0	-0.02	0	2.6	19.7	78.1	3.96	0.00	0.00		
	Oct-18	0	0.11	0	2.1	18.6	79.3	4.26	0.00	0.00		
	Feb-19	0	0.22	0	2.4	18.7	78.9	4.22	0.00	0.00		
BH15 leacha	Feb-16	0.5	1.22	75.3	20.5	0	4.1		0.38	0.10		

Project Name: Eaglehawk Landfill 2016 Monitoring
Job Number: 60563317
Client: City of Greater Bendigo
SITE: EAGLEHAWK LANDFILL
Monitoring Round: July 2019
Instrument: TDL-500 and GA5000

							TDL	GA5000						
			UTM Zone 55				CH_4		CO_2	O_2	Balance	CO	H_2S	Pressure
Location ID	Type	Description	Easting	Northing	Date	Time	ppmv	% v/v	% v/v	% v/v	% v/v	ppmv	ppmv	Barometric (mb)
EPA Action Level - Subsurface services on and adjacent to the landfill site								**5000-10000**						
EPA Action Level - Buildings/structures on and adjacent to the landfill site														
	Ambient	Carpark outside office			10/07/2019	9:40	1.6	0.0	0.1	21.2	78.8	0.0	0.0	986
St1	Structure	Exit Weighbridge (North)	253976	5931724	10/07/2019	11:33	1.3	0.0	0.1	20.9	79.0	0.0	0.0	984
St2	Structure	Entry Weighbridge (Nth)	253998	5931730	10/07/2019	11:29	1.9	0.0	0.1	21.0	78.9	0.0	0.0	984
Se1	Service	SW drain (West of site office)	254010	5931737	10/07/2019	11:31	30.2	0.0	0.1	21.0	79.0	0.0	0.0	984
Se2	Service	SW pit (Site entrance)	254007	5931747	10/07/2019	12:08	1.8	0.0	0.1	21.2	78.7	0.0	0.0	985
B1	Building	Brick (Nth side)	254006	5931733	10/07/2019	11:56	2.1	0.0	0.0	21.0	78.9	0.0	0.0	984
Se3	Service	Telephone line (Nth-East cnr brick building)	254007	5931745	10/07/2019	12:04	2.1	0.0	0.1	21.2	78.8	0.0	0.0	985
B2	Building	Brick (East side)	254023	5931734	10/07/2019	11:48	3.9	0.0	0.1	20.7	79.2	0.0	0.0	985
Se4	Service	Drain gatic brick building (East side)	254025	5931739	10/07/2019	11:55	9.6	0.0	0.1	20.9	79.0	0.0	0.0	985
Se5	Service	Water mains service pit	254024	5931726	10/07/2019	11:52	71.3	0.6	0.2	20.7	78.6	0.0	0.0	985
Se6	Service	Telstra pit (West of garages)	254011	5931719	10/07/2019	11:44	16.3%	16.0	4.5	6.2	73.5	0.0	0.0	985
Se7	Service	Open steel gatic (West of garages)	253993	5931693	10/07/2019	11:36	1.8	0.0	0.1	20.9	79.1	0.0	0.0	984
B3	Building	Recycling centre (Sth side)	253884	5931640	10/07/2019	9:57	2.0	0.0	0.1	21.2	78.7	0.0	0.0	986
B4	Building	First aid room (Recycling centre Sth side)	253860	5931645	10/07/2019	9:52	1.8	0.0	0.1	21.1	78.8	0.0	0.0	986
Se8	Service	SW pit (West of site building)	253982	5931705	10/07/2019	11:35	213.0	0.0	0.1	20.9	79.1	0.0	0.0	984
B5	Building	Inside site office/smoko room	254008	5931731	10/07/2019	11:59	6.0	0.0	0.1	21.1	78.9	0.0	0.0	984
Se9	Service	SW pit (w of weighbridge)	253982	5931712	10/07/2019	10:08	421.0	0.0	0.1	21.4	78.6	0.0	0.0	987
Se10	Service	SW Pit (curb near electric box)	253975	5931701	10/07/2019	10:05	2.8	0.0	0.1	21.3	78.6	0.0	0.0	986
Se11	Service	Recycling centre (cnr SE downpipe)	253898	5931664	10/07/2019	9:55	4000.0	0.1	0.1	21.2	78.8	0.0	0.0	986
Se12	Service	Recycling centre (cnr SW downpipe)	253868	5931643	10/07/2019	9:54	2.2	0.0	0.1	21.2	78.8	0.0	0.0	986
Se13	Service	Recycling centre (cnr NW downpipe)	253868	5931688	10/07/2019	9:49	16.5	0.0	0.1	21.1	78.8	0.0	0.0	986
Se14	Service	Recycling centre (cnr NE downpipe)	253873	5931688	10/07/2019	9:44	1.0	0.0	0.1	21.2	78.7	0.0	0.0	986
Se15	Service	Pit next to wheelwash	253941	5931689	10/07/2019	10:00	3.7	0.0	0.1	21.3	78.7	0.0	0.0	986
Se22	Service	Telstra Pit 2 (South of office)	253951	5931657	10/07/2019	10:03	122.0	0.0	0.1	21.3	78.6	0.0	0.0	987
B7	Building	New Portable (lunchroom/office)			10/07/2019	11:38	1.8	0.0	0.1	20.8	79.2	0.0	0.0	985
B8	Building	New Portable (toilets)			10/07/2019	12:01	2.3	0.0	0.1	21.1	78.8	0.0	0.0	984
Recycling Eco Centre														
Se16	Service	SW drain entrance	254065	5931778	10/07/2019	13:11	1.0	0.0	0.1	20.9	79.0	0.0	0.0	982
Se17	Service	SW drain carpark	254043	5931779	10/07/2019	13:13	0.9	0.0	0.1	21.0	78.9	0.0	0.0	982
Se18	Service	SW pit exit	254030	5931757	10/07/2019	12:59	1.5	0.0	0.1	21.0	78.9	0.0	0.0	982
Se19	Service	SW drain exit	254033	5931743	10/07/2019	12:57	29.9	0.0	0.1	21.0	78.9	0.0	0.0	982
Se20	Service	SW drain (near timber frames)	254065	5931715	10/07/2019	13:03	0.9	0.0	0.1	20.9	79.0	0.0	0.0	982
Se21	Service	Shed downpipe	254097	5931753	10/07/2019	13:06	1.0	0.0	0.0	21.0	79.0	0.0	0.0	982
B6	Building	Shed Site office	254092	5931747	10/07/2019	13:08	0.9	0.0	0.0	21.0	78.9	0.0	0.0	982
Leachate Sump														
St3	Structure	Leachate Sump 1	253502	5931466	Not Sampled									
		Leachate Sump 2												

ID	Easting	Northing	CH4_(ppmv)	Location
327	144.244376	-36.728078	1.0	Mud
328	144.244188	-36.727978	1.0	Mud
329	144.243972	-36.727921	1.1	Mud
330	144.243738	-36.727856	1.2	Grass
331	144.243466	-36.727856	1.2	Gravel
332	144.243210	-36.727873	1.3	Gravel
333	144.242957	-36.727895	1.3	Gravel
334	144.242727	-36.727931	1.4	Gravel
335	144.242448	-36.727944	1.3	Gravel
336	144.242187	-36.727945	1.4	Gravel
337	144.241929	-36.727945	1.3	Gravel
339	144.241665	-36.727995	1.5	Gravel
340	144.241414	-36.728054	1.5	Gravel
341	144.241164	-36.728130	1.6	Gravel
342	144.240943	-36.728207	1.5	Gravel
343	144.240723	-36.728303	1.6	Gravel
344	144.240505	-36.728418	1.8	Gravel
345	144.240311	-36.728537	1.6	Gravel
346	144.240030	-36.728667	1.5	Gravel
347	144.239844	-36.728791	1.6	Gravel
348	144.239624	-36.728906	1.6	Gravel
349	144.239418	-36.729038	3.7	Clay/Gravel
350	144.239234	-36.729166	2.3	Clay/Gravel
351	144.238983	-36.729287	1.7	Clay/Gravel
352	144.239127	-36.729443	1.9	Grass
353	144.239347	-36.729323	2.0	Grass
354	144.239591	-36.729220	8.5	Clay Cap
355	144.239766	-36.729075	1.8	Clay Cap
356	144.239967	-36.728988	4.5	Clay Cap
357	144.240179	-36.728855	1.8	Grass
358	144.240362	-36.728726	1.5	Grass
359	144.240582	-36.728596	3.0	Clay
360	144.240791	-36.728477	5.0	Gravel
361	144.240990	-36.728357	1.5	Grass
362	144.241218	-36.728264	1.6	Grass
363	144.241474	-36.728193	2.5	Clay
364	144.241743	-36.728130	1.5	Grass
365	144.242028	-36.728117	1.6	Grass
366	144.242304	-36.728117	1.7	Grass
367	144.242587	-36.728103	1.6	Grass
368	144.242844	-36.728087	1.5	Grass
369	144.243116	-36.728067	1.5	Grass
370	144.243383	-36.728065	1.6	Long Grass
371	144.243651	-36.728088	1.6	Long Grass
372	144.243931	-36.728143	1.5	Long Grass
373	144.244201	-36.728203	1.6	Mud
374	144.244016	-36.728350	1.4	Mud road/track
375	144.243778	-36.728406	1.5	Mud road/track
376	144.243516	-36.728489	1.6	Mud road/track
377	144.243269	-36.728526	1.4	Mud road/track
378	144.243014	-36.728578	1.3	Mud road/track
379	144.242810	-36.728633	1.4	Mud road/track
380	144.242531	-36.728715	1.4	Mud road/track
381	144.242328	-36.728859	1.5	Mud road/track
382	144.242116	-36.728960	1.5	Mud road/track
383	144.241873	-36.729104	1.6	Mud road/track
384	144.241614	-36.729006	2.0	Grass
385	144.241328	-36.728928	2.2	Grass

ID	Easting	Northing	CH4_(ppmv)	Location
386	144.241062	-36.728873	1.4	Grass
387	144.240806	-36.728839	1.3	Grass
388	144.240577	-36.728971	1.5	Grass
389	144.240376	-36.729111	1.3	Grass
390	144.240158	-36.729240	2.1	Grass
391	144.239946	-36.729350	2.2	Grass
392	144.239739	-36.729496	1.7	Grass
393	144.239528	-36.729629	2.0	Grass
394	144.239732	-36.729763	1.9	Grass
395	144.239946	-36.729631	1.9	Rocks
396	144.240182	-36.729539	1.9	Dirt
397	144.240425	-36.729456	4.5	Dirt
398	144.240710	-36.729367	2.0	Dirt
399	144.240999	-36.729399	1.6	Clay
400	144.241288	-36.729498	1.6	Clay
401	144.241570	-36.729417	2.2	Clay
402	144.241859	-36.729358	1.8	Cap
403	144.242147	-36.729297	1.4	Grass
404	144.242420	-36.729189	1.3	Cap/Gravel
405	144.242398	-36.728959	1.4	Grass
406	144.242672	-36.728875	1.4	Grass
407	144.242868	-36.729013	1.3	Grass
408	144.242706	-36.729312	1.4	Grass
409	144.242447	-36.729504	1.3	Grass
410	144.242226	-36.729653	1.2	Grass
411	144.241613	-36.729679	1.7	Dirt
412	144.241372	-36.729840	1.2	Dirt
413	144.240992	-36.729941	3.0	Dirt
414	144.240650	-36.729940	2.4	Dirt
415	144.240455	-36.730133	5.7	Dirt
416	144.240409	-36.730342	5.4	Grass
417	144.240836	-36.730216	1.7	Clay
418	144.241292	-36.730177	2.8	Dirt
419	144.241681	-36.730077	4.1	Dirt
420	144.242115	-36.730089	1.8	Grass
421	144.242546	-36.730119	1.8	Grass
422	144.242933	-36.730059	1.5	Dirt road
423	144.242979	-36.729771	1.4	Grass
424	144.243484	-36.729820	1.6	Dirt
425	144.243729	-36.729699	1.5	Dirt
426	144.243918	-36.729551	1.7	Dirt
427	144.244168	-36.729433	1.7	Dirt
428	144.244365	-36.729202	1.6	Dirt
429	144.244634	-36.729017	1.5	Dirt
430	144.244873	-36.729208	1.6	Dirt
431	144.245098	-36.729375	2.6	Dirt
432	144.244765	-36.729488	1.9	Grass
433	144.244570	-36.729698	1.8	Dirt
434	144.244330	-36.729853	1.8	Grass
435	144.244024	-36.729959	2.1	Grass
436	144.243788	-36.730125	1.9	Dirt
437	144.243526	-36.730279	2.2	Grass
438	144.243332	-36.730440	2.1	Grass
439	144.243098	-36.730636	1.9	Grass
440	144.242805	-36.730785	2.8	Grass
441	144.242637	-36.731006	2.8	Grass
442	144.242407	-36.731269	1.9	Dirt road
443	144.242704	-36.731173	1.9	Grass

ID	Easting	Northing	CH4_(ppmv)	Location
444	144.242967	-36.731051	2.0	Grass/Dirt
445	144.243249	-36.730922	1.9	Grass/Dirt
446	144.243552	-36.730784	1.8	Grass/Dirt
447	144.243818	-36.730625	2.5	Dirt
449	144.244223	-36.730426	1.5	Grass
450	144.240292	-36.730540	3.8	Grass
451	144.240166	-36.730797	16.7	Grass
452	144.240116	-36.731059	25.1	Grass/Bark
453	144.240068	-36.731262	11.0	Grass/Clay
454	144.240149	-36.731500	3.2	Grass
454A	144.240430	-36.731570	7.7	Clay
455	144.240730	-36.731506	2.9	Grass
456	144.241042	-36.731435	2.4	Grass
457	144.241340	-36.731339	2.5	Grass
458	144.241637	-36.731219	2.3	Bark
459	144.241906	-36.731054	1.9	Bark
460	144.242156	-36.730877	2.5	Grass
461	144.242413	-36.730723	3.5	Grass
462	144.242640	-36.730554	4.3	Grass
463	144.242274	-36.730426	4.5	Grass
464	144.241987	-36.730600	3.5	Grass
465	144.241703	-36.730780	3.3	Dirt
466	144.241361	-36.730935	3.5	Dirt
467	144.241052	-36.731074	3.1	Dirt
468	144.240746	-36.731168	3.9	Grass
469	144.240370	-36.731070	5.6	Grass/Bark
470	144.240692	-36.730927	3.8	Grass/Bark
471	144.241080	-36.730748	2.3	Grass
472	144.241387	-36.730627	4.3	Bark
473	144.241606	-36.730392	3.6	Dirt
474	144.240787	-36.730520	2.2	Dirt
475	144.241989	-36.731422	1.4	Dirt road
476	144.241680	-36.731535	2.0	Dirt road
477	144.241362	-36.731619	2.2	Dirt road
478	144.241048	-36.731699	1.4	Dirt road
479	144.240729	-36.731793	1.3	Dirt road
480	144.240421	-36.731890	1.3	Dirt road
481	144.240137	-36.731848	1.2	Dirt road
482	144.239868	-36.731676	0.9	Dirt road
483	144.240348	-36.729981	2.9	Dirt road
484	144.240158	-36.730206	2.4	Clay
485	144.240009	-36.730413	20.9	Clay
486	144.239931	-36.730666	14.8	Clay
487	144.239839	-36.730882	13.8	Clay
488	144.239812	-36.731119	8.3	Clay
489	144.239819	-36.731442	3.7	Clay
490	144.239597	-36.731142	2.1	Dirt road
491	144.239567	-36.730881	2.7	Dirt road
492	144.239603	-36.730661	6.7	Clay
493	144.239640	-36.730458	5.4	Clay
494	144.239766	-36.730241	2.7	Clay
495	144.239893	-36.730084	6.4	Grass
496	144.239571	-36.730066	36.0	Clay
497	144.239367	-36.729863	44.0	Clay
498	144.239220	-36.729619	1.4	Clay
499	144.243227	-36.729282	0.9	Grass
500	144.243471	-36.729145	1.0	Clay
501	144.243763	-36.729049	1.3	Clay

ID	Easting	Northing	CH4_(ppmv)	Location
502	144.244057	-36.728959	2.5	Clay
503	144.244228	-36.728683	1.2	Clay
504	144.243958	-36.728593	1.3	Grass
505	144.243735	-36.728702	1.4	Clay
506	144.243277	-36.728929	1.3	Clay
		AVERAGE	3.2	

Instrument: TDL500			12/06/2018	7-9/08/2018	10-11/07/2019			
ID	**Easting**	**Northing**	**CH4 ppm**	**CH4 ppm**	**CH4 ppm**	**Location**	**Comment**	**Additional Detail**
1	254011	5931704	4	2.1	1.4	Carpark	Ambient Air adjacent to Se7	
2	253996	5931703	6.7	2.4	1.8	Water Pit	Se7	
3	254005	5931718	11.40%	1305.0	16.3%	Telstra Pit	Se6	
4	253873	5931908	3.9	2.6	1.2	SW	Offsite	
5	253875	5931925	3.8	2.5	1.4	SW	Offsite	cnr Violet
6	253831	5931945	4	2.6	1.2	CULVERT	Offsite	Empty Block
7	253817	5931957	3.7	2.6	1.1	Water Pit	Offsite	
8	253815	5931965	3.5	2.5	1.0	SW	Offsite	
9	253810	5931980	3.7	2.5	1.0	SW	Offsite	
10	253801	5931974	3.6	2.5	1.0	SW	Offsite	Outside 13 Violet
11	253788	5931988	3.6	2.5	0.9	CULVERT	Offsite	Outside 9 Violet
12	253780	5931995	3.6	2.5	0.9	SW	Offsite	Outside 9 Violet
13	253778	5931992	3.7	2.5	0.9	Telstra Pit	Offsite	Outside 9 Violet
14	253761	5932009	3.8	2.5	0.9	CULVERT	Offsite	
15	253746	5932023	3.8	2.5	0.9	CULVERT	Offsite	
16	253727	5932006	3.9	2.4	1.1	SW	Offsite	
17	253725	5932009	3.8	2.4	1.2	CULVERT	Offsite	
18	253708	5932007	3.9	2.4	1.1	CULVERT	Offsite	Outside 5 Violet
19	253667	5932040	4.1	2.4	not measured	CULVERT	Offsite	
20	253677	5932001	4.3	2.4	1.1	PIT	Offsite	
21	253683	5932000	3.9	2.4	1.2	Water Pit	Offsite	
22	253679	5931994	4.5	2.4	1.1	CULVERT	Offsite	
23	254029	5931864	4.4	2.1	1.2	Telstra Pit	Offsite	Next to Green traffic box
24	254028	2531862	4.6	2.1	1.3	SW	Offsite	Next to Give Way sign
25	254022	2531863	4.7	2.2	1.2	SW	Offsite	Worksource Eaglehawk sign
26	254012	5931855	4.8	2.1	not measured	Water Pit	Offsite	Outside Eaglehawk autoelectrical
27	253995	5931861	4.7	2.1	1.2	Telstra Pit	Offsite	Outside Eaglehawk autoelectrical
28	253996	5931867	4.6	2.1	1.3	SW	Offsite	Outside Eaglehawk autoelectrical
29	253959	5931902	4.5	2.1	1.3	Telstra Pit	Offsite	
30	253953	5931909	4.4	2.1	1.3	SW	Offsite	Large Grate
31	253944	5931908	4.4	2.1	1.3	SW	Offsite	Cnr Green shed
32	253935	5931915	4.6	2.1	1.3	SW	Offsite	Over rd from #31
33	253920	5931894	4.6	2.1	1.3	Telstra Pit	Offsite	Outside green roller door
34	253964	5931862	4.7	not measured	not measured	DOWN PIPE	Offsite	Closed gates
35	253925	5931841	4.5	2.1	1.2	Telstra Pit	Offsite	Outside Bendigo Insulation
36	253927	5931843	4.6	2.1	1.2	PIT	Offsite	Outside Bendigo Insulation
37	253935	5931839	4.5	2.1	1.4	Water Pit	Offsite	Outside Flood building
38	253965	5931830	4.5	2.1	1.4	SW	Offsite	Over rd from #39
39	253965	5931819	4.6	2.1	1.5	SW	Offsite	Ouside Central Vic Pet Cremations
40	253991	5931789	4.3	2.1	1.3	ELECTRICITY BOX	Offsite	
41	253992	5931797	4.7	2.1	1.1	DW	Offsite	
42	254002	5931806	4.5	2.1	1.3	DW	Offsite	
43	254016	5931824	4.4	2.1	1.4	DW	Offsite	Outside office 1
44	254016	5931820	4.5	2.1	1.4	Telstra Pit	Offsite	On footpath next to tree
45	254018	5931829	4.8	2.1	1.4	DOWN PIPE	Offsite	off building/shop
46	254029	5931841	23.4	2.1	7.3	GAS Manifold on Shop	Offsite	
47	253679	5931980	4.5	2.4	1.1	CULVERT	Offsite	
48	253677	5931968	44	2.4	1.3	CULVERT	Offsite	Outside 10 Walker Crescent
49	253677	5931953	4.5	2.4	1.2	CULVERT	Offsite	Outside 14 Walker Crescent
50	253844	5931876	4.4	2.3	1.2	CULVERT	Offsite	
51	253825	5931849	4.5	2.3	1.1	CULVERT	Offsite	
52	253885	5931925	3.9	2.1	1.2	SW	Offsite	
53	253918	5931962	4.1	2.1	1.3	SW	Offsite	Cnr Bragg and UCG rd
54	253915	5931975	4.1	2.1	1.2	SW	Offsite	Cnr Bragg and UCG rd
55	253896	5931987	4	2.1	1.3	SW	Offsite	Outside 201 UCG rd
56	253896	5931985	3.9	2.2	1.3	Telstra Pit	Offsite	Outside 201 UCG rd
57	253864	5932011	3.6	2.3	1.3	Water Pit	Offsite	Outside 203 UCG rd
58	253860	5932011	3.8	2.3	not measured	Telstra Pit	Offsite	
59	253860	5932014	3.8	2.3	1.2	SW	Offsite	Outside 203 UCG rd
60	253854	5932012	3.9	2.3	1.1	SW	Offsite	Outside 203 UCG rd
61	253780	5932082	3.6	2.4	1.0	SW	Offsite	
62	253740	5932081	3.3	2.4	not measured	Telstra Pit	Offsite	
63	253745	5932159	3.2	2.4	not measured	HOLLOW	Offsite	
64	253757	5932145	3.4	2.4	1.1	SW	Offsite	
65	253787	5932092	3.3	2.4	1.1	SW	Offsite	Outside Central Line Marking
66	253806	5932080	2.7	2.3	1.1	Telstra Pit	Offsite	Outside Greg Boyd Motors
67	253860	5932032	3.6	2.2	1.0	Telstra Pit	Offsite	Outside Midland Wrecking
68	253923	5931983	3.6	2.2	0.6	Telstra Pit	Offsite	
69	253951	5931942	3.6	2.1	1.1	SW	Offsite	Under Give Way sign
70	254030	5931846	4.6	2.1	1.3	SW	Offsite	Over rd from #69
71	254040	5931856	4.7	2.2	1.3	SW	Offsite	Under Scott Cr Sign
72	254043	5931856	4.7	2.2	1.2	Telstra Pit	Offsite	Under Scott Cr Sign
73	254040	5931845	4.7	2.3	1.1	SW	Offsite	Next to Give Way sign
74	254057	5931842	5.4	2.3	1.3	SW	Offsite	Next to Carpark (Tipshop)
75	254053	5931835	4.7	2.3	1.3	SW	Offsite	Cnr of Tipshop
76	254032	5931808	4.8	2.3	1.1	SW	Offsite	Near Cactus
77	254038	5931798	4.8	2.3	1.4	SW	Offsite	Near sign/entrance
78	254045	5931801	4.7	2.3	1.3	SW	Offsite	
79	254064	5931837	4.6	2.2	1.2	SW	Offsite	
80	254070	5931839	4.5	2.2	1.3	SW	Offsite	Cnr of UCG rd
81	254094	5931825	4.5	2.4	0.9	SW	Offsite	Ecocentre back entrance
82	254105	5931815	4.6	2.4	1.0	SW	Offsite	Ecocentre back entrance
83	254136	5931788	4.4	2.4	1.0	SW	Offsite	cnr UCG rd and Turner St
84	254142	5931780	4.4	2.4	0.9	SW	Offsite	cnr UCG rd and Turner St
85	254145	5931798	4.5	2.4	1.0	SW	Offsite	Under Power pole
86	254150	5931801	4.5	2.4	1.1	Telstra Pit	Offsite	Cnr Victoria and UCG rd
87	254199	5931864	4.4	2.4	1.1	CULVERT	Offsite	Outside 4 Victoria St
88	254257	5931914	4.4	2.4	0.9	SW	Offsite	
89	254256	5931933	4.6	2.4	1.1	SW	Offsite	West of Victoria St
90	254263	5931960	4.6	2.4	1.2	SW	Offsite	Cnr TT building
91	254227	5931978	4.7	2.4	1.0	DITCH	Offsite	
92	254203	5931924	4.7		not measured	DITCH	Offsite	Not accessible
93	254187	5931928	4.8		not measured	CONDUIT	Offsite	Not accessible

Instrument: TDL500			12/06/2018	7-9/08/2018	10-11/07/2019			
ID	**Easting**	**Northing**	**CH4 ppm**	**CH4 ppm**	**CH4 ppm**	**Location**	**Comment**	**Additional Detail**
94	254154	5931933	4.7		not measured	CONDUIT	Offsite	Not accessible
95	254193	5931892	4.5	2.3	1.0	CLUBHOUSE	Offsite	
96	254167	5931887	4.6	2.3	1.0	CONDUIT	Offsite	
97	254141	5931870	4.4	2.3	1.1	SHIPPING CONTAINER	Offsite	
98	254053	5931054	6.2	2.3	not measured	SW	Offsite	
99	254029	5931898	4.2	2.1	not measured	SW	Offsite	
100	254009	5931888	4.1	2.1	1.1	SW	Offsite	
101	254192	5931764	3.6	2.4	1.1	SW	Offsite	
102	254207	5931752	3.7	2.4	1.2	Telstra Pit	Offsite	
103	254233	5931727	3.7	2.4	1.0	SW	Offsite	
104	254260	5931687	3.5	2.4	1.0	Telstra Pit	Offsite	
105	254359	5931605	3.5	2.4	1.3	Telstra Pit	Offsite	
106	254389	5931580	3.6	2.4	1.2	Telstra Pit	Offsite	
107	254392	5931582	3.5	2.4	1.2	SW	Offsite	171 UCG rd
108	254404	5931587	3.5	2.4	1.0	SW	Offsite	
109	254409	5931565	3.4	2.4	1.1	CONDUIT	Offsite	171 UCG rd
110	254470	5931510	3.4	2.4	1.1	Telstra Pit	Offsite	165 UCG rd
111	254508	5931483	3.1	2.3	0.9	SW	Offsite	
112	254525	5931491	3.3	2.3	1.0	SW	Offsite	
113	254584	5931519	3.2	2.4	1.0	SW	Offsite	Park entrance
114	254456	5931463	3.4	2.2	0.8	SW	Offsite	cnr Victoria St
115	254163	5931038	3.5	2.3	1.0	W	Offsite	
116	254179	5931028	3.9	2.4	1.0	CULVERT	Offsite	
117	254190	5931033	3.9	2.3	1.1	CULVERT	Offsite	73 Hosten
118	254206	5931037	4.1	2.4	1.1	CONDUIT	Offsite	
119	254226	5931048	4.1	2.4	1.2	W	Offsite	
120	254240	5931068	4.3	2.5	1.2	SW	Offsite	
121	254192	5931128	4.4	2.5	1.1	W	Offsite	32 Butler
122	254255	5931063	4.2	2.4	1.2	SW	Offsite	24 Staley
123	254356	5931113	4.4	2.4	1.2	SW	Offsite	
124	254429	5931163	4.3	2.2	0.9	F-HYDRANT	Offsite	Ouside School
125	254444	5931162	4.4	2.3	1.0	CULVERT	Offsite	Butler
126	254545	5931183	4.3	2.1	1.1	Telstra Pit	Offsite	
127	254544	5931212	4.3	not measured	not measured	Telstra Pit	Offsite	
128	254088	5931829	not measured	2.5	0.9	Telstra Pit	Offsite	Eaglehawk Ecocentre sign
129	254113	5931807	not measured	2.5	1.1	Telstra Pit	Offsite	Over rd from Victoria st
130	254192	5931849	not measured	2.4	1.2	Telstra Pit	Offsite	Victoria St
131	254217	5931872	not measured	2.4	0.9	Telstra Pit	Offsite	Under Watson Ave sign
132	254273	5931929	not measured	2.4	1.0	SW	Offsite	Cnr Brown and Victoria
133	254278	5931929	not measured	2.4	1.1	SW	Offsite	Cnr Brown and Victoria
134	254286	5931935	not measured	2.4	1.1	SW	Offsite	Cnr Brown and Victoria
135	254265	5931952	not measured	2.4	1.2	Hydrant	Offsite	Cnr of TT building
136	254259	5931940	not measured	2.4	1.1	Telstra Pit	Offsite	Near #89
137	254263	5931961	not measured	2.4	1.1	Small Drain	Offsite	Cnr of TT building
138	254272	5931971	not measured	2.4	1.0	SW grate	Offsite	
139	254290	5931985	not measured	2.3	1.1	DOWN PIPE	Offsite	Sandstone building
140	254292	5931985	not measured	2.3	1.0	Small SW grate	Offsite	
141	254303	5931987	not measured	2.3	1.1	Water Manifold	Offsite	Irrigation Control
142	254304	5931992	not measured	2.3	1.0	Sewer Vent	Offsite	3x Vents
143	254316	5932002	not measured	2.3	1.1	SW Grate	Offsite	
144	254307	5932014	not measured	2.3	1.0	SW Grate	Offsite	
145	254291	5932032	not measured	2.3	0.9	SW	Offsite	
146	254281	5932055	not measured	2.4	1.0	SW	Offsite	in Carpark
147	254276	5932063	not measured	2.4	1.1	SW Grate	Offsite	
148	254264	5932022	not measured	2.5	1.0	SW Grate	Offsite	
149	254260	5932023	not measured	2.5	0.8	SW Grate	Offsite	
150	254257	5932027	not measured	2.5	0.8	SW Grate	Offsite	
151	254249	5932030	not measured	2.5	0.9	SW Grate	Offsite	
152	254218	5932013	not measured	2.5	0.9	SW concrete	Offsite	
153	254218	5932013	not measured	2.5	1.2	Grate under Downpipe	Offsite	
154	254223	5932008	not measured	2.5	1.1	Grate under Downpipe	Offsite	
155	254227	5932009	not measured	2.5	1.1	Grate under Downpipe	Offsite	
156	254231	5931998	not measured	2.5	1.0	Grate under Downpipe	Offsite	
157	254238	5931989	not measured	2.5	1.1	Grate under Downpipe	Offsite	
158	254243	5931983	not measured	2.5	1.0	Grate under Downpipe	Offsite	
159	254250	5931976	not measured	2.4	1.0	Grate under Downpipe	Offsite	
160	254253	5931969	not measured	2.4	0.9	Grate under Downpipe	Offsite	
161	254198	5931894	not measured	2.4	1.0	Water Meter	Offsite	
162	254168	5931877	not measured	2.3	not measured	Sewer Vent on Toilet Block	Offsite	
163	253852	5932032	not measured	2.3	1.0	SW	Offsite	205 UCG rd
164	253763	5932103	not measured	2.4	1.1	Telstra Pit	Offsite	Cnr Everley and UCG rd
165	253676	5932074	not measured	2.4	1.2	SW	Offsite	Bracewell
166	253686	5932073	not measured	2.4	1.1	Telstra Pit	Offsite	Bracewell
167	253683	5932002	not measured	2.4	1.2	Telstra Pit	Offsite	
168	253725	5932005	not measured	2.4	1.0	Telstra Pit	Offsite	3 Violet
169	253880	5931928	not measured	2.6	1.2	SW grate	Offsite	
170	254427	5931127	not measured	2.3	1.0	Telstra Pit	Offsite	Cnr Bailey and Staley
171	254479	5931083	not measured	2.3	1.0	Telstra Pit	Offsite	22 Staley
172	254246	5931068	not measured	2.5	1.2	Telstra Pit	Offsite	22 Staley
173	254224	5931051	not measured	2.4	1.2	Telstra Pit	Offsite	Cnr Hosten and Butler
174	254168	5931022	not measured	2.2	1.0	Telstra Pit	Offsite	
175	254437	5931160	not measured	2.2	1.0	Telstra Pit	Offsite	Outside School
176	254514	5931296	not measured	2.1	1.2	Telstra Pit	Offsite	
177	254521	5931316	not measured	2.1	1.1	Telstra Pit	Offsite	15 Vinton
178	254503	5931322	not measured	2.1	1.1	Telstra Pit	Offsite	10A Vinton
179	254503	5931330	not measured	2.1	1.2	SW	Offsite	10A Vinton
180	254511	5931335	not measured	2.1	1.2	SW	Offsite	11 Vinton
181	254454	5931452	not measured	2.2	1.0	SW	Offsite	Cnr Vinton
182	254443	5931447	not measured	2.2	1.1	SW	Offsite	Cnr Vinton
183	254442	5931443	not measured	2.2	1.0	Hydrant	Offsite	Cnr Vinton
184	254424	5931550	not measured	2.1	1.1	Telstra Pit	Offsite	162C UCG rd

ATTACHMENT 8 PLATES



Plate 1

SD01, minor flow, sampled during higher flow



Plate 2

SD02A, very low flow, not sampled



Plate 3

SD03, flowing at approx. 10 L/min, sampled at these conditions



Plate 4

SD05, very low flow, not sampled



Plate 5

SD06, minor flow, sampled at higher flow conditions



Plate 6

SD07, very low flow, not sampled



Plate 7

SW01, dry, not sampled

NOISE

global environmental solutions

Eaglehawk Landfill

Environmental Noise Assessment

Report Number 640.11501-R01

23 October 2017

City of Greater Bendigo

PO Box 733

Bendigo, Vic. 3552

Version: v1.0

Eaglehawk Landfill

Environmental Noise Assessment

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Suite 2, 2 Domville Avenue
Hawthorn VIC 3122 Australia

+61 3 9249 9400 +61 3 9249 9499
melbourne@slrconsulting.com www.slrconsulting.com

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

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DOCUMENT CONTROL

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640.11501-R01-v1.0	23 October 2017	Graeme Campbell	JA	Graeme Campbell
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Executive Summary

SLR Consulting Australia Pty Ltd was retained by the City of Greater Bendigo to assess noise emissions from the operation of the Eaglehawk Landfill.

Recommended maximum noise levels under the EPA's NIRV guideline have been calculated for the most affected residential dwellings to the north of the site.

Noise measurements of mobile plant were carried out at the site, along with two weeks of noise and vibration logging.

The operational noise was modelled based on site noise measurements and using SoundPlan software for two operational scenarios under enhanced meteorological conditions.

Noise emissions have been predicted to comply with the respective daytime and evening noise limits for the site.

Recommendations have been provided for mitigation treatment for the green waste mulcher and gas generator.

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APPENDICES

Appendix A Noise logging results
Appendix B Vibration logging results
Appendix C Predicted noise contour map of current operations
Appendix D Prediicted noise contour map of proposed operations using the north road

1 INTRODUCTION

SLR Consulting Australia Pty Ltd was commissioned by the City of Greater Bendigo to conduct a noise and vibration assessment of the current operations at the Eaglehawk Landfill.

The objectives of this study were to:

1. Establish noise level design goals (criteria) for environmental noise emissions at potentially noise affected sensitive receivers.
2. Carry out noise and vibration measurements near the closest residence to determine compliance with EPA and relevant standards.
3. Develop a computer noise model (incorporating the surrounding topography and all acoustically significant plant and equipment) to enable the calculation of predicted noise levels at the nearest potentially affected noise sensitive receivers.
4. From results of the computer modelling, assess noise levels from current and proposed future operations to the noise criteria at the nearest potentially affected receivers.
5. Compare the predicted level of noise emissions from the facility with the design goals, and where required recommend appropriate noise mitigation measures that will result in compliance with the relevant criteria.

We were requested to carry out two weeks of noise and vibration monitoring as part of the assessment.

2 PROJECT DESCRIPTION AND SITE DETAILS

The landfill site is located approximately 4.5 km north-west of the Bendigo CBD. **Figure 1** shows the location of the facility relative to the nearest dwellings and roads.

There is a public waste recycling depot adjacent to the entrance road to the landfill site, as well as small factory suites to the north of the road. There is a garden supplies depot adjacent to the east of the landfill.

The site is designated as a Public Use Zone 6 with the nearest residential premises located to the north within a General Residential Zone. The surrounding area is undulating terrain.

Figure 1 Aerial image of site and surrounds

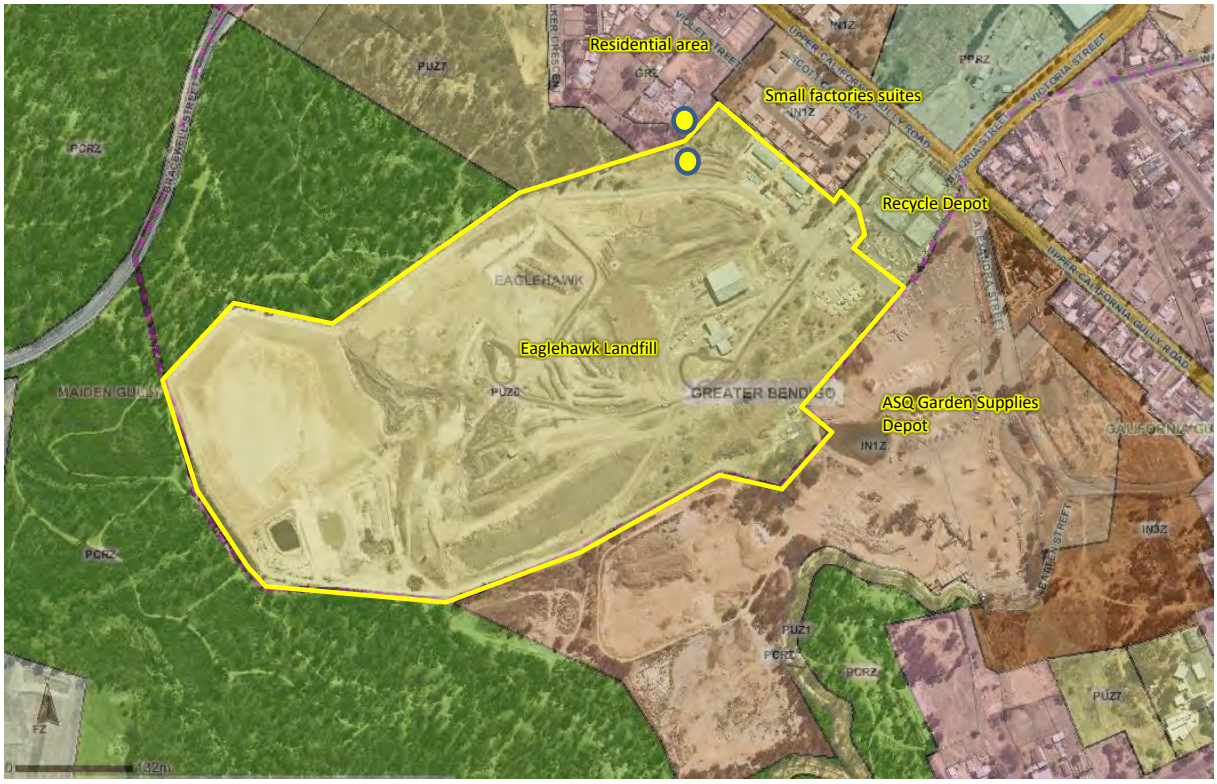


Image courtesy of DELWP

Noise and vibration measurement locations

2.1 Site Layout

Currently the landfill is filling in the north-west corner of the site and progressing to the south. There is already filled land in the centre of the site.

The main entrance road is off Upper California Gully Road to the east via a weighbridge. The main building on the centre of the site is a waste recycling facility. Green waste is mulched occasionally to the east of this main shed.

There is a gas generator situated on the south boundary of the site.

Operations on the site include movement of kerbside trucks, green waste trucks, residual waste trucks, street sweepers, residential cars with hard waste, and landfill excavators, compactors, water truck, and bulldozer.

2.2 Hours of Operation

The current operating hours for the site are as follows:

Monday to Sunday 7:00 am to 5:00 pm

2.3 Nearest Sensitive Receptors

The nearest residences are identified in the aerial photograph presented in **Figure 1.** A complaint about excessive noise had been received from one of these residents at 10 Bragg Street. The residence behind this dwelling at 16 Walker Crescent, is slightly more elevated and so we have considered noise emissions to this dwelling also.

3 OPERATIONAL NOISE LIMITS

3.1 Victorian Environment Protection Authority Requirements

The required outcomes relevant to this site include compliance with the EPA guideline entitled *"Noise from Industry in Regional Victoria"* (NIRV) Publication 1411, dated October 2011.

NIRV has been provided by the EPA to determine recommended maximum noise levels for industries in regional Victoria. It uses land use zonings as a basis for establishing recommended noise levels at residential receivers. NIRV allows for adjustments to be applied to the recommended noise level where high background noise levels, or multiple industries are present. Further adjustments can be applied based on the distance between the receiver and the industry zone and where the industry is an extractive type industry.

There are separate recommended noise levels for the day, evening and night periods defined as follows:

Table 1 Applicable Periods for NIRV

Day	Monday to Friday	0700h to 1800h
	Saturday	0700h to 1300h
Evening	Monday to Friday	1800h to 2200h
	Saturday	1300h to 2200h
	Sunday & Public Holidays	0700h to 2200h
Night	Monday to Sunday	2200h to 0700h

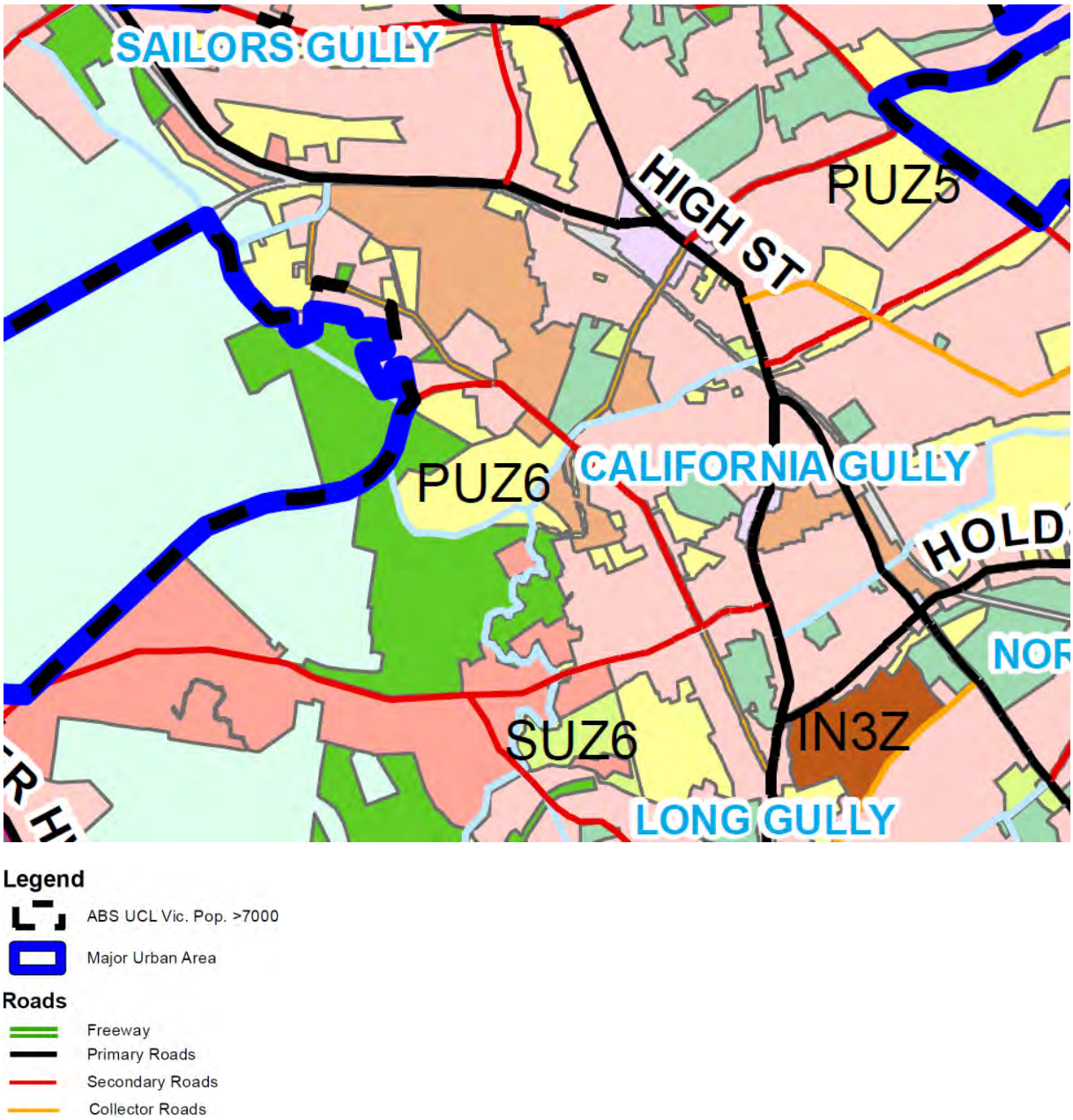
For the assessment of noise, NIRV refers to the procedures provided in the *'State Environment Protection Policy (Control of noise from commerce, industry and trade) No. N-1'* (SEPP N-1). SEPP N-1 is a statutory policy applicable in the Melbourne metropolitan area; it does not have mandatory status in regional Victoria. Whilst not used for the derivation of noise limits (in regional Victoria), SEPP N-1 provides the assessment methodology which allows the application of adjustments to the noise level to account for characteristics which make the noise more or less annoying (such as tonality, impulsiveness, intermittency, duration etc).

To determine if noise emissions from an industry or other business are excessive, the effective noise level (determined in accordance with SEPP N-1) is compared with the recommended maximum noise level established using NIRV, or the noise limits established using SEPP N-1.

Review of the land-use zoning maps in the area as shown in **Figure 2** indicate that the nearest residences are within the urban growth boundary and therefore according to NIRV are in a major urban area. The recommended maximum noise levels from the landfill are therefore determined from SEPP N-1.

Under SEPP N-1 noise limits are based on the land-use zoning of the area surrounding the residence, as defined by the relevant authority, and on the measured background noise levels at the residence when those levels are especially high or low.

Figure 2 SEPP boundary map North-East



3.2 Background noise

Background noise measurements were not specifically carried out in the area although continuous noise logging was carried out at the nearest residence at 10 Bragg Street to measure noise from the facility. Analysis of this logging indicated that there was occasional noise from industry but it was not continuous and therefore this data could be used as a measure of background noise level in the area.

The measurement microphone was approximately 1.3 m above the ground and the calibration was checked before and after the measurements. Measurements were carried out between 22 August and 6 September 2017.

The noise logger (ARL NGARA serial number 878086) was situated on the front lawn of the dwelling beside the front fence.

Figure 3 Noise logger location 10 Bragg Street



The results of the background noise measurements are given in **Appendix A**. The results are summarised in **Table 2** below. The weather conditions during the measurement period were generally dry with no significant rain, and light to moderate winds mainly from the west or south.

Table 2 Summary of background noise measurements, L90[1], dBA

Period	Tue 22	Wed 23	Thu 24	Fri 25	Sat 26	Sun 27	Mon 28	Tue 29	Wed 30	Thu 31	Fri 1	Sat 2	Sun 3	Mon 4	Tue 5	Lowest value
Day	-	41	41	39	39	-	39	38	41	42	43	42	-	43	42	38
Evening	29	35	35	31	34	39	34	28	38	37	40	41	40	34	35	31
Night	25	30	30	26	30	31	27	26	31	31	33	34	33	32	28	25

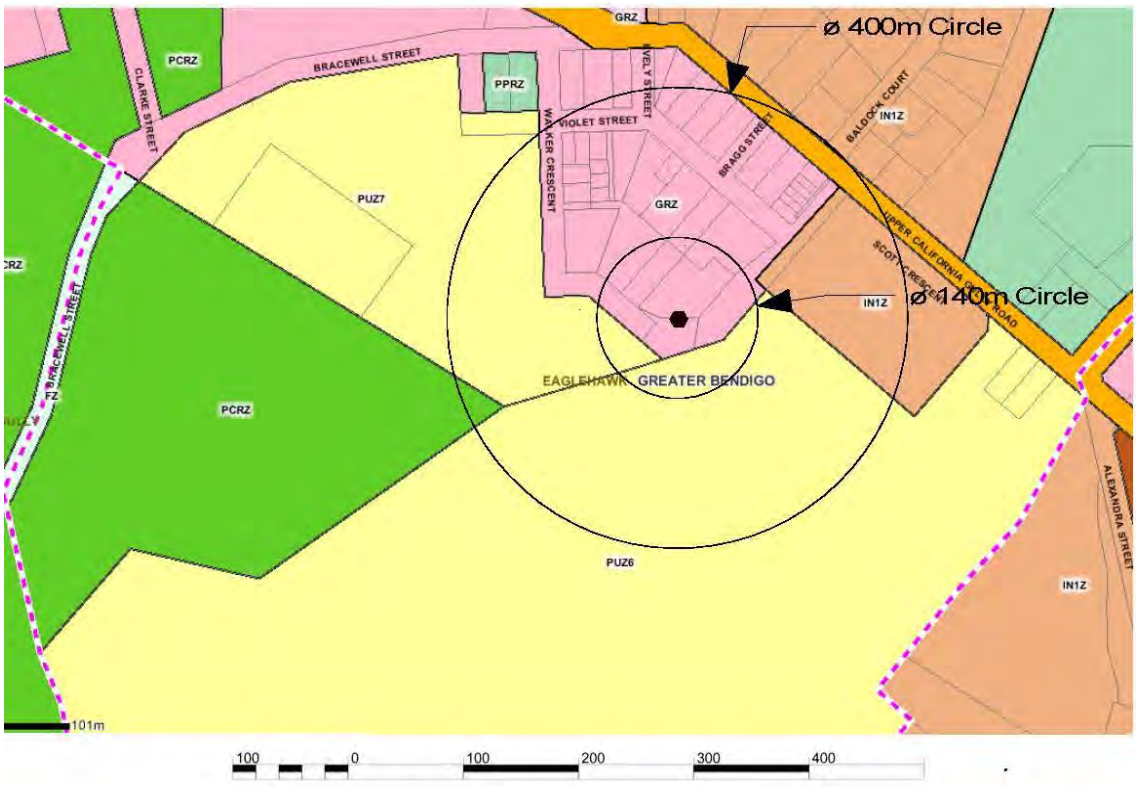
Note: Evening results on Sundays are unusually high, partly due to strong winds.

3.3 Zoning levels

The surrounding land-use zonings in the area are shown in **Figure 4.** The site is situated in a Public Use Zone 6 (PUZ6).

[1] L90 - The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level. Arithmetic average of hourly L90's shown for each period.

Figure 4 SEPP N-1 Zoning Level calculation



NRZ1 Neighbourhood Residential Zone = Type 1
GRZ General Residential Zone = Type 1
PUZ6 Public Use Zone = Type 3
PPRZ Public Park & Recreation Zone = Type 1
RDZ2 Road zone category 2 = Type 2
CRZ1 Commercial 1 Zone = Type 2
Industrial zone 1 = Type 3
PCRZ Public Conservation & Resource Zone = Type 1
PUZ7 Public Use Zone 7 = Type 1

NORTH

SEPP N-1 INFLUENCING FACTORS AND ZONING LEVELS

10 Bragg Street, Eaglehawk, Bendigo			
	AREA, %		
SEPP N-1 ZONE	Type 1 (eg. Residential)	Type 2 (eg. Commercial)	Type 3 (eg. Heavy Industry)
Circle -140m diameter:	75%	0%	25%
Circle - 400m diameter:	51%	2%	47%
INFLUENCING FACTOR:		0.3659	
ZONING LEVEL, dB:	Day	Evening	Night
	57	50	45

SLR Consulting Pty Ltd
Consultants in Acoustics, Noise and Vibration
Suite 6, 131 Bulleen Road
BALWYN NORTH
VICTORIA 3104
A.B.N. 29 001 584 612
Telephone: (03) 9249 9400
Facsimile: (03) 9249 9499

SEPP N-1 Zone Map for
10 Bragg Street, Eaglehawk

DRAWN: GRC	DATE: 01 Sept 2017	SCALE Approx. 1:2640	JOB NO. / DWG NO. 640.11501 / 1A4	REVISION

3.4 SEPP N-1 Noise Limits

Table 3 shows the calculation of the noise limits for the residence at 10 Bragg Street. **Table 3** shows the calculation of the noise limits. To be conservative we have used the lowest measured background noise level for each period.

Table 3 SEPP N-1 noise limits (NIRV recommended maximum noise levels)

Total Influencing Factor	0.3659
Zoning Levels, dBA	
Day	57
Evening	50
Night	45
Measured background noise level at position, L_{90}, dBA	
Day	38 (Low)
Evening	31 (Low)
Saturday (1300h-2200h)	34 (Low)
Sunday (0700h-2200h) (used Sat.)	34 (Low)
Night	25 (Low)
Noise Limit, dBA	
Day	52
Evening	44
Saturday (1300h-2200h)	45
Sunday (0700h-2200h)	45
Night	38

Note: Due to multiple industries being present, the above limits are for the total noise emitted. For each industry's contribution the limit would be 3 dB less than the above.

3.5 Effects of meteorology on noise levels

Currently the EPA SEPP N-1 does not address in detail the assessment of noise emissions under prevailing atmospheric conditions such as wind and temperature inversions. However their measurement guidelines require that noise limits are not to be exceeded under weather conditions favourable for noise propagation from the industry to the noise sensitive receiver that occur for at least 20% of the time.

Noise emissions have been predicted under weather conditions favourable for noise propagation from the industry to the noise sensitive receivers in accordance with this requirement.

3.6 Emissions from other industries

There is potential noise from the nearby ASQ industry to the east of the site, as well as other industries to the north.

4 ASSESSMENT OF VIBRATION IMPACTS

4.1 Vibration

A vibration logger was deployed on the site near the north-east corner opposite the nearest residences to measure ground vibration. See **Figure 5**. The logger (Instantel Minimate BE 10612, and Geophone BG12606) were deployed on the 7 August and collected on the 22 August 2017.

The logger continuously measured the level of vibration and recorded the highest peak particle velocity in all three orthogonal directions every one minute.

Figure 5 Location of vibration logger, boundary near north-east corner of site



The results of the vibration logging are shown in **Appendix B**. There was no significant ground vibration measured over the period and the highest level recorded was 0.13 mm/s. This level of vibration would not be perceptible. A vibration level of 1 mm/s may just be perceived by a person, whereas 5 mm/s would be noticeable and 10 mm/s significantly noticeable.

4.2 Noise

A noise logger was deployed in the front yard of the residence at 10 Bragg Street which is located north of the site. See **Figure 3.** The logger was initially deployed on the 7 August but it failed on the 11 August 2017. It was re-started on the 22 August and recorded until the 6 September 2017. The results of the second deployment are given in Appendix A.

An audio recording was available from the noise logger which enabled a review of any specific events.

Staff at the facility recorded the date and time of any significant noise events over the period. This is replicated below.

Table 4 Notes of significant noise events heard during monitoring period

Date	Source	Comment (from review of recorded audio)
8 Aug 2017	ASQ crushing at 7am, stopped at 9am	Just audible
9 Aug 2017	Landfill street sweeper cleaning roads around weighbridge 2:30pm to 3pm	Not audible
11 Aug 2017	Landfill loader and dump truck moving green waste from behind weighbridge, 2 to 4:15pm	Recording not available
15 Aug 2017	ASQ crusher operating, 7:30am, unsure of finish	Recording not available
23 Aug 2017	Loud banging and clanging from One Steel at lunchtime	Just audible
24 Aug 2017	ASQ crush operating at 7:30am	Not clearly audible
25 Aug 2017	ASQ crush operating at 7:30am	Not clearly audible
30 Aug 2017	FEO knocking in their steel bins with backhoe approx. 4pm to 4:10pm	Not clearly audible

The dominant noise measured by the noise logger was bird song and distant traffic. There was some industrial noise such as reversing beepers and truck movements but it is not known where these were located.

Table 5 shows a summary of the Leq noise levels measured by the logger outside the residence. Because there was no clear period of industry noise from the site or from other industries, we have compared the overall measured noise level due to the contribution of background noise and some industry noise, to the NIRV recommended maximum noise levels.

This indicates that apart from a few days where the excess was small, one of which was a very windy day (Sunday 3 September), the measured Leq noise level typically did not exceed the recommended maximum noise level for the day, evening and night periods. And that during this period there was normal operation of the landfill and likely from other industries.

Table 5 Noise logging summary results, Leq (arithmetic average hourly Leq's)

Period	Tue 22	Wed 23	Thu 24	Fri 25	Sat 26	Sun 27	Mon 28	Tue 29	Wed 30	Thu 31	Fri 1	Sat 2	Sun 3	Mon 4	Tue 5
Day		51	52	51	52	-	52	52	53	50	51	52	-	52	51
Evening	39	39	39	38	44	48	40	35	42	43	44	47	54	42	43
Night	33	37	36	33	38	36	34	33	38	39	39	42	41	40	35
NIRV recommended maximum noise level															
Day	52	52	52	52	52	-	52	52	52	52	52	52	-	52	52
Evening	44	44	44	44	45	45	44	44	44	44	44	45	45	44	44
Night	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38

… Level exceeds RMNL

5 NOISE MODELLING

In order to determine the noise levels at the nearest residential receivers from the landfill operations, a noise model was prepared using SoundPlan noise modelling software.

Noise modelling of the proposed operations was conducted using the ISO 9613 algorithms incorporated in the SoundPLAN V7.3 noise modelling software. The algorithm predicts sound pressure levels under meteorological conditions favourable to propagation from sources to receivers. This includes the effect of air absorption, ground attenuation and shielding to predict noise levels at the surrounding receptors, and assumes downwind propagation, or, equivalently, propagation under a moderate ground-based temperature inversion.

5.1.1 Noise Sources

SLR carried out noise level measurements of the main items of plant at the landfill site on 7 August 2017. Sound power levels of these items of equipment are listed in **Table 6** below.

Table 6 Sound power level data for modelled plant items, Leq

Name	Source	Lw	Comment	Octave Band Centre Frequency, Hz						
		dBA		63	125	250	500	1k	2k	4k
				dB	dB	dB	dB	dB	dB	dB
CAT LD1215 Front End Loader	Point	105	2m high	110	102	101	101	101	97	92
Volvo Front End Loader	Point	101	2m high	115	109	98	96	96	92	88

Street Sweeper, idle	Point	104	2m high	105	103	103	102	98	95	90
Street Sweeper	Point	101	2m high	105	102	101	98	95	93	87
Komatsu Excavator PC200LC	Point	99	2m high	104	107	99	97	91	90	87
Bomag Compactor LC4477	Point	114	2m high	111	124	108	111	105	105	103
Oz Line Dozer PD285-1	Point	112	2m high	116	117	111	110	106	103	95
Bin Tipper	Point	100	2m high	94	95	90	90	98	93	84
Kerbside Truck	Line	95	2m high, 15/30 min. = -3dB included	98	91	88	89	91	88	83
Water Truck	Line	92	2m high, 5/30 min. = -8 dB included	86	87	82	82	90	85	76

5.2 Noise modelling results

Two operational scenarios have been modelled;

- one representing the current operations;
- another representing kerbside and water truck movements along the north access road;

It has been conservatively assumed that all plant for each operating condition are operating on the site simultaneously over a 30 minute assessment period, which in reality may not be the case and therefore lower noise levels may be present compared to the predicted noise levels shown in this report.

We have assumed that the kerbside truck movements occur along the road over a cumulative total of 15 minutes for a 30 minute period from the gatehouse to the landfill cell. Similarly we have assumed that the water truck operates along the road for a period of 5 minutes in a 30 minute period.

The noise barrier fence at the north boundary to Bragg Street has been included in the model and provides significant noise reduction to 10 Bragg Street.

Table 7 shows the predicted effective noise level at the closest residential receivers to the site along with the NIRV recommended maximum noise levels.

Table 7 Noise modeling results, predicted operational noise levels, dBA

Scenario	Residential dwelling	
	10 Bragg Street	16 Walker Crescent
1. Current operations	39	41
2. Access road to the north	39	41
RMNL (-3 dB for multiple industries)		
Day	49	49
Evening	41	41
Saturday 1300h-12200h	42	42
Sunday 0700h-2200h	42	42
Night	35	35

Note: No adjustments for noise character have been applied.

A noise contour plot was generated for both of the above operational scenarios to show the propagation of noise from the site. These are presented in **Appendices C & D**.

From the above results it can be seen that compliance is achieved for both operational scenarios for the day and evening operations.

The dominant source of noise to the residential locations was from the two front end loaders located near the green waste mulcher and recycled waste facility. The proposed bin truck movements on the north road were the next dominant source in this proposed scenario.

The reason for the dominance of the front end loaders is due mainly to their closer proximity to the residences and the reduced shielding.

When the landfill cell becomes filled and the mobile plant become more elevated, then noise from these sources will contribute more and the overall noise level from the site will increase.

The predicted results indicate that there is no margin for tonal or impulsive adjustments of the noise from current operations. These adjustments would be either +2 or +5 dB depending on their loudness. These adjustments would typically apply to reversing beepers, tail gate bangs and crashes, empty bin trucks driving over speed humps, and the green waste mulcher.

Therefore it is recommended that broadband reversing alarms be used on the mobile plant on the site, and that speed humps not be used on the north road if this is used for access to the landfill cell.

Noise from the adjacent ASQ garden depot was not clearly measured at the logger location, but it is suspected of being audible. It, and other nearby industries, may contribute characteristic noise such as banging, which makes it more audible.

6 DISCUSSION

We have not included the operation of the gas generator and the green waste mulcher in the noise calculations because they were not operating at the time of our site attendance and so we could not measure them.

Based on our calculations of these two sources with estimated noise spectra we have concluded that the gas generator will not significantly contribute to the noise level at the residences with a sound power level of 110 dBA due to the substantial shielding provided by the site and its greater distance away even.

Noise from the green waste mulcher must be less than 110 dBA sound power level, (or ~82 dBA sound pressure level at 10m away) to not exceed the RMNL at the residences. This includes a tonal adjustment of +5 dB.

Alternatively the green waste mulcher must be either located further away from the residences, or enclosed or substantially shielded.

7 CONCLUSION

SLR Consulting Australia Pty Ltd was retained by the City of Greater Bendigo to assess noise emissions from the operation of the Eaglehawk Landfill.

Recommended maximum noise levels under the EPA's NIRV guideline have been calculated for the most affected residential dwellings to the north of the site. The operational noise was modelled using SoundPlan software for two operational scenarios under enhanced meteorological conditions.

Noise emissions have been predicted to comply with the respective daytime and evening noise limits for the site.

Recommendations have been provided for mitigation treatment for the green waste mulcher and gas generator.

NOISE MONITORING RESULTS

SLR

SLR Consulting Australia Pty Ltd
6/131 Bulleen Rd
Balwyn North VIC 3104

Results of Noise Monitoring

Client: City of Greater Bendigo
Job Number: 640.11501 **Location:** 10 Bragg Street, Eaglehawk
Microphone position: front yard, 1.4m **Initials:** GRC
Initial calibration: 94 dBA **Final calibration:** 94 dBA

Hour	Sound Pressure Level, dB(A)																				
	Tue, 22-08-2017			Wed, 23-08-2017			Thu, 24-08-2017			Fri, 25-08-2017			Sat, 26-08-2017			Sun, 27-08-2017			Mon, 28-08-2017		
	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}
00:00 to 01:00				31.7	22.5	30.0	36.0	28.3	42.8	34.6	28.5	32.4	35.0	25.4	33.5	34.3	26.9	32.1	33.5	29.1	31.8
01:00 to 02:00				30.1	22.1	31.7	33.8	28.1	32.1	36.0	28.8	33.2	32.3	23.7	29.9	31.8	25.0	29.8	34.8	29.3	33.4
02:00 to 03:00				29.0	21.5	28.5	35.1	27.6	34.3	36.4	28.1	35.1	32.6	22.9	30.6	33.0	25.4	31.0	33.1	28.0	32.3
03:00 to 04:00				33.6	22.7	33.6	34.5	28.0	34.0	34.2	27.8	34.0	30.2	23.5	28.6	56.1	34.7	51.7	35.2	28.2	34.7
04:00 to 05:00				34.0	23.4	32.2	35.8	29.5	33.9	35.5	28.3	34.0	29.8	24.4	28.4	46.2	36.2	42.9	35.7	30.0	33.7
05:00 to 06:00				37.6	29.4	35.3	38.4	31.4	36.2	39.3	31.1	37.5	34.6	23.6	33.3	41.1	31.8	37.6	40.4	34.0	38.3
06:00 to 07:00				45.1	34.0	44.6	47.9	36.0	47.7	48.3	37.4	47.8	46.5	30.4	46.3	47.4	35.6	46.8	47.8	38.4	47.4
07:00 to 08:00				51.5	40.4	52.3	52.6	42.6	54.0	50.9	43.9	51.5	53.9	39.3	55.0	56.9	39.3	54.9	53.4	41.8	54.1
08:00 to 09:00				52.9	40.3	52.9	53.0	42.2	54.9	53.7	42.8	54.1	53.3	38.7	54.7	52.6	38.5	52.5	57.2	42.1	54.6
09:00 to 10:00				51.1	38.6	50.8	52.6	41.7	56.9	48.9	41.7	49.7	54.7	38.1	54.5	54.4	43.1	51.9	51.0	40.7	50.2
10:00 to 11:00	54.3	38.9	79.1	47.6	37.8	47.7	47.9	40.6	50.5	49.6	39.1	48.5	48.1	38.5	50.4	54.9	43.9	53.8	50.2	39.6	52.8
11:00 to 12:00	47.2	38.4	46.2	49.0	39.0	49.9	50.0	43.9	50.5	48.5	36.8	50.2	48.0	38.9	49.0	52.8	41.9	49.8	50.7	39.2	52.4
12:00 to 13:00	44.9	37.6	43.7	57.5	40.7	55.7	48.8	41.8	47.6	57.1	37.9	53.1	48.8	38.3	48.2	51.6	42.1	48.6	48.2	39.3	48.0
13:00 to 14:00	46.1	37.8	47.4	50.8	41.2	51.4	48.9	41.3	47.9	48.6	36.6	47.8	48.2	38.8	48.8	53.0	42.7	50.1	50.2	39.0	52.5
14:00 to 15:00	48.2	39.2	48.0	51.1	41.0	51.8	48.2	40.9	51.3	49.1	37.5	48.8	46.6	38.3	47.2	54.9	41.9	53.6	49.8	38.0	50.8
15:00 to 16:00	47.5	39.6	48.7	52.3	42.5	52.5	50.3	40.6	49.2	50.7	38.4	55.7	49.1	37.8	50.4	52.6	41.3	51.9	47.6	39.3	51.7
16:00 to 17:00	59.4	38.3	56.2	53.2	41.3	51.7	51.2	39.7	52.9	49.7	39.2	52.6	47.9	36.8	51.2	53.9	41.1	51.6	53.6	38.5	53.1
17:00 to 18:00	49.7	35.3	52.1	50.1	42.4	47.8	52.3	39.0	57.3	49.1	35.1	52.0	46.8	35.2	49.5	46.1	35.0	47.1	46.9	35.3	48.5
18:00 to 19:00	39.9	30.6	37.0	43.9	37.3	41.4	41.6	35.7	39.8	41.4	32.4	38.4	40.3	32.1	47.0	40.0	33.8	38.0	43.4	35.8	41.4
19:00 to 20:00	38.5	29.9	37.1	40.7	36.3	39.1	40.8	35.7	38.8	40.6	32.7	38.5	37.6	30.1	35.1	39.3	34.5	37.6	41.3	34.0	39.0
20:00 to 21:00	37.5	28.2	45.4	39.9	34.2	38.7	40.9	35.0	38.9	39.2	29.9	36.5	37.1	27.9	34.6	39.8	33.0	45.6	40.5	33.5	45.2
21:00 to 22:00	37.1	27.2	34.5	39.7	31.6	37.1	39.8	34.7	38.0	38.1	30.2	36.4	37.0	28.9	34.6	38.1	32.8	36.2	37.3	31.1	35.1
22:00 to 23:00	34.3	23.6	31.6	37.9	31.3	35.6	38.5	32.4	36.2	37.1	28.7	35.4	35.4	28.8	33.3	37.3	30.3	36.5	35.2	28.6	33.6
23:00 to 24:00	31.7	22.9	30.1	34.1	27.9	32.1	35.6	29.8	33.8	37.1	28.0	34.1	35.3	28.3	33.2	36.2	30.0	34.2	32.0	26.0	30.3
$L10_{(18h)}$, L_{eq}, 6-24h				47.1			46.7			46.5			45.3			47.9			46.5		
$L_{eq(15h)}$, log av 7-22h						50.6			52.0			50.7			50.5			50.8			50.9
$L_{eq(9h)}$, log av 22-7h			36.7			40.3			39.7			38.0			44.1			39.5			41.6
$L_{eq(24h)}$, log av 0-24h						48.7			50.1			48.8			48.6			49.2			49.1
L90 Day					40.5			41.3			39.0			38.6						39.3	
L90 Evening		29.0			34.9			35.3			31.3			34.0			39.0			33.6	
L90 Night		24.7			29.8			30.2			25.6			30.3			30.8			27.4	
Wind @0900h, km/h		E 6						S 9			SW 7			SSW 20			S 11				
Wind @1500h, km/h								SW 20			SW 17			W 17			S 22			SE 11	

Weather Data from Bureau of Meteorology AWS, Bendigo

Hourly percentiles based on Lp at 0.1s intervals

v. 640.11501 10BraggSt CESARL8_20170201.xlsm, Printed : 07-09-2017 5:16 PM

SLR

SLR Consulting Australia Pty Ltd
6/131 Bulleen Rd
Balwyn North VIC 3104

Results of Noise Monitoring

Client: City of Greater Bendigo
Job Number: 640.11501 **Location:** 10 Bragg Street, Eaglehawk
Microphone position: front yard, 1.4m **Initials:** GRC
Initial calibration: 94 dBA **Final calibration:** 94 dBA

Hour	Sound Pressure Level, dB(A)																				
	Tue, 29-08-2017			Wed, 30-08-2017			Thu, 31-08-2017			Fri, 01-09-2017			Sat, 02-09-2017			Sun, 03-09-2017			Mon, 04-09-2017		
	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}
00:00 to 01:00	30.5	23.9	29.1	31.6	24.6	31.1	35.7	28.0	33.5	40.1	27.8	37.3	42.5	31.9	40.2	43.4	30.1	40.2	50.1	34.2	47.5
01:00 to 02:00	30.0	24.3	29.4	31.3	23.7	29.3	33.4	26.8	31.4	37.8	28.6	35.8	40.8	31.3	39.7	41.3	31.5	39.3	43.6	31.9	40.8
02:00 to 03:00	30.0	24.5	28.3	30.5	23.5	28.0	33.7	26.9	32.1	39.4	28.8	38.0	37.4	30.3	35.1	44.1	35.5	41.3	39.0	29.9	36.4
03:00 to 04:00	33.8	25.1	33.7	33.8	24.6	33.9	38.0	28.8	38.9	40.1	29.0	37.5	36.8	30.5	34.7	46.0	35.3	42.5	39.1	30.2	37.8
04:00 to 05:00	35.2	26.7	33.2	37.8	26.2	35.2	36.3	30.9	34.5	39.3	29.5	36.1	37.7	30.9	35.4	43.5	31.1	39.8	41.5	33.5	39.1
05:00 to 06:00	38.9	30.0	36.8	35.6	28.0	33.6	42.2	33.4	39.4	43.1	32.3	40.0	39.2	33.0	36.9	43.1	32.1	40.1	44.2	33.5	40.8
06:00 to 07:00	49.0	37.5	50.6	48.5	36.2	48.6	49.7	40.2	50.2	51.7	41.5	50.6	47.7	37.5	47.4	44.8	31.9	43.5	48.8	37.5	47.8
07:00 to 08:00	57.2	43.4	56.5	52.3	40.8	53.4	51.3	43.9	52.5	52.3	45.7	51.7	51.4	40.5	52.2	56.8	35.8	52.7	52.6	41.2	53.6
08:00 to 09:00	53.4	41.2	54.0	58.5	40.5	56.0	56.1	44.4	55.5	51.5	46.0	50.9	53.1	41.9	55.2	53.9	38.9	54.0	52.8	43.6	53.7
09:00 to 10:00	49.0	37.7	50.8	50.9	39.5	54.5	53.6	44.9	55.0	53.9	44.2	50.8	53.4	43.9	54.5	60.7	42.9	57.8	52.1	43.7	53.4
10:00 to 11:00	49.7	37.6	54.5	50.0	38.4	53.9	51.4	42.8	49.2	53.7	43.1	50.7	51.1	43.2	52.6	64.8	43.4	60.1	52.2	43.4	49.9
11:00 to 12:00	50.9	39.6	47.3	51.7	41.0	50.0	49.6	42.5	48.8	54.3	42.2	53.1	49.5	42.6	49.7	82.2	42.5	77.9	52.6	44.2	50.7
12:00 to 13:00	57.0	37.7	52.3	52.3	41.3	48.6	48.2	41.1	48.0	54.3	41.9	50.8	48.2	41.1	46.8	53.9	42.0	50.3	52.6	43.8	49.9
13:00 to 14:00	51.1	37.2	50.5	51.3	39.2	47.8	47.5	38.8	46.6	49.9	41.7	48.3	48.6	41.2	47.8	53.9	43.3	50.9	54.6	45.6	52.7
14:00 to 15:00	47.9	37.2	51.3	51.3	41.2	51.4	46.6	39.8	44.9	49.2	41.3	49.6	48.6	40.9	46.6	55.6	45.3	52.4	51.8	40.5	51.6
15:00 to 16:00	52.4	37.9	54.1	50.5	41.9	52.8	47.8	39.1	46.7	49.9	41.8	48.7	50.1	42.3	50.3	53.6	42.7	53.9	53.2	42.9	52.9
16:00 to 17:00	48.5	35.4	50.9	60.7	41.5	57.2	50.5	39.8	51.4	50.0	42.4	51.8	49.0	42.6	48.5	53.7	41.6	52.1	50.5	42.4	49.0
17:00 to 18:00	47.4	32.4	54.2	51.6	41.6	54.4	52.2	39.8	53.0	52.2	41.8	53.2	49.1	43.0	47.8	52.5	42.5	50.8	47.6	38.7	48.7
18:00 to 19:00	39.3	29.5	36.4	45.0	38.9	44.1	46.2	39.5	44.3	46.9	41.5	45.5	46.7	41.6	46.4	46.9	35.8	56.6	44.5	35.3	48.1
19:00 to 20:00	38.7	28.5	35.6	44.4	38.6	42.3	44.8	38.0	42.5	46.0	39.9	44.3	46.8	41.1	45.9	48.3	37.2	50.2	38.4	30.2	36.8
20:00 to 21:00	39.0	27.0	35.9	44.0	38.0	42.6	45.3	37.2	42.8	45.3	38.7	43.4	48.2	41.7	45.9	41.4	33.2	44.8	44.7	34.3	44.5
21:00 to 22:00	35.3	24.9	32.6	41.5	34.6	39.3	43.7	34.1	40.8	45.2	37.9	42.7	46.4	38.0	47.2	41.0	33.0	38.8	42.9	34.3	39.9
22:00 to 23:00	33.1	24.5	30.8	39.5	32.6	37.1	42.1	30.0	39.7	43.7	34.4	42.9	46.2	39.2	43.7	41.2	31.5	38.9	41.2	33.2	38.4
23:00 to 24:00	30.3	23.9	30.2	38.1	29.9	40.4	40.4	28.4	36.7	43.1	32.6	40.4	47.7	38.3	44.7	40.8	32.7	38.5	39.1	29.9	39.1
$L10_{(18h)}$, L_{eq}, 6-24h	46.1			49.0			48.2			49.6			49.0			52.6			48.5		
$L_{eq(15h)}$, log av 7-22h			51.7			52.3			50.3			50.1			50.3			66.4			50.7
$L_{eq(9h)}$, log av 22-7h			39.8			42.1			42.6			41.2			42.1			42.9			41.7
$L_{eq(24h)}$, log av 0-24h			49.9			50.5			48.6			48.5			48.7			64.4			49.1
L90 Day		37.9			40.6			41.5			42.9			42.2						42.7	
L90 Evening		27.5			37.5			37.2			39.5			41.4			40.0			33.5	
L90 Night		26.1			30.8			30.7			32.5			33.9			32.8			32.1	
Wind @0900h, km/h		SSW 11			SW 15			SSE 15			E 11			NNE 9			WSW 22			WNW 20	
Wind @1500h, km/h		W 9			SSE 19			ENE 7			NNE 17			NE 11			W 37			W 19	

Hourly percentiles based on Lp at 0.1s intervals

v. 640.11501 10BraggSt CESARL8_20170201.xlsm, Printed : 07-09-2017 5:16 PM

NOISE MONITORING RESULTS

SLR

SLR Consulting Australia Pty Ltd
6/131 Bulleen Rd
Balwyn North VIC 3104

Results of Noise Monitoring

Client: City of Greater Bendigo
Job Number: 640.11501 **Location:** 10 Bragg Street, Eaglehawk
Microphone positio front yard, 1.4 **Initials:** GRC
Initial calibration: 94 dBA **Final calibration:** 94 dBA

Hour	Sound Pressure Level, dB(A)																							
	Tue, 05-09-2017			Wed, 06-09-2017																				
	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}	L_{eq}
00:00 to 01:00	39.7	29.5	36.7	33.3	25.2	35.5																		
01:00 to 02:00	42.8	30.1	39.5	31.8	23.9	29.5																		
02:00 to 03:00	40.3	29.1	37.2	32.2	25.0	30.5																		
03:00 to 04:00	42.5	32.6	39.4	34.0	25.7	34.5																		
04:00 to 05:00	41.8	32.7	38.9	33.2	26.0	32.4																		
05:00 to 06:00	41.5	33.3	38.8	37.3	30.5	35.1																		
06:00 to 07:00	49.2	38.1	48.7	47.9	37.4	46.1																		
07:00 to 08:00	51.4	40.7	52.4	53.0	39.8	52.9																		
08:00 to 09:00	51.3	43.0	54.4	51.7	41.2	52.2																		
09:00 to 10:00	51.0	42.0	53.4	50.9	40.1	51.8																		
10:00 to 11:00	51.2	41.8	52.2	48.2	40.1	46.6																		
11:00 to 12:00	52.1	43.0	49.6																					
12:00 to 13:00	50.2	41.4	47.5																					
13:00 to 14:00	51.5	40.5	49.2																					
14:00 to 15:00	53.5	43.5	50.8																					
15:00 to 16:00	53.0	44.2	51.0																					
16:00 to 17:00	53.5	43.3	50.8																					
17:00 to 18:00	50.5	42.3	48.0																					
18:00 to 19:00	52.0	36.9	52.3																					
19:00 to 20:00	42.1	34.5	41.4																					
20:00 to 21:00	42.6	34.8	39.7																					
21:00 to 22:00	41.0	31.6	38.5																					
22:00 to 23:00	38.2	30.7	36.0																					
23:00 to 24:00	33.8	26.0	31.0																					
$L10_{(18h),\ arav}$ 6-24h	48.2																							
$L_{eq(15h),\ logav}$ 7-22h			50.5																					
$L_{eq(9h),\ logav}$ 22-7h			38.2																					
$L_{eq(24h),\ logav}$ 0-24h			48.8																					
L90 Day		42.3			40.3																			
L90 Evening		34.5																						
L90 Night		27.8																						
Wind @0900h, km/h	W 22			WNW 17																				
Wind @1500h, km/h	WNW 15																							

Hourly percentiles based on Lp at 0.1s intervals

v. 640.11501 10BraggSt CESARL8_20170201.xlsm, Printed : 07-09-2017 5:16 PM

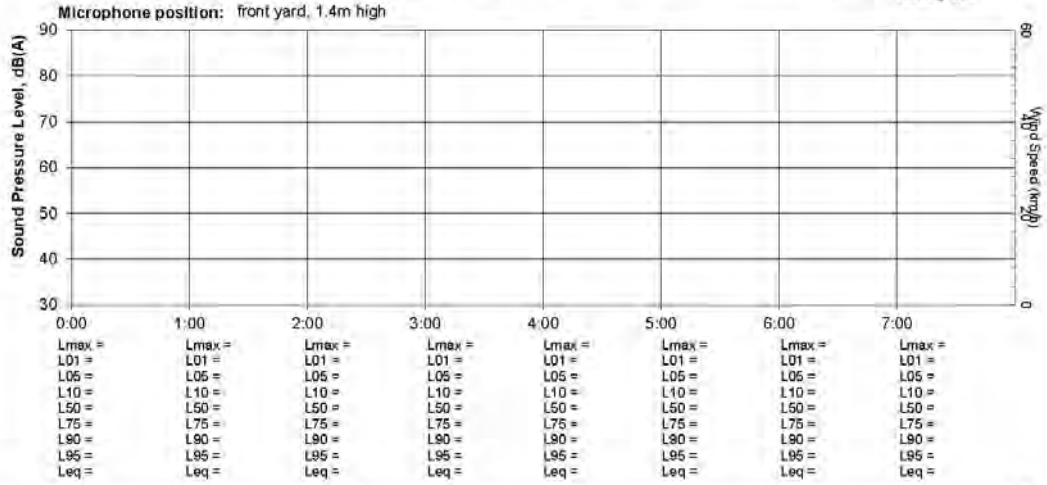
NOISE MONITORING RESULTS

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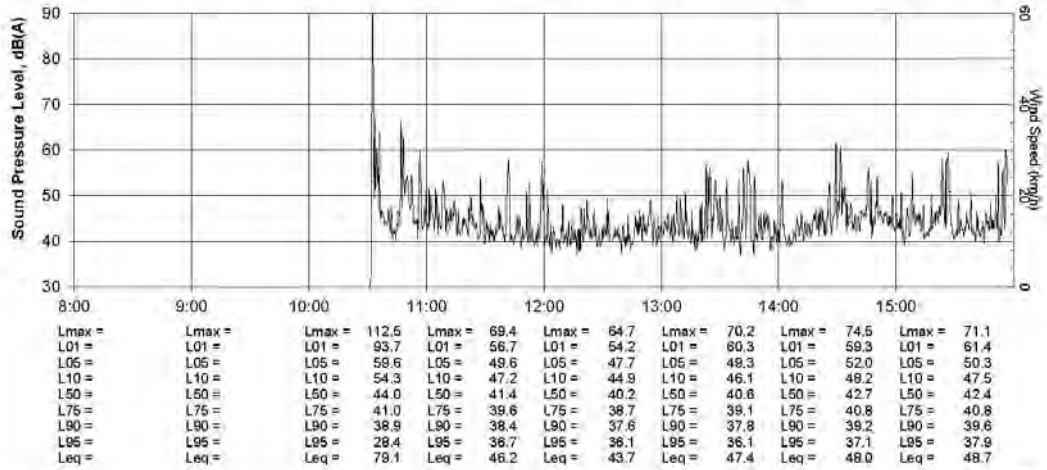
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Tuesday 22 Aug 2017

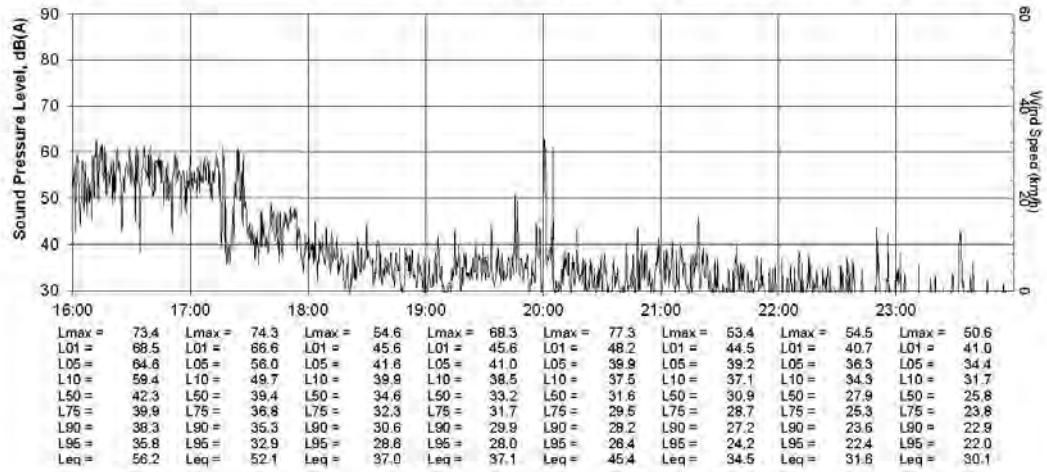
Microphone position: front yard, 1.4m high



Lmax =	Lmax =	Lmax =	Lmax =	Lmax =	Lmax =	Lmax =	Lmax =
L01 =	L01 =	L01 =	L01 =	L01 =	L01 =	L01 =	L01 =
L05 =	L05 =	L05 =	L05 =	L05 =	L05 =	L05 =	L05 =
L10 =	L10 =	L10 =	L10 =	L10 =	L10 =	L10 =	L10 =
L50 =	L50 =	L50 =	L50 =	L50 =	L50 =	L50 =	L50 =
L75 =	L75 =	L75 =	L75 =	L75 =	L75 =	L75 =	L75 =
L90 =	L90 =	L90 =	L90 =	L90 =	L90 =	L90 =	L90 =
L95 =	L95 =	L95 =	L95 =	L95 =	L95 =	L95 =	L95 =
Leq =	Leq =	Leq =	Leq =	Leq =	Leq =	Leq =	Leq =



Lmax =		Lmax =		Lmax =	112.5	Lmax =	69.4	Lmax =	64.7	Lmax =	70.2	Lmax =	74.5	Lmax =	71.1
L01 =		L01 =		L01 =	93.7	L01 =	56.7	L01 =	54.2	L01 =	60.3	L01 =	59.3	L01 =	61.4
L05 =		L05 =		L05 =	58.6	L05 =	49.6	L05 =	47.7	L05 =	49.3	L05 =	52.0	L05 =	50.3
L10 =		L10 =		L10 =	54.3	L10 =	47.2	L10 =	44.9	L10 =	46.1	L10 =	48.2	L10 =	47.5
L50 =		L50 =		L50 =	44.0	L50 =	41.4	L50 =	40.2	L50 =	40.6	L50 =	42.7	L50 =	42.4
L75 =		L75 =		L75 =	41.0	L75 =	39.6	L75 =	38.7	L75 =	39.1	L75 =	40.8	L75 =	40.8
L90 =		L90 =		L90 =	38.9	L90 =	38.4	L90 =	37.6	L90 =	37.8	L90 =	39.2	L90 =	39.6
L95 =		L95 =		L95 =	28.4	L95 =	36.7	L95 =	36.1	L95 =	36.1	L95 =	37.1	L95 =	37.9
Leq =		Leq =		Leq =	79.1	Leq =	46.2	Leq =	43.7	Leq =	47.4	Leq =	48.0	Leq =	48.7



Lmax =	73.4	Lmax =	74.3	Lmax =	54.6	Lmax =	68.3	Lmax =	77.3	Lmax =	53.4	Lmax =	54.5	Lmax =	50.6
L01 =	68.5	L01 =	66.6	L01 =	45.6	L01 =	45.6	L01 =	48.2	L01 =	44.5	L01 =	40.7	L01 =	41.0
L05 =	64.6	L05 =	56.0	L05 =	41.6	L05 =	41.0	L05 =	39.9	L05 =	39.2	L05 =	36.3	L05 =	34.4
L10 =	59.4	L10 =	49.7	L10 =	39.9	L10 =	38.5	L10 =	37.5	L10 =	37.1	L10 =	34.3	L10 =	31.7
L50 =	42.3	L50 =	39.4	L50 =	34.6	L50 =	33.2	L50 =	31.6	L50 =	30.9	L50 =	27.9	L50 =	25.8
L75 =	39.9	L75 =	36.8	L75 =	32.3	L75 =	31.7	L75 =	29.5	L75 =	28.7	L75 =	25.3	L75 =	23.8
L90 =	38.3	L90 =	35.3	L90 =	30.6	L90 =	29.9	L90 =	28.2	L90 =	27.2	L90 =	23.6	L90 =	22.9
L95 =	35.8	L95 =	32.9	L95 =	28.8	L95 =	28.0	L95 =	28.4	L95 =	24.2	L95 =	22.4	L95 =	22.0
Leq =	56.2	Leq =	52.1	Leq =	37.0	Leq =	37.1	Leq =	45.4	Leq =	34.5	Leq =	31.6	Leq =	30.1

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

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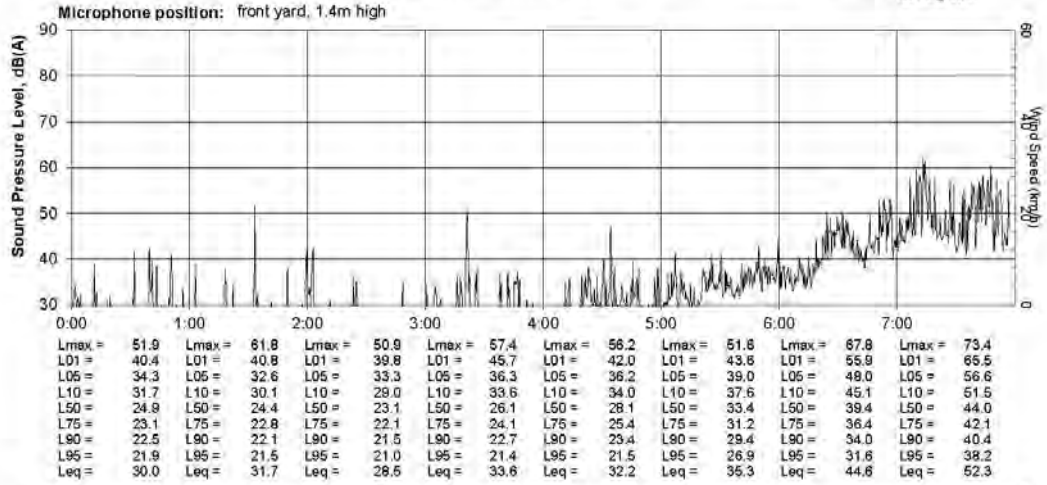
NOISE MONITORING RESULTS

SLR

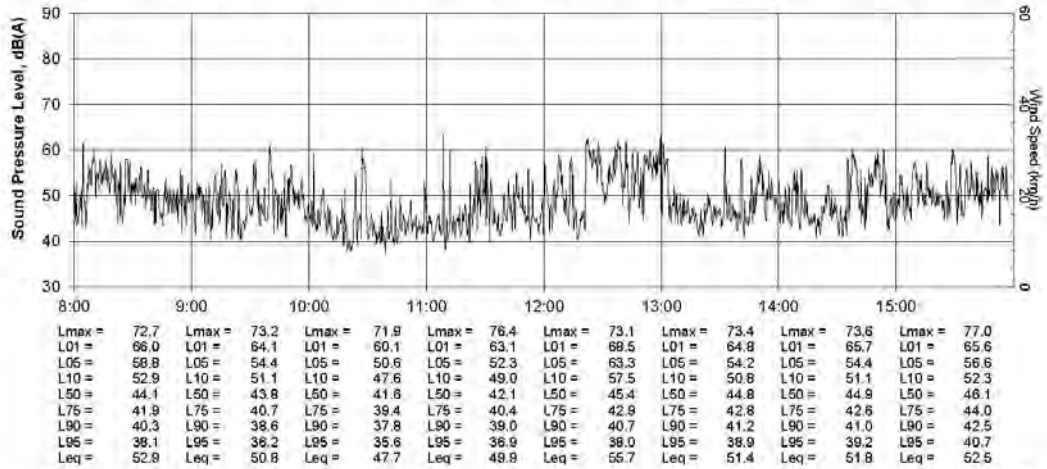
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Wednesday 23 Aug 2017

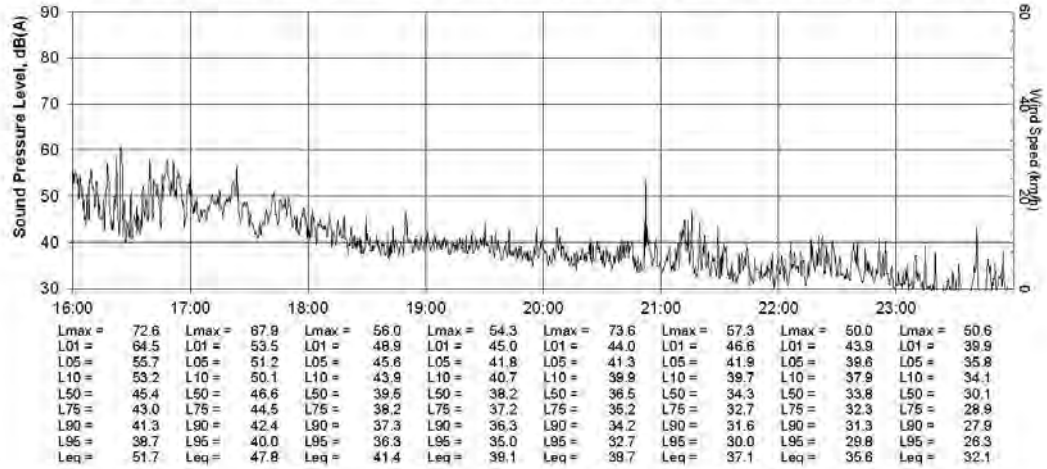
Microphone position: front yard, 1.4m high



Lmax =	51.9	Lmax =	61.8	Lmax =	50.9	Lmax =	57.4	Lmax =	56.2	Lmax =	51.6	Lmax =	67.8	Lmax =	73.4
L01 =	40.4	L01 =	40.8	L01 =	39.8	L01 =	45.7	L01 =	42.0	L01 =	43.6	L01 =	55.9	L01 =	65.5
L05 =	34.3	L05 =	32.6	L05 =	33.3	L05 =	36.3	L05 =	36.2	L05 =	39.0	L05 =	48.0	L05 =	56.6
L10 =	31.7	L10 =	30.1	L10 =	29.0	L10 =	33.6	L10 =	34.0	L10 =	37.6	L10 =	45.1	L10 =	51.5
L50 =	24.9	L50 =	24.4	L50 =	23.1	L50 =	26.1	L50 =	28.1	L50 =	33.4	L50 =	39.4	L50 =	44.0
L75 =	23.1	L75 =	22.8	L75 =	22.1	L75 =	24.1	L75 =	25.4	L75 =	31.2	L75 =	36.4	L75 =	42.1
L90 =	22.5	L90 =	22.1	L90 =	21.5	L90 =	22.7	L90 =	23.4	L90 =	29.4	L90 =	34.0	L90 =	40.4
L95 =	21.9	L95 =	21.5	L95 =	21.0	L95 =	21.4	L95 =	21.5	L95 =	26.9	L95 =	31.6	L95 =	38.2
Leq =	30.0	Leq =	31.7	Leq =	28.5	Leq =	33.6	Leq =	32.2	Leq =	35.3	Leq =	44.6	Leq =	52.3



Lmax =	72.7	Lmax =	73.2	Lmax =	71.9	Lmax =	76.4	Lmax =	73.1	Lmax =	73.4	Lmax =	73.6	Lmax =	77.0
L01 =	66.0	L01 =	64.1	L01 =	60.1	L01 =	63.1	L01 =	68.5	L01 =	64.8	L01 =	65.7	L01 =	65.6
L05 =	58.8	L05 =	54.4	L05 =	50.6	L05 =	52.3	L05 =	63.3	L05 =	54.2	L05 =	54.4	L05 =	56.6
L10 =	52.9	L10 =	51.1	L10 =	47.6	L10 =	49.0	L10 =	57.5	L10 =	50.8	L10 =	51.1	L10 =	52.3
L50 =	44.1	L50 =	43.8	L50 =	41.6	L50 =	42.1	L50 =	45.4	L50 =	44.8	L50 =	44.9	L50 =	46.1
L75 =	41.9	L75 =	40.7	L75 =	39.4	L75 =	40.4	L75 =	42.9	L75 =	42.8	L75 =	42.6	L75 =	44.0
L90 =	40.3	L90 =	38.6	L90 =	37.8	L90 =	39.0	L90 =	40.7	L90 =	41.2	L90 =	41.0	L90 =	42.5
L95 =	38.1	L95 =	36.2	L95 =	35.6	L95 =	36.9	L95 =	38.0	L95 =	38.9	L95 =	39.2	L95 =	40.7
Leq =	52.9	Leq =	50.8	Leq =	47.7	Leq =	49.9	Leq =	55.7	Leq =	51.4	Leq =	51.8	Leq =	52.5



Lmax =	72.6	Lmax =	67.9	Lmax =	56.0	Lmax =	54.3	Lmax =	73.6	Lmax =	57.3	Lmax =	50.0	Lmax =	50.6
L01 =	64.5	L01 =	53.5	L01 =	48.9	L01 =	45.0	L01 =	44.0	L01 =	46.6	L01 =	43.9	L01 =	39.9
L05 =	55.7	L05 =	51.2	L05 =	45.6	L05 =	41.8	L05 =	41.3	L05 =	41.9	L05 =	39.6	L05 =	35.8
L10 =	53.2	L10 =	50.1	L10 =	43.9	L10 =	40.7	L10 =	39.9	L10 =	39.7	L10 =	37.9	L10 =	34.1
L50 =	45.4	L50 =	46.6	L50 =	39.5	L50 =	38.2	L50 =	36.5	L50 =	34.3	L50 =	33.8	L50 =	30.1
L75 =	43.0	L75 =	44.5	L75 =	38.2	L75 =	37.2	L75 =	35.2	L75 =	32.7	L75 =	32.3	L75 =	28.9
L90 =	41.3	L90 =	42.4	L90 =	37.3	L90 =	36.3	L90 =	34.2	L90 =	31.6	L90 =	31.3	L90 =	27.9
L95 =	39.7	L95 =	40.0	L95 =	36.3	L95 =	35.0	L95 =	32.7	L95 =	30.0	L95 =	29.8	L95 =	26.3
Leq =	51.7	Leq =	47.8	Leq =	41.4	Leq =	39.1	Leq =	39.7	Leq =	37.1	Leq =	35.6	Leq =	32.1

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

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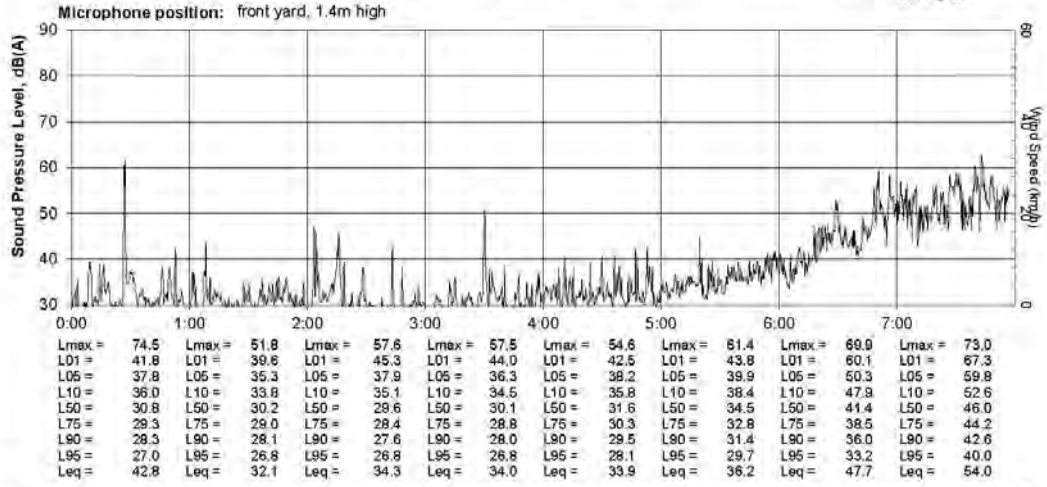
NOISE MONITORING RESULTS

SLR

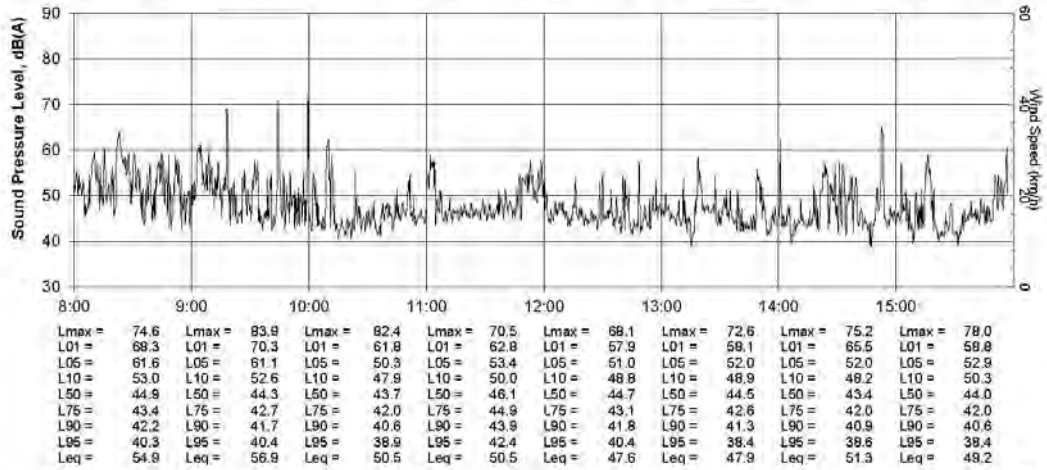
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Thursday 24 Aug 2017

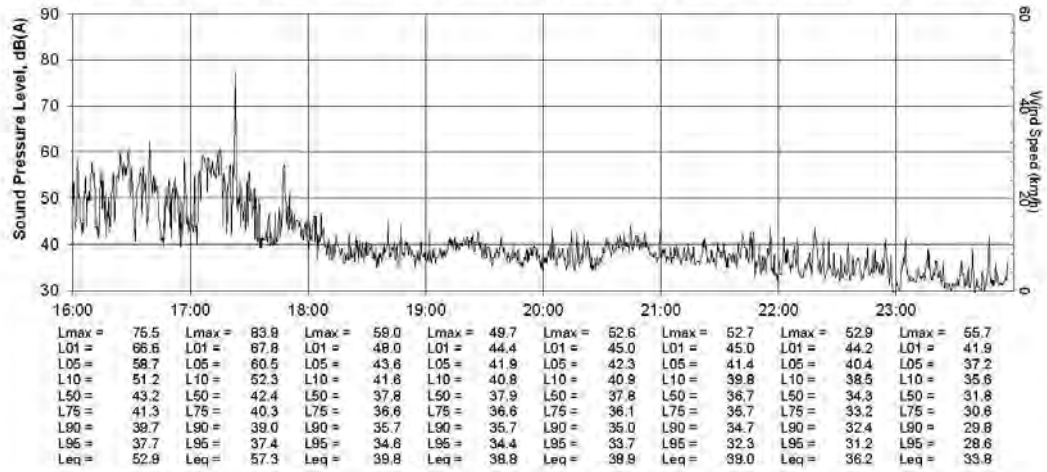
Microphone position: front yard, 1.4m high



Lmax =	74.5	Lmax =	51.8	Lmax =	57.6	Lmax =	57.5	Lmax =	54.6	Lmax =	61.4	Lmax =	69.9	Lmax =	73.0
L01 =	41.8	L01 =	39.6	L01 =	45.3	L01 =	44.0	L01 =	42.5	L01 =	43.8	L01 =	60.1	L01 =	67.3
L05 =	37.8	L05 =	35.3	L05 =	37.9	L05 =	36.3	L05 =	38.2	L05 =	39.9	L05 =	50.3	L05 =	59.8
L10 =	36.0	L10 =	33.8	L10 =	35.1	L10 =	34.5	L10 =	35.8	L10 =	38.4	L10 =	47.9	L10 =	52.6
L50 =	30.8	L50 =	30.2	L50 =	29.6	L50 =	30.1	L50 =	31.6	L50 =	34.5	L50 =	41.4	L50 =	46.0
L75 =	29.3	L75 =	29.0	L75 =	28.4	L75 =	28.8	L75 =	30.3	L75 =	32.8	L75 =	38.5	L75 =	44.2
L90 =	28.3	L90 =	28.1	L90 =	27.6	L90 =	28.0	L90 =	29.5	L90 =	31.4	L90 =	36.0	L90 =	42.6
L95 =	27.0	L95 =	26.8	L95 =	26.8	L95 =	26.8	L95 =	28.1	L95 =	29.7	L95 =	33.2	L95 =	40.0
Leq =	42.8	Leq =	32.1	Leq =	34.3	Leq =	34.0	Leq =	33.9	Leq =	36.2	Leq =	47.7	Leq =	54.0



Lmax =	74.6	Lmax =	83.9	Lmax =	82.4	Lmax =	70.5	Lmax =	68.1	Lmax =	72.6	Lmax =	75.2	Lmax =	78.0
L01 =	68.3	L01 =	70.3	L01 =	61.8	L01 =	62.8	L01 =	57.9	L01 =	59.1	L01 =	65.5	L01 =	59.8
L05 =	61.6	L05 =	61.1	L05 =	50.3	L05 =	53.4	L05 =	51.0	L05 =	52.0	L05 =	52.0	L05 =	52.9
L10 =	53.0	L10 =	52.6	L10 =	47.9	L10 =	50.0	L10 =	48.8	L10 =	48.9	L10 =	48.2	L10 =	50.3
L50 =	44.9	L50 =	44.3	L50 =	43.7	L50 =	46.1	L50 =	44.7	L50 =	44.5	L50 =	43.4	L50 =	44.0
L75 =	43.4	L75 =	42.7	L75 =	42.0	L75 =	44.9	L75 =	43.1	L75 =	42.6	L75 =	42.0	L75 =	42.0
L90 =	42.2	L90 =	41.7	L90 =	40.6	L90 =	43.8	L90 =	41.8	L90 =	41.3	L90 =	40.9	L90 =	40.6
L95 =	40.3	L95 =	40.4	L95 =	38.9	L95 =	42.4	L95 =	40.4	L95 =	38.4	L95 =	38.6	L95 =	38.4
Leq =	54.9	Leq =	56.9	Leq =	50.5	Leq =	50.5	Leq =	47.6	Leq =	47.9	Leq =	51.3	Leq =	49.2



Lmax =	75.5	Lmax =	83.8	Lmax =	59.0	Lmax =	49.7	Lmax =	52.6	Lmax =	52.7	Lmax =	52.9	Lmax =	55.7
L01 =	66.6	L01 =	67.8	L01 =	48.0	L01 =	44.4	L01 =	45.0	L01 =	45.0	L01 =	44.2	L01 =	41.9
L05 =	58.7	L05 =	60.5	L05 =	43.6	L05 =	41.9	L05 =	42.3	L05 =	41.4	L05 =	40.4	L05 =	37.2
L10 =	51.2	L10 =	52.3	L10 =	41.6	L10 =	40.8	L10 =	40.9	L10 =	39.8	L10 =	38.5	L10 =	35.6
L50 =	43.2	L50 =	42.4	L50 =	37.8	L50 =	37.9	L50 =	37.8	L50 =	36.7	L50 =	34.3	L50 =	31.8
L75 =	41.3	L75 =	40.3	L75 =	36.6	L75 =	36.6	L75 =	36.1	L75 =	35.7	L75 =	33.2	L75 =	30.6
L90 =	39.7	L90 =	39.0	L90 =	35.7	L90 =	35.7	L90 =	35.0	L90 =	34.7	L90 =	32.4	L90 =	29.8
L95 =	37.7	L95 =	37.4	L95 =	34.8	L95 =	34.4	L95 =	33.7	L95 =	32.3	L95 =	31.2	L95 =	28.6
Leq =	52.9	Leq =	57.3	Leq =	39.8	Leq =	38.8	Leq =	38.9	Leq =	39.0	Leq =	36.2	Leq =	33.8

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

v. 640.11501 10Bragg.sf CESARLS_20170201.ism, Printed: 07-09-2017 5:16 PM

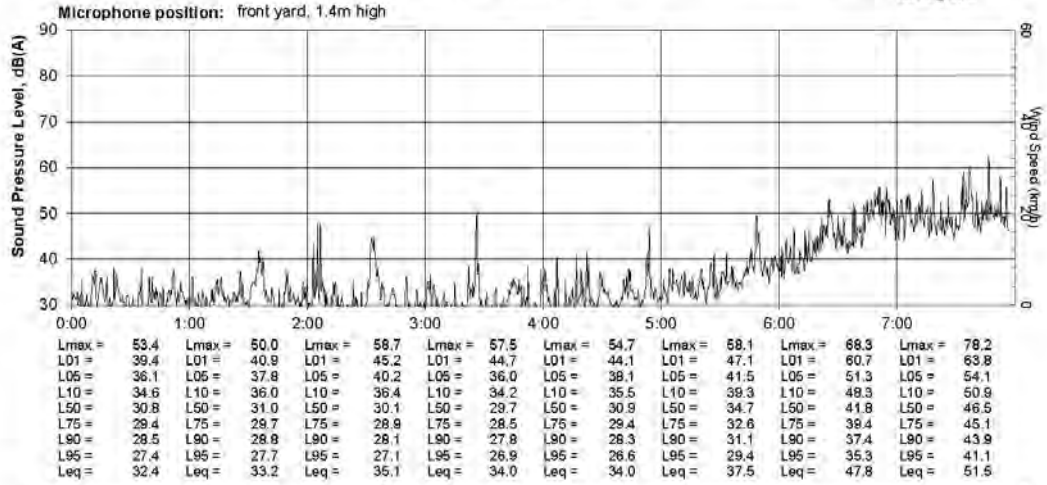
NOISE MONITORING RESULTS

SLR

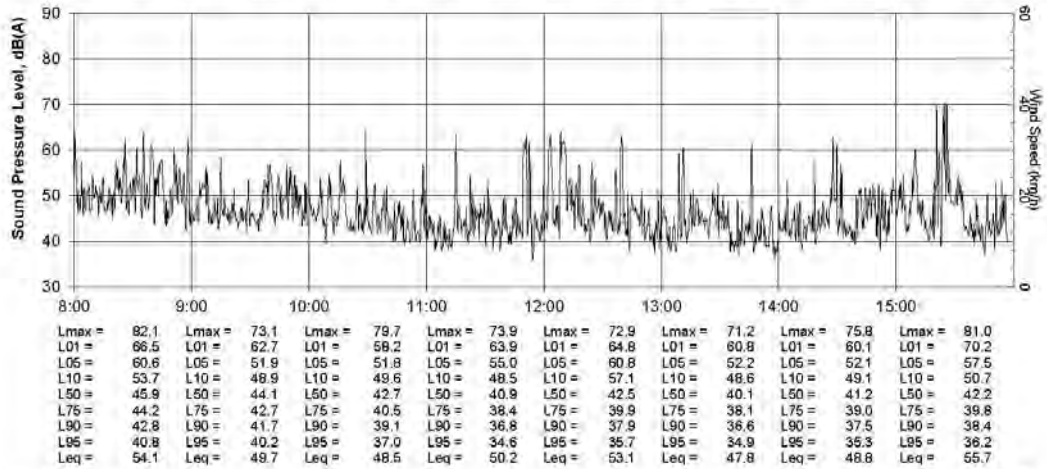
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Friday 25 Aug 2017

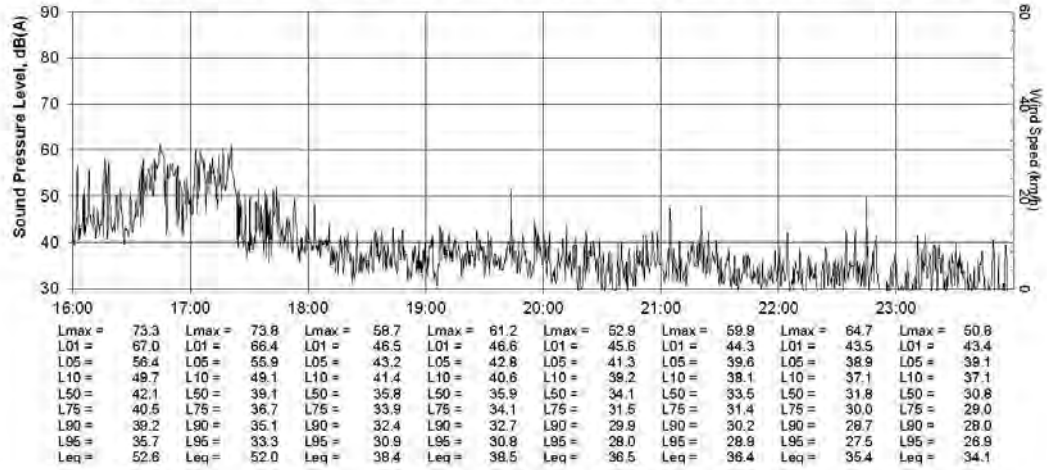
Microphone position: front yard, 1.4m high



Lmax =	53.4	Lmax =	50.0	Lmax =	58.7	Lmax =	57.5	Lmax =	54.7	Lmax =	58.1	Lmax =	68.3	Lmax =	78.2
L01 =	39.4	L01 =	40.9	L01 =	45.2	L01 =	44.7	L01 =	44.1	L01 =	47.1	L01 =	60.7	L01 =	63.8
L05 =	36.1	L05 =	37.8	L05 =	40.2	L05 =	36.0	L05 =	38.1	L05 =	41.5	L05 =	51.3	L05 =	54.1
L10 =	34.6	L10 =	36.0	L10 =	36.4	L10 =	34.2	L10 =	35.5	L10 =	39.3	L10 =	48.3	L10 =	50.9
L50 =	30.8	L50 =	31.0	L50 =	30.1	L50 =	29.7	L50 =	30.9	L50 =	34.7	L50 =	41.8	L50 =	46.5
L75 =	29.4	L75 =	29.7	L75 =	28.9	L75 =	28.5	L75 =	29.4	L75 =	32.6	L75 =	39.4	L75 =	45.1
L90 =	28.5	L90 =	28.8	L90 =	28.1	L90 =	27.8	L90 =	28.3	L90 =	31.1	L90 =	37.4	L90 =	43.9
L95 =	27.4	L95 =	27.7	L95 =	27.1	L95 =	26.9	L95 =	26.6	L95 =	29.4	L95 =	35.3	L95 =	41.1
Leq =	32.4	Leq =	33.2	Leq =	35.1	Leq =	34.0	Leq =	34.0	Leq =	37.5	Leq =	47.8	Leq =	51.5



Lmax =	82.1	Lmax =	73.1	Lmax =	79.7	Lmax =	73.9	Lmax =	72.9	Lmax =	71.2	Lmax =	75.8	Lmax =	81.0
L01 =	66.5	L01 =	62.7	L01 =	58.2	L01 =	63.9	L01 =	64.8	L01 =	60.8	L01 =	60.1	L01 =	70.2
L05 =	60.6	L05 =	51.9	L05 =	51.8	L05 =	55.0	L05 =	60.8	L05 =	52.2	L05 =	52.1	L05 =	57.5
L10 =	53.7	L10 =	48.9	L10 =	49.6	L10 =	48.5	L10 =	57.1	L10 =	48.6	L10 =	49.1	L10 =	50.7
L50 =	45.9	L50 =	44.1	L50 =	42.7	L50 =	40.9	L50 =	42.5	L50 =	40.1	L50 =	41.2	L50 =	42.2
L75 =	44.2	L75 =	42.7	L75 =	40.5	L75 =	38.4	L75 =	39.9	L75 =	38.1	L75 =	39.0	L75 =	39.8
L90 =	42.8	L90 =	41.7	L90 =	39.1	L90 =	36.8	L90 =	37.9	L90 =	36.6	L90 =	37.5	L90 =	38.4
L95 =	40.8	L95 =	40.2	L95 =	37.0	L95 =	34.6	L95 =	35.7	L95 =	34.9	L95 =	35.3	L95 =	36.2
Leq =	54.1	Leq =	49.7	Leq =	48.5	Leq =	50.2	Leq =	53.1	Leq =	47.8	Leq =	48.8	Leq =	55.7



Lmax =	73.3	Lmax =	73.8	Lmax =	58.7	Lmax =	61.2	Lmax =	52.9	Lmax =	59.9	Lmax =	64.7	Lmax =	50.6
L01 =	67.0	L01 =	66.4	L01 =	46.5	L01 =	46.6	L01 =	45.6	L01 =	44.3	L01 =	43.5	L01 =	43.4
L05 =	56.4	L05 =	55.9	L05 =	43.2	L05 =	42.8	L05 =	41.3	L05 =	39.6	L05 =	38.9	L05 =	39.1
L10 =	49.7	L10 =	49.1	L10 =	41.4	L10 =	40.6	L10 =	39.2	L10 =	38.1	L10 =	37.1	L10 =	37.1
L50 =	42.1	L50 =	39.1	L50 =	35.8	L50 =	35.9	L50 =	34.1	L50 =	33.5	L50 =	31.8	L50 =	30.8
L75 =	40.5	L75 =	36.7	L75 =	33.9	L75 =	34.1	L75 =	31.5	L75 =	31.4	L75 =	30.0	L75 =	29.0
L90 =	39.2	L90 =	35.1	L90 =	32.4	L90 =	32.7	L90 =	29.9	L90 =	30.2	L90 =	28.7	L90 =	28.0
L95 =	35.7	L95 =	33.3	L95 =	30.9	L95 =	30.8	L95 =	28.0	L95 =	28.9	L95 =	27.5	L95 =	26.9
Leq =	52.6	Leq =	52.0	Leq =	38.4	Leq =	38.5	Leq =	36.5	Leq =	36.4	Leq =	35.4	Leq =	34.1

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

v. 640.11501.10Bragg@.CESARL8_20170201.ism, Printed: 07-09-2017 @ 8 AM

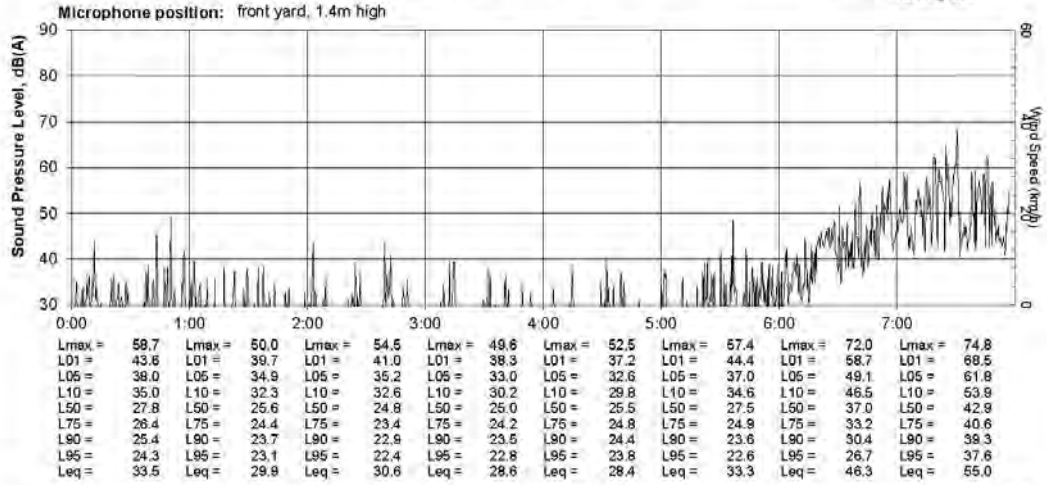
NOISE MONITORING RESULTS

SLR

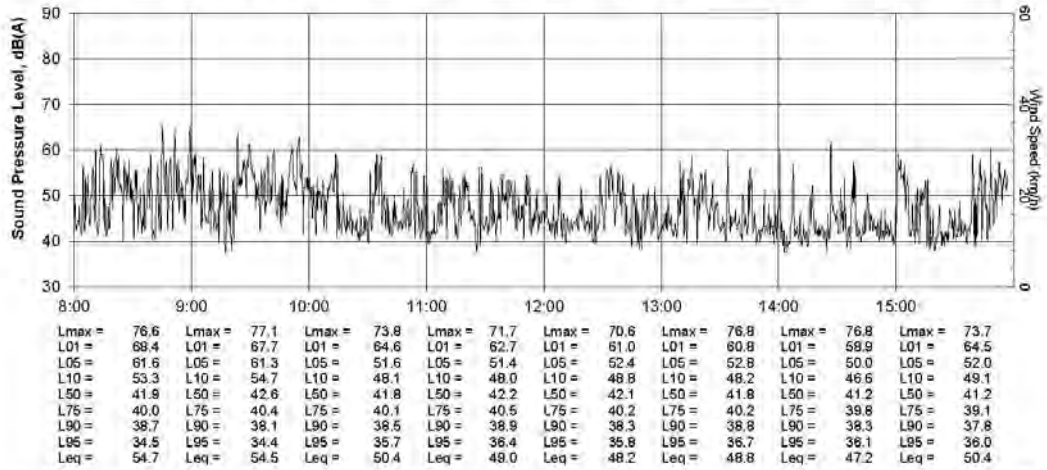
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Saturday 26 Aug 2017

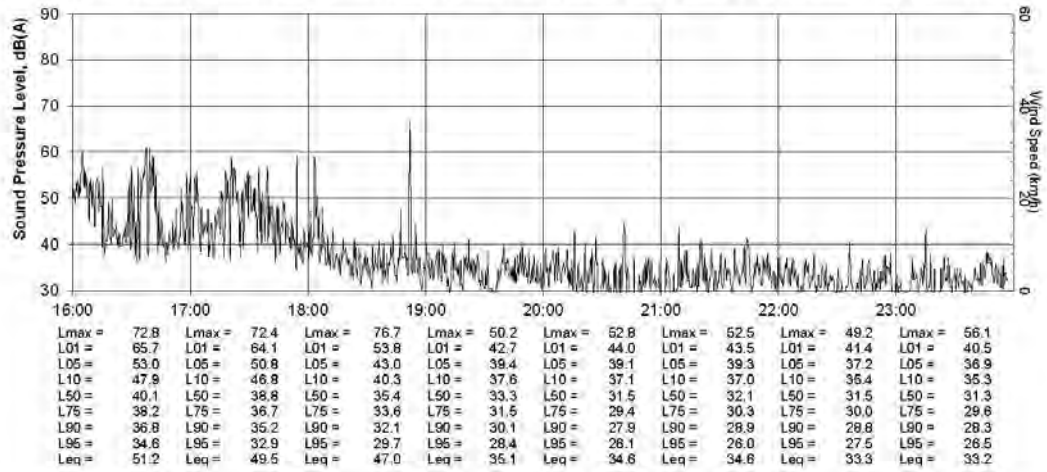
Microphone position: front yard, 1.4m high



Lmax =	58.7	Lmax =	50.0	Lmax =	54.5	Lmax =	49.6	Lmax =	52.5	Lmax =	57.4	Lmax =	72.0	Lmax =	74.8
L01 =	43.6	L01 =	39.7	L01 =	41.0	L01 =	38.3	L01 =	37.2	L01 =	44.4	L01 =	58.7	L01 =	68.5
L05 =	38.0	L05 =	34.9	L05 =	35.2	L05 =	33.0	L05 =	32.6	L05 =	37.0	L05 =	49.1	L05 =	61.8
L10 =	35.0	L10 =	32.3	L10 =	32.6	L10 =	30.2	L10 =	29.8	L10 =	34.6	L10 =	46.5	L10 =	53.9
L50 =	27.8	L50 =	25.6	L50 =	24.8	L50 =	25.0	L50 =	25.5	L50 =	27.5	L50 =	37.0	L50 =	42.9
L75 =	26.4	L75 =	24.4	L75 =	23.4	L75 =	24.2	L75 =	24.8	L75 =	24.9	L75 =	33.2	L75 =	40.6
L90 =	25.4	L90 =	23.7	L90 =	22.9	L90 =	23.5	L90 =	24.4	L90 =	23.6	L90 =	30.4	L90 =	39.3
L95 =	24.3	L95 =	23.1	L95 =	22.4	L95 =	22.8	L95 =	23.8	L95 =	22.6	L95 =	26.7	L95 =	37.6
Leq =	33.5	Leq =	29.9	Leq =	30.6	Leq =	28.6	Leq =	28.4	Leq =	33.3	Leq =	46.3	Leq =	55.0



Lmax =	76.6	Lmax =	77.1	Lmax =	73.8	Lmax =	71.7	Lmax =	70.6	Lmax =	76.8	Lmax =	76.8	Lmax =	73.7
L01 =	68.4	L01 =	67.7	L01 =	64.6	L01 =	62.7	L01 =	61.0	L01 =	60.8	L01 =	58.9	L01 =	64.5
L05 =	61.6	L05 =	61.3	L05 =	51.6	L05 =	51.4	L05 =	52.4	L05 =	52.8	L05 =	50.0	L05 =	52.0
L10 =	53.3	L10 =	54.7	L10 =	48.1	L10 =	48.0	L10 =	48.8	L10 =	48.2	L10 =	46.6	L10 =	49.1
L50 =	41.9	L50 =	42.6	L50 =	41.8	L50 =	42.2	L50 =	42.1	L50 =	41.8	L50 =	41.2	L50 =	41.2
L75 =	40.0	L75 =	40.4	L75 =	40.1	L75 =	40.5	L75 =	40.2	L75 =	40.2	L75 =	39.8	L75 =	39.1
L90 =	38.7	L90 =	38.1	L90 =	38.5	L90 =	38.9	L90 =	38.3	L90 =	38.8	L90 =	38.3	L90 =	37.8
L95 =	34.5	L95 =	34.4	L95 =	35.7	L95 =	36.4	L95 =	35.8	L95 =	36.7	L95 =	36.1	L95 =	36.0
Leq =	54.7	Leq =	54.5	Leq =	50.4	Leq =	49.0	Leq =	48.2	Leq =	48.8	Leq =	47.2	Leq =	50.4



Lmax =	72.8	Lmax =	72.4	Lmax =	76.7	Lmax =	50.2	Lmax =	52.8	Lmax =	52.5	Lmax =	49.2	Lmax =	56.1
L01 =	65.7	L01 =	64.1	L01 =	53.8	L01 =	42.7	L01 =	44.0	L01 =	43.5	L01 =	41.4	L01 =	40.5
L05 =	53.0	L05 =	50.8	L05 =	43.0	L05 =	39.4	L05 =	39.1	L05 =	39.3	L05 =	37.2	L05 =	36.9
L10 =	47.9	L10 =	46.8	L10 =	40.3	L10 =	37.6	L10 =	37.1	L10 =	37.0	L10 =	35.4	L10 =	35.3
L50 =	40.1	L50 =	38.8	L50 =	35.4	L50 =	33.3	L50 =	31.5	L50 =	32.1	L50 =	31.5	L50 =	31.3
L75 =	38.2	L75 =	36.7	L75 =	33.6	L75 =	31.5	L75 =	29.4	L75 =	30.3	L75 =	30.0	L75 =	29.6
L90 =	36.8	L90 =	35.2	L90 =	32.1	L90 =	30.1	L90 =	27.9	L90 =	28.9	L90 =	28.8	L90 =	28.3
L95 =	34.6	L95 =	32.9	L95 =	29.7	L95 =	28.4	L95 =	28.1	L95 =	26.0	L95 =	27.5	L95 =	26.5
Leq =	51.2	Leq =	49.5	Leq =	47.0	Leq =	35.1	Leq =	34.6	Leq =	34.8	Leq =	33.3	Leq =	33.2

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

v 640.11501 10Bragg.sl CESARLS_20170201.ism, Printed: 07-09-2017 9:18 AM

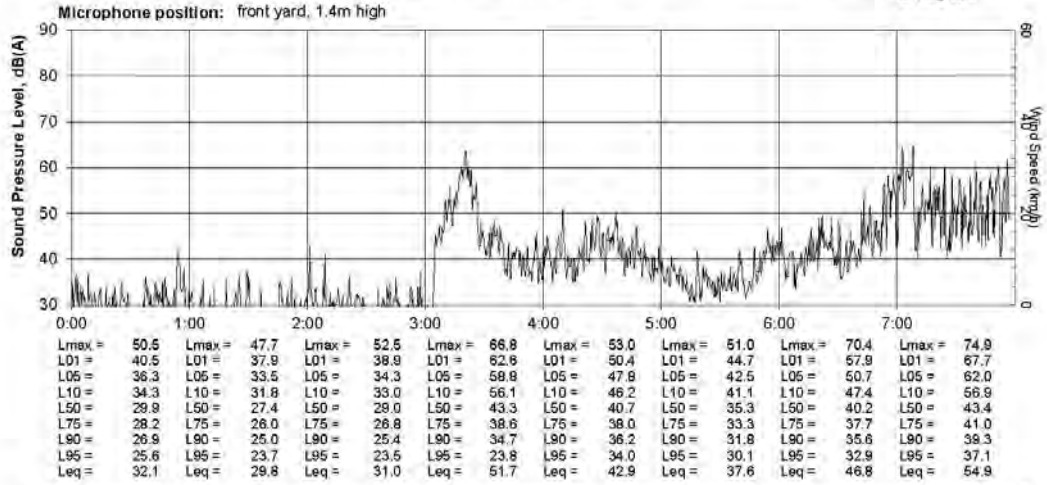
NOISE MONITORING RESULTS

SLR

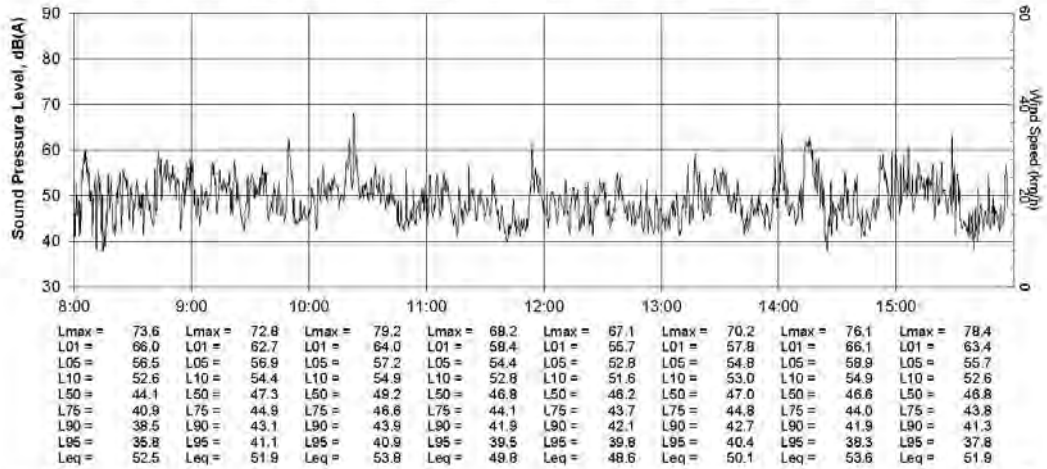
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Sunday 27 Aug 2017

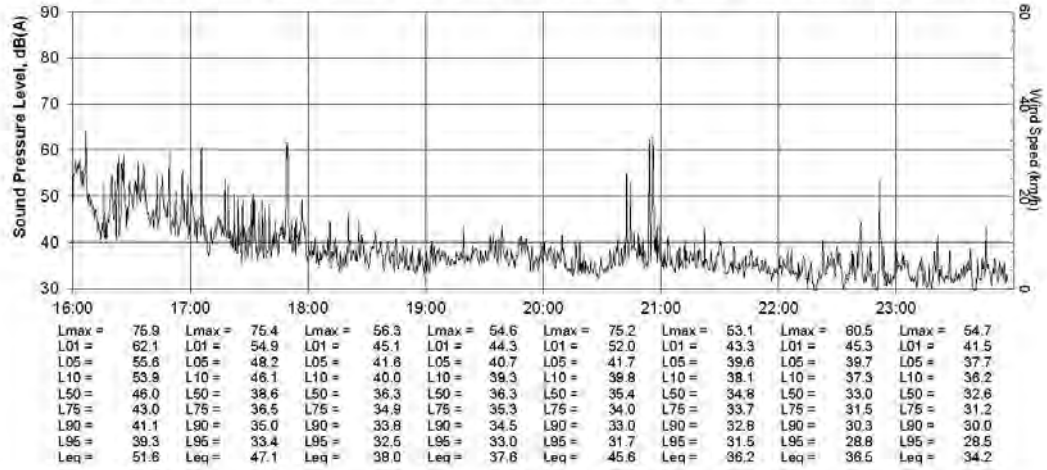
Microphone position: front yard, 1.4m high



Lmax =	50.6	Lmax =	47.7	Lmax =	52.5	Lmax =	66.8	Lmax =	53.0	Lmax =	51.0	Lmax =	70.4	Lmax =	74.9
L01 =	40.5	L01 =	37.9	L01 =	38.9	L01 =	62.6	L01 =	50.4	L01 =	44.7	L01 =	57.9	L01 =	67.7
L05 =	36.3	L05 =	33.5	L05 =	34.3	L05 =	59.8	L05 =	47.9	L05 =	42.5	L05 =	50.7	L05 =	62.0
L10 =	34.3	L10 =	31.8	L10 =	33.0	L10 =	56.1	L10 =	46.2	L10 =	41.1	L10 =	47.4	L10 =	56.9
L50 =	29.9	L50 =	27.4	L50 =	28.0	L50 =	43.3	L50 =	40.7	L50 =	35.3	L50 =	40.2	L50 =	43.4
L75 =	28.2	L75 =	26.0	L75 =	26.8	L75 =	38.6	L75 =	38.0	L75 =	33.3	L75 =	37.7	L75 =	41.0
L90 =	26.9	L90 =	25.0	L90 =	25.4	L90 =	34.7	L90 =	36.2	L90 =	31.8	L90 =	35.6	L90 =	39.3
L95 =	25.6	L95 =	23.7	L95 =	23.5	L95 =	23.8	L95 =	34.0	L95 =	30.1	L95 =	32.9	L95 =	37.1
Leq =	32.1	Leq =	29.8	Leq =	31.0	Leq =	51.7	Leq =	42.9	Leq =	37.6	Leq =	46.8	Leq =	54.9



Lmax =	73.6	Lmax =	72.8	Lmax =	79.2	Lmax =	68.2	Lmax =	67.1	Lmax =	70.2	Lmax =	76.1	Lmax =	78.4
L01 =	66.0	L01 =	62.7	L01 =	64.0	L01 =	59.4	L01 =	55.7	L01 =	57.8	L01 =	66.1	L01 =	63.4
L05 =	56.5	L05 =	56.9	L05 =	57.2	L05 =	54.4	L05 =	52.8	L05 =	54.8	L05 =	58.9	L05 =	55.7
L10 =	52.6	L10 =	54.4	L10 =	54.9	L10 =	52.8	L10 =	51.6	L10 =	53.0	L10 =	54.9	L10 =	52.6
L50 =	44.1	L50 =	47.3	L50 =	49.2	L50 =	46.8	L50 =	46.2	L50 =	47.0	L50 =	46.6	L50 =	46.8
L75 =	40.9	L75 =	44.9	L75 =	46.6	L75 =	44.1	L75 =	43.7	L75 =	44.8	L75 =	44.0	L75 =	43.8
L90 =	38.5	L90 =	43.1	L90 =	43.9	L90 =	41.9	L90 =	42.1	L90 =	42.7	L90 =	41.9	L90 =	41.3
L95 =	35.8	L95 =	41.1	L95 =	40.9	L95 =	39.5	L95 =	39.8	L95 =	40.4	L95 =	38.3	L95 =	37.8
Leq =	52.5	Leq =	51.9	Leq =	53.8	Leq =	49.8	Leq =	48.6	Leq =	50.1	Leq =	53.6	Leq =	51.9



Lmax =	75.9	Lmax =	75.4	Lmax =	56.3	Lmax =	54.6	Lmax =	75.2	Lmax =	53.1	Lmax =	60.5	Lmax =	54.7
L01 =	62.1	L01 =	54.9	L01 =	45.1	L01 =	44.3	L01 =	52.0	L01 =	43.3	L01 =	45.3	L01 =	41.5
L05 =	55.6	L05 =	48.2	L05 =	41.6	L05 =	40.7	L05 =	41.7	L05 =	39.6	L05 =	39.7	L05 =	37.7
L10 =	53.9	L10 =	46.1	L10 =	40.0	L10 =	39.3	L10 =	39.8	L10 =	38.1	L10 =	37.3	L10 =	36.2
L50 =	46.0	L50 =	38.6	L50 =	36.3	L50 =	36.3	L50 =	35.4	L50 =	34.8	L50 =	33.0	L50 =	32.6
L75 =	43.0	L75 =	36.5	L75 =	34.9	L75 =	35.3	L75 =	34.0	L75 =	33.7	L75 =	31.5	L75 =	31.2
L90 =	41.1	L90 =	35.0	L90 =	33.8	L90 =	34.5	L90 =	33.0	L90 =	32.8	L90 =	30.3	L90 =	30.0
L95 =	39.3	L95 =	33.4	L95 =	32.5	L95 =	33.0	L95 =	31.7	L95 =	31.5	L95 =	28.8	L95 =	28.5
Leq =	51.8	Leq =	47.1	Leq =	38.0	Leq =	37.8	Leq =	45.6	Leq =	36.2	Leq =	36.5	Leq =	34.2

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

v 640.11501 10Bragg.sl CESARLE_20170201.vsm, Printed: 07-09-2017 9:18 AM

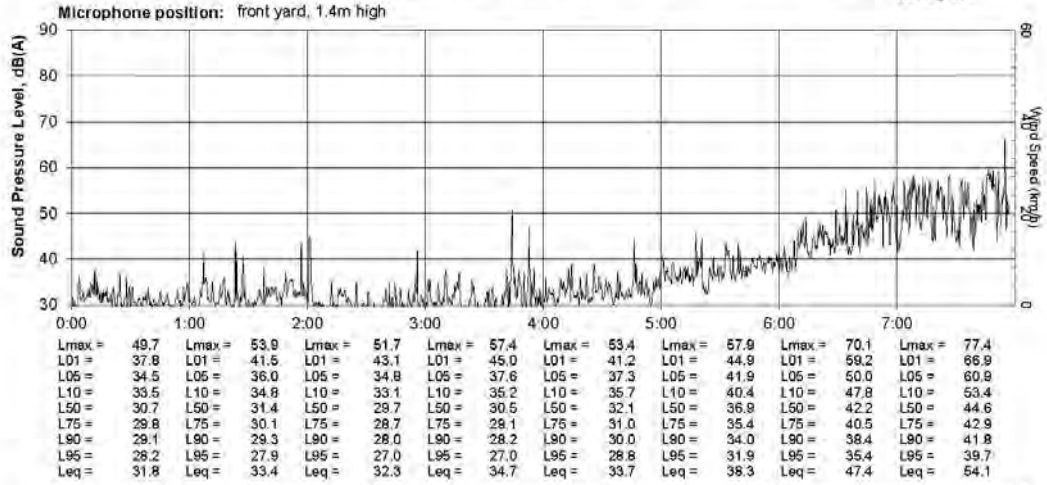
NOISE MONITORING RESULTS

SLR

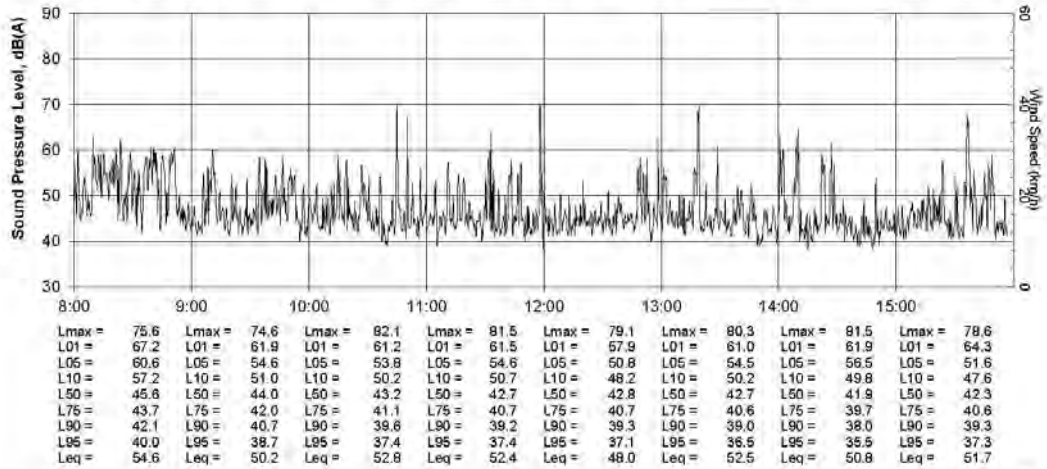
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Monday 28 Aug 2017

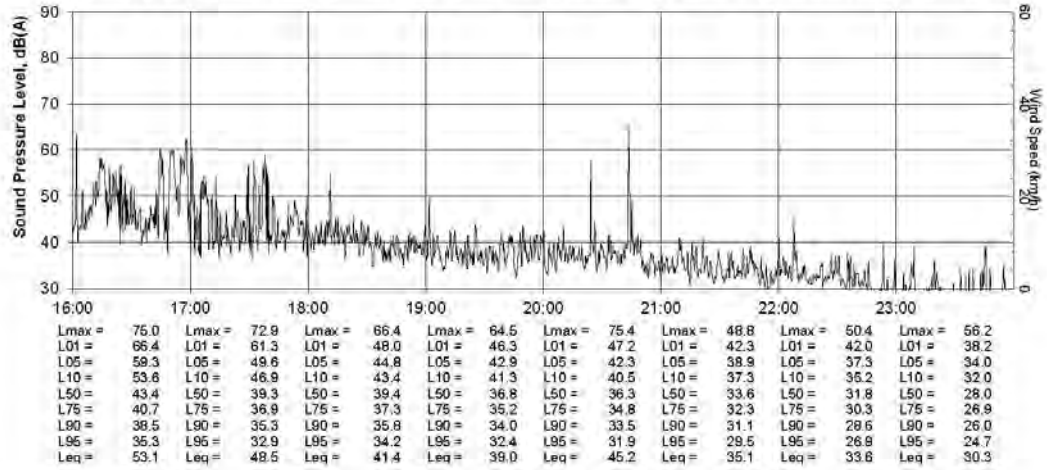
Microphone position: front yard, 1.4m high



Lmax =	49.7	Lmax =	53.9	Lmax =	51.7	Lmax =	57.4	Lmax =	53.4	Lmax =	57.9	Lmax =	70.1	Lmax =	77.4
L01 =	37.8	L01 =	41.5	L01 =	43.1	L01 =	45.0	L01 =	41.2	L01 =	44.9	L01 =	59.2	L01 =	66.9
L05 =	34.5	L05 =	36.0	L05 =	34.8	L05 =	37.6	L05 =	37.3	L05 =	41.9	L05 =	50.0	L05 =	60.9
L10 =	33.5	L10 =	34.8	L10 =	33.1	L10 =	35.2	L10 =	35.7	L10 =	40.4	L10 =	47.8	L10 =	53.4
L50 =	30.7	L50 =	31.4	L50 =	29.7	L50 =	30.5	L50 =	32.1	L50 =	36.9	L50 =	42.2	L50 =	44.6
L75 =	29.8	L75 =	30.1	L75 =	28.7	L75 =	29.1	L75 =	31.0	L75 =	35.4	L75 =	40.5	L75 =	42.9
L90 =	29.1	L90 =	29.3	L90 =	28.0	L90 =	28.2	L90 =	30.0	L90 =	34.0	L90 =	38.4	L90 =	41.8
L95 =	28.2	L95 =	27.9	L95 =	27.0	L95 =	27.0	L95 =	28.8	L95 =	31.9	L95 =	35.4	L95 =	39.7
Leq =	31.8	Leq =	33.4	Leq =	32.3	Leq =	34.7	Leq =	33.7	Leq =	38.3	Leq =	47.4	Leq =	54.1



Lmax =	75.6	Lmax =	74.6	Lmax =	82.1	Lmax =	81.5	Lmax =	79.1	Lmax =	80.3	Lmax =	81.5	Lmax =	78.6
L01 =	67.2	L01 =	61.9	L01 =	61.2	L01 =	61.5	L01 =	57.9	L01 =	61.0	L01 =	61.9	L01 =	64.3
L05 =	60.6	L05 =	54.6	L05 =	53.8	L05 =	54.6	L05 =	50.8	L05 =	54.5	L05 =	56.5	L05 =	51.6
L10 =	57.2	L10 =	51.0	L10 =	50.2	L10 =	50.7	L10 =	48.2	L10 =	50.2	L10 =	49.8	L10 =	47.6
L50 =	45.6	L50 =	44.0	L50 =	43.2	L50 =	42.7	L50 =	42.8	L50 =	42.7	L50 =	41.9	L50 =	42.3
L75 =	43.7	L75 =	42.0	L75 =	41.1	L75 =	40.7	L75 =	40.7	L75 =	40.6	L75 =	39.7	L75 =	40.6
L90 =	42.1	L90 =	40.7	L90 =	39.6	L90 =	39.2	L90 =	39.3	L90 =	39.0	L90 =	38.0	L90 =	39.3
L95 =	40.0	L95 =	38.7	L95 =	37.4	L95 =	37.4	L95 =	37.1	L95 =	36.5	L95 =	35.5	L95 =	37.3
Leq =	54.6	Leq =	50.2	Leq =	52.8	Leq =	52.4	Leq =	48.0	Leq =	52.5	Leq =	50.8	Leq =	51.7



Lmax =	75.0	Lmax =	72.9	Lmax =	66.4	Lmax =	64.5	Lmax =	75.4	Lmax =	48.8	Lmax =	50.4	Lmax =	56.2
L01 =	66.4	L01 =	61.3	L01 =	48.0	L01 =	46.3	L01 =	47.2	L01 =	42.3	L01 =	42.0	L01 =	38.2
L05 =	59.3	L05 =	49.6	L05 =	44.8	L05 =	42.9	L05 =	42.3	L05 =	38.9	L05 =	37.3	L05 =	34.0
L10 =	53.6	L10 =	46.9	L10 =	43.4	L10 =	41.3	L10 =	40.5	L10 =	37.3	L10 =	35.2	L10 =	32.0
L50 =	43.4	L50 =	39.3	L50 =	39.4	L50 =	36.8	L50 =	36.3	L50 =	33.6	L50 =	31.8	L50 =	28.0
L75 =	40.7	L75 =	36.9	L75 =	37.3	L75 =	35.2	L75 =	34.8	L75 =	32.3	L75 =	30.3	L75 =	26.9
L90 =	38.5	L90 =	35.3	L90 =	35.8	L90 =	34.0	L90 =	33.5	L90 =	31.1	L90 =	28.6	L90 =	26.0
L95 =	35.3	L95 =	32.9	L95 =	34.2	L95 =	32.4	L95 =	31.9	L95 =	29.5	L95 =	26.8	L95 =	24.7
Leq =	53.1	Leq =	48.5	Leq =	41.4	Leq =	39.0	Leq =	45.2	Leq =	35.1	Leq =	33.6	Leq =	30.3

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

v 640.11501 10Bragg@ CESAR18_20170201.vlsm, Printed: 07-09-2017 5:16 PM

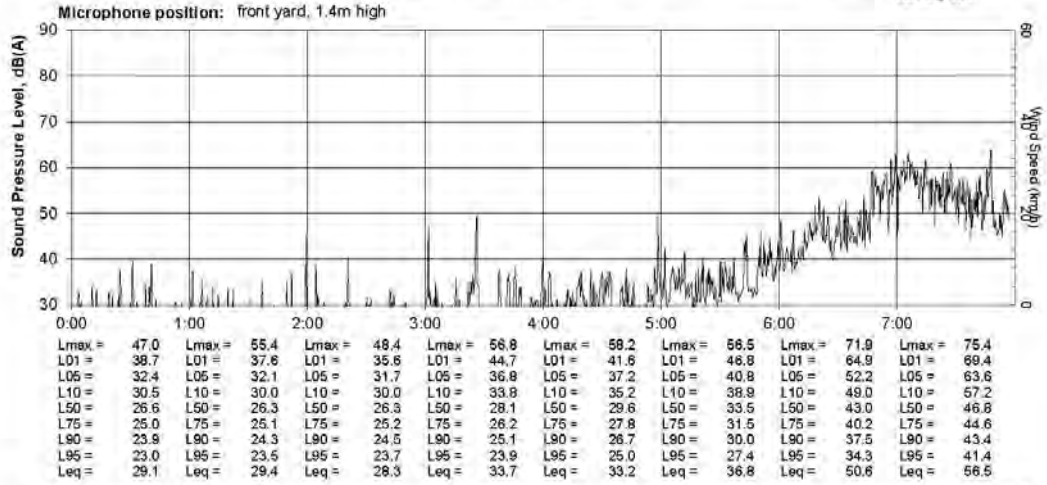
NOISE MONITORING RESULTS

SLR

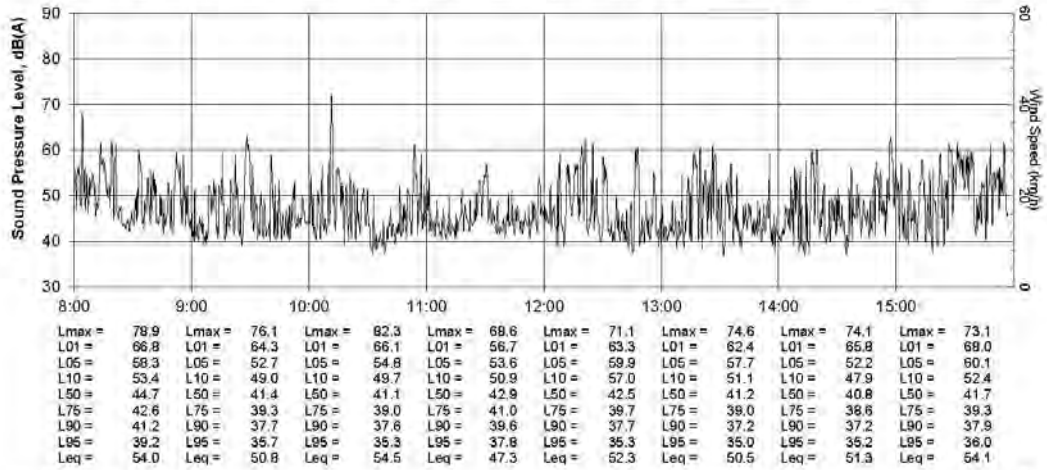
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Tuesday 29 Aug 2017

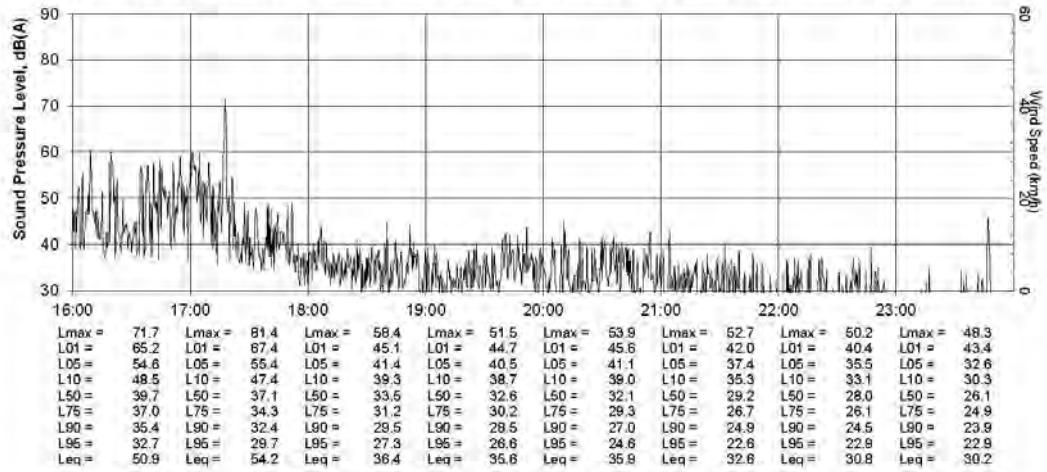
Microphone position: front yard, 1.4m high



Lmax =	47.0	Lmax =	55.4	Lmax =	48.4	Lmax =	56.8	Lmax =	58.2	Lmax =	56.5	Lmax =	71.9	Lmax =	75.4
L01 =	38.7	L01 =	37.6	L01 =	35.6	L01 =	44.7	L01 =	41.6	L01 =	46.8	L01 =	64.9	L01 =	69.4
L05 =	32.4	L05 =	32.1	L05 =	31.7	L05 =	36.8	L05 =	37.2	L05 =	40.8	L05 =	52.2	L05 =	63.6
L10 =	30.5	L10 =	30.0	L10 =	30.0	L10 =	33.8	L10 =	35.2	L10 =	38.9	L10 =	49.0	L10 =	57.2
L50 =	26.6	L50 =	26.3	L50 =	26.3	L50 =	28.1	L50 =	29.6	L50 =	33.5	L50 =	43.0	L50 =	46.8
L75 =	25.0	L75 =	25.1	L75 =	25.2	L75 =	26.2	L75 =	27.8	L75 =	31.5	L75 =	40.2	L75 =	44.6
L90 =	23.9	L90 =	24.3	L90 =	24.5	L90 =	25.1	L90 =	26.7	L90 =	30.0	L90 =	37.5	L90 =	43.4
L95 =	23.0	L95 =	23.5	L95 =	23.7	L95 =	23.9	L95 =	25.0	L95 =	27.4	L95 =	34.3	L95 =	41.4
Leq =	29.1	Leq =	29.4	Leq =	28.3	Leq =	33.7	Leq =	33.2	Leq =	36.8	Leq =	50.6	Leq =	56.5



Lmax =	78.9	Lmax =	76.1	Lmax =	82.3	Lmax =	68.6	Lmax =	71.1	Lmax =	74.6	Lmax =	74.1	Lmax =	73.1
L01 =	66.8	L01 =	64.3	L01 =	66.1	L01 =	56.7	L01 =	63.3	L01 =	62.4	L01 =	65.8	L01 =	69.0
L05 =	58.3	L05 =	52.7	L05 =	54.8	L05 =	53.6	L05 =	59.9	L05 =	57.7	L05 =	52.2	L05 =	60.1
L10 =	53.4	L10 =	49.0	L10 =	49.7	L10 =	50.9	L10 =	57.0	L10 =	51.1	L10 =	47.9	L10 =	52.4
L50 =	44.7	L50 =	41.4	L50 =	41.1	L50 =	42.9	L50 =	42.5	L50 =	41.2	L50 =	40.8	L50 =	41.7
L75 =	42.6	L75 =	39.3	L75 =	39.0	L75 =	41.0	L75 =	39.7	L75 =	39.0	L75 =	38.6	L75 =	39.3
L90 =	41.2	L90 =	37.7	L90 =	37.6	L90 =	39.6	L90 =	37.7	L90 =	37.2	L90 =	37.2	L90 =	37.9
L95 =	39.2	L95 =	35.7	L95 =	35.3	L95 =	37.8	L95 =	35.3	L95 =	35.0	L95 =	35.2	L95 =	36.0
Leq =	54.0	Leq =	50.8	Leq =	54.5	Leq =	47.3	Leq =	52.3	Leq =	50.5	Leq =	51.3	Leq =	54.1



Lmax =	71.7	Lmax =	81.4	Lmax =	58.4	Lmax =	51.5	Lmax =	53.9	Lmax =	52.7	Lmax =	50.2	Lmax =	48.3
L01 =	65.2	L01 =	67.4	L01 =	45.1	L01 =	44.7	L01 =	45.6	L01 =	42.0	L01 =	40.4	L01 =	43.4
L05 =	54.6	L05 =	55.4	L05 =	41.4	L05 =	40.5	L05 =	41.1	L05 =	37.4	L05 =	35.5	L05 =	32.6
L10 =	48.5	L10 =	47.4	L10 =	39.3	L10 =	38.7	L10 =	39.0	L10 =	35.3	L10 =	33.1	L10 =	30.3
L50 =	39.7	L50 =	37.1	L50 =	33.5	L50 =	32.6	L50 =	32.1	L50 =	29.2	L50 =	28.0	L50 =	26.1
L75 =	37.0	L75 =	34.3	L75 =	31.2	L75 =	30.2	L75 =	29.3	L75 =	26.7	L75 =	26.1	L75 =	24.9
L90 =	35.4	L90 =	32.4	L90 =	29.5	L90 =	28.5	L90 =	27.0	L90 =	24.9	L90 =	24.5	L90 =	23.9
L95 =	32.7	L95 =	29.7	L95 =	27.3	L95 =	26.6	L95 =	24.6	L95 =	22.6	L95 =	22.9	L95 =	22.9
Leq =	50.9	Leq =	54.2	Leq =	36.4	Leq =	35.6	Leq =	35.9	Leq =	32.6	Leq =	30.8	Leq =	30.2

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

v 640.11501 10Bragg.sll CESARLS_20170201.ism, Printed: 07-09-2017 6:18 PM

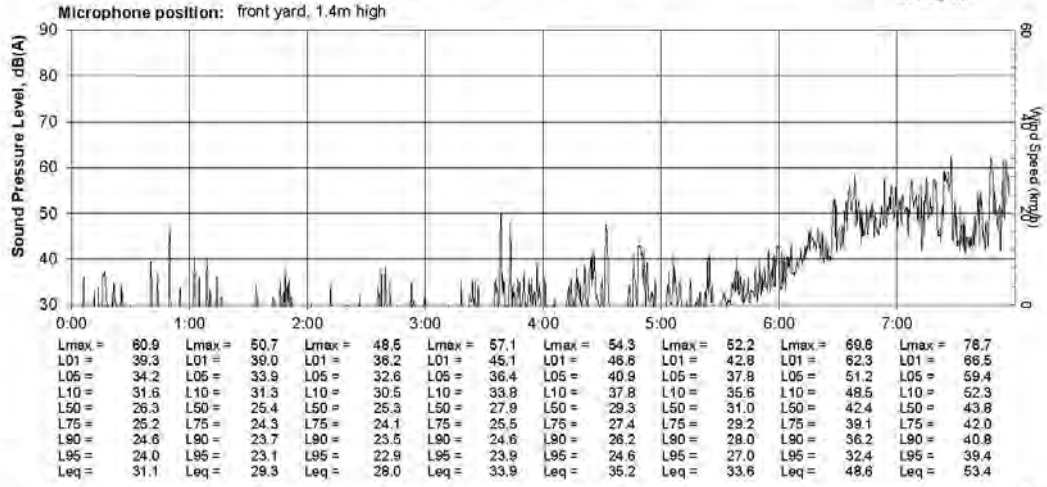
NOISE MONITORING RESULTS

SLR

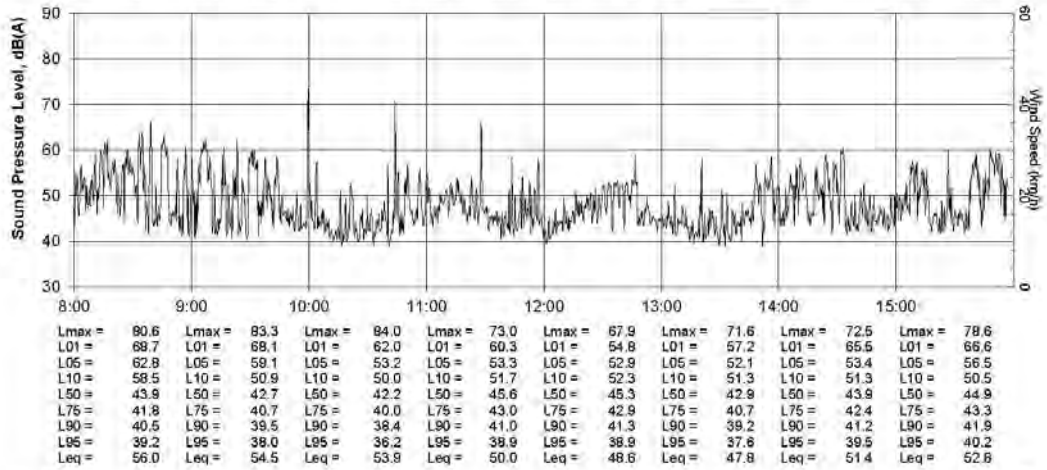
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Wednesday 30 Aug 2017

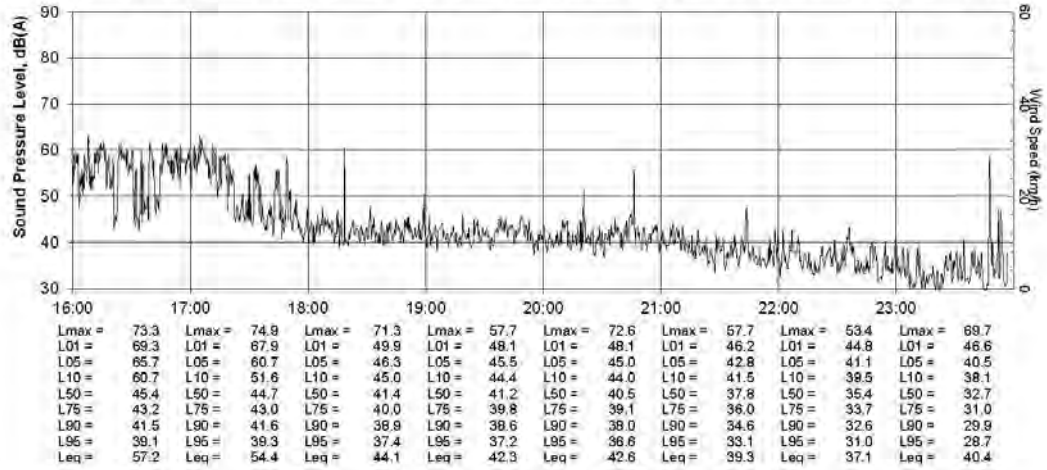
Microphone position: front yard, 1.4m high



Lmax =	60.9	Lmax =	50.7	Lmax =	48.5	Lmax =	57.1	Lmax =	54.3	Lmax =	52.2	Lmax =	69.6	Lmax =	76.7
L01 =	39.3	L01 =	39.0	L01 =	36.2	L01 =	45.1	L01 =	46.6	L01 =	42.8	L01 =	62.3	L01 =	66.5
L05 =	34.2	L05 =	33.9	L05 =	32.6	L05 =	36.4	L05 =	40.9	L05 =	37.8	L05 =	51.2	L05 =	59.4
L10 =	31.6	L10 =	31.3	L10 =	30.5	L10 =	33.8	L10 =	37.8	L10 =	35.6	L10 =	48.5	L10 =	52.3
L50 =	26.3	L50 =	25.4	L50 =	25.3	L50 =	27.9	L50 =	29.3	L50 =	31.0	L50 =	42.4	L50 =	43.8
L75 =	25.2	L75 =	24.3	L75 =	24.1	L75 =	25.5	L75 =	27.4	L75 =	29.2	L75 =	39.1	L75 =	42.0
L90 =	24.6	L90 =	23.7	L90 =	23.5	L90 =	24.6	L90 =	26.2	L90 =	28.0	L90 =	36.2	L90 =	40.8
L95 =	24.0	L95 =	23.1	L95 =	22.9	L95 =	23.9	L95 =	24.6	L95 =	27.0	L95 =	32.4	L95 =	39.4
Leq =	31.1	Leq =	29.3	Leq =	28.0	Leq =	33.9	Leq =	35.2	Leq =	33.6	Leq =	48.6	Leq =	53.4



Lmax =	80.6	Lmax =	83.3	Lmax =	84.0	Lmax =	73.0	Lmax =	67.9	Lmax =	71.6	Lmax =	72.5	Lmax =	78.6
L01 =	68.7	L01 =	68.1	L01 =	62.0	L01 =	60.3	L01 =	54.8	L01 =	57.2	L01 =	65.5	L01 =	66.6
L05 =	62.8	L05 =	59.1	L05 =	53.2	L05 =	53.3	L05 =	52.9	L05 =	52.1	L05 =	53.4	L05 =	56.5
L10 =	58.5	L10 =	50.9	L10 =	50.0	L10 =	51.7	L10 =	52.3	L10 =	51.3	L10 =	51.3	L10 =	50.5
L50 =	43.9	L50 =	42.7	L50 =	42.2	L50 =	45.6	L50 =	45.3	L50 =	42.9	L50 =	43.9	L50 =	44.9
L75 =	41.8	L75 =	40.7	L75 =	40.0	L75 =	43.0	L75 =	42.9	L75 =	40.7	L75 =	42.4	L75 =	43.3
L90 =	40.5	L90 =	39.5	L90 =	38.4	L90 =	41.0	L90 =	41.3	L90 =	39.2	L90 =	41.2	L90 =	41.9
L95 =	39.2	L95 =	38.0	L95 =	36.2	L95 =	39.9	L95 =	38.9	L95 =	37.6	L95 =	39.5	L95 =	40.2
Leq =	56.0	Leq =	54.5	Leq =	53.9	Leq =	50.0	Leq =	48.6	Leq =	47.8	Leq =	51.4	Leq =	52.6



Lmax =	73.3	Lmax =	74.8	Lmax =	71.3	Lmax =	57.7	Lmax =	72.6	Lmax =	57.7	Lmax =	53.4	Lmax =	69.7
L01 =	69.3	L01 =	67.9	L01 =	49.9	L01 =	48.1	L01 =	48.1	L01 =	46.2	L01 =	44.8	L01 =	46.6
L05 =	65.7	L05 =	60.7	L05 =	46.3	L05 =	45.5	L05 =	45.0	L05 =	42.8	L05 =	41.1	L05 =	40.5
L10 =	60.7	L10 =	51.6	L10 =	45.0	L10 =	44.4	L10 =	44.0	L10 =	41.5	L10 =	39.5	L10 =	38.1
L50 =	45.4	L50 =	44.7	L50 =	41.4	L50 =	41.2	L50 =	40.5	L50 =	37.8	L50 =	35.4	L50 =	32.7
L75 =	43.2	L75 =	43.0	L75 =	40.0	L75 =	39.8	L75 =	39.1	L75 =	36.0	L75 =	33.7	L75 =	31.0
L90 =	41.5	L90 =	41.6	L90 =	38.9	L90 =	38.6	L90 =	38.0	L90 =	34.6	L90 =	32.6	L90 =	29.9
L95 =	39.1	L95 =	39.3	L95 =	37.4	L95 =	37.2	L95 =	36.6	L95 =	33.1	L95 =	31.0	L95 =	28.7
Leq =	57.2	Leq =	54.4	Leq =	44.1	Leq =	42.3	Leq =	42.6	Leq =	39.3	Leq =	37.1	Leq =	40.4

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

v. 640.11501 10Bragg.sll CESARLS_20170201.ism, Printed: 07-09-2017 9:16 AM

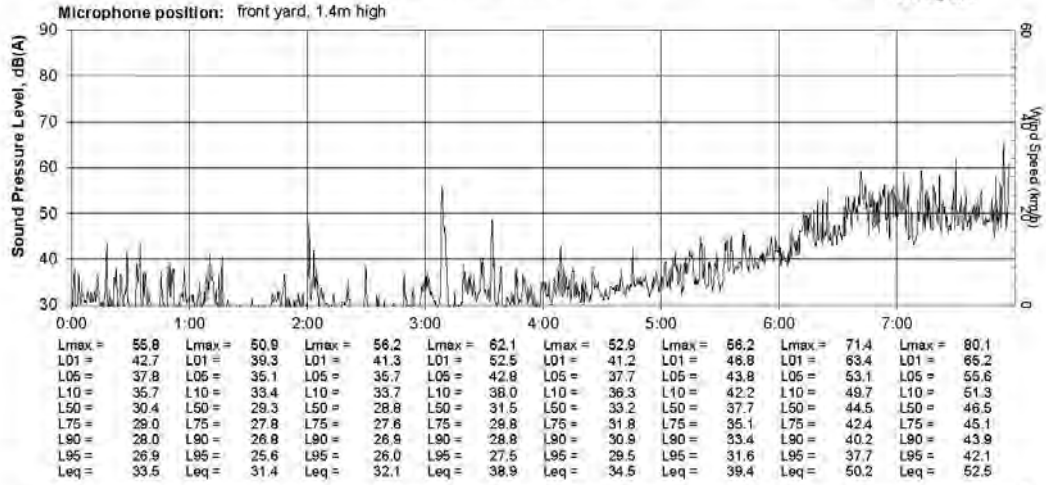
NOISE MONITORING RESULTS

SLR

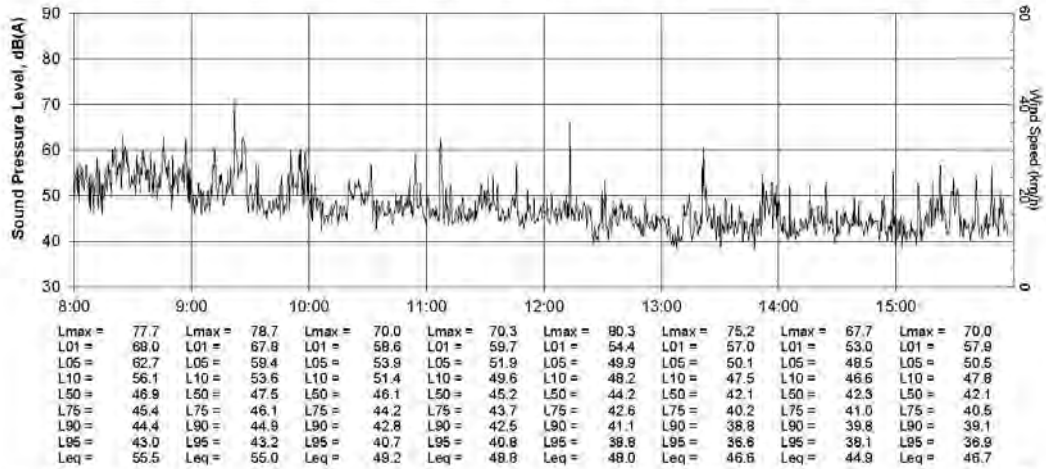
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Thursday 31 Aug 2017

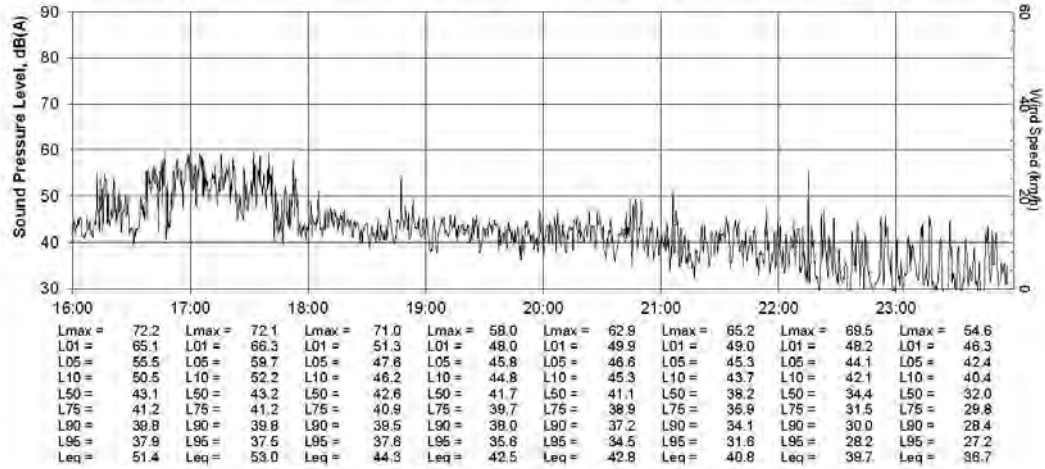
Microphone position: front yard, 1.4m high



Lmax =	55.8	Lmax =	50.9	Lmax =	56.2	Lmax =	62.1	Lmax =	52.9	Lmax =	66.2	Lmax =	71.4	Lmax =	80.1
L01 =	42.7	L01 =	39.3	L01 =	41.3	L01 =	52.5	L01 =	41.2	L01 =	46.8	L01 =	63.4	L01 =	65.2
L05 =	37.8	L05 =	35.1	L05 =	35.7	L05 =	42.8	L05 =	37.7	L05 =	43.8	L05 =	53.1	L05 =	55.6
L10 =	35.7	L10 =	33.4	L10 =	33.7	L10 =	38.0	L10 =	36.3	L10 =	42.2	L10 =	49.7	L10 =	51.3
L50 =	30.4	L50 =	29.3	L50 =	28.8	L50 =	31.5	L50 =	33.2	L50 =	37.7	L50 =	44.5	L50 =	46.5
L75 =	29.0	L75 =	27.8	L75 =	27.6	L75 =	29.8	L75 =	31.8	L75 =	35.1	L75 =	42.4	L75 =	45.1
L90 =	28.0	L90 =	26.8	L90 =	26.9	L90 =	28.8	L90 =	30.9	L90 =	33.4	L90 =	40.2	L90 =	43.9
L95 =	26.9	L95 =	25.6	L95 =	26.0	L95 =	27.5	L95 =	29.5	L95 =	31.6	L95 =	37.7	L95 =	42.1
Leq =	33.5	Leq =	31.4	Leq =	32.1	Leq =	38.9	Leq =	34.5	Leq =	39.4	Leq =	50.2	Leq =	52.5



Lmax =	77.7	Lmax =	78.7	Lmax =	70.0	Lmax =	70.3	Lmax =	80.3	Lmax =	75.2	Lmax =	67.7	Lmax =	70.0
L01 =	68.0	L01 =	67.8	L01 =	58.6	L01 =	59.7	L01 =	54.4	L01 =	57.0	L01 =	53.0	L01 =	57.9
L05 =	62.7	L05 =	59.4	L05 =	53.9	L05 =	51.9	L05 =	49.9	L05 =	50.1	L05 =	48.5	L05 =	50.5
L10 =	56.1	L10 =	53.6	L10 =	51.4	L10 =	49.6	L10 =	48.2	L10 =	47.5	L10 =	46.6	L10 =	47.8
L50 =	46.9	L50 =	47.5	L50 =	46.1	L50 =	45.2	L50 =	44.2	L50 =	42.1	L50 =	42.3	L50 =	42.1
L75 =	45.4	L75 =	46.1	L75 =	44.2	L75 =	43.7	L75 =	42.6	L75 =	40.2	L75 =	41.0	L75 =	40.5
L90 =	44.4	L90 =	44.9	L90 =	42.8	L90 =	42.5	L90 =	41.1	L90 =	38.8	L90 =	39.8	L90 =	39.1
L95 =	43.0	L95 =	43.2	L95 =	40.7	L95 =	40.8	L95 =	38.8	L95 =	36.6	L95 =	38.1	L95 =	36.9
Leq =	55.5	Leq =	55.0	Leq =	49.2	Leq =	48.8	Leq =	48.0	Leq =	46.6	Leq =	44.9	Leq =	46.7



Lmax =	72.2	Lmax =	72.1	Lmax =	71.0	Lmax =	58.0	Lmax =	62.9	Lmax =	65.2	Lmax =	69.5	Lmax =	54.6
L01 =	65.1	L01 =	66.3	L01 =	51.3	L01 =	48.0	L01 =	49.9	L01 =	49.0	L01 =	48.2	L01 =	46.3
L05 =	55.5	L05 =	59.7	L05 =	47.6	L05 =	45.8	L05 =	46.6	L05 =	45.3	L05 =	44.1	L05 =	42.4
L10 =	50.5	L10 =	52.2	L10 =	46.2	L10 =	44.8	L10 =	45.3	L10 =	43.7	L10 =	42.1	L10 =	40.4
L50 =	43.1	L50 =	43.2	L50 =	42.6	L50 =	41.7	L50 =	41.1	L50 =	38.2	L50 =	34.4	L50 =	32.0
L75 =	41.2	L75 =	41.2	L75 =	40.9	L75 =	39.7	L75 =	38.9	L75 =	35.9	L75 =	31.5	L75 =	29.8
L90 =	39.8	L90 =	39.8	L90 =	39.5	L90 =	38.0	L90 =	37.2	L90 =	34.1	L90 =	30.0	L90 =	28.4
L95 =	37.9	L95 =	37.5	L95 =	37.8	L95 =	35.8	L95 =	34.5	L95 =	31.8	L95 =	28.2	L95 =	27.2
Leq =	51.4	Leq =	53.0	Leq =	44.3	Leq =	42.5	Leq =	42.8	Leq =	40.8	Leq =	39.7	Leq =	38.7

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

v. 640.11501 10Bragg@ CESARL8_20170201.ism, Printed: 07-09-2017 9:18 AM

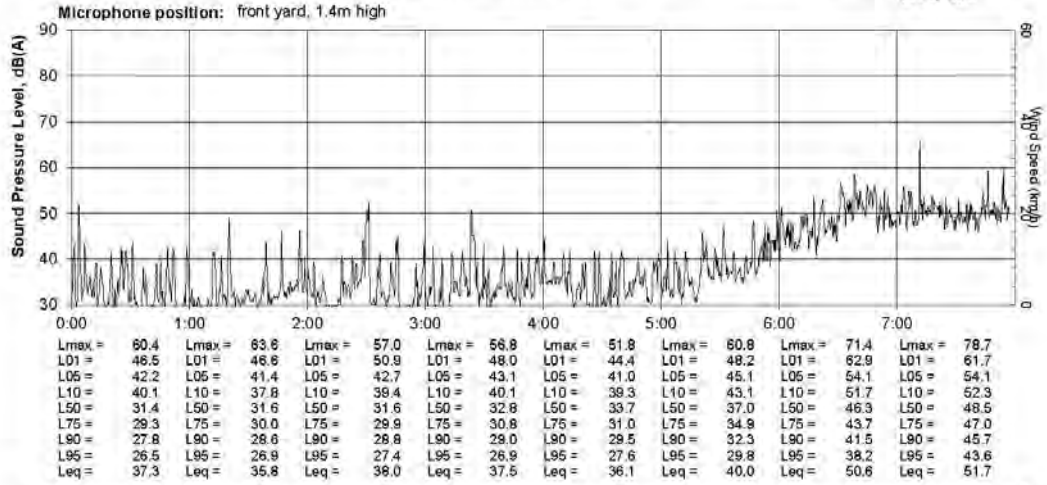
NOISE MONITORING RESULTS

SLR

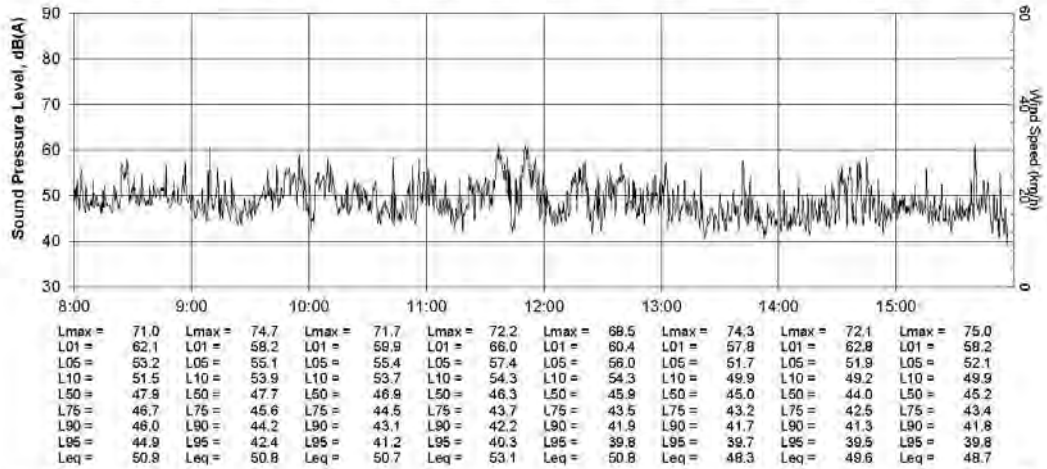
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Friday 01 Sep 2017

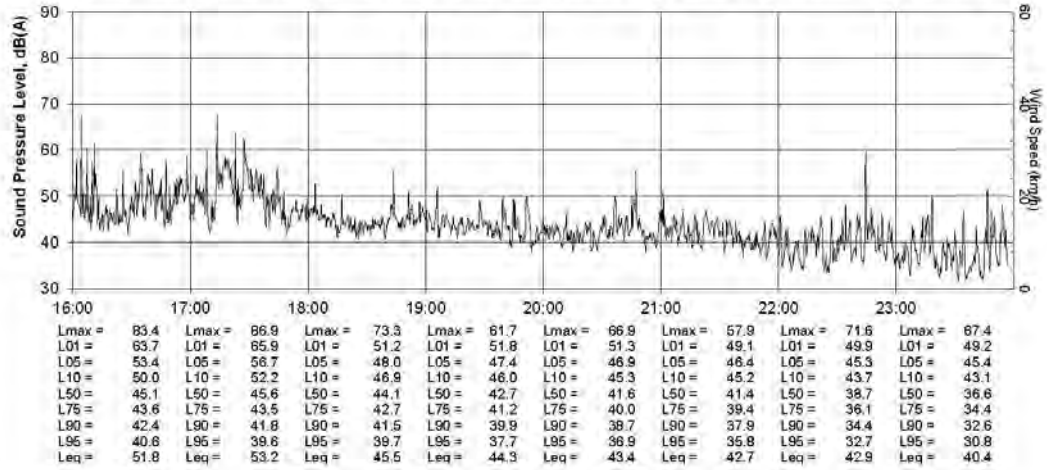
Microphone position: front yard, 1.4m high



Lmax =	60.4	Lmax =	63.6	Lmax =	57.0	Lmax =	56.8	Lmax =	51.8	Lmax =	60.8	Lmax =	71.4	Lmax =	78.7
L01 =	46.5	L01 =	46.6	L01 =	50.9	L01 =	48.0	L01 =	44.4	L01 =	48.2	L01 =	62.9	L01 =	61.7
L05 =	42.2	L05 =	41.4	L05 =	42.7	L05 =	43.1	L05 =	41.0	L05 =	45.1	L05 =	54.1	L05 =	54.1
L10 =	40.1	L10 =	37.8	L10 =	39.4	L10 =	40.1	L10 =	39.3	L10 =	43.1	L10 =	51.7	L10 =	52.3
L50 =	31.4	L50 =	31.6	L50 =	31.6	L50 =	32.8	L50 =	33.7	L50 =	37.0	L50 =	46.3	L50 =	48.5
L75 =	29.3	L75 =	30.0	L75 =	29.9	L75 =	30.8	L75 =	31.0	L75 =	34.9	L75 =	43.7	L75 =	47.0
L90 =	27.8	L90 =	28.6	L90 =	28.8	L90 =	29.0	L90 =	29.5	L90 =	32.3	L90 =	41.5	L90 =	45.7
L95 =	26.5	L95 =	26.9	L95 =	27.4	L95 =	26.9	L95 =	27.6	L95 =	29.8	L95 =	38.2	L95 =	43.6
Leq =	37.3	Leq =	35.8	Leq =	36.0	Leq =	37.5	Leq =	36.1	Leq =	40.0	Leq =	50.6	Leq =	51.7



Lmax =	71.0	Lmax =	74.7	Lmax =	71.7	Lmax =	72.2	Lmax =	68.5	Lmax =	74.3	Lmax =	72.1	Lmax =	75.0
L01 =	62.1	L01 =	58.2	L01 =	59.9	L01 =	66.0	L01 =	60.4	L01 =	57.8	L01 =	62.8	L01 =	58.2
L05 =	53.2	L05 =	55.1	L05 =	55.4	L05 =	57.4	L05 =	56.0	L05 =	51.7	L05 =	51.9	L05 =	52.1
L10 =	51.5	L10 =	53.9	L10 =	53.7	L10 =	54.3	L10 =	54.3	L10 =	49.9	L10 =	49.2	L10 =	49.9
L50 =	47.9	L50 =	47.7	L50 =	46.9	L50 =	46.3	L50 =	45.9	L50 =	45.0	L50 =	44.0	L50 =	45.2
L75 =	46.7	L75 =	45.6	L75 =	44.5	L75 =	43.7	L75 =	43.5	L75 =	43.2	L75 =	42.5	L75 =	43.4
L90 =	46.0	L90 =	44.2	L90 =	43.1	L90 =	42.2	L90 =	41.9	L90 =	41.7	L90 =	41.3	L90 =	41.8
L95 =	44.9	L95 =	42.4	L95 =	41.2	L95 =	40.3	L95 =	39.8	L95 =	39.7	L95 =	39.5	L95 =	39.8
Leq =	50.9	Leq =	50.8	Leq =	50.7	Leq =	53.1	Leq =	50.8	Leq =	48.3	Leq =	49.6	Leq =	48.7



Lmax =	83.4	Lmax =	86.9	Lmax =	73.3	Lmax =	61.7	Lmax =	66.9	Lmax =	57.9	Lmax =	71.6	Lmax =	67.4
L01 =	63.7	L01 =	65.9	L01 =	51.2	L01 =	51.8	L01 =	51.3	L01 =	49.1	L01 =	49.9	L01 =	49.2
L05 =	53.4	L05 =	56.7	L05 =	48.0	L05 =	47.4	L05 =	46.9	L05 =	46.4	L05 =	45.3	L05 =	45.4
L10 =	50.0	L10 =	52.2	L10 =	46.9	L10 =	46.0	L10 =	45.3	L10 =	45.2	L10 =	43.7	L10 =	43.1
L50 =	45.1	L50 =	45.6	L50 =	44.1	L50 =	42.7	L50 =	41.6	L50 =	41.4	L50 =	38.7	L50 =	36.6
L75 =	43.6	L75 =	43.5	L75 =	42.7	L75 =	41.2	L75 =	40.0	L75 =	39.4	L75 =	36.1	L75 =	34.4
L90 =	42.4	L90 =	41.8	L90 =	41.5	L90 =	39.9	L90 =	38.7	L90 =	37.9	L90 =	34.4	L90 =	32.6
L95 =	40.6	L95 =	39.6	L95 =	39.7	L95 =	37.7	L95 =	36.9	L95 =	35.8	L95 =	32.7	L95 =	30.8
Leq =	51.8	Leq =	53.2	Leq =	45.5	Leq =	44.3	Leq =	43.4	Leq =	42.7	Leq =	42.9	Leq =	40.4

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

v 640.11501 10Bragg@ CESARL8_20170201.vsm, Printed: 07-09-2017 9:18 AM

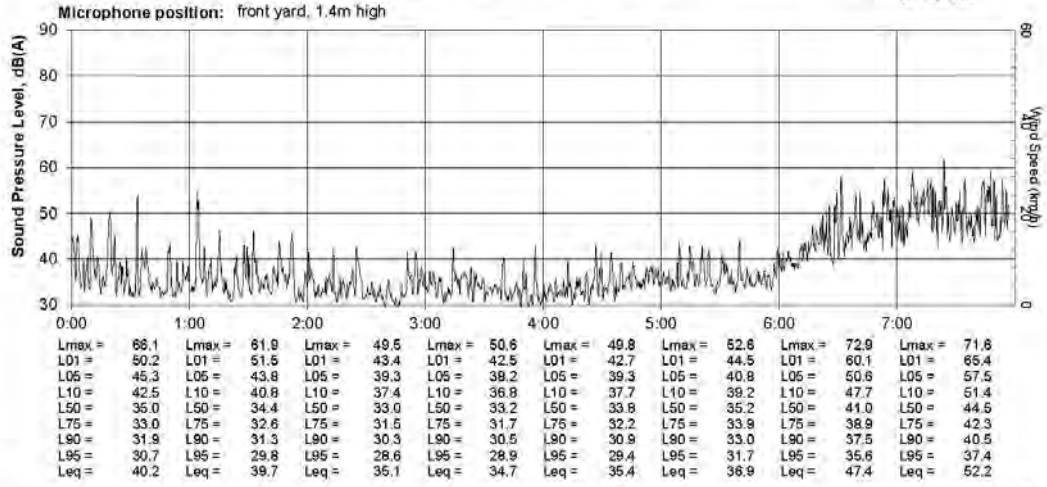
NOISE MONITORING RESULTS

SLR

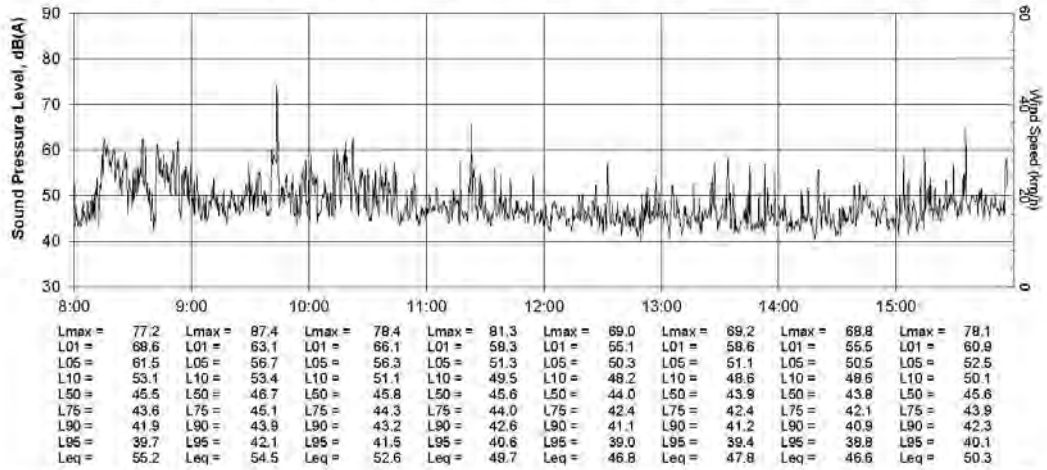
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Saturday 02 Sep 2017

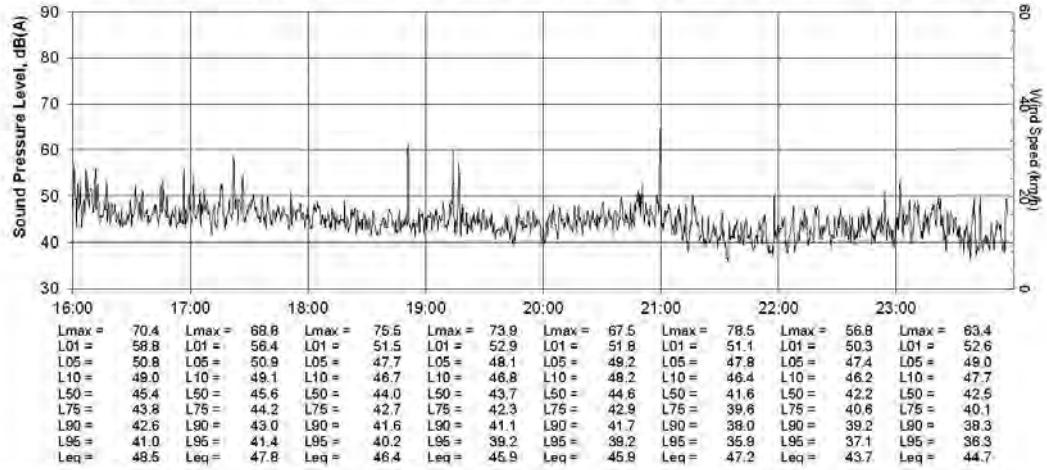
Microphone position: front yard, 1.4m high



Lmax =	68.1	Lmax =	61.9	Lmax =	49.5	Lmax =	50.6	Lmax =	49.8	Lmax =	52.6	Lmax =	72.9	Lmax =	71.6
L01 =	50.2	L01 =	51.5	L01 =	43.4	L01 =	42.5	L01 =	42.7	L01 =	44.5	L01 =	60.1	L01 =	65.4
L05 =	45.3	L05 =	43.8	L05 =	39.3	L05 =	39.2	L05 =	39.3	L05 =	40.8	L05 =	50.6	L05 =	57.5
L10 =	42.5	L10 =	40.8	L10 =	37.4	L10 =	36.8	L10 =	37.7	L10 =	39.2	L10 =	47.7	L10 =	51.4
L50 =	35.0	L50 =	34.4	L50 =	33.0	L50 =	33.2	L50 =	33.8	L50 =	35.2	L50 =	41.0	L50 =	44.5
L75 =	33.0	L75 =	32.6	L75 =	31.5	L75 =	31.7	L75 =	32.2	L75 =	33.9	L75 =	38.9	L75 =	42.3
L90 =	31.9	L90 =	31.3	L90 =	30.3	L90 =	30.5	L90 =	30.9	L90 =	33.0	L90 =	37.5	L90 =	40.5
L95 =	30.7	L95 =	29.8	L95 =	28.6	L95 =	28.9	L95 =	29.4	L95 =	31.7	L95 =	35.6	L95 =	37.4
Leq =	40.2	Leq =	39.7	Leq =	35.1	Leq =	34.7	Leq =	35.4	Leq =	36.9	Leq =	47.4	Leq =	52.2



Lmax =	77.2	Lmax =	87.4	Lmax =	78.4	Lmax =	81.3	Lmax =	69.0	Lmax =	69.2	Lmax =	68.8	Lmax =	78.1
L01 =	68.6	L01 =	63.1	L01 =	66.1	L01 =	59.3	L01 =	55.1	L01 =	58.6	L01 =	55.5	L01 =	60.9
L05 =	61.5	L05 =	56.7	L05 =	56.3	L05 =	51.3	L05 =	50.3	L05 =	51.1	L05 =	50.5	L05 =	52.5
L10 =	53.1	L10 =	53.4	L10 =	51.1	L10 =	49.5	L10 =	48.2	L10 =	48.6	L10 =	48.6	L10 =	50.1
L50 =	45.5	L50 =	46.7	L50 =	45.8	L50 =	45.6	L50 =	44.0	L50 =	43.9	L50 =	43.8	L50 =	45.6
L75 =	43.6	L75 =	45.1	L75 =	44.3	L75 =	44.0	L75 =	42.4	L75 =	42.4	L75 =	42.1	L75 =	43.9
L90 =	41.9	L90 =	43.9	L90 =	43.2	L90 =	42.6	L90 =	41.1	L90 =	41.2	L90 =	40.9	L90 =	42.3
L95 =	39.7	L95 =	42.1	L95 =	41.5	L95 =	40.6	L95 =	39.0	L95 =	39.4	L95 =	38.8	L95 =	40.1
Leq =	55.2	Leq =	54.5	Leq =	52.6	Leq =	49.7	Leq =	46.8	Leq =	47.8	Leq =	46.6	Leq =	50.3



Lmax =	70.4	Lmax =	68.8	Lmax =	75.5	Lmax =	73.9	Lmax =	67.5	Lmax =	78.5	Lmax =	56.8	Lmax =	63.4
L01 =	58.8	L01 =	56.4	L01 =	51.5	L01 =	52.9	L01 =	51.8	L01 =	51.1	L01 =	50.3	L01 =	52.6
L05 =	50.8	L05 =	50.9	L05 =	47.7	L05 =	48.1	L05 =	49.2	L05 =	47.8	L05 =	47.4	L05 =	49.0
L10 =	49.0	L10 =	49.1	L10 =	46.7	L10 =	46.8	L10 =	48.2	L10 =	46.4	L10 =	46.2	L10 =	47.7
L50 =	45.4	L50 =	45.6	L50 =	44.0	L50 =	43.7	L50 =	44.6	L50 =	41.6	L50 =	42.2	L50 =	42.5
L75 =	43.8	L75 =	44.2	L75 =	42.7	L75 =	42.3	L75 =	42.9	L75 =	39.6	L75 =	40.6	L75 =	40.1
L90 =	42.6	L90 =	43.0	L90 =	41.6	L90 =	41.1	L90 =	41.7	L90 =	38.0	L90 =	39.2	L90 =	38.3
L95 =	41.0	L95 =	41.4	L95 =	40.2	L95 =	39.2	L95 =	39.2	L95 =	35.9	L95 =	37.1	L95 =	36.3
Leq =	48.5	Leq =	47.8	Leq =	46.4	Leq =	45.9	Leq =	45.9	Leq =	47.2	Leq =	43.7	Leq =	44.7

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

v 640.11501 10Bragg3l CESARLS_20170201.ism, Printed: 07-09-2017 9:18 AM

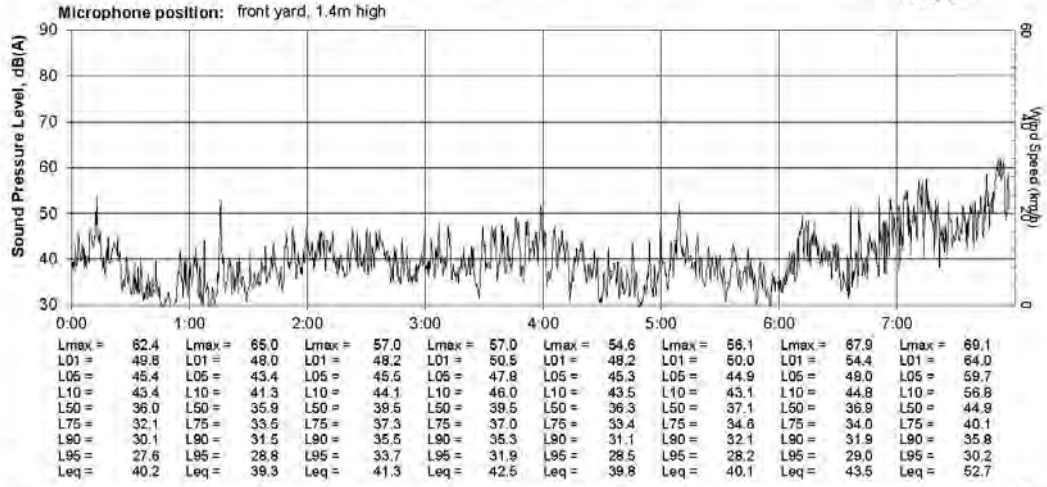
NOISE MONITORING RESULTS

SLR

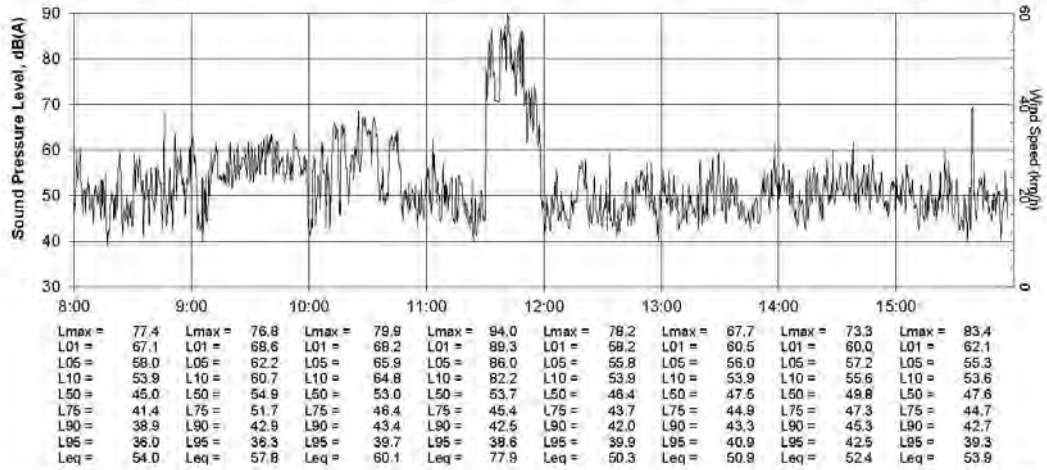
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Sunday 03 Sep 2017

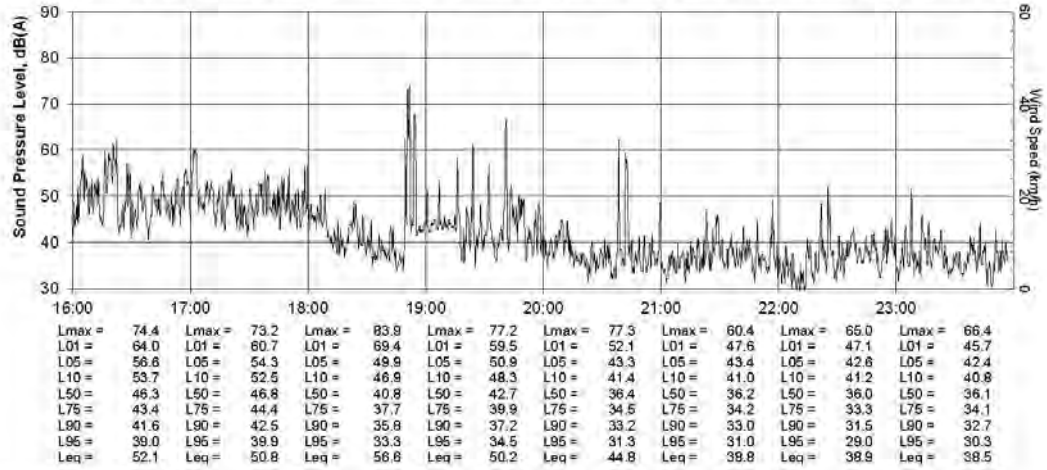
Microphone position: front yard, 1.4m high



Lmax =	62.4	Lmax =	65.0	Lmax =	57.0	Lmax =	57.0	Lmax =	54.6	Lmax =	56.1	Lmax =	67.9	Lmax =	69.1
L01 =	49.8	L01 =	48.0	L01 =	48.2	L01 =	50.5	L01 =	48.2	L01 =	50.0	L01 =	54.4	L01 =	64.0
L05 =	45.4	L05 =	43.4	L05 =	45.5	L05 =	47.8	L05 =	45.3	L05 =	44.9	L05 =	48.0	L05 =	59.7
L10 =	43.4	L10 =	41.3	L10 =	44.1	L10 =	46.0	L10 =	43.5	L10 =	43.1	L10 =	44.8	L10 =	56.8
L50 =	36.0	L50 =	35.9	L50 =	38.5	L50 =	39.5	L50 =	36.3	L50 =	37.1	L50 =	36.9	L50 =	44.9
L75 =	32.1	L75 =	33.5	L75 =	37.3	L75 =	37.0	L75 =	33.4	L75 =	34.6	L75 =	34.0	L75 =	40.1
L90 =	30.1	L90 =	31.5	L90 =	35.5	L90 =	35.3	L90 =	31.1	L90 =	32.1	L90 =	31.9	L90 =	35.8
L95 =	27.6	L95 =	28.8	L95 =	33.7	L95 =	31.9	L95 =	28.5	L95 =	28.2	L95 =	29.0	L95 =	30.2
Leq =	40.2	Leq =	39.3	Leq =	41.3	Leq =	42.5	Leq =	39.8	Leq =	40.1	Leq =	43.5	Leq =	52.7



Lmax =	77.4	Lmax =	76.8	Lmax =	79.9	Lmax =	94.0	Lmax =	78.2	Lmax =	67.7	Lmax =	73.3	Lmax =	83.4
L01 =	67.1	L01 =	68.6	L01 =	68.2	L01 =	89.3	L01 =	68.2	L01 =	60.5	L01 =	60.0	L01 =	62.1
L05 =	58.0	L05 =	62.2	L05 =	65.9	L05 =	86.0	L05 =	55.8	L05 =	56.0	L05 =	57.2	L05 =	55.3
L10 =	53.9	L10 =	60.7	L10 =	64.8	L10 =	82.2	L10 =	53.9	L10 =	53.9	L10 =	55.6	L10 =	53.6
L50 =	45.0	L50 =	54.9	L50 =	53.0	L50 =	53.7	L50 =	46.4	L50 =	47.5	L50 =	49.8	L50 =	47.6
L75 =	41.4	L75 =	51.7	L75 =	46.4	L75 =	45.4	L75 =	43.7	L75 =	44.9	L75 =	47.3	L75 =	44.7
L90 =	38.9	L90 =	42.9	L90 =	43.4	L90 =	42.5	L90 =	42.0	L90 =	43.3	L90 =	45.3	L90 =	42.7
L95 =	36.0	L95 =	36.3	L95 =	39.7	L95 =	39.6	L95 =	39.9	L95 =	40.9	L95 =	42.5	L95 =	39.3
Leq =	54.0	Leq =	57.8	Leq =	60.1	Leq =	77.9	Leq =	50.3	Leq =	50.9	Leq =	52.4	Leq =	53.9



Lmax =	74.4	Lmax =	73.2	Lmax =	83.9	Lmax =	77.2	Lmax =	77.3	Lmax =	60.4	Lmax =	65.0	Lmax =	66.4
L01 =	64.0	L01 =	60.7	L01 =	69.4	L01 =	59.5	L01 =	52.1	L01 =	47.6	L01 =	47.1	L01 =	45.7
L05 =	56.6	L05 =	54.3	L05 =	49.9	L05 =	50.9	L05 =	43.3	L05 =	43.4	L05 =	42.6	L05 =	42.4
L10 =	53.7	L10 =	52.5	L10 =	46.9	L10 =	48.3	L10 =	41.4	L10 =	41.0	L10 =	41.2	L10 =	40.8
L50 =	46.3	L50 =	46.8	L50 =	40.8	L50 =	42.7	L50 =	36.4	L50 =	36.2	L50 =	36.0	L50 =	36.1
L75 =	43.4	L75 =	44.4	L75 =	37.7	L75 =	39.9	L75 =	34.5	L75 =	34.2	L75 =	33.3	L75 =	34.1
L90 =	41.6	L90 =	42.5	L90 =	35.8	L90 =	37.2	L90 =	33.2	L90 =	33.0	L90 =	31.5	L90 =	32.7
L95 =	39.0	L95 =	39.9	L95 =	33.3	L95 =	34.5	L95 =	31.3	L95 =	31.0	L95 =	29.0	L95 =	30.3
Leq =	52.1	Leq =	50.8	Leq =	56.8	Leq =	50.2	Leq =	44.8	Leq =	39.8	Leq =	38.9	Leq =	38.5

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

v 640.11501 10Bragg@ CESAR18_20170201.ism, Printed: 07-09-2017 5:16 PM

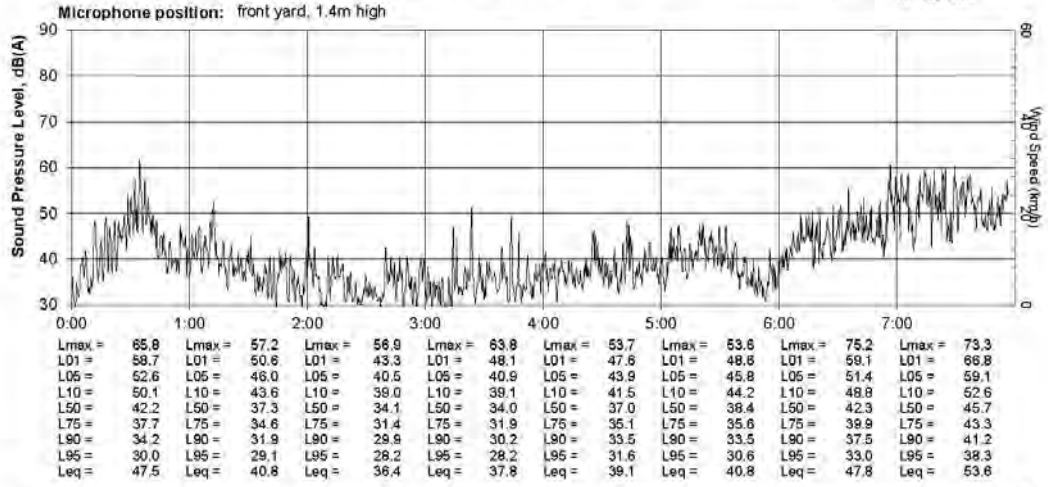
NOISE MONITORING RESULTS

SLR

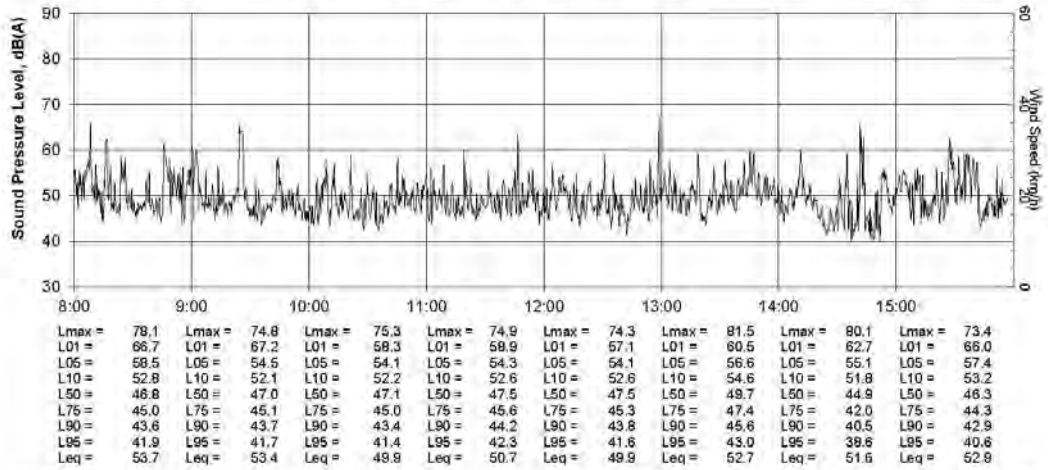
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Monday 04 Sep 2017

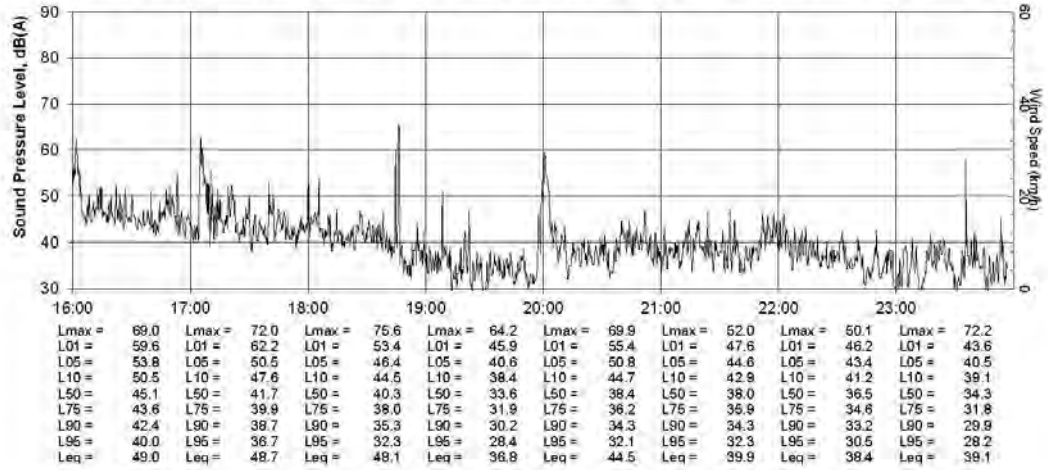
Microphone position: front yard, 1.4m high



Lmax =	65.8	Lmax =	57.2	Lmax =	56.9	Lmax =	63.8	Lmax =	53.7	Lmax =	53.6	Lmax =	75.2	Lmax =	73.3
L01 =	58.7	L01 =	50.6	L01 =	43.3	L01 =	48.1	L01 =	47.6	L01 =	48.6	L01 =	59.1	L01 =	66.8
L05 =	52.6	L05 =	46.0	L05 =	40.5	L05 =	40.9	L05 =	43.9	L05 =	45.8	L05 =	51.4	L05 =	59.1
L10 =	50.1	L10 =	43.6	L10 =	39.0	L10 =	39.1	L10 =	41.5	L10 =	44.2	L10 =	48.8	L10 =	52.6
L50 =	42.2	L50 =	37.3	L50 =	34.1	L50 =	34.0	L50 =	37.0	L50 =	38.4	L50 =	42.3	L50 =	45.7
L75 =	37.7	L75 =	34.6	L75 =	31.4	L75 =	31.9	L75 =	35.1	L75 =	35.6	L75 =	39.9	L75 =	43.3
L90 =	34.2	L90 =	31.9	L90 =	29.9	L90 =	30.2	L90 =	33.5	L90 =	33.5	L90 =	37.5	L90 =	41.2
L95 =	30.0	L95 =	29.1	L95 =	28.2	L95 =	28.2	L95 =	31.6	L95 =	30.6	L95 =	33.0	L95 =	38.3
Leq =	47.5	Leq =	40.8	Leq =	36.4	Leq =	37.8	Leq =	39.1	Leq =	40.8	Leq =	47.8	Leq =	53.6



Lmax =	78.1	Lmax =	74.8	Lmax =	75.3	Lmax =	74.9	Lmax =	74.3	Lmax =	81.5	Lmax =	80.1	Lmax =	73.4
L01 =	66.7	L01 =	67.2	L01 =	58.3	L01 =	59.9	L01 =	57.1	L01 =	60.5	L01 =	62.7	L01 =	66.0
L05 =	58.5	L05 =	54.5	L05 =	54.1	L05 =	54.3	L05 =	54.1	L05 =	56.6	L05 =	55.1	L05 =	57.4
L10 =	52.8	L10 =	52.1	L10 =	52.2	L10 =	52.6	L10 =	52.6	L10 =	54.6	L10 =	51.8	L10 =	53.2
L50 =	46.8	L50 =	47.0	L50 =	47.1	L50 =	47.5	L50 =	47.5	L50 =	49.7	L50 =	44.9	L50 =	46.3
L75 =	45.0	L75 =	45.1	L75 =	45.0	L75 =	45.6	L75 =	45.3	L75 =	47.4	L75 =	42.0	L75 =	44.3
L90 =	43.6	L90 =	43.7	L90 =	43.4	L90 =	44.2	L90 =	43.8	L90 =	45.6	L90 =	40.5	L90 =	42.9
L95 =	41.9	L95 =	41.7	L95 =	41.4	L95 =	42.3	L95 =	41.6	L95 =	43.0	L95 =	38.6	L95 =	40.6
Leq =	53.7	Leq =	53.4	Leq =	49.9	Leq =	50.7	Leq =	49.9	Leq =	52.7	Leq =	51.6	Leq =	52.9



Lmax =	69.0	Lmax =	72.0	Lmax =	75.6	Lmax =	64.2	Lmax =	69.9	Lmax =	52.0	Lmax =	50.1	Lmax =	72.2
L01 =	59.6	L01 =	62.2	L01 =	53.4	L01 =	45.9	L01 =	55.4	L01 =	47.6	L01 =	46.2	L01 =	63.6
L05 =	53.8	L05 =	50.5	L05 =	46.4	L05 =	40.6	L05 =	50.8	L05 =	44.6	L05 =	43.4	L05 =	40.5
L10 =	50.5	L10 =	47.6	L10 =	44.5	L10 =	38.4	L10 =	44.7	L10 =	42.9	L10 =	41.2	L10 =	39.1
L50 =	45.1	L50 =	41.7	L50 =	40.3	L50 =	33.6	L50 =	38.4	L50 =	38.0	L50 =	36.5	L50 =	34.3
L75 =	43.6	L75 =	39.9	L75 =	38.0	L75 =	31.9	L75 =	36.2	L75 =	35.9	L75 =	34.6	L75 =	31.8
L90 =	42.4	L90 =	38.7	L90 =	35.3	L90 =	30.2	L90 =	34.3	L90 =	34.3	L90 =	33.2	L90 =	29.9
L95 =	40.0	L95 =	36.7	L95 =	32.3	L95 =	28.4	L95 =	32.1	L95 =	32.3	L95 =	30.5	L95 =	28.2
Leq =	49.0	Leq =	48.7	Leq =	48.1	Leq =	36.8	Leq =	44.5	Leq =	39.9	Leq =	38.4	Leq =	39.1

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

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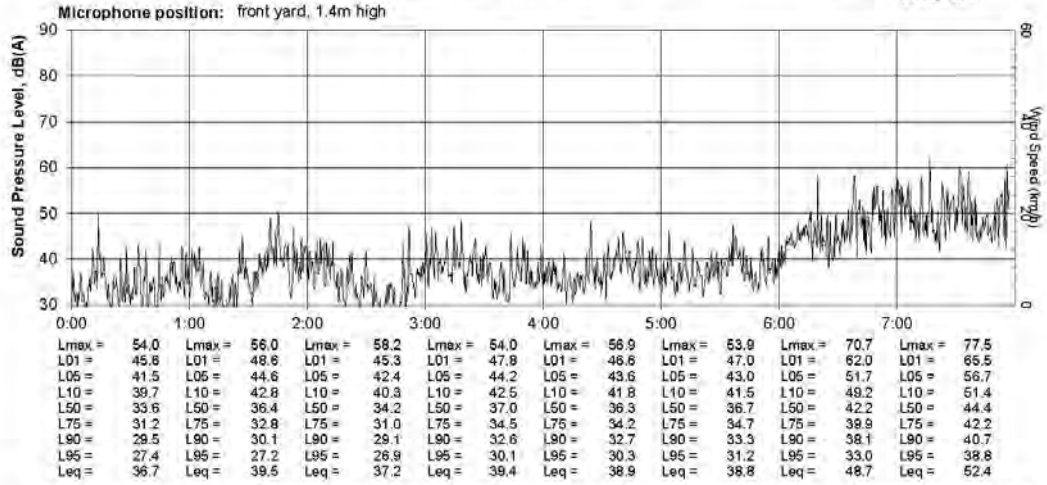
NOISE MONITORING RESULTS

SLR

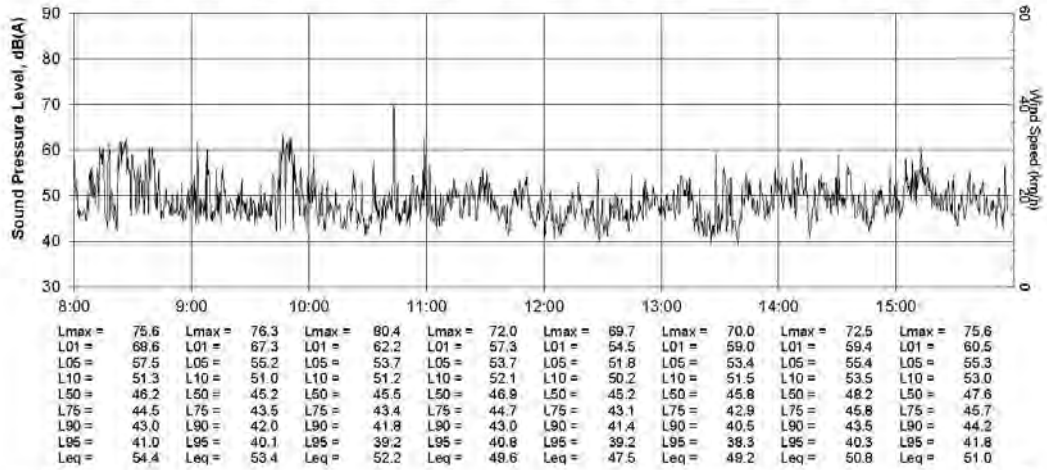
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Tuesday 05 Sep 2017

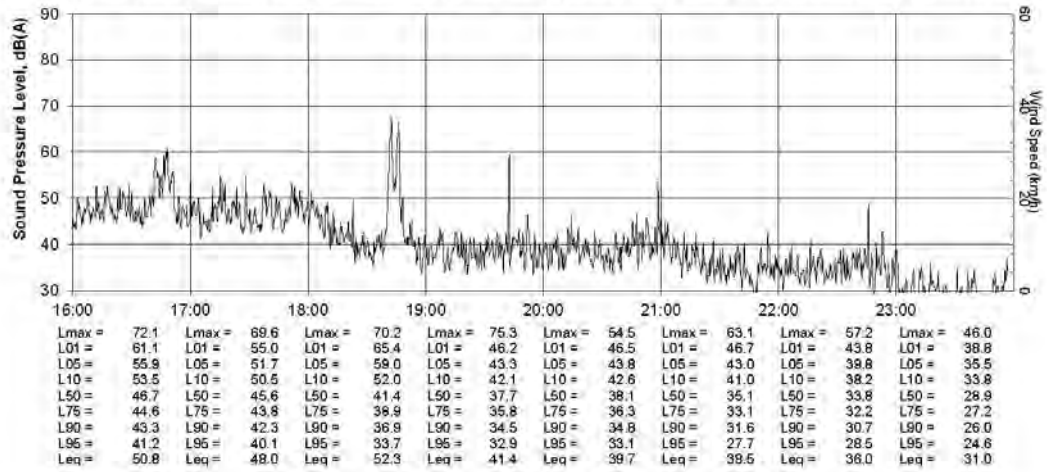
Microphone position: front yard, 1.4m high



Lmax =	54.0	Lmax =	56.0	Lmax =	58.2	Lmax =	54.0	Lmax =	56.9	Lmax =	53.9	Lmax =	70.7	Lmax =	77.5								
L01 =	45.8	L01 =	48.6	L01 =	45.3	L01 =	47.8	L01 =	46.6	L01 =	47.0	L01 =	62.0	L01 =	65.5								
L05 =	41.5	L05 =	44.6	L05 =	42.4	L05 =	44.2	L05 =	43.6	L05 =	43.0	L05 =	51.7	L05 =	56.7								
L10 =	39.7	L10 =	42.8	L10 =	40.3	L10 =	42.5	L10 =	41.8	L10 =	41.5	L10 =	49.2	L10 =	51.4								
L50 =	33.6	L50 =	36.4	L50 =	34.2	L50 =	37.0	L50 =	36.3	L50 =	36.7	L50 =	42.2	L50 =	44.4								
L75 =	31.2	L75 =	32.8	L75 =	31.0	L75 =	34.5	L75 =	34.2	L75 =	34.7	L75 =	39.9	L75 =	42.2								
L90 =	29.5	L90 =	30.1	L90 =	29.1	L90 =	32.6	L90 =	32.7	L90 =	33.3	L90 =	38.1	L90 =	40.7								
L95 =	27.4	L95 =	27.2	L95 =	26.9	L95 =	30.1	L95 =	30.3	L95 =	31.2	L95 =	33.0	L95 =	38.8								
Leq =	36.7	Leq =	39.5	Leq =	37.2	Leq =	39.4	Leq =	38.9	Leq =	38.8	Leq =	48.7	Leq =	52.4								



Lmax =	75.6	Lmax =	76.3	Lmax =	80.4	Lmax =	72.0	Lmax =	69.7	Lmax =	70.0	Lmax =	72.5	Lmax =	75.6								
L01 =	68.6	L01 =	67.3	L01 =	62.2	L01 =	57.3	L01 =	54.5	L01 =	59.0	L01 =	59.4	L01 =	60.5								
L05 =	57.5	L05 =	55.2	L05 =	53.7	L05 =	53.7	L05 =	51.8	L05 =	53.4	L05 =	55.4	L05 =	55.3								
L10 =	51.3	L10 =	51.0	L10 =	51.2	L10 =	52.1	L10 =	50.2	L10 =	51.5	L10 =	53.5	L10 =	53.0								
L50 =	46.2	L50 =	45.2	L50 =	45.5	L50 =	46.9	L50 =	45.2	L50 =	45.8	L50 =	48.2	L50 =	47.6								
L75 =	44.5	L75 =	43.5	L75 =	43.4	L75 =	44.7	L75 =	43.1	L75 =	42.9	L75 =	45.8	L75 =	45.7								
L90 =	43.0	L90 =	42.0	L90 =	41.8	L90 =	43.0	L90 =	41.4	L90 =	40.5	L90 =	43.5	L90 =	44.2								
L95 =	41.0	L95 =	40.1	L95 =	39.2	L95 =	40.8	L95 =	39.2	L95 =	38.3	L95 =	40.3	L95 =	41.8								
Leq =	54.4	Leq =	53.4	Leq =	52.2	Leq =	49.6	Leq =	47.5	Leq =	49.2	Leq =	50.8	Leq =	51.0								



Lmax =	72.1	Lmax =	69.6	Lmax =	70.2	Lmax =	75.3	Lmax =	54.5	Lmax =	63.1	Lmax =	57.2	Lmax =	46.0								
L01 =	61.1	L01 =	55.0	L01 =	65.4	L01 =	46.2	L01 =	46.5	L01 =	46.7	L01 =	43.8	L01 =	38.8								
L05 =	55.9	L05 =	51.7	L05 =	59.0	L05 =	43.3	L05 =	43.8	L05 =	43.0	L05 =	39.8	L05 =	35.5								
L10 =	53.5	L10 =	50.5	L10 =	52.0	L10 =	42.1	L10 =	42.6	L10 =	41.0	L10 =	38.2	L10 =	33.8								
L50 =	46.7	L50 =	45.6	L50 =	41.4	L50 =	37.7	L50 =	38.1	L50 =	35.1	L50 =	33.8	L50 =	28.9								
L75 =	44.6	L75 =	43.8	L75 =	38.9	L75 =	35.8	L75 =	36.3	L75 =	33.1	L75 =	32.2	L75 =	27.2								
L90 =	43.3	L90 =	42.3	L90 =	36.8	L90 =	34.5	L90 =	34.8	L90 =	31.6	L90 =	30.7	L90 =	26.0								
L95 =	41.2	L95 =	40.1	L95 =	33.7	L95 =	32.9	L95 =	33.1	L95 =	27.7	L95 =	28.5	L95 =	24.6								
Leq =	50.8	Leq =	48.0	Leq =	52.3	Leq =	41.4	Leq =	39.7	Leq =	39.5	Leq =	36.0	Leq =	31.0								

Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

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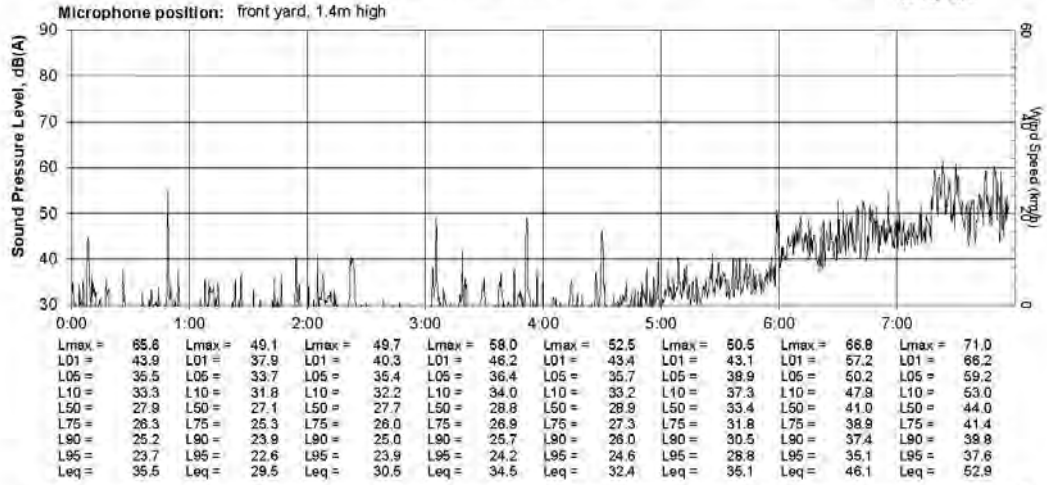
NOISE MONITORING RESULTS

SLR

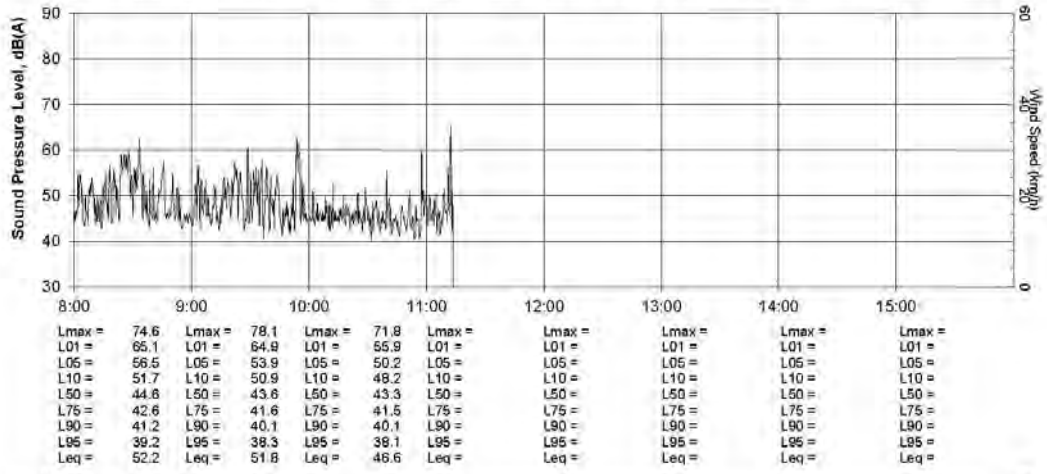
Results of Noise Monitoring

Client: City of Greater Bendigo **Location** 10 Bragg Street, Eaglehawk **Date:** Wednesday 06 Sep 2017

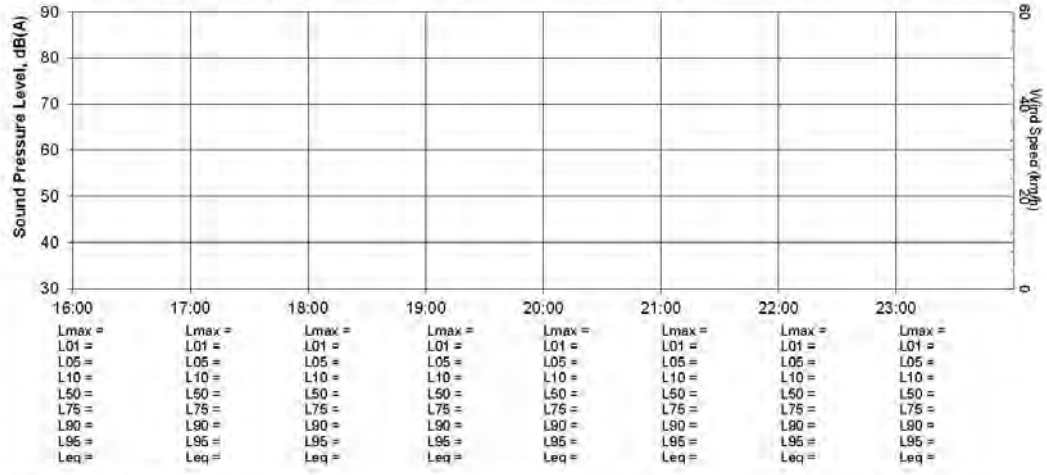
Microphone position: front yard, 1.4m high



Lmax =	65.6	Lmax =	49.1	Lmax =	49.7	Lmax =	58.0	Lmax =	52.5	Lmax =	50.5	Lmax =	66.8	Lmax =	71.0
L01 =	43.9	L01 =	37.9	L01 =	40.3	L01 =	46.2	L01 =	43.4	L01 =	43.1	L01 =	57.2	L01 =	66.2
L05 =	35.5	L05 =	33.7	L05 =	35.4	L05 =	36.4	L05 =	35.7	L05 =	38.9	L05 =	50.2	L05 =	59.2
L10 =	33.3	L10 =	31.8	L10 =	32.2	L10 =	34.0	L10 =	33.2	L10 =	37.3	L10 =	47.9	L10 =	53.0
L50 =	27.9	L50 =	27.1	L50 =	27.7	L50 =	28.8	L50 =	28.9	L50 =	33.4	L50 =	41.0	L50 =	44.0
L75 =	26.3	L75 =	25.3	L75 =	26.0	L75 =	26.9	L75 =	27.3	L75 =	31.8	L75 =	38.9	L75 =	41.4
L90 =	25.2	L90 =	23.9	L90 =	25.0	L90 =	25.7	L90 =	26.0	L90 =	30.5	L90 =	37.4	L90 =	39.8
L95 =	23.7	L95 =	22.6	L95 =	23.9	L95 =	24.2	L95 =	24.6	L95 =	28.8	L95 =	35.1	L95 =	37.6
Leq =	35.5	Leq =	29.5	Leq =	30.5	Leq =	34.5	Leq =	32.4	Leq =	36.1	Leq =	46.1	Leq =	52.9



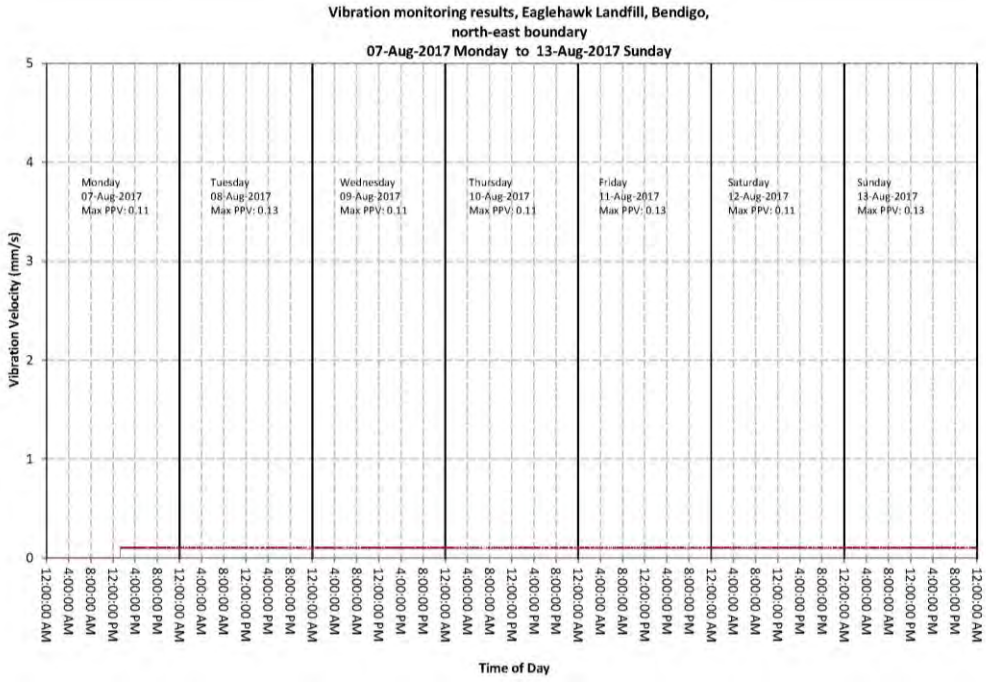
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L01 =	65.1	L01 =	64.9	L01 =	55.9	L01 =		L01 =		L01 =		L01 =	
L05 =	56.5	L05 =	53.9	L05 =	50.2	L05 =		L05 =		L05 =		L05 =	
L10 =	51.7	L10 =	50.9	L10 =	48.2	L10 =		L10 =		L10 =		L10 =	
L50 =	44.6	L50 =	43.6	L50 =	43.3	L50 =		L50 =		L50 =		L50 =	
L75 =	42.6	L75 =	41.6	L75 =	41.5	L75 =		L75 =		L75 =		L75 =	
L90 =	41.2	L90 =	40.1	L90 =	40.1	L90 =		L90 =		L90 =		L90 =	
L95 =	39.2	L95 =	38.3	L95 =	39.1	L95 =		L95 =		L95 =		L95 =	
Leq =	52.2	Leq =	51.8	Leq =	46.6	Leq =		Leq =		Leq =		Leq =	

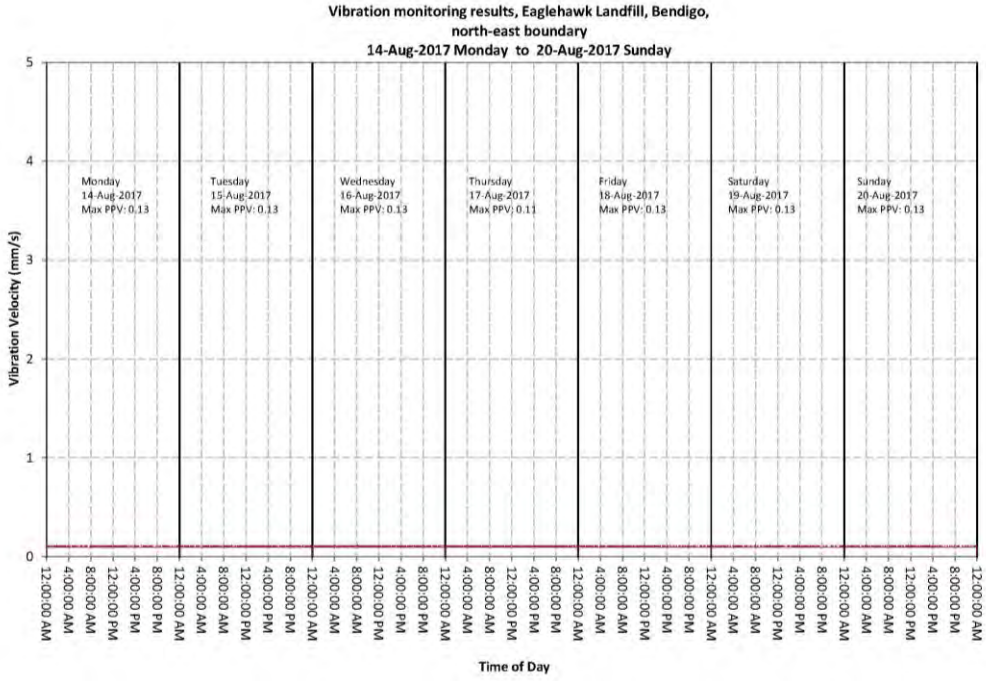


Lmax =	Lmax =	Lmax =	Lmax =	Lmax =	Lmax =	Lmax =	Lmax =
L01 =	L01 =	L01 =	L01 =	L01 =	L01 =	L01 =	L01 =
L05 =	L05 =	L05 =	L05 =	L05 =	L05 =	L05 =	L05 =
L10 =	L10 =	L10 =	L10 =	L10 =	L10 =	L10 =	L10 =
L50 =	L50 =	L50 =	L50 =	L50 =	L50 =	L50 =	L50 =
L75 =	L75 =	L75 =	L75 =	L75 =	L75 =	L75 =	L75 =
L90 =	L90 =	L90 =	L90 =	L90 =	L90 =	L90 =	L90 =
L95 =	L95 =	L95 =	L95 =	L95 =	L95 =	L95 =	L95 =
Leq =	Leq =	Leq =	Leq =	Leq =	Leq =	Leq =	Leq =

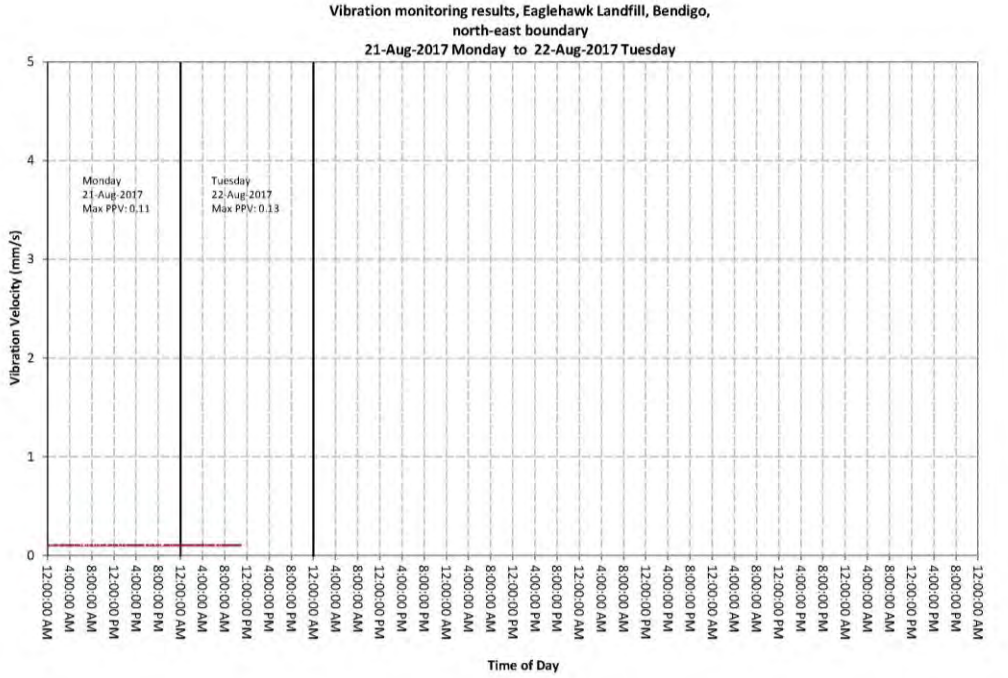
Graph based on Leq at 20s intervals.
Hourly percentiles based on Lp at 0.1s intervals

VIBRATION MONITORING RESULTS

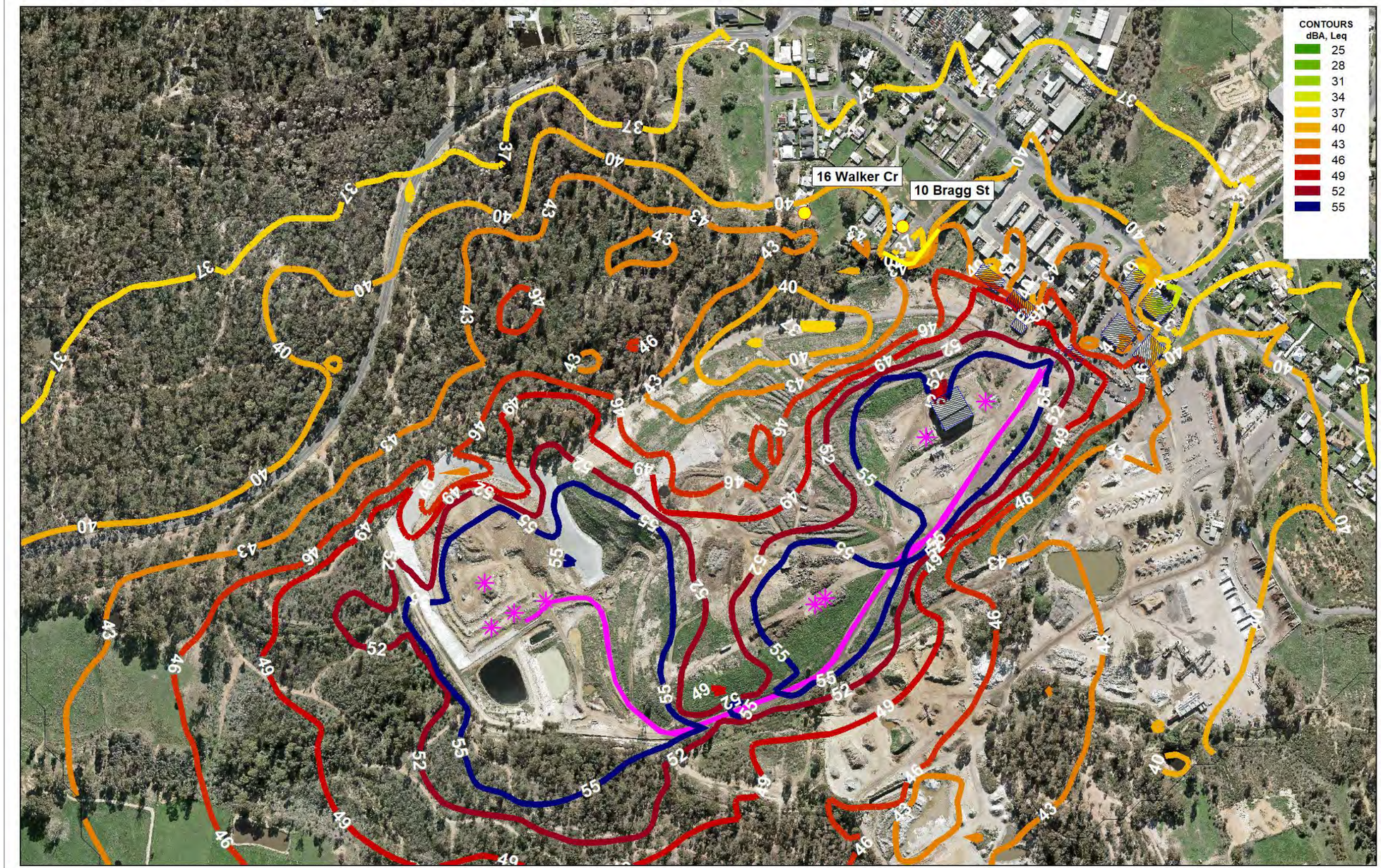




VIBRATION MONITORING RESULTS



PREDICTED NOISE FROM CURRENT OPERATIONS



SUITE 2 / 2 DOMVILLE AVENUE
HAWTHORN
VIC 3122
AUSTRALIA
T: 61 3 9249 9400
F: 61 3 9249 9499
www.slrconsulting.com

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SCALE
0 20 40 80 120 160 200 240 m

ORIENTATION

LEGEND
- Wall
- Emission line
- Point source
- Area source
- Main building
- Point receiver
- Limit line

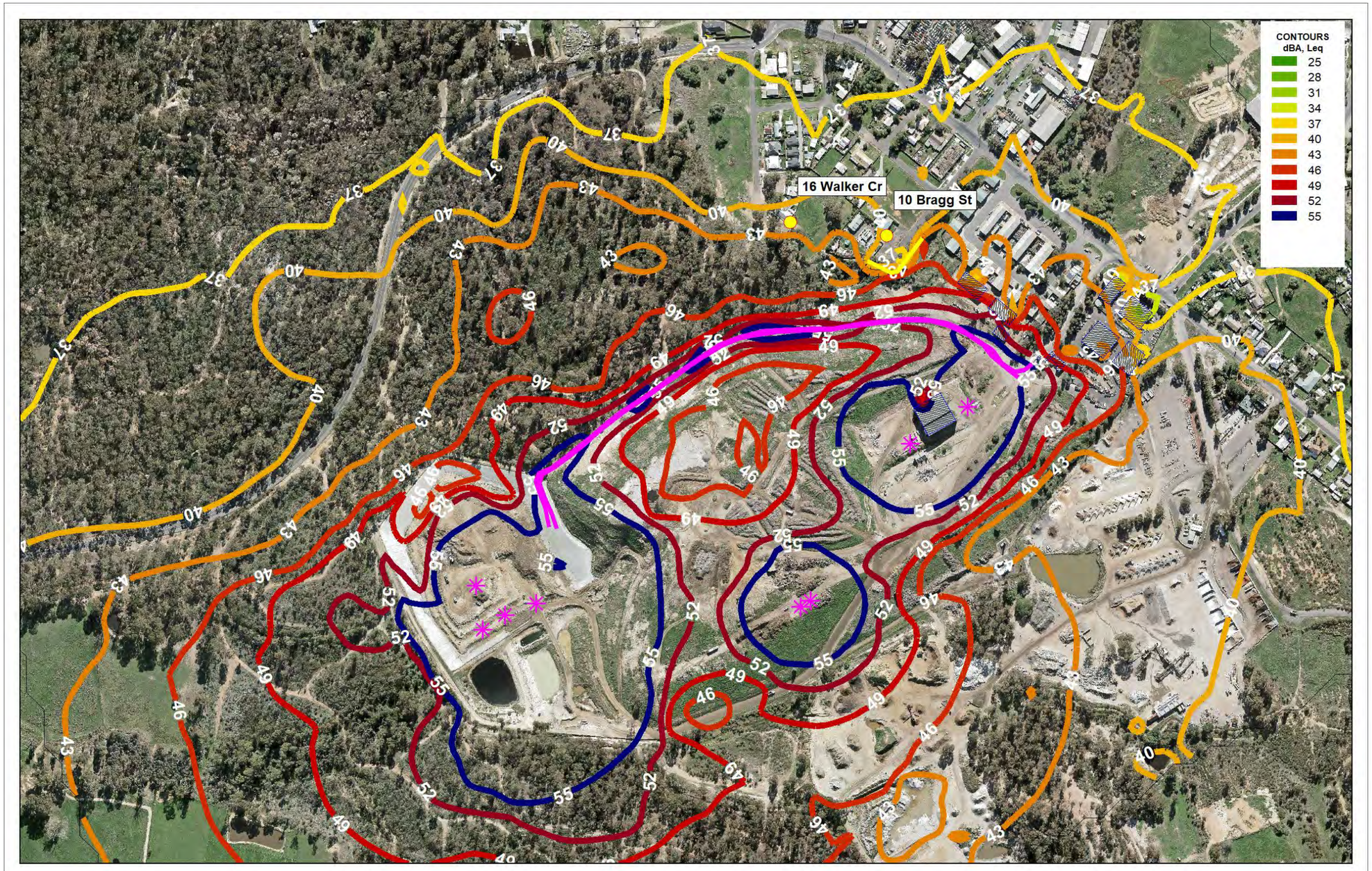
PROJECT	Eaglehawk Landfill
CLIENT	City of Greater Bendigo
DESCRIPTION	Curent Landfill Operation Predicted noise levels

Date:	23-Oct-2017
Project No.:	640.11501
Report No.:	640.11501-R1
Prediction Method:	ISO9613
Prepared By:	GRC
Prediction Height:	1.5 m

APPENDIX
C

MAP NO.
001

PREDICTED NOISE FROM PROPOSED OPERATIONS USING NORTH ROAD



SUITE 2 / 2 DOMVILLE AVENUE
HAWTHORN
VIC 3122
AUSTRALIA
T: 61 3 9249 9400
F: 61 3 9249 9499
www.slrconsulting.com

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SCALE
0 20 40 80 120 160 200 240 m

ORIENTATION
N

LEGEND
- Wall
- Emission line
- Point source
- Area source
- Main building
- Point receiver
- Limit line

PROJECT	Eaglehawk Landfill
CLIENT	City of Greater Bendigo
DESCRIPTION	Proposed Landfill Operation using North Road Predicted noise levels

Date: 23-Oct-2017	
Project No.: 640.11501	
Report No.: 640.11501-R1	
Prediction Method: ISO9613	
Prepared By: GRC	
Prediction Height:1.5 m	

APPENDIX
D

MAP NO.
001

ODOUR

CITY OF GREATER BENDIGO

Odour Assessment for Eaglehawk Landfill



30 March 2019

CEE

Consulting Environmental Engineers

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Prepared by:

CEE Pty Ltd

150 Chesterville Road, Cheltenham VIC 3192

Version	*Prepared by*	*Date*	*Reviewed by*
0-Draft	Ian Wallis	23 July 2018	JR
1-Final Draft	Ian Wallis	30 December 2018	JR/SF
2-Final	Ian Wallis	30 March 2018	JR/SF

Issued to:

City of Greater Bendigo

195-229 Lyttleton Terrace

Bendigo Victoria 3552

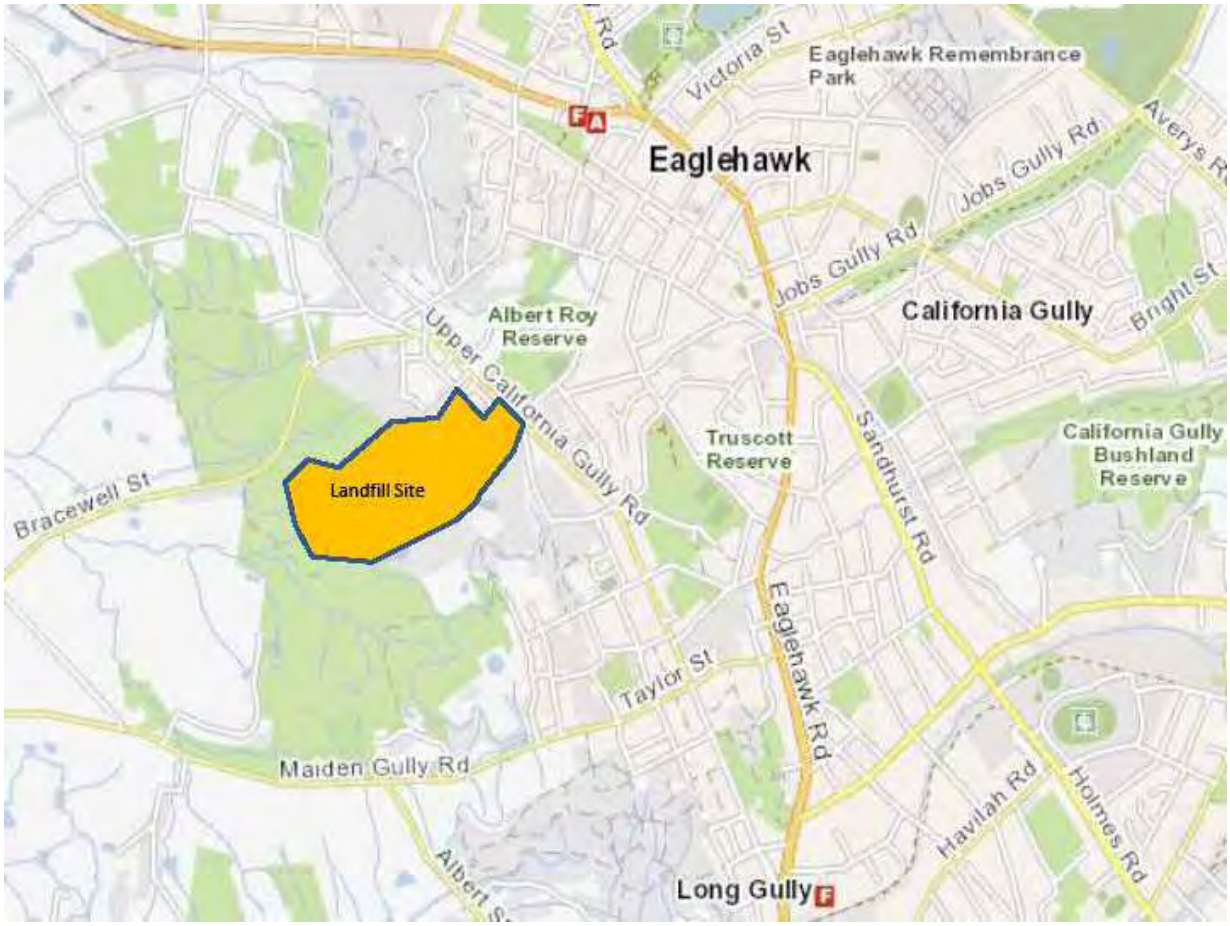
This report constitutes the professional opinion and judgement of Consulting Environmental Engineers

1. Background

The City of Greater Bendigo manages the wastes from the City and has developed an extensive landfill, waste transfer and recycling facility in Eaglehawk. The site is 5 km north-west of the Bendigo CBD. The Eaglehawk facility occupies an area of 28 ha and is located to the west of Upper California Gully Road (see Figure 1-1).

Adjacent land uses are industrial on the south boundary, with park and residential uses further to the south, residential immediately to the east, apart from a small commercial zone at the north-east corner of the landfill, residential to the north and a long strip of park and public open space along the western boundary. The land further west is zoned as farming, but is actually used as rural residential lots. The landfill has no defined buffer zone and potential conflicts with residential and commercial uses.

Figure 1-1 Location Map for Eaglehawk Landfill and Recycling Centre



EPA guidelines for the management of landfills (EPA Pub. 1642, EPA, Oct 2017) specifies a default buffer distance of 500 m between the perimeter of a landfill, such as Eaglehawk, receiving municipal (putrescible) waste. The default buffer distance is the same for both operating and closed landfills, although the buffer for operating landfills is to manage the risk of landfill gas and amenity impacts, while the buffer for closed landfills is to manage the risk of landfill gas impacts only.

The landfill site is owned by the City of Greater Bendigo. The landfill has been licensed to receive waste since 1975, although the site has apparently been used for the disposal of mine wastes and other waste for a much longer period. The first stages of the landfill do not have a liner or leachate drainage system but subsequent cells have PE liners and a leachate collection system. All completed cells have been covered with a clay cap and a landfill gas harvesting system is operating (since 2004). The landfill gas is used to generate power for the grid.

The site has an:

- Active waste disposal zone (Cell 5, on the western side of the landfill),
- Waste transfer zone (approximately 40 per cent of the municipal waste received at the site is transferred to a landfill at Patho in Campaspe Shire),
- Resource recovery centre and recycle shop,
- Organics shed (where fortnightly collections of waste food and organic wastes are stored before being transferred to a composting site),
- Mulching site, where green wastes are collected and periodically mulched,
- Sites for solid inert waste, shredded tyres, prescribed waste including asbestos and lightly contaminated soil (Category C).

Cell 5 was constructed in 2014 and will be filled about 2023. It is intended to be the last active waste disposal cell at the site as the Council has decided that no more cells will be built. At present, approximately 40 per cent of the household waste received at the site is transferred to another landfill at Patho to the north and the long-term plan is to expand the transfer to 100 per cent once Cell 5 is full.

The EPA Landfill Guidelines allow for the default buffer distance to be reduced based on a risk assessment that considers design and operational measures, and the assessment demonstrating that the environment would be protected and amenity not adversely affected at the reduced distance. The assessment involves a series of technical studies on landfill gas, hydrogeology, landfill design and history of operations and odour impact assessment. The assessment is undertaken as an environmental audit conducted under Section 53V of the Environment Protection Act 1970 that assesses the risk of harm from the amended buffer area to surrounding development or proposed development. An EPA auditor has been appointed by the City of Bendigo to assess the evidence and recommend a reasonable and appropriate buffer zone.

As part of the risk assessment for defining the recommended buffer zone, the City of Greater Bendigo appointed Consulting Environmental Engineers (CEE) to investigate and report on odour risk for the Eaglehawk Landfill Site.

2. Scope of Work for Odour Assessment

The scope of work for the odour assessment was defined by the City Council in July 2017, well before the appointment of the auditor. The scope defined by the City for the odour assessment was to investigate and report on:

- Compliance with EPA licence condition at the EPA-licenced boundary for the landfill including recommended actions if compliance is not currently achieved.
- An appropriate buffer zone to limit the risk of odour nuisance in the area surrounding the landfill and recommended planning overlay and building restrictions (if any) within the recommended buffer distance.

The odour assessment is required to consider current and future operations of the landfill, use predictive modelling to establish the extent of odour risk and recommend a suitable buffer distance to implement in the Council Planning Scheme. The buffer distance will take into account current landfill design, environment and amenity risk, operational measures, human health, and any unintended events such as wet weather and machinery failure.

The odour assessment addresses the requirements in EPA Publication 788.2 October 2014, *Siting, Design, Operation and Rehabilitation of Landfills* and EPA Publication 1625-June 2016, *Assessing Planning Proposals near Landfills*, the Planning and Environment Act and the Environment Protection Act.

In summary, Council required that the odour investigation assess and report on:

- If at the time of investigation, the odours at the EPA licenced boundary were compliant with the licence.
- The risk to the residential area associated with airborne odour releases;
- If the 500 m landfill buffer distance could be reduced to 250 m or other lesser distance from the landfill boundary based on appropriate modelling methods;
- If waste was excavated on the east side of the industrial shed as per the Transfer Station Master Plan, would the odour release cause a nuisance and what actions could be done (if any) to avoid an odour nuisance during the construction phase.

Upset Conditions

At the Project Review Meeting on 31 July 2018, and after the appointment of the auditor, the scope was increased to address upset conditions in the landfill.

3. Current and Future Site Operations

Figure 3-1 shows the present operations and illustrates the areas where various types of waste are currently handled. All wastes enter the site via a weighbridge at the east entrance to the site.

1. At present the landfill receives approximately 100,000 t/yr of mixed and putrescible wastes. Of these, approximately 60,000 t/yr are buried in the active cell on the west side of the landfill. The active landfill area extends over 200 m^2 each day and is covered each night, in accordance with EPA Licence conditions.
2. Liquid wastes delivered to the site by tankers are deposited in shallow trenches dug into the active cell.
3. Approximately 40,000 t/yr of putrescibles wastes are transferred to the Patho landfill near Echuca. These wastes are discharged onto a concrete slab (shown as the Patho waste transfer site), and pushed by loader into trailers on the north side of the transfer site.
4. About 5,000 t/yr of food and organic wastes (FOGO) are collected in a large shed in the north-east corner of the site (labelled as Organics Shed). These wastes are removed weekly to a composting site at another location.
5. Most wastes arrive at the site in municipal garbage trucks. However about 2,000 t/yr of mixed wastes are brought to the site in trailers and small trucks, and deposited behind the organics shed in the areas labelled as domestic car face.
6. Soil and demolition wastes are stored on the edge of the active cell and along the southern edge of the landfill, and later used as cover or road material.
7. A large quantity of green waste from Council pruning and green waste collections is stored in the mulch area. Every two to four weeks, the mulch is chipped. It is stored on the landfill until dry and then used as cover material or mulch for outside gardens, depending on the quality of the mulch.
8. Leachate from the active cell is collected in the leachate pond in the south-west of the landfill, from where it is recycled over the top of the active cell.
9. Most of the area between the organics shed and the active cell are former active cells that have been filled and capped in recent decades.

As noted above, there is a recycling centre and shop at the front entrance to the landfill.

Figure 3-2 shows the possible future operations at the site. The principal changes are:

1. The Patho transfer station will be moved into the shed;
2. The organics storage and transfer will be relocated to the Patho transfer site;
3. The mulching/green waste storage and mulching area will be extended to the south-west of the site.

The revised operations are currently anticipated to commence in about 2020 and continue for the life of the active cell (to about 2023). After that, a new and larger waste transfer station will be constructed on the site, with all putrescible wastes being transferred to the Patho landfill. Organic wastes, mulch and green wastes will continue to be handled on the site.

Figure 3-1 Plan Showing Current Operations on Eaglehawk Landfill



Figure 3-2 Plan Showing Proposed Future Operations on Eaglehawk Landfill



4. Adjacent Land Uses and Potential Constraints

Figure 4-1 shows the land use zoning of the site and adjacent areas. For reference, the figure shows the 500 m distance EPA buffer zone as a red line surrounding the landfill. The figure also shows a smaller nominal 250 m buffer zone that is a future target for the Council when odour, landfill gas and other potential risks are fully managed.

Most of the land immediately to the west, north-west and south-west of the landfill is forested crown land, zoned Public Conservation and Resource Zone (PCRZ) and Public Use Zone (PUZ7). However, there are a number of established rural residential properties west of the landfill in the farming zone that extends from 200 m to 600 m west of the landfill (and from the current active cell for disposal of wastes).

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There is a mixture of land uses to the north of the landfill, of which the most sensitive is the general residential zone (GRZ coloured pink) which abuts the north boundary of the landfill (and is separated by a vegetated bund and wooden fence). There is extensive residential development in this zone, although there are some unused blocks, and so there is regular pressure on the Council to permit development of the empty blocks.

To the north there is also a public utility zone PUZ), which is currently a forested area recently damaged by bushfires, so the remaining growth is sparse.

To the north-east of the landfill is a commercial zone (IN1Z) which abuts the north-east boundary of the landfill from about 150 m from the Organics Shed, with a range of established commercial properties across Upper California Gully Road. The green zone (PPRZ) is a public recreation area with a range of established uses including BMX, badminton, cricket, baseball and dog exercise.

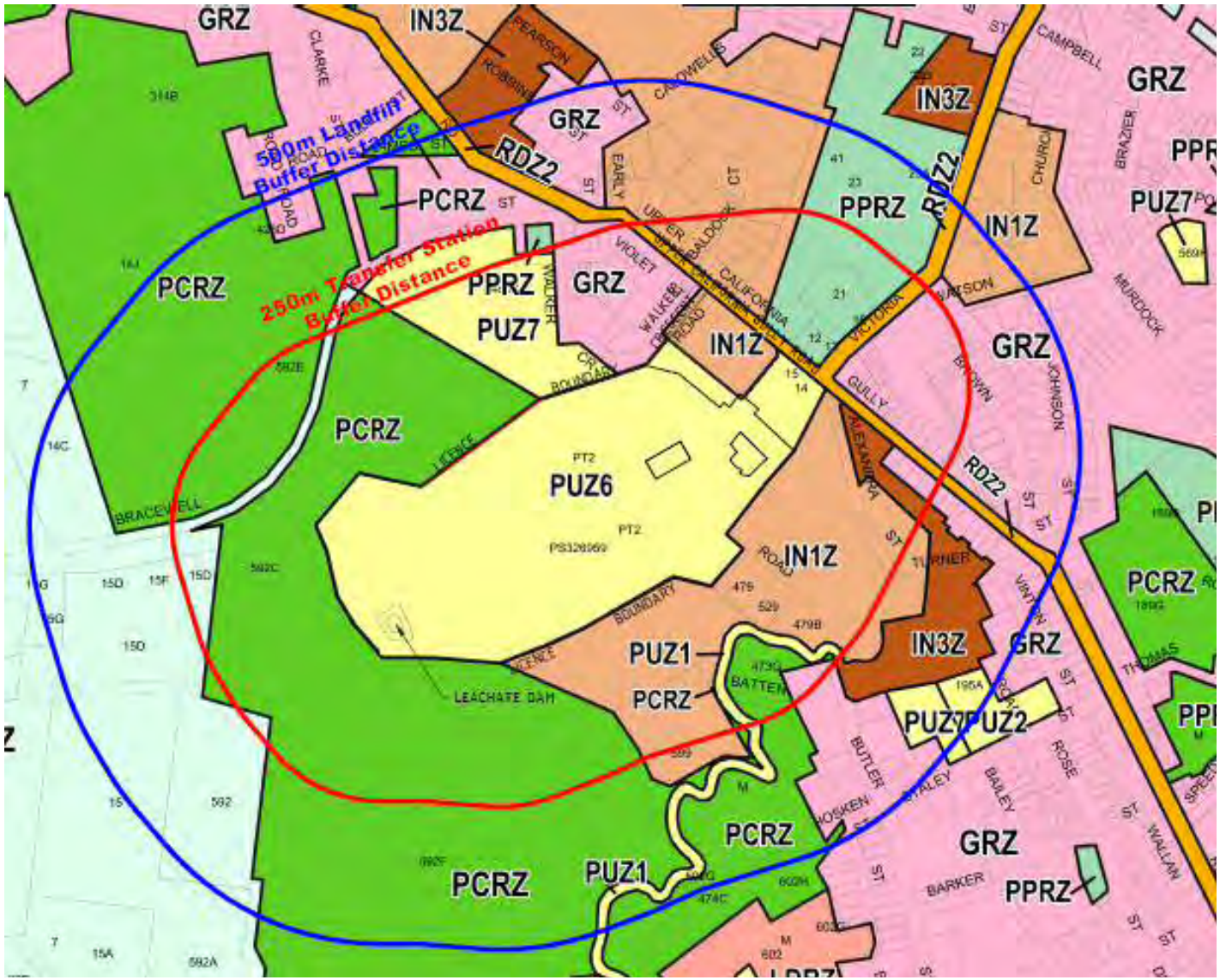
To the east of the landfill there is another general residential zone (GRZ coloured pink) which extends from about 250 m away from the Organics Shed, and is more distant from the active landfill cell.

The south boundary of the landfill abuts a large soil and concrete recycling operation that is privately owned and operated. There is another zone or residential development that extends from about 220 m to the south, including the large California Gully Primary School on the 500 m buffer line.

Currently, there are over one hundred residences in the general residential and rural residential zones within the Council Planning Scheme that are within the EPA default buffer of 500 m for putrescible landfills as shown by the blue line in Figure 4-1.

Council is experiencing pressure from owners and property developers to construct dwellings and unit developments within the 500 m buffer distance. In addition, there have been recent odour complaints by residents in close proximity to the landfill during normal operating conditions. The odour complaints have increased since Council started using the Organics Shed as a transfer station for Food Organics Greenwaste Organics (FOGO). The FOGO is supposed to be removed by the end of each day, but there is quite often a residual of 3 to 5 m^3 remaining to be cleared the next morning.

Figure 4-1. Buffer Zone (500 m) for Putrescible Landfill and Smaller (250 m) Buffer Zone for Proposed Transfer Station



The FOGO odour increases on wet days. To address this odour issue, Council has commenced spreading zeolite sand on the concrete floor and over any FOGO left in the shed on Friday afternoon to Monday morning to reduce odour emissions. The shed doors are also kept closed during weekends.

Operations Constraint

The major operational constraint is that the site receives approximately 100,000 t/yr of mixed and putrescibles wastes every year, including about 5,000 t/yr of FOGO wastes. Thus, operation of the site as a landfill must continue for the next few years. After that period, the site will continue operation as a waste transfer site.

As shown in Figure 3-2, Council is currently considering moving the FOGO transfer from the Industrial Shed to an open hardstand area on the east side of the Industrial Shed and to moving the mulching operations to the rear of the landfill.

Capacity of Existing Landfill Cells

The Eaglehawk landfill is estimated to reach full capacity by 2023 and be fully rehabilitated by the end of the 2025. The site is being considered for ongoing use as a Resource Recovery Centre and Transfer Station after closure of the landfill cells. A Transfer Station Redevelopment Master Plan is being developed in anticipation of the landfill closure.

The proposed Transfer Station Plan means that part of the existing mounded landfill wastes on the east side of the industrial shed will need to be removed. If Council approve the development of the proposed Transfer Station on the Landfill Site, it will need to be built and operational by the end of the 2022/2023 Financial Year.

Stages in Odour Assessment

The odour assessment focuses on current operations, as the current operations can be observed, odour emission rates measured and information obtained from nearby residents to check the predictions of odour dispersion modelling.

Odour emissions are likely to increase when the existing mounded landfill wastes are excavated, as that will remove the cap on the part of the landfill and require the landfill gas collection system to be decommissioned. It is anticipated that it may take about a year to get through this phase. Thereafter, odour emissions may gradually decrease, depending on several factors:

1. The level of odour capture and odour scrubbing in the new transfer station;
2. The actual emission rate of odour from the FOGO stored on an external hardstand which is likely to be the same or perhaps even higher than from the present storage arrangement in a shed, particularly in wet weather;
3. The amount of mulching carried out at the site;
4. The effectiveness of the cap on cell 5, and the period before commercial quantities of landfill gas develop so that gas collection can commence; and
5. The final decades when the active cells produce too little landfill gas to support a commercial operation to collect and burn the gas. There is a risk of increased leakage of gas and odour during that period unless appropriate management plans are out in place.

5. Methodology for Odour Assessment

The methodology followed in the odour risk assessment was as follows.

1. Site inspection to appreciate current operations on the site, and to develop the odour sampling program and timing.
2. Odour sampling program, involving the collection of representative samples of air from various locations and testing by olfactometry in a NATA-certified laboratory to determine odour concentrations and odour emission rates.
3. Assessment of the extent of operations (eg, area of active fill, quantity of waste on Patho transfer hard stand) and fugitive emissions to develop an inventory of odour emissions from the site under normal operations and various scenarios for higher odour emissions;
4. Obtaining wind and meteorological data for Bendigo from the Bureau of Meteorology (BoM) and processing that data to develop input files for odour dispersion modelling.
5. Defining an appropriate odour criterion as a basis for assessing the risk of odour impact on local amenity.
6. Preparing input files and then using the AERMOD dispersion model to predict contours of odour concentrations for the various scenarios. The predictions from the AERMOD model were checked using the Ausplume dispersion model.
7. Carrying out a survey of the community in the area around the landfill to establish their perception of the extent, frequency and intensity of odour, that they attributed to the landfill, and also to establish areas in which odour was not detected. The results of the community surveys are a form of verification of the odour model predictions.
8. Carrying out surveys near the perimeter of the landfill to check if odour occurs beyond the landfill boundary at noticeable levels.
9. Plotting the results of odour modelling and the community surveys on a series of comparable plans.
10. Reporting on whether, at the time of investigation, the odours at the EPA licenced boundary were compliant with the licence.
11. Assessing whether the 500 m landfill buffer distance could be reduced to 250 m or other lesser distance from the landfill boundary, taking into account the results of odour modelling for normal operations, upset conditions and future operations, and the findings from the community survey.
12. Assessing whether waste excavated in future on the east side of the industrial shed as per the Transfer Station Master Plan would release sufficient odour to cause a nuisance, and the actions that could be undertaken to limit or avoid an odour complaint during the construction phase.
13. Preparing a progress report for the Technical Review Committee.
14. Preparing this final report, taking into account comments made on the progress report.

6. Odour Objective

Legislation relevant to assessing odour impacts in Victoria is the Environmental Protection Act 1970. The Regulations to the Act - the *Environment Protection (Scheduled Premises and Exemptions) Regulations, 1996*, require that *"odours offensive to the senses of human beings must not be discharged beyond the boundaries of the premises"*.

The requirements of the Act and Regulation are formalised through *the State Environment Protection Policy (Air Quality Management) – SEPP (AQM*). Note No.8 to Schedule A of the *SEPP AQM* states that the odour concentration to be achieved at the boundary of a new development is 1 OU. This limit is based on dispersion modelling using the AERMOD model (formerly the Ausplume model) at a 3-minute averaging time and 99.9% frequency. This design standard is extremely rigorous by international and local standards.

The urban community expects a high level of control against odour nuisance and thus the odour criterion is set at the 99.9 percentile frequency. This means that the predicted odour level must be within the odour criterion for 99.9 % of the hours in a year, as set out in the SEPP (AQM).

A 3-minute averaging period is used to ensure that short term peaks in odour levels are predicted and assessed.

The units for odour measurement using dynamic olfactometry are 'odour units' (OU), which are dimensionless and are effectively 'dilutions to the odour threshold'. The procedure for measurement of odour is the *Australian Standard —Determination of Odour Concentration by Dynamic Olfactometry, AS4323.3:2001.* A panel of six or more persons determine when they can only just detect the difference between an odorous sample and a filtered, non-odorous air sample (this determines the odour threshold). Thus 1 OU corresponds to the situation where half the Panel members can detect an odour in a controlled odour-free laboratory atmosphere.

Samples of ambient air with a low odour level (less than about 10 OU) cannot be measured accurately by the Panel method. Hence it is necessary to use a computer model to extrapolate odour predictions to the low concentration range.

Risk Assessment

Section 16 of the SEPP (AQM) states that a Risk Assessment may be carried out to

(a) develop air quality objectives and design criteria;
(b) establish air quality management priorities;
(c) assess the environmental and health impacts of air pollution; and
(d) identify the emissions or sources of greatest risk to beneficial uses.

The outcome of a risk assessment is an appropriate odour criterion for particular types of air contaminants (eg, odour from a landfill).

Using risk assessment and the correlation of complaints to predicted odour levels, several agencies have set an odour target which meets the objective of being the practical odour limit at which no odour complaints occur. For example, South East Water (SEW) and North East Water (NEW) apply an odour target of 4 OU based on 99.9th percentile compliance using *Ausplume* dispersion model predictions. Selection of this odour target of 4 OU was based on a 2010 SEW study around two treatment plants that identified 4 OU at the 99.9 percentile for a 3-minute averaging time as the odour contour encompassing all odour complaints or reports. A similar procedure was followed by NEW in selecting a 4 OU target. The 4 OU level has been accepted as an appropriate risk-assessed target by the EPA and VCAT Planning Panels (Wodonga Planning Scheme Amendment C105, 2017).

In WA, the Water Corporation has adopted a 5 OU target, based on correlation of odour complaints and odour modelling around the existing Halls Head, Broome, Subiaco, Mandurah, Woodman Point and Beenyup treatment plants. The 5 OU contour was found to encompass odour complaints from the urban community and also the zone in which the community reported in surveys that odour can be perceived as annoying. The 5 OU contour was calculated using the Ausplume model at 99.9 percentile frequency over a 1-hour averaging period. This criterion has been endorsed by the WA EPA in determining an acceptable level of odour for sensitive land uses (EPA Bulletin 1272, October 2007).

For landfills, the risk assessment in the Broiler Code (EPA Publication 1643, 2017) has commonly been adopted in VCAT submissions by proponents (Odour Assessment, Proposed Extension of Wests Road Landfill, CAMM, May 2018; Odour Impact Assessment, - Proposed Extension of Wests Road Landfill, Werribee, ESA, May 2018). The risk matrix is shown in Table 6-1 and indicates the 5 OU level at 99.9 percentile frequency encompasses low risk.

Table 6-1. Odour Risk Matrix for Broiler Farms

Frequency	Odour concentration		
Odour events per year	10+ OU	6–9 OU	1–5 OU
0–9	see note below		
10-44	H	M	L
45-175	H	H	M
>175	H	H	M

Key:

L = low risk (compliant with SEPP (AQM))

M = medium risk

H = high risk

Landfill odour has a different and slightly more offensive character than broiler farm odour. Thus, a slightly more stringent odour target for landfills is considered appropriate. From a comparison of the odour model predictions for the Melbourne Regional Landfill at Ravenhall (CAMM, 2018) and the distribution of odour complaints (approximately 450 complaints), CEE considers an appropriate odour criterion to protect residential amenity in the region of the Eaglehawk Landfill is 4 OU at 99.9 percentile frequency.

7. Odour Emission Rates

Odour emission rates were based on measurements at the Eaglehawk landfill by Ektimo supplemented by measurements at other landfill sites.

Ektimo was engaged by Consulting Environmental Engineers to conduct odour monitoring at the Bendigo Landfill located on Upper California Gully Road. Three rounds of monitoring were conducted. Monitoring was conducted on 8 March 2018, 10 April 2018 and 1 May 2018 at the locations shown in Figure 7-1.

Figure 7-1 Odour Monitoring Locations at Eaglehawk Landfill - 2018



Selection of Odour Sampling Technique

The purpose of odour sampling is to obtain a sample of air that represents the odour level of the source being sampled. For flat, relatively homogeneous surfaces, such as the leachate pond, an isolation flux hood was used in accordance with AS 4323.4.

Wastes on the tipping face are lumpy and uneven, and cannot be sealed by a flux hood. A representative sample cannot be enclosed within the small area of a flux hood. Thus, indirect measurements are widely used to sample odours from a tipping face, typically the upwind-downwind method or the back-calculation method. Both of these methods suffer from inaccuracies because the edge of the plume is poorly defined and the plume meanders during sampling. The inaccuracies can be minimized by using the enclosure method, which is a variation of the upwind-downwind method, but involves a plastic tunnel which keeps the plume of travelling air within well defined boundaries.

The fan used to create the plume operates at a constant speed and thus minimises the inaccuracies associated with variations in wind speed over time.

The IFH method was used to collect samples on the leachate pond and interim cap, and the enclosure method was used on the tipping face and the mulch pile. The upwind-downwind method was used to measure odour emissions from the FOGO wastes. These wastes are contained in a large rectangular shed with a roll-a-door at each end. By half-opening each roller-a-door, the east-west breeze entered via one door, traversed the stored FOGO wastes and left via the downwind door. By collecting air samples over a grid at each door opening a representative sample of upwind and downwind odour was obtained. The frame of the doors, the floor and the base of the half-open doors provided a firm boundary to the plume and thus enabled upwind and downwind samples to be collected in optimum conditions (where the edges of the plume are precisely known). Odour emissions from the whole surface of the FOGO were included in the downwind samples.

The waste composition varies from hour-to-hour (depending on the streets from which garbage is being collected), from day-to-day (depending on the suburb from which garbage is being collected), from season-to-season (as seasonal factors and weather affect the waste composition). To gain some understanding of the variability at Bendigo, samples were collected on two or three separate weeks (depending on the source). Odour emission rates in the literature for landfill tipping faces cover a wide range (Asimakis and Pollock, 2015). The emission rates used in this assessment are near the middle of the range reported for other landfills.

Current Active Cell - Active Tipping Face

Monitoring was conducted using the temporary enclosure technique. A portion of material was removed from the active tipping face for sampling and spread out for sampling using a front-end loader. The temporary enclosure was immediately erected on the material covering approximately 14m^2 (taking less than 10 minutes). The temporary enclosure was allowed to equilibrate for 10 minutes prior to odour sampling and flow rate measurements. Sampling was conducted over two days; 10 April 2018 and 1 May 2018. The sample collection enclosure is shown in Figure 7-2.

The area of the active tipping face depends on the activities at the time and management of the active tipping face. The rate at which waste is added by incoming trucks and the rate at which waste is covered by the front-end loader influence the area of exposed waste. The enclosure was as close to working compactors as safety considerations allowed and the effects of compaction are included in the samples. Thus, emissions as a result of compaction are included, but not tipping events.

Estimates of the tipping face area ranged from 32 m^2 (10 April 2018) to 48 m^2 (1 May 2018). Based on Google Earth images dated 21 December 2017, the tipping face area was significantly larger than 200 m^2. The tipping face is typically uncovered (exposed) between 0800 hrs to 1630 hrs. Measured odour emission rates are based on tipping face areas estimated at the time of measurement.

M Asimakis and T Pollock, *Review of Odour Emission Rate Measurements on Active Tipping*

Face of Landfills, CASANZ, 2015

Figure 7-2 Odour Sampling on Active Face



Interim Cap on Active Cell in use without gas extraction

The interim cap area is defined as the area of the current active cell (with negligible gas extraction). This area comprises basically wastes that have previously been discharged and covered. Monitoring was conducted using the isolation flux hood method over the area of the current cell from 7 locations. One of the 7 locations was on the southern batter. Sampling was conducted over two days; 8 March 2018 and 1 May 2018.

Mulch (Green Waste) Area

Green waste is stockpiled onsite prior to shredding. At the time of the monitoring program, the stockpiles were relatively dry with only low odour noted in the general area. The material is shredded by a subcontractor several times a year. It was noted onsite that the green waste was most odorous immediately after shredding.

The size and area of the shredded green waste will increase from low (at the commencement of shredding) to a maximum at the completion of shredding. It would be likely that odour emissions from the shredded material would decrease over time after shredding (this could conceivably begin to increase again once biological process begins to break down the material).

Monitoring was conducted shortly after the shredding process to capture the maximum odour emissions attributed to the shredding process (this will not take into consideration future possible biological activity).

Monitoring was conducted using the temporary enclosure technique. A portion of material was removed from the shredded green waste pile for sampling and spread out for sampling using a front-end loader. The temporary enclosure was immediately erected on the material covering an area of approximately 14m^2. The temporary enclosure was allowed to equilibrate for at least 10 minutes prior to odour sampling and flow rate measurements being conducted. Sampling was conducted on 10 April 2018.

Figure 7-3 Odour Sampling on Mulch at Eaglehawk Landfill



Patho Transfer Area

The Bendigo landfill is unusual in that from 40 to 60 percent of the wastes are dropped at the site, loaded into larger trailers and transported to the Patho landfill near Echuca. This means that there is a second active face at the transfer site, where wastes are discharged from the trucks onto a concrete pad and then pushed by a large front loaded into an adjacent truck and trailer at a lower level.

The amount of wastes in the transfer area depends on the rate at which waste is added and the rate at which waste is removed. The estimate of the transfer area was 16 m^2 at the time of testing (10 April 2018). Based on Google Earth images dated 21 December 2017, the transfer area was significantly larger at 96 m^2. The transfer area is typically used between 0800 hrs to 1630 hrs with only a residual layer overnight. Odour emission rates in this report are based on transfer area dimensions estimated at the time of measurement.

Monitoring was conducted using the temporary enclosure technique (see Figure 7-4). The wastes are heterogeneous and typical of domestic garbage. A portion of material was removed from the transfer area for sampling and spread out for sampling using a front-end loader. The temporary enclosure was immediately erected on the material covering approximately 14m^2 (taking less than 10 minutes). The temporary enclosure was allowed to equilibrate for at least 10 minutes prior to odour sampling and flow rate measurements being conducted. Sampling was conducted on 10 April 2018.

The layer of Patho material in the temporary enclosure was approximately 0.3 m thick. Any odour stripping in the enclosure should be similar to the rate of stripping in an ambient breeze.

Figure 7-4 Odour Sampling on Patho Transfer Wastes



Organics Shed

The Organics Shed receives FOGO material (food and organics, with the food in small biodegradable bags) at various times during the day. Material is removed every day (except Monday's) via a B double truck. The quantity of material in the shed is variable but stated to be typically 30 t. On the two occasions monitoring was conducted, the quantity present was significantly less than this (estimated to be approximately 17 t on 8 March 2018 and 5 t on 1 May 2018 based on the pile dimensions and an assumed bulk density of 221 kg/m^3).

The shed doors are generally open during the day except when material is being removed (doors closed to reduce odour emissions). The doors are closed overnight and on weekends. Based on FOGO delivery records, typically six truckloads of FOGO are received per day, typically between 10 am and 1 pm. Unloading time is a few minutes, when high odour levels would occur. However, these periods are short compared with the undisturbed period each day (and occur at a time of high convective dispersion). The truck unloading event was not specifically measured for this reason.

Monitoring was conducted with the southern and northern roller doors open to facilitate a flow through of air. Sampling was conducted on the southern (outflow or emission end) door and the northern door (inflow or upwind end). The doorway was sampled from 9 discreet points at approximately the centre of equal areas. Odour samples and velocity measurements were conducted simultaneously from each point (odour samples as integrated samples for equal volumes at each point). Sampling was conducted over two days; 8 March 2018 and 1 May 2018.

The odour levels were particularly elevated in the samples collected in the downwind door of the organics shed, indicating it is a major odour source on the site. FOGO wastes were detected off the site during the community survey.

Figure 7-5 Odour Sampling on Organics Shed



Leachate Pond

Monitoring was conducted on the leachate pond on 1 May 2018 using the isolation flux technique. Only low odour was measured.

Figure 7-6 Odour Sampling on Leactahe Pond



Summary of Ektimo Odour Measurements

The results of the Ektimo odour measurements at the landfill are listed in Table 7-1.

Table 7-1 Summary of Odour Emissions Measured by Ektimo

Location		Results			
		Concentration ou	Flux Rate ou/m²/min	Mass Rate ou/min	Odour Character
Round 1 (8/3/18)					
Interim Cap: Point 1 (Centre North)		<30	<1	-	neutral,dusty
Interim Cap: Point 2 (North East)		<30	<1	-	mildly unpleasant, sweet
Interim Cap: Point 3 (South East)		<30	<1	-	neutral,dusty
Interim Cap: Point 4 (South Batter)		<30	<1	-	neutral,dusty
Organics Shed		92	-	160000	very unpleasant, sweet, rubbish
Organics Shed Upwind		<30	-	<50000	neutral, no discernable odour
Round 2 (10/4/18)					
Active Tip Face **(Average)** corrected		330	180	5700	mildly unpleasant, garbage, green waste
Active Tip Face	Test 1	300	-	-	-
Active Tip Face	Test 2	350	-	-	-
Inlet Odour Concentration		<30			
Fresh Mulch **(Average)** corrected		410	400	68000	mildly unpleasant, green waste
Fresh Mulch	Test 1	460	-	-	-
Inlet Odour Concentration		54	-	-	-
Transfer Area **(Average)** corrected		160	170	2700	mildly unpleasant, garbage
Transfer Area	Test 1	150		-	-
Transfer Area	Test 2	170		-	
Inlet Odour Concentration		<30		-	-
Round 3 (1/5/18)					
Active Tip Face **(Average)** corrected		660	940	45000	mildly unpleasant, garbage, landfill
Active Tip Face	Test 1	710		-	
Active Tip Face	Test 2	710		-	
Inlet Odour Concentration		90		-	
Interim Cap: Point 5 (North East)		160	5.6	-	mildly unpleasant, garbage, landfill
Interim Cap: Point 6 (Centre West)		<30	<1	-	mildly unpleasant, garbage
Interim Cap: Point 7 (South West)		<30	<1	-	mildly unpleasant, garbage
Leachate Pond		62	2.2	-	mildly unpleasant, garbage, sour
Organics Shed **(Average)**		62	-	120000	mildly unpleasant, garbage
Organics Shed	Test 1	54		-	
Organics Shed	Test 2	70		-	
Organics Shed Upwind		<30	-	<6000	
Interim Cap: Average of all locations		≦50	≦1.7	≦39000	

Further Emission Data

Further contemporary odour emission results from landfills were obtained from the references listed below. From the suite of available measurements, a conservative odour emission scenario was developed to establish the likely extent of noticeable odour from the Eaglehawk landfill under current operating conditions. The emission inventory is summarised in Table 7-2.

M Asimakis and T Pollock, *Review of Odour Emission Rate Measurements on Active Tipping Face of Landfills,* CASANZ, 2015

M Asimakis and T Pollock, Review *of Odour Emission Rate Measurements on Active Tipping Face of Landfills,* Report to Mount Alexander Shire Council, 2016

CAMM (2018), Odour Assessment, Statement of Evidence to VCAT - Proposed Extension of Wests Road Landfill, May 2018

ESA (2018), Odour Impact Assessment, Statement of Evidence to VCAT - Proposed Extension of Wests Road Landfill, Werribee, May 2018.

Phases of Odour Generation in Landfills

The main phases of odour generation associated with the decomposition of putrescible wastes and landfills are summarised below:

- Municipal waste delivered to landfills has a characteristic, highly offensive "garbage bin" odour resulting from microbial putrefaction of food wastes and leafy vegetation (such as lawn clippings), due to storage in wheelie bins and commercial bins, and transport in garbage trucks;

- Recently deposited putrescible wastes are decomposed mainly by aerobic microbes, while microbial fermentation becomes more important as oxygen concentrations decline. These processes generate a range of odorous compounds including ammonia, volatile fatty acids, amines and esters, along with carbon dioxide; and

- Anaerobic conditions (i.e., where oxygen is absent) subsequently develop within the landfill, leading to the generation of landfill gas (LFG), comprising approximately equal volumes of methane and carbon dioxide, along with traces of highly offensive compounds including volatile fatty acids and a range of reduced sulphur compounds including hydrogen sulphide ("rotten egg gas") and mercaptans ("rotting cabbage" odours).

Factors Affecting the Generation Rate of Odour and Landfill Gas

The main factors that affect the generation rate of LFG and odour in landfills receiving municipal waste are as follows:

- The composition of wastes - higher proportions of putrescible matter in landfills result in increased generation rates of odour and LFG;
- The rate of odour generation within recently deposited wastes within landfills is significantly higher during months with high air temperatures and high levels of solar radiation, which result in increased microbial biomass and metabolic rates;
- The moisture content of wastes within the landfill – higher moisture levels result in increased rates of microbial decomposition of organic matter, more rapid oxygen depletion and increased generation rates of LFG and odour. Rainfall leads to higher odour emissions in the following days;
- The degree of compaction – the higher the degree of compaction, the less oxygen is present in the wastes;
- The age of wastes – the generation of LFG (and associated highly offensive odours) commences after the deposited wastes become anaerobic - the generation of significant volumes of LFG typically commence within about one year of waste placement, peak within five to seven years and continue (at reducing rates) for at least 20 years; and
- The thickness of landfill cells – thicker landfill cells generate more LFG and odours per square metre of landfill surface.

The rate of odour and LFG generation within a particular landfill cell will be relatively constant in the short term while odours associated with recently deposited wastes are more variable, depending on the source and nature of the wastes, moisture levels and ambient temperatures.

Factors Affecting the Emission of Odours to Atmosphere

- Odours are emitted directly to atmosphere from garbage trucks while wastes are discharged at the tipping face;

- The hourly rate of waste deposition will have a significant influence on odour emission rates from the tipping face;

- Odorous air is forced out of recently deposited wastes during compaction on the tipping face (compaction reduces the volume of wastes by a factor of about three and also punctures plastic bags containing highly odorous wastes);

- The application of daily cover to recently deposited and compacted wastes substantially reduces odour emissions from recently deposited wastes;

- Variations in atmospheric pressure can result in significant variations in odour emission rates from uncapped cells – "barometric pumping" can result in higher off-site odours, although stronger winds can at times compensate for this effect.

- Installation of horizontal perforated plastic pipes connected to LFG extraction systems in active landfill cells can reduce odour emissions – in practice however, such reductions are limited by the horizontal spacing of the pipes, their risk of being crushed by heavy machinery and the need to control extraction rates to limit the ingress of air into gas extraction systems);

- The installation of intermediate cover and the commissioning of vertical LFG collection wells (within four months of the completion of filling of each cell, as required by EPA's licensing guidelines) should achieve a substantial reduction in LFG and associated odour emissions (however, as noted below, Council has installed vertical wells in Cell 4C during its development and is currently in the process of connecting them to the LFG collection system);

- Intermediate cover can be applied to the batters of completed cells, but the batters will represent a potentially significant source of odour until the final cap is installed; and

- Landfill cells which have been capped (including an impervious synthetic membrane) and have an effective LFG extraction system (involving vertical gas wells) should not represent significant odour sources, providing they are well-operated and the final cap is regularly monitored to detect and rectify any significant LFG emissions.

Table 7-2. Summary of Odour Emissions Estimate for Normal Operations

	Bendigo Landfill Odour Inventory							
Type	**Source**	**East**	**North**	**Length**	**Area**	**SOER**	**OU/s**	**Basis for Estimate**
Area	Active North	253,334	5,931,577	10	100	16	**1,600**	ETC sampling result
Area	Active East	253,430	5,931,530	10	100	23	**2,300**	from Tim Pollock paper
Area	Recent Fill North	253,345	5,931,554	30	900	0.03	**27**	from ESA paper
Area	Recent Fill West	253,417	5,931,517	30	900	0.1	**90**	from ESA paper
Area	Recent Fill East	253,353	5,931,484	30	900	0.2	**180**	from ESA paper
Area	Leachate Pond	253,380	5,931,370	41	1681	0.05	**84**	ETC sampling result
Area	Mulch	253,600	5,931,570	15	225	6.6	**1,485**	ETC sampling result
Area	Transfer Truck	253,860	5,931,619	9	81	10	**810**	estimated
Area	Transfer Pile	253,870	5,931,602	12	144	6	**864**	estimated
Area	Trailer Unloading	253,804	5,931,640	9	81	4	**324**	estimated
Volume	Organics Shed	253,877	5,931,670	Sig Y = 9	Sig Z=2	Ht = 1	**2,000**	ETC sampling result
						Total	**9,764**	

ESA (2018), Odour Impact Assessment, Statement of Evidence to VCAT - Proposed Extension of Wests Road Landfill, Werribee, May 2018.E

8. Local Wind Conditions

Wind and dispersion conditions for predicting odour levels in the area surrounding the landfill were based on wind and meteorological measurements taken at the Bendigo airport. Data were obtained from the Bureau of Meteorology and processed into a meteorological file suitable for use in the AERMOD and Ausplume dispersion models.

The meteorological files were prepared from the wind, temperature and solar radiation measurements using the stability classification criteria published by the Victorian EPA and the US EPA.

Over three years, the median wind speed measured at Bendigo was 3.6 m/s, and consistent from year to year. Figure 8-1 shows the wind rose for the Bendigo site for all hours in the year. The narrow bars (shown as black) near the centre of the wind rose represent the low speed winds (less than 1 m/s). Note that the 10-percentile wind speed was consistently only 0.6 m/s from year to year.

The wider bars represent stronger winds, for example the wide red sectors indicate wind speeds from 3 to 6 m/s, and the blue sectors indicate wind speeds above 6 m/s. Longer bars on the wind rose indicate the sectors with the dominant wind directions. It can be seen that the wind pattern is dominated by south-east winds, although there are winds from all sectors of the compass.

Figure 8-2 shows the wind rose for night hours when there are generally weaker winds (mean speed at night is 3.25 m/s) and a lower rate of dispersion. It can be seen in Figure 8-2 that night winds come predominantly from the south to south-east sectors.

This means that odours are more likely to be transported north-east of the plant than in other directions. However, night drainage winds are typically down-valley and in the topographic conditions at the landfill, these night winds are expected to carry odours to the west, leading to elevated odour levels in the rural residential areas of Bracewell Road.

References:

EPA Victoria ."*Plume Calculation Procedure",* EPA Publ. 210, 1985

EPA Victoria Publication No. 1550 – "Guidelines for Input Meteorological Data for AERMOD" (EPAV, Rev 3, September 2014)

EPA Victoria Publication No. 1551 – "Guidance Notes for Using the Regulatory Air Pollution Model AERMOD in Victoria" (EPAV, Rev6, October 2016)

US EPA "*Meteorological Monitoring Guidance for Regulatory Modelling Applications".* US EPA, February 2000.

Figure 8-1. Wind Rose for Bendigo – All Hours

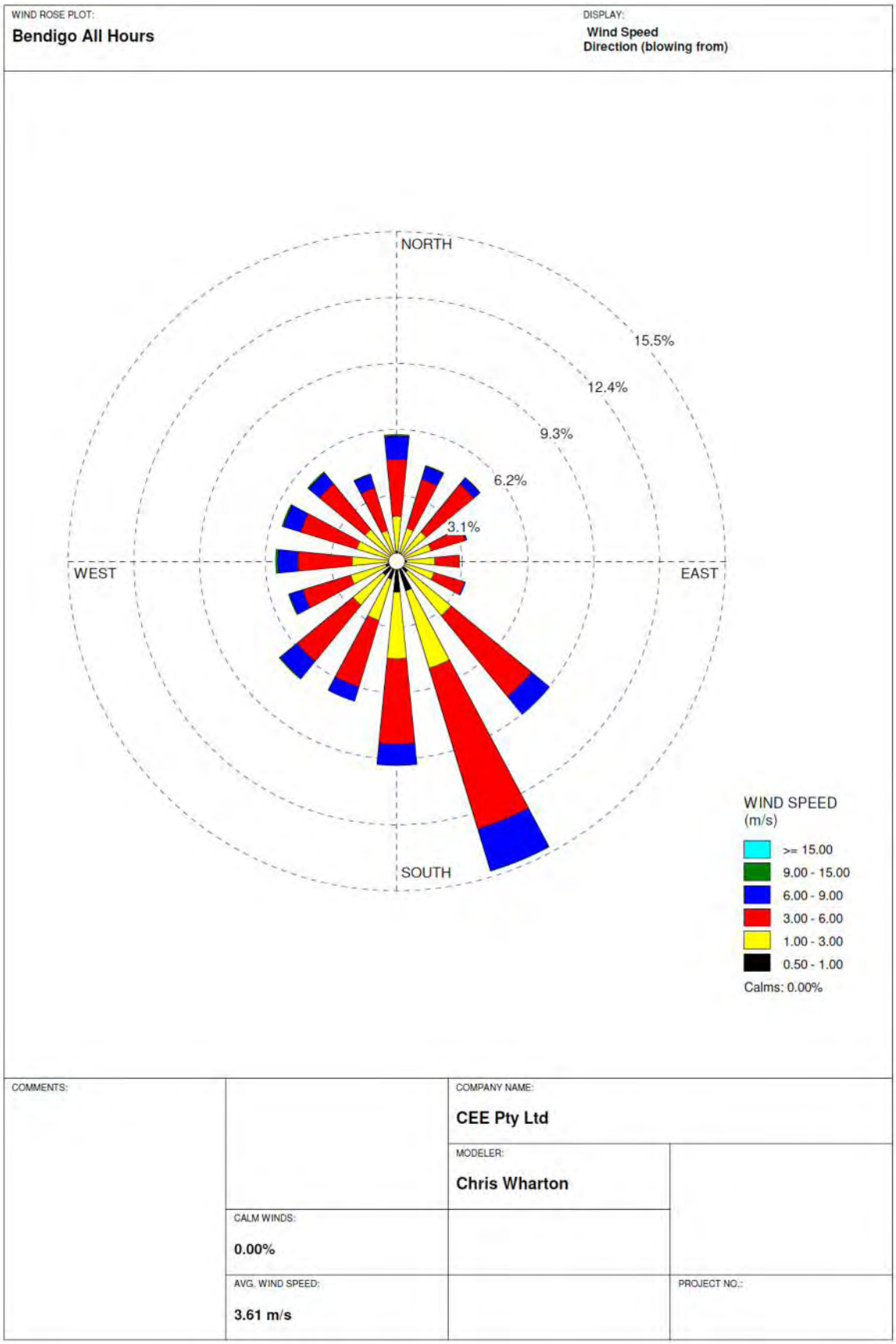
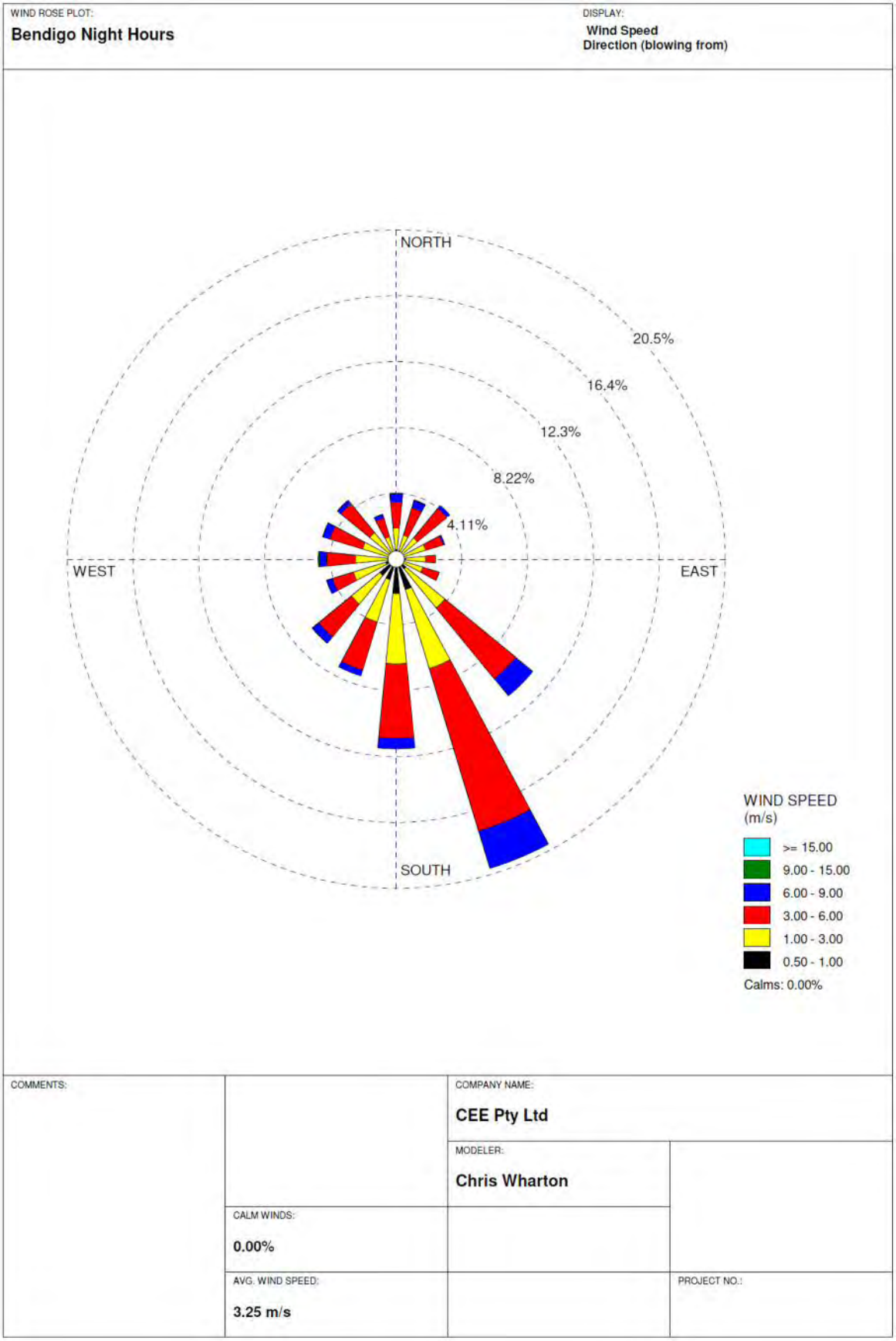


Figure 8-2 Wind Rose for Bendigo – Night Hours



9. Odour Dispersion Modelling

Odour modelling for this assessment has been carried out using the following procedure:

- AERMOD model as issued by the US EPA
- Checked by Ausplume Model version 6
- Odour emission rates as listed in Table 2 above;
- 3-minute averaging time;
- Meteorological file for Bendigo;
- Landfill geometry from images of the existing site;
- Other model parameters to best suit the Eaglehawk area.

The topography of the area surrounding the landfill is undulating with trees surrounding the western part of the landfill on three sides.

The AERMOD dispersion odour model has been used with a 3-minute averaging time to predict 99.9 percentile odour contours in the vicinity of the existing Eaglehawk the future Bendigo landfill. Odour transport and dispersion modelling was undertaken using the latest version of AERMOD (18081) and in accordance with all procedures specified in EPA Publication 1551. The peak to mean ratio (of 1.82) referenced in Section 5 of EPA Publication 1551 has been used to convert output to 3-minutes.

The fundamental dispersion model for this assessment is the EPA regulatory model AERMOD, with Ausplume used only as a check. While in general Ausplume predicts similar odour contours to AERMOD, the AERMOD predictions should be given precedence. The plots of predicted odour contours cover the following situations.

Normal Operations.

Figure 9-1 shows the predicted odour contours for normal operations with winds and meteorological conditions measured in 2016. Figure 9-2 shows the predicted odour contours for normal operations with winds and meteorological conditions measured in 2017. The odour emission rates are listed in Table 7-2 and total 9,764 OU/s (rounded to 9,800 OU/s in the figure titles). These are a conservative estimate of odour emissions in normal operations, based on measurements.

Upset Conditions

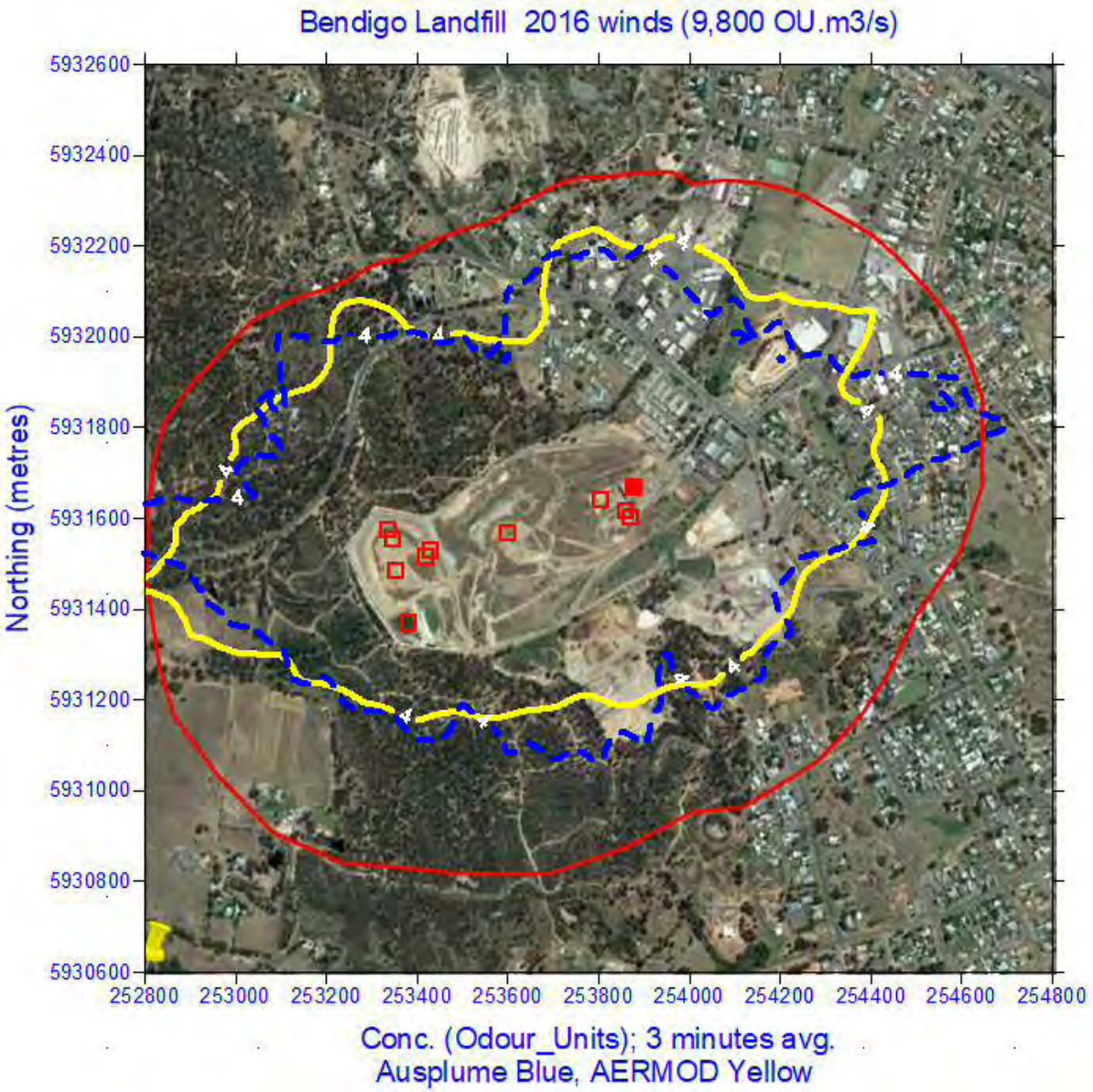
The next three figures illustrate possible odour conditions in upset events.

- Figure 9-3 shows the predicted odour contours with a 50 % increase in emissions from the active cell (for example, during wet weather or when an unusually large volume of wastes arrives). Total odour emissions would be 11,700 OU/s:
- Figure 9-4 shows the predicted odour contours with a doubling in emissions from the FOGO shed (for example, when there is no cartage to the composting facility). Total odour emissions from the site increase to 10,900 OU/s:
- Figure 9-5 shows the predicted odour contours with a doubling in emissions from the recent fill area (for example, in prolonged wet weather or when a large volume of liquid wastes is delivered or there is a significant reduction in barometric pressure at a time of light winds). Total odour emissions increase to 14,000 OU/s:

Normal Operations – 2016 Winds

Figure 9-1 shows the predicted odour contours with the two dispersion models and the 2016 wind file. The 4 OU contour is shown as a solid yellow line for AERMOD and a dashed blue line for Ausplume. The red line shows the 500 m buffer zone.

Figure 9-1. Odour Dispersion Model Prediction using 2016 Wind File

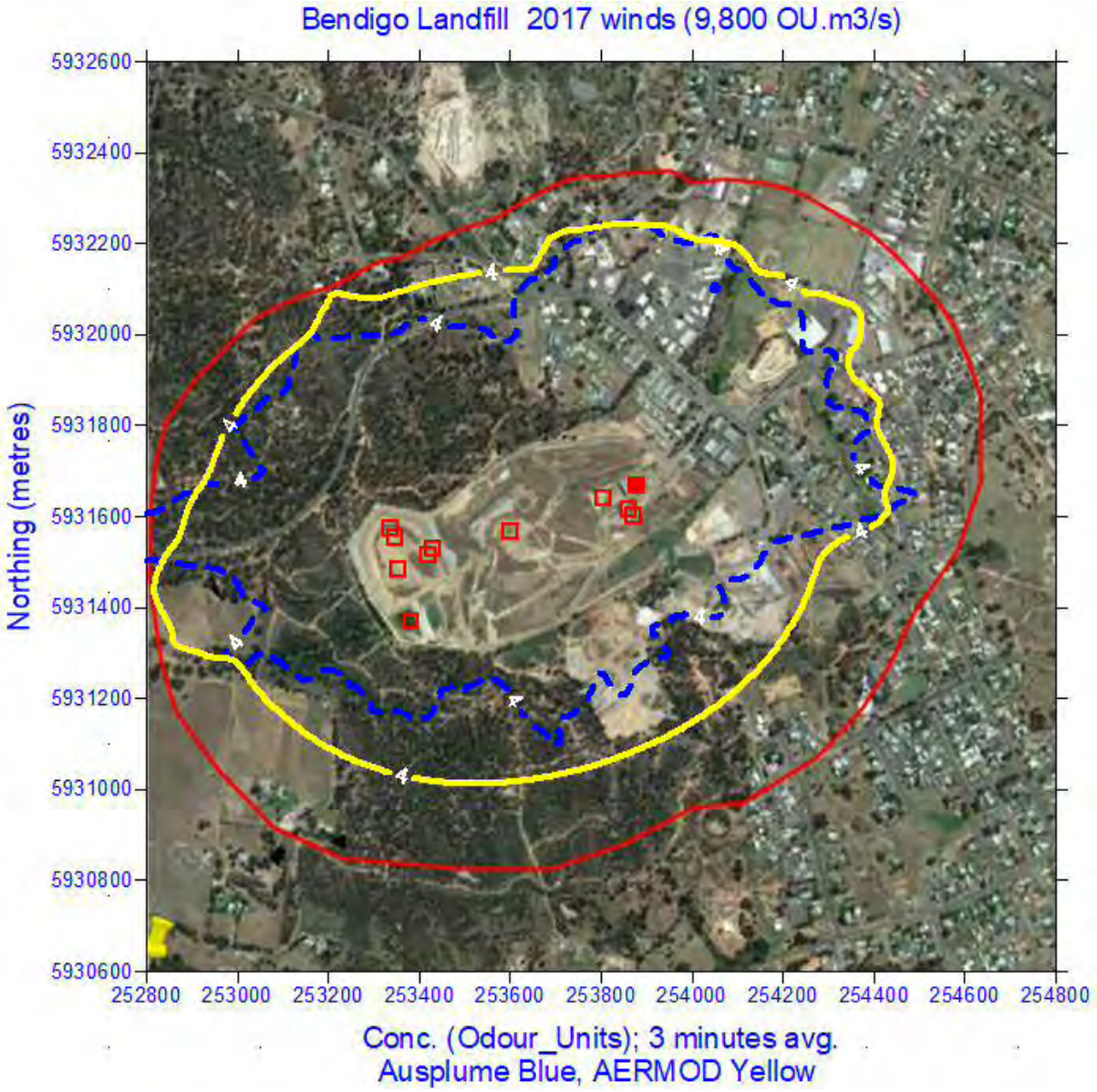


It can be seen that under normal operations, the 4 OU contour is contained within the 500 m buffer. However, it extends over existing residential areas north and south-east of the landfill, but not over the residential area to the south of the landfill. The 4 OU contour extends to the buffer on the west of the landfill.

Normal Operations – 2017 Winds

Figure 9-2 shows the predicted odour contours with the two dispersion models and the 2017 wind file. The 4 OU contour is shown as a solid yellow line for AERMOD and a dashed blue line for Ausplume. The red line shows the 500 m buffer zone.

Figure 9-2. Odour Dispersion Model Predictions using 2017 Wind File



The predicted 2017 contours are similar to the 2016 contours, but extend slightly further to the north. Under normal operations, the 4 OU contour is contained within the 500 m buffer. It extends over existing residential areas north and south-east of the landfill, but not over the residential area to the south of the landfill. The 4 OU contour extends to the buffer on the west and north of the landfill.

Appendix B shows AERMOD predicted odour contours for three years – 2016, 2017 and 2018. From a comparison of the predicted odour contours, it is apparent that there is little difference between the predicted contours for the three different years.

Upset Scenario 1 – Increased Odour from Active Face

Figure 9-3 shows the predicted odour contours with the dispersion models and the 2017 wind file for the upset scenario involving increased odour emissions from the active face. The 4 OU contour is shown as a solid yellow line for AERMOD and a dashed blue line for Ausplume. The red line shows the 500 m buffer zone.

Figure 9-3. Odour Dispersion Model Predictions – Scenario 1

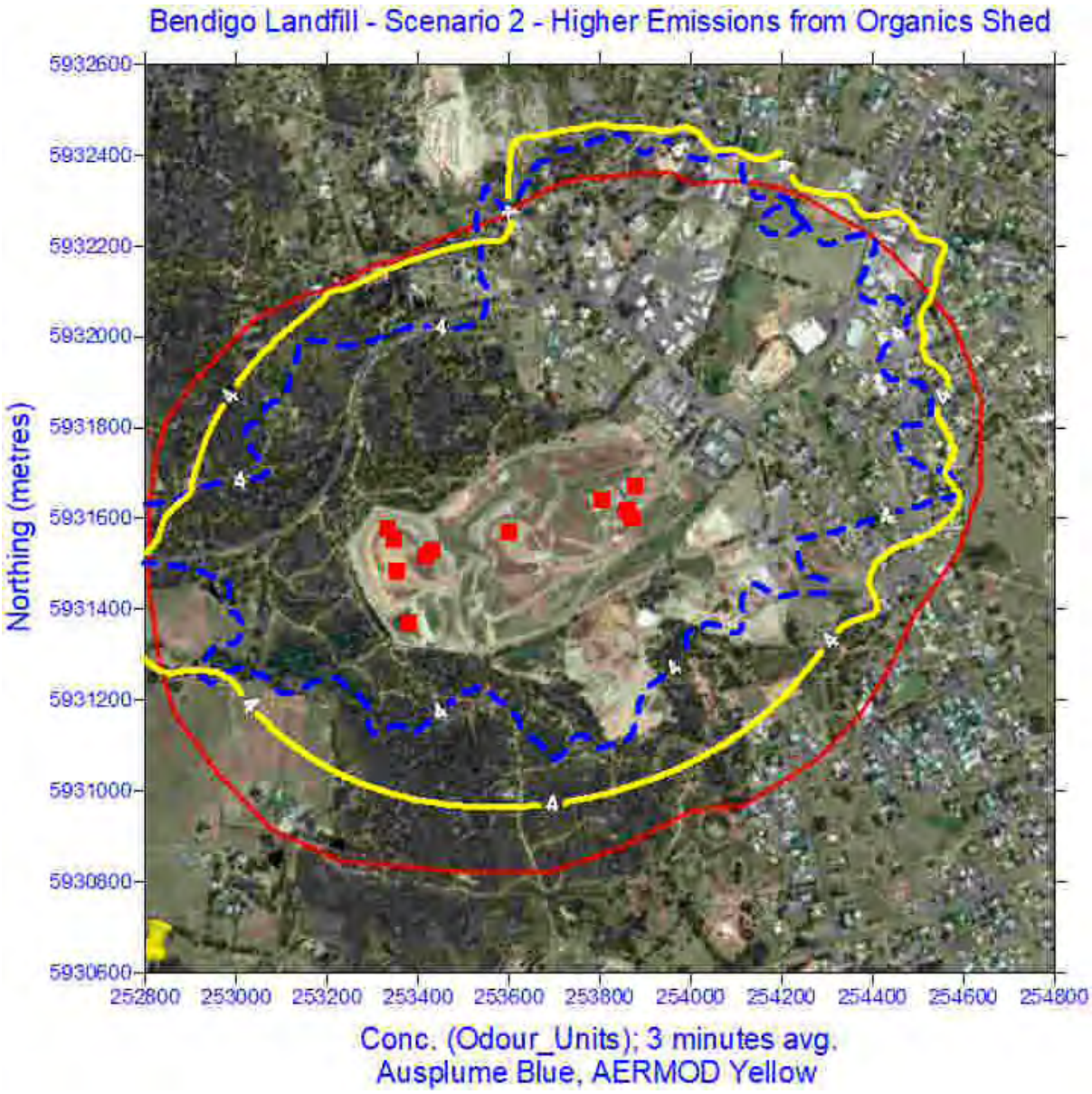


There are greater odour emissions in Scenario 1 (of 11,700 OU/s) and the 4 OU contours are further from the landfill. Under Scenario 1, the 4 OU contour extends beyond the buffer zone marginally to the west and the north of the landfill, but is contained within the 500 m buffer to the east and the south.

Upset Scenario 2 – Increased Odour from Organics Shed

Figure 9-4 shows the predicted odour contours with the dispersion models and the 2017 wind file for the upset scenario involving increased odour emissions from the organic shed. The 4 OU contour is shown as a solid yellow line for AERMOD and a dashed blue line for Ausplume. The red line shows the 500 m buffer zone.

Figure 9-4. Odour Dispersion Model Predictions – Scenario 2

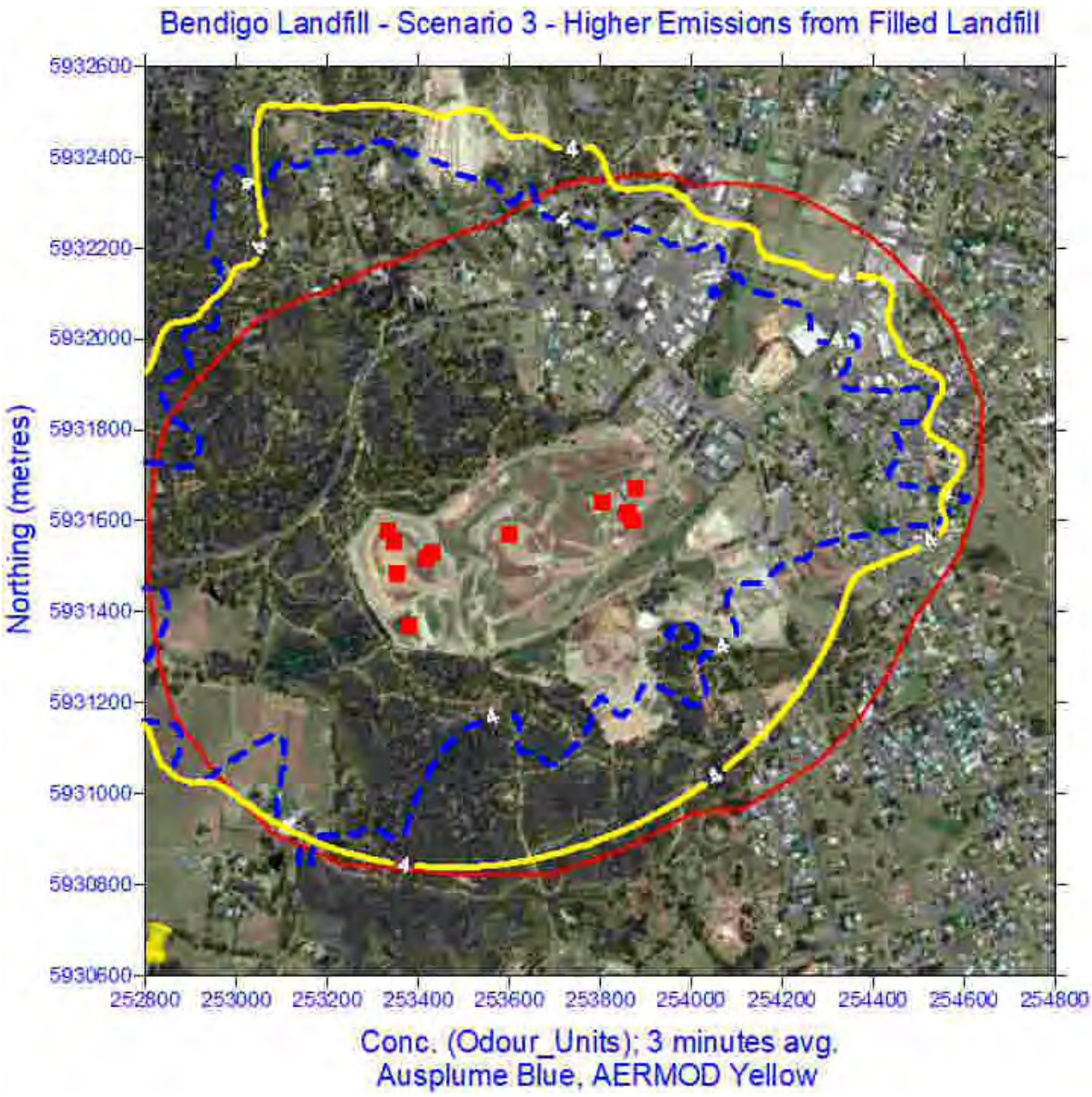


There are greater odour emissions in Scenario 2 (of 11,800 OU/s) and the 4 OU contours are further from the landfill. Under Scenario 2, the 4 OU contour extends beyond the buffer zone marginally to the west and the north-east of the landfill, but is contained within the 500 m buffer to the south-east and the south.

Upset Scenario 3 – Increased Odour from Recent Fill Area

Figure 9-5 shows the predicted odour contours with the dispersion models and the 2017 wind file for the upset scenario involving increased odour emissions from the recent fill area face. The 4 OU contour is shown as a solid yellow line for AERMOD and a dashed blue line for Ausplume. The red line shows the 500 m buffer zone.

Figure 9-5. Odour Dispersion Model Predictions – Scenario 3



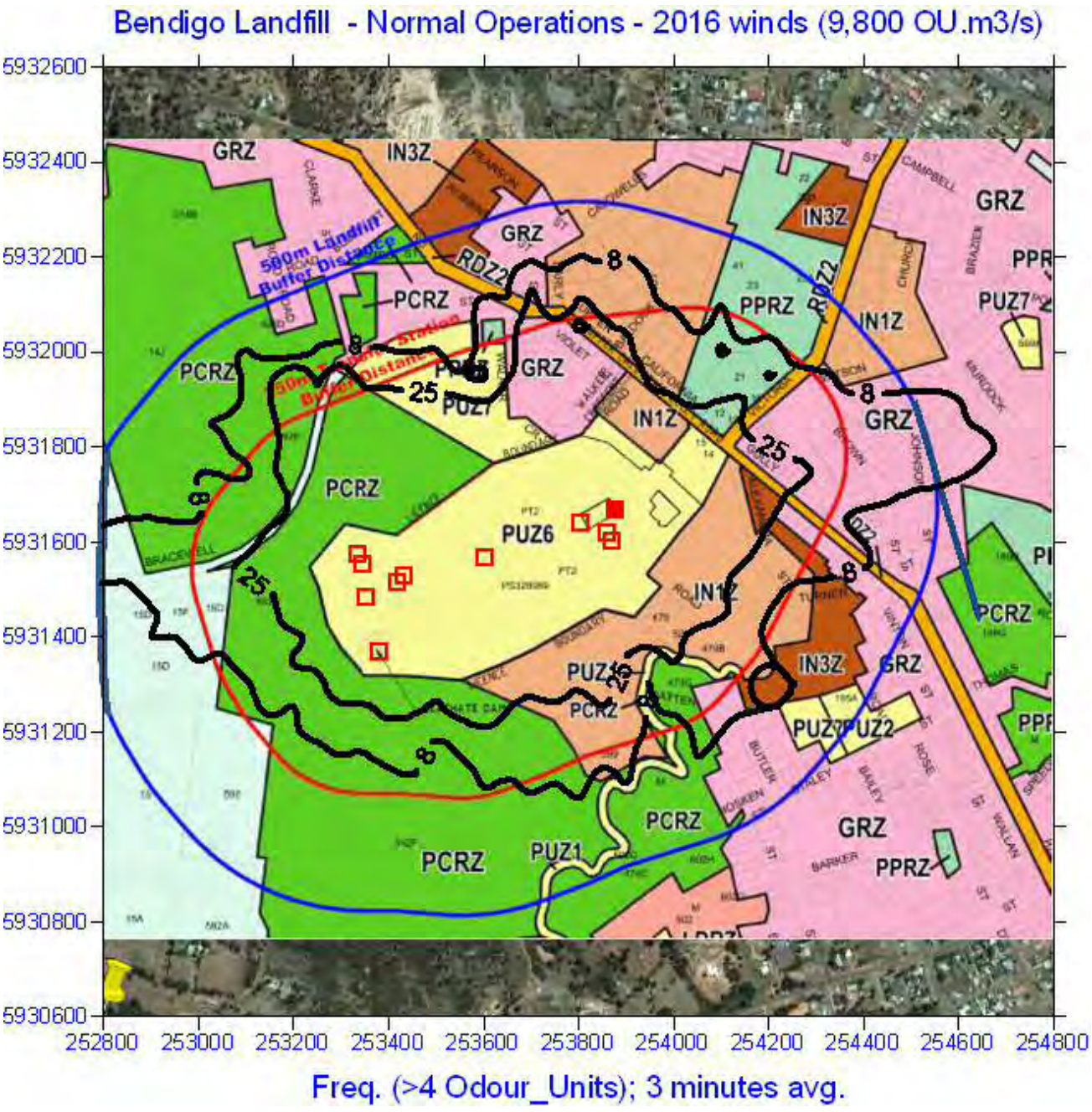
There are high odour emissions in Scenario 3 (of 14,000 OU/s) and the 4 OU contours extend further from the landfill. Under Scenario 3, the 4 OU contour extends beyond the buffer zone to the west and north of the landfill, but is contained within the 500 m buffer to the east and the south.

Appendix B shows AERMOD predicted odour contours for three years – 2016, 2017 and 2018 for Scenario 1. There is little difference between the predicted contours for the three different years, but a large difference from the normal operations case.

Assessment of Risk – Normal Operations

Figure 9-6 shows the predicted frequency (in hours per year) of odour levels exceeding 4 OU (based on wind conditions in 2016 and normal operations). The two black lines show 8 hours per year (corresponding to the 99.9 % frequency) and 25 hours per year (corresponding to a noticeable degree of annoyance). The blue line shows the 500 m buffer zone.

Figure 9-6. Hours per Year Over 4 OU – Normal Operations

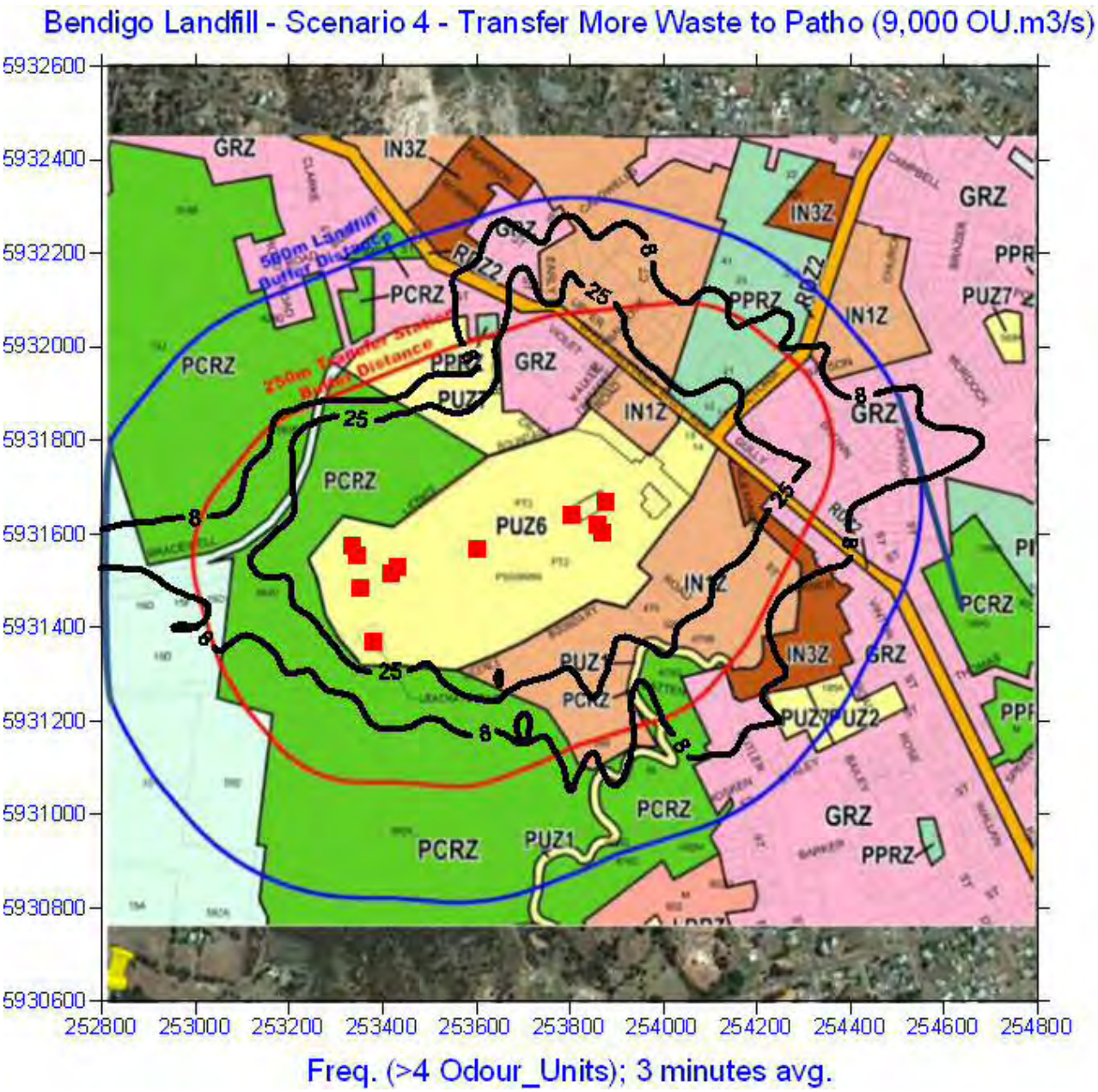


It can be seen that under normal operations, the 8 hours per year frequency extends over existing residential areas north and south-east of the landfill, and also into the rural residential area west of the landfill. The 25 hours per year frequency extends only over the existing residential area north-east of the landfill.

Assessment of Risk – Transfer More Wastes to Patho

Figure 9-7 shows the predicted frequency (in hours per year) of odour levels exceeding 4 OU (based on wind conditions in 2016 and more wastes being transferred to Patho. The two black lines show 8 hours per year (corresponding to the 99.9 % frequency) and 25 hours per year (corresponding to a noticeable degree of annoyance). The blue line shows the 500 m buffer zone. Odour emissions reduce to 9,000 OU/s.

Figure 9-7. Hours per Year Over 4 OU – More Transfer to Patho Landfill



Transfer of more wastes to Patho, with no change in other operations on the site, provides only a minor improvement. The 8 hours per year frequency continues over existing residential areas north and south-east of the landfill, and also into the rural residential area west of the landfill. The 25 hours per year frequency extends only over the existing residential area north-east of the landfill.

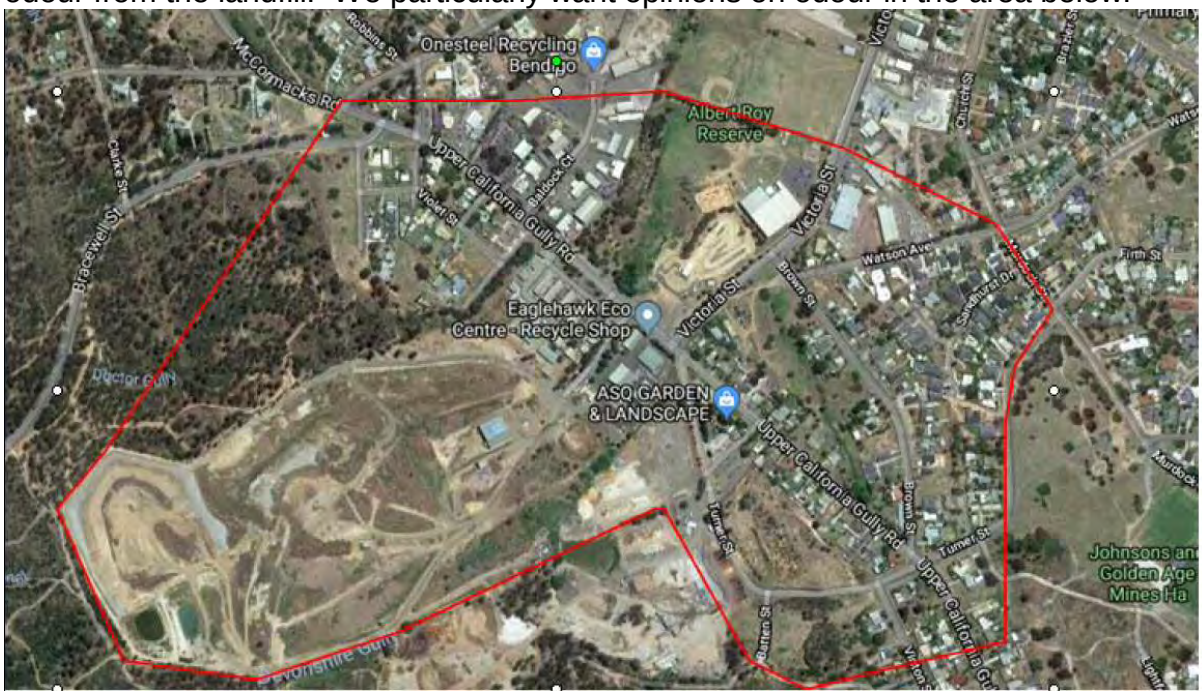
10. Community Survey and Responses

To verify that the odour dispersion model predictions were a reasonable representation of actual odour conditions, CEE carried out a survey of residents' perceptions of odour in June 2018. A pamphlet was delivered to 200 premises within the 500 m buffer zone, asking for perceptions in relation to landfill odour. A copy of the pamphlet is shown below (with the email addresses and phone numbers now deleted)

Have you noticed any odour coming from Eaglehawk Landfill?

The City of Greater Bendigo has had reports of odour emanating from the Eaglehawk Landfill and has employed Consulting Environmental Engineers to check the affected area and gain feedback from nearby residents.

Local residents are an important source of information and this is a good opportunity for residents who live nearby to tell us if, where and when they may have noticed any odour from the landfill. We particularly want opinions on odour in the area below.



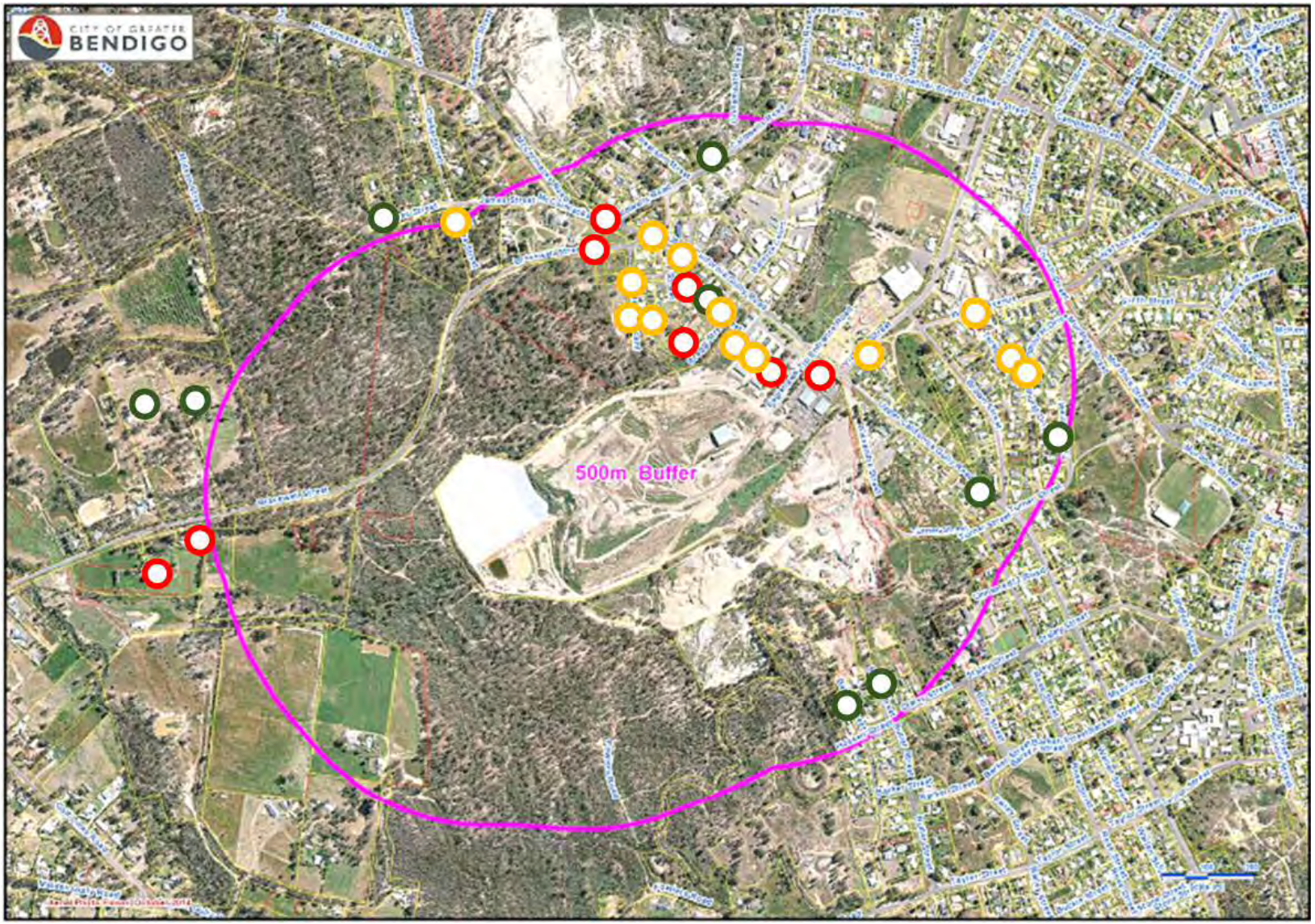
Residents were asked to respond by one of the following methods
By email: email address given
By phone: phone number given
By Text: Send a text message to phone number given.
By marking the attached plan to indicate location of any odour detected.

All feedback received from residents will be summarised and a map will be prepared showing the results of the survey:

(1) Odour is often high; (red)
(2) Odour is occasionally noticeable (orange)
(3) Where odour is not detected (green).

There was a good return from the community in the survey and the responses are summarised in Figure 10-1. Appendix A has some examples of the responses.

Figure 10-1 Responses of Residents to Odour Survey



Results of Community Survey

There were 29 responses to the survey of community perceptions about odour from the landfill. The responses are interpreted as follows:

- The eight red responses indicate households that reported annoying levels of odour, often on a regular basis. Six of the respondants lived north-east or north of the landfill, at 150 m to 400 m distance. There were two responses at 500 m west of the landfill who were both very annoyed by odour (probably from the active cell). Their residences are located close to the creek that drains the landfill site and flows to the west. Night drainage breezes, carrying elevated odour, are expected to convey odours from the active cell to the west.

- The 13 orange responses indicate households that notice odour a few times per year, or that notice odour more fequently but are not particularly upset by it. These households extend over residential areas to the north and east of the landfill.

- The eight green responses indicate households that do not detect odour or occasionally detect odour at very low levels and consider it acceptable in relation to other ambient odours in the area (from horses and commercial activities).

Correlation between Community Responses and Odour Predictions

Responses from the community can only be obtained where there are residents that are willing to participate in the survey. Over half of the 500 m buffer zone is forest or recreation zones, with no residents. Another large proportion of the area is commercial premises, and they are generally reluctant to participate in odour surveys. Taking land use into account, and the fact that there are a number of empty houses and rented properties, there is considered to be a satisfactory and representative response to the odour survey.

There about 120 houses in the area of the survey so the response rate from residential premises is about 24 % which is considered very good. Including commercial premises, the response rate was 14.5 %, which is within the normal range of 10 to 15 % for surveys without phone follow-up or financial inducements.

There were strong comments from some of the red responses (odour detected) and they stated that ocour was detected regularly, from several to many times a year, at nuisance levels. All of these responses are encompassed by the predicted 4 OU contour.

Thus, there is good agreement between the responses of the community and the predictions of the odour model. Both showed the highest odour and adverse effect on amenity occur to the north-east, north and west of the landfill. It is considered that the community survey provides a satisfactory degree of verification for the odour model predictions.

11. Sampling Methods and Sensitivity Analysis

This section provides extra information on sampling methods, a comparison of the measured emission rates with values measured on other landfills and a sensitivity analysis. Note that all collected samples were analysed in accordance with AS4343.3.

Optimized Sampling Methods

The purpose of odour sampling is to obtain a sample of air that represents the odour level of the source being sampled. The IFH method was used to collect samples on the leachate pond and interim cap, which are flat and relatively homogeneous. The enclosure method was used on the tipping face and the mulch pile, where it is not practical to seal the IFH and the wastes are heterogeneous and so a large area must be sampled.

The upwind-downwind method was used to measure odour emissions from the FOGO wastes, using the existing doors to define the perimeter of the upwind and downwind plumes. The FOGO Shed has two large roller doors at each end of the shed. There are no other openings in the shed of consequence in relation to these doors. When a breeze is blowing through the shed (in one door and out the other), the FOGO Shed has a clearly defined exit area. Odour generated from within the shed (organic pile, shed floor etc) therefore exits via this exit area.

By sampling the odour concentration exiting the roller door at nine points simultaneously with the exit velocity, the SOER of the Organics Shed was measured directly. This employs a similar principle and methodology as exhaust stack testing where the exit area was divided into equal areas and sampling conducted (velocity and odour sampling) in the centre of equal areas.

The enclosure method was adopted for the tipping face because wastes on the tipping face are lumpy and uneven, and a flux hood would not seal. Further, a representative sample cannot be enclosed within the small area of a flux hood. The volume of the temporary enclosure is 19 m^3. Indirect measurements are widely used to sample odours from a tipping face, typically the upwind-downwind method or the back-calculation method. Both of these methods suffer from inaccuracies because the edge of the plume is poorly defined, the plume meanders during sampling and there is a variation in wind speed over the time of sampling. These inaccuracies can be minimized by using the enclosure method, which is a variation of the upwind-downwind method, but involves a plastic tunnel which keeps the plume of travelling air within well defined boundaries. The fan used to create the plume operates at a constant speed and minimises the inaccuracies associated with variations in wind speed over time.

EPA Publication 1666.1 is applicable to the preparation, handling, storage and measurement of environmental odour samples. It does not provide guidance on sampling methodology. While AS4323.4 states that the IFH method is applicable to active tipping faces at landfill sites, in practice an IFH does not obtain an accurate or representative sample. The enclosure method is an improved variation of the upwind-

downwind method listed in Appendix A of AS4323.4.

The base of the enclosure was open and thus odours due to the operation of the nearby operating compactor on the active cell were sampled together with the odour from the just-discharged wastes. Compactors and dozers can cause a 'bellows' effect where odorous air is squeezed out of the waste as the machinery passes over the surface and, conversely, ambient air is drawn into the waste as it expands to some degree after the machinery moves away. Another factor is disturbance; for example, dumping and pushing material (with a dozer) would be similar to the disturbance of the material prior to covering with the temporary enclosure. The compactor and dozer were operating nearby, within a safe distance of the temporary enclosure, while samples were collected.

Other factors influencing odour emissions are wind stripping and the barometric effect, where air moves in and out of the landfill in response to changes in atmospheric pressure. Wind stripping is simulated by the temporary enclosure (at the 'wind speed' within the enclosure). The upwind-downwind approach, being an indirect method, has drawbacks in terms of accuracy (refer to AS4323.4 Appendix A), safe access around heavy machinery and stability of the wind conditions. On balance the temporary enclosure technique was chosen as most appropriate taking these factors into consideration.

Comparison of Measured Emission Rates with Other Results.

The SOER values used for the active tipping face in this assessment are 16 and 23 OU/m^2/s. Comparable SOER values from other sites are 3 and 16 OU/m^2/s (Ektimo at Bendigo, 2018); 14 to 16 OU/m^2/s (Asimakis and Pollock data, 2016), 150 to 330 OU/m^2/s (G Ross in ESR, 2018) and 23 OU/m^2/s (Asamakis and Pollock for Wyndham, 2011).

The SOER values used for the recent cover fill in this assessment range from 0.03 to 0.2 OU/m^2/s. Comparable SOER values from other sites are 0.03 and 0.21 OU/m^2/s (Environmental Alliances for Albany landfill, 2018) and 0.035 to 0.69 OU/m^2/s (Golders for Wollert landfill, 2012).

The SOER values used for the leachate pond in this assessment was 0.05 OU/m^2/s which is within the range of 0.04 to 0.61 OU/m^2/s reported by Golders (Wollert, 2012) and 0.04 to 0.08 OU/m^2/s reported by PAE (Melbourne Regional Landfill, 2015).

Sensitivity Analysis

The predictions from three scenarios are presented earlier in this report:
1. Increase emissions from the active cell (for example, during wet weather or when an unusually large volume of wastes arrives).
2. Increase emissions from the FOGO shed (for example, when there is no cartage to the composting facility).
3. Increase emissions from the recent fill area (for example, in prolonged wet weather or there is a significant reduction in barometric pressure at a time of light winds).

These are all feasible scenarios, and should be taken into account when deciding on the size of the buffer zone.

On the other hand, reductions in odour emissions are perhaps equally likely:

1. Lower emissions from the active cell (for example, during cool weather or when the tipping face is kept below 100 m^2 in area).
2. Lower emissions from the FOGO shed (for example, from use of zealite or with quick cartage to the composting facility).
3. Lower emissions from the recent fill area (for example, in prolonged cool weather or there is a significant increase in barometric pressure at a time of light winds).

Several respondents mentioned that odour seems to be elevated only at intervals – both weekly (over weekend, which could implicate over-weekend storage in the FOGO shed) and monthly (which could implicate the tipping face – either an unusual expansion or slow compaction or delivery of very odorous wastes).

The same spatial patterns in odour are evident from year to year (as shown in Appendix B). It should be noted that the model predictions are for the 99.9 percentile, which is the highest 8 hours at each site each year. To provide a perspective for a different frequency, Figure 9-6 shows the predicted frequency (in hours per year) of odour levels exceeding 4 OU. The two black lines show 8 hours per year (corresponding to the 99.9 % frequency) and 25 hours per year (corresponding to a noticeable degree of annoyance).

Rotting garbage has a readily identifiable smell, and this was mentioned by respondents to the survey. Those living to the west identified a garbage odour while those to the north tended to identify either FOGO or a mixture of odours including garbage.

In our view, the results of the community survey provide strong support for the predictions of the odour modelling. The respondents that were most upset by odour mostly provided a commentary on strong and frequent odours at their residence.

In discussions with community members during the distribution of the pamphlet shown in Section 10, older residents commented that they noticed landfill odour but accepted it and thus would not object. This acceptance may not be the case for new residents that have recently moved into the area.

12. Response to Questions Asked by Council

This section provides responses to the questions asked by the Council, based on the findings of the odour dispersion modelling and the community survey.

11.1 Odour beyond the Boundary of the Landfill

The Council required that the odour investigation assess and report on if, at the time of investigation, the odours at the EPA licenced boundary were compliant with the licence.

The City holds EPA Licence No. 46490 issued on 9 May 1975 to operate the Eaglehawk Landfill. Condition LI_A1 of the Licence states that" You *must ensure that odours offensive to the senses of human beings are not discharged, emitted or released beyond the boundary of the premises".*

Based on the findings of the community survey, odour modelling and the detection of odour by CEE personnel beyond the boundary, it is considered that odour can be detected beyond the boundary of the landfill.

In this context, it is noted that the EPA fined the Council in March 2017 for a breach of the Licence. EPA officers inspected the site and observed extensive areas of exposed waste that should have had at least 30 cm of soil cover to prevent litter being blown about by the elements and leaving the property. The waste was not covered and was exposed. Under such conditions, higher odour would be released from the active cell.

11.2 Odour Risk to Residential Areas

The Council required that the odour investigation assess and report on the risk to the residential area associated with airborne odour releases.

The extent of the risk of a reduction in amenity due to odour is illustrated by the red and orange circles in Figure 10-1 and the extent of the 4 OU contour in the odour dispersion model plots in Chapter 9. In summary, residential land north and east of the landfill is within the 4 OU contour, and there is good evidence that rural residential sites west of the landfill also experience elevated odour levels.

11.3 Potential to Reduce Buffer Zone

The Council required that the odour investigation assess and report on if the 500 m landfill buffer distance could be reduced to 250 m or other lesser distance from the landfill boundary.

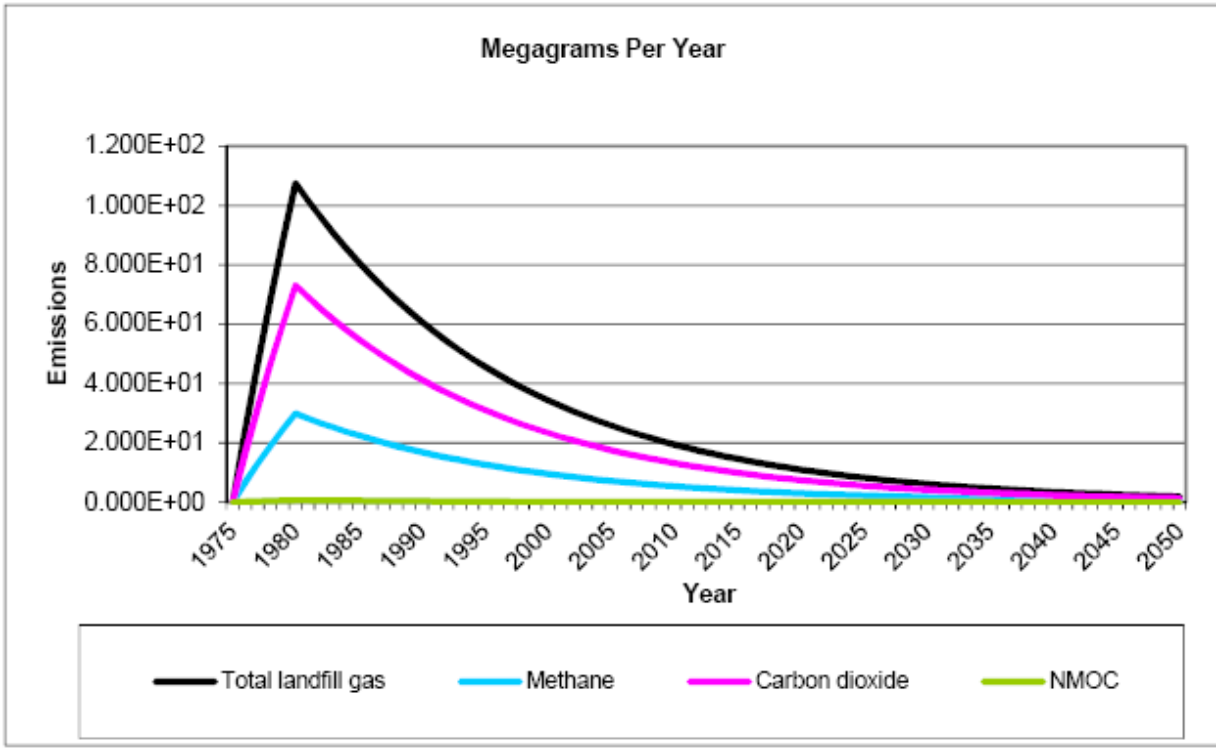
Based on the findings of the community survey and the odour modelling results, it is considered that there can be no reduction in the buffer zone to the west, north and east of the facility. A minor reduction in the buffer zone, by about 50 to 100 m, could be acceptable to the south of the facility. This is based on the wind patterns and topographic conditions resulting in less frequent transport of odour to the south of the landfill.

11.4 Potential for Odours with Excavation

The Council required that the odour investigation assess and report on if waste was excavated on the east side of the industrial shed as per the *Transfer Station Master Plan*, would the odour release cause a nuisance and what actions could be done (if any) to avoid an odour complaint during the construction phase.

The area to be excavated is an older landfill zone, but the age of the wastes stored are not defined. Even if this section of landfill was completed as long ago as 1975, significant quantities of landfill and odorous gases will continue to be released until 2025, as indicated in Figure 11-1.

Figure 11-1 Estimate of Gas Release from 1975 Municipal Landfill



The effects of odour can be minimised by (1) installing a gas collection system around the excavation; and (2) carrying out the excavation quickly and resealing the landfill with a new impermeable cap.

11.5 Long Term Risk of Odours

The active landfill operations will not be completed until 2022. There is then a period of about 40 years when odour can continue to escape from the filled cells. The release of odour can be managed by capping all cells and installing a landfill gas extraction system.

Long term, however, there is a risk that the gas extraction system can be discontinued as uneconomic. Then there may be a period of subsequent odour release, albeit at a low rate.

13. Appendix - Examples of Responses from Residents

I have been living in Bracewell St for 15 years and never complained. However, the odours have often been a nuisance and have got particularly bad in the last year as the tip has moved closer. Earlier, the tip smelled spasmodically – especially just before a weather change - but now it is particularly obnoxious more often than not.

Perhaps the removal of trees and scrub in the recent fire has made the odour worse. The odour is particularly bad in the mornings (especially if I take my dog for a walk down the gully) and in the evenings. We have been promised by the Council twice that the tip will close but it is still operating. Addition of cover over garbage each day is an improvement but there is still a major odour problem.

Bracewell St - had to cancel an engagement party because of the offensive odours – neighbours also have a problem with the odour.

I am sorry but we have lived in Vinton Street for 8 years and we have never had a problem or a smell from the tip I think the people who complain need to get a life. I think these days we have a big problem we need everything but not at our back door but if they are not there to use, we complain too.

We are residents from Walker Crescent Eaglehawk and get smells from the land fill weekly now. They have been very reasonable for a long time but the last 6 months have been horrendous. I am unable to scan the sheet you put in our letterbox so hope this e-mail is sufficient. Thanks for looking into this.

Hello Ian
I am a resident in Eaglehawk and fall within the 500 m buffer Zone – near Corner Violet Street and Walker Crescent. The odour from the landfill station has become more apparent over recent years. If you need further information please feel free to email.

I have lived at Violet St Eaglehawk for 7 years. I have noticed a detectable sour odour from the landfill only once per year on average.

	*Thank you for the opportunity to participate in the survey.* *As illustrated on the map, we experience occasional odour.* *It has improved over the years.*

Appendix B – Predicted Odour Contours for Multiple Years

This appendix provides plots of predicted odour contours for three successive years for two odour emission scenarios:

- Base case - Normal Emissions (Figures B1, B2 and B3); and
- Scenario 1 - Higher Active Face Emissions (Figures B4, B5 and B6).

Figure B-1 shows the predicted odour contours for normal operations and the 2016 wind file. The 4 OU contour is shown as a solid yellow line for AERMOD. The red line shows the 500 m buffer zone.

It can be seen that under normal operations, the 4 OU contour is contained within the 500 m buffer. It extends over existing residential areas north and south-east of the landfill, but not over the residential area to the south of the landfill. The 4 OU contour extends to the buffer on the west of the landfill and close to the buffer on the north.

Figures B-2 and B-3 show the predicted odour contours with the dispersion models and the 2017 and 2018 wind files, respectively. The 4 OU contour for these other years are very similar to the prediction for 2016.

Figure B-1 shows the predicted odour contours for Scenario 1 – Higher Active Face Emissions and the 2016 wind file. The 4 OU contour is shown as a solid yellow line for AERMOD. The red line shows the 500 m buffer zone.

It can be seen that under Scenario 1, the 4 OU contour is contained within the 500 m buffer to the east and south, but projects outside the buffer in parts to the north and west.

Figures B-2 and B-3 show the predicted odour contours with the dispersion models and the 2017 and 2018 wind files, respectively. The 4 OU contour for these other years are very similar to the prediction for 2016.

From a comparison of the predicted odour contours, it is apparent that there is little difference between the predicted contours for the three different years but a significant difference between the predicted contours for the two different emission scenarios.

Figure B-1. Base Case – Normal Emissions using 2016 Wind File

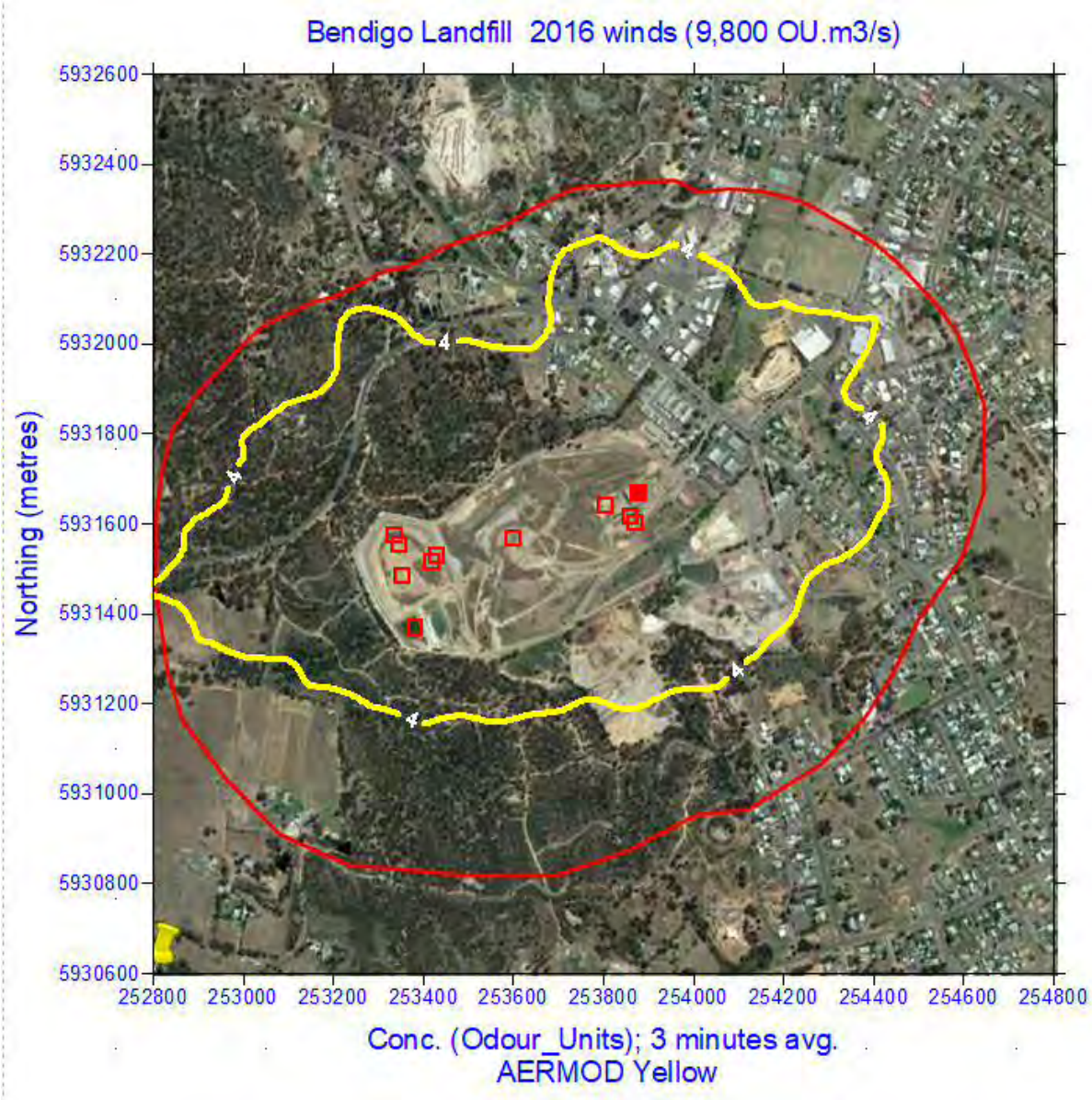


Figure B-2. Base Case – Normal Emissions using 2017 Wind File

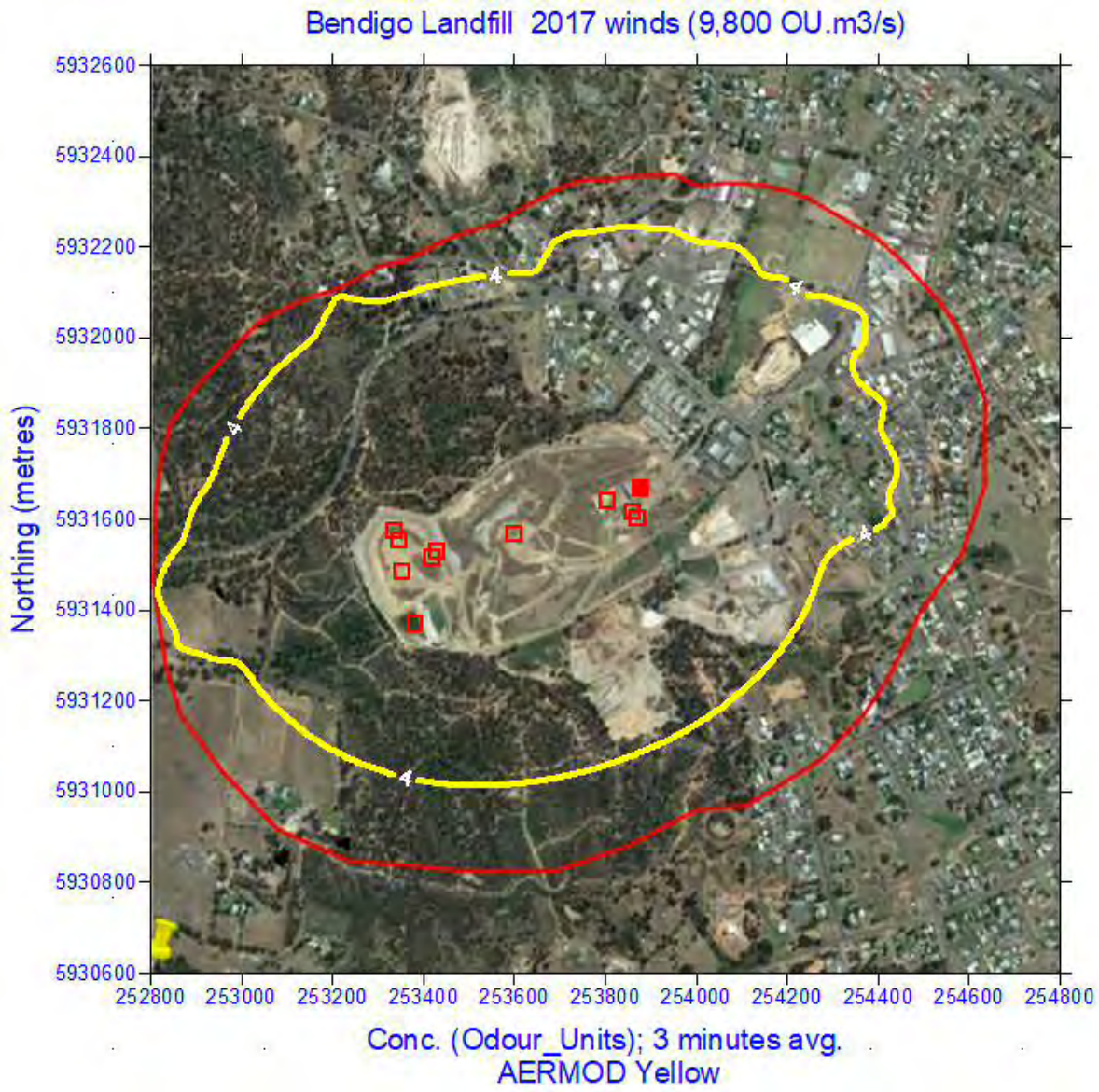


Figure B-3. Base Case – Normal Emissions using 2018 Wind File

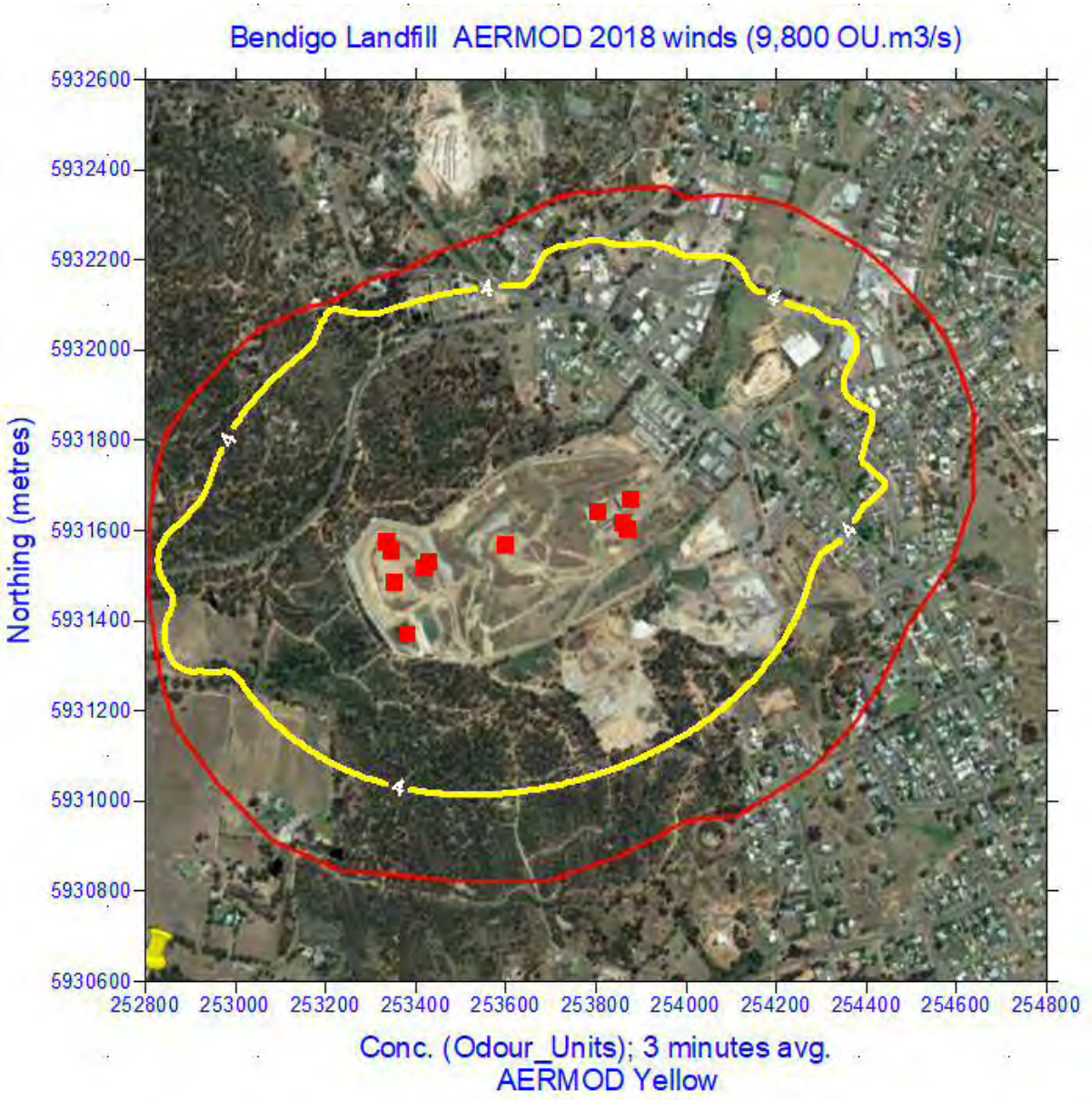


Figure B-4. Scenario 1 – Higher Active Face Emissions using 2016 Wind File

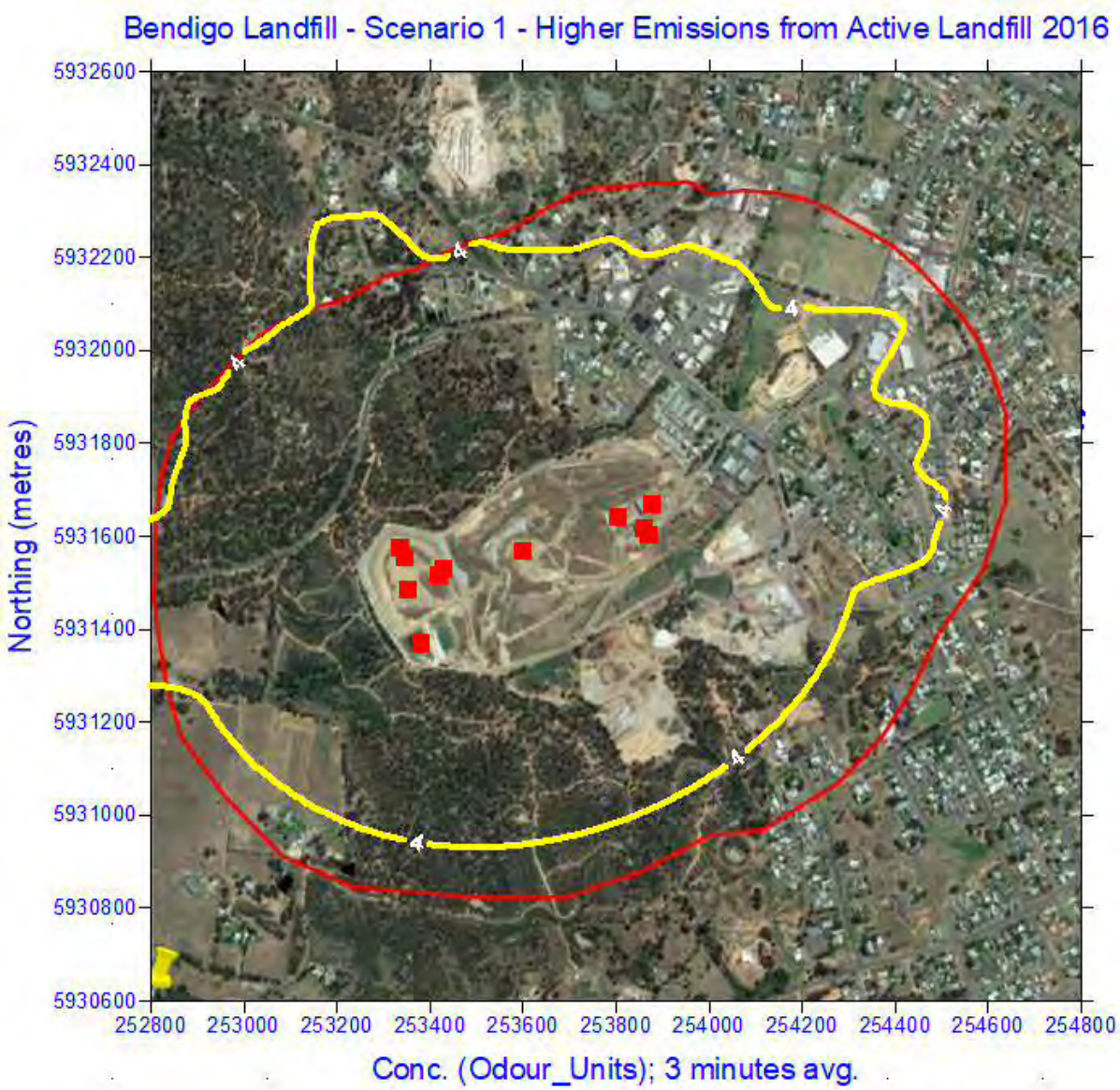


Figure B-5. Scenario 1 – Higher Active Face Emissions using 2017 Wind File

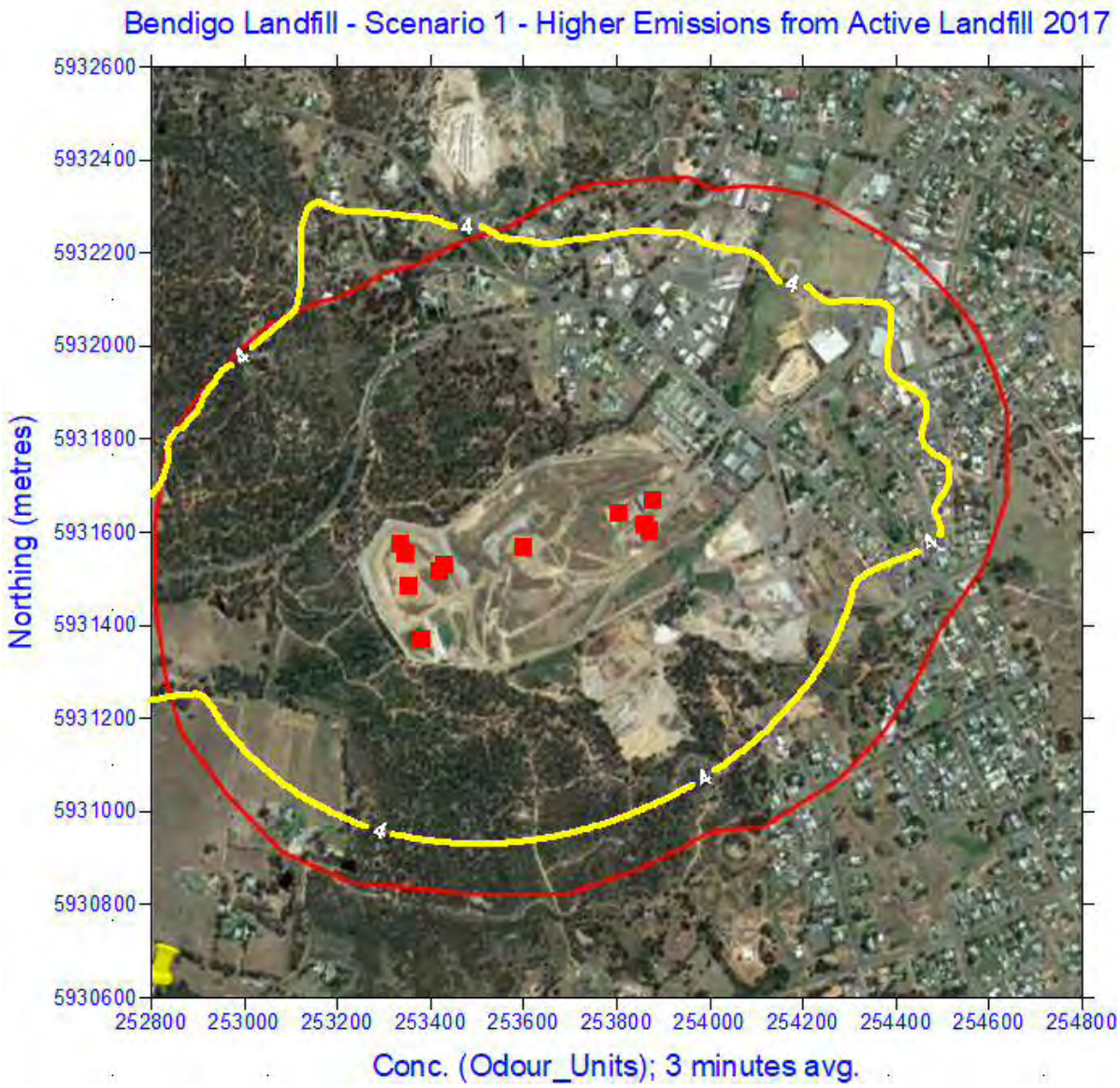
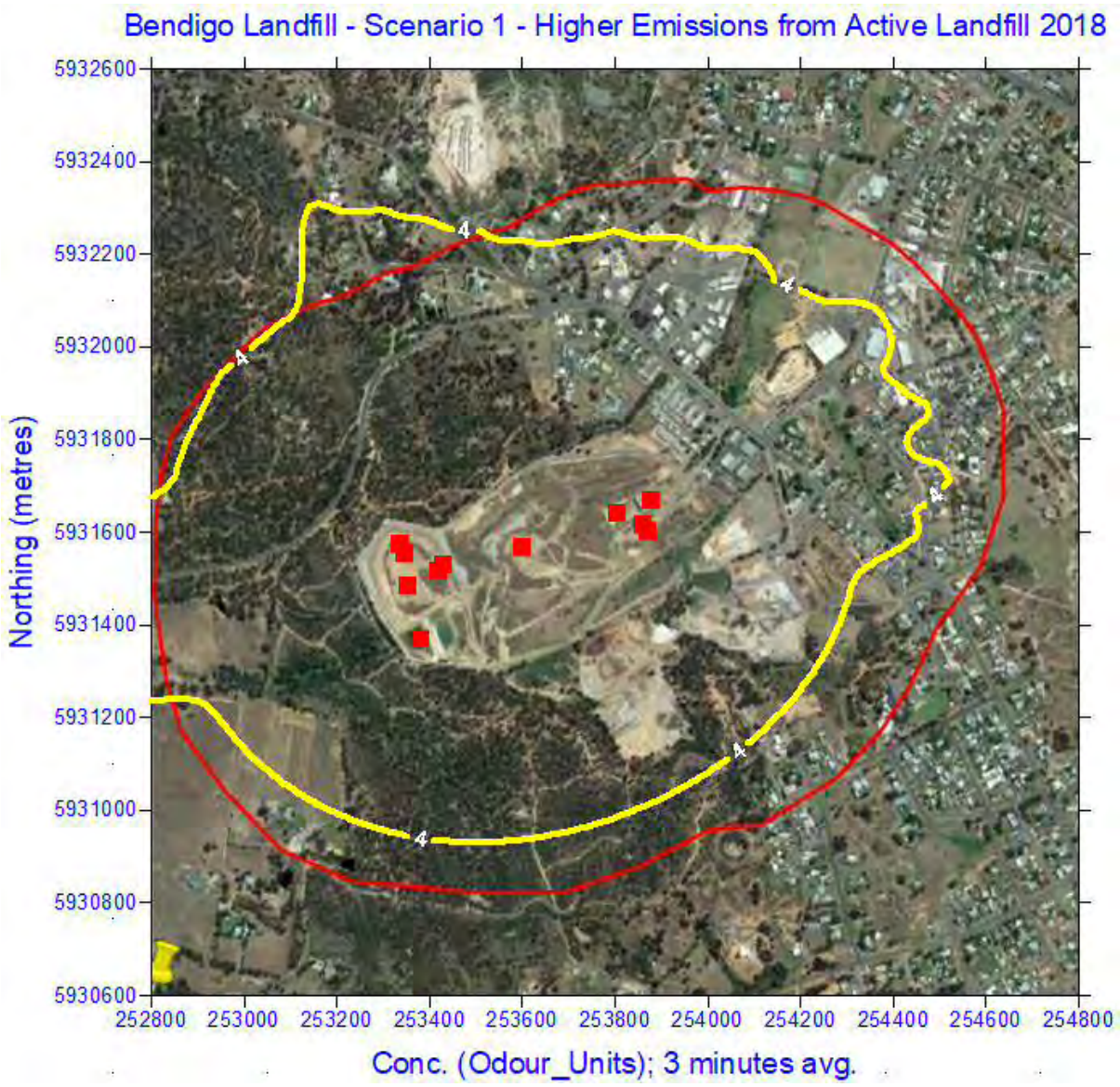


Figure B-6. Scenario 1 – Higher Active Face Emissions using 2018 Wind File



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ERM's Melbourne Office
Citic House
Level 6, 99 King Street
Melbourne VIC 3000

PO BOX 266
South Melbourne VIC 3205

T: +61 3 9696 8011
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