Appendix G

ERA 53(b) (Anaerobic Digester) Report

PRECISE ENVIRONMENTAL
Consulting Environmental Scientists

Proposed Environmentally Relevant Activity 53 (b) - organic material processing by anerobic digestion

Proposed Scenic Rim Agricultural Industrial Precinct

6200 – 6206 Cunningham Highway, Kalbar, Queensland

Kalfresh Pty Ltd

April 2020

Precise Environmental Pty Ltd
ATF Precise Environmental Unit Trust
7/14 Fremantle Street, Burleigh Heads QLD 4220
T 1300 488 215 **P** 07 5593 7848 **F** 07 5593 7020

Correspondence
PO Box 4424, Robina Town Centre QLD 4230
E mail@preciseenvironmental.com.au

www.preciseenvironmental.com.au

ACN: 118147078 ABN: 94335911259

Details

Report:

Precise Environmental Pty Ltd		***Job No:***	PE2898.19
Project Manager:	Chris Butler	***Email:***	chris@preciseenvironmental.com.au
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Issuing office:

Precise Environmental Pty Ltd ATF Precise Environmental Unit Trust
Unit 7 / 14 Fremantle Street, Burleigh Heads, Queensland 4220
Tel. (07) 5593 7848
Fax (07) 5593 7020

Chris Butler BEnvSc DipAppSc MEIANZ,
CEnvP (Site Contamination Specialist)
Director | Principal Scientist

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1 INTRODUCTION

1.1 Purpose of the report

This report has been prepared by Precise Environmental (PE) on behalf of Kalfresh Pty Ltd (the client) for the proposed Scenic Rim Agricultural Industrial Precinct (SRAIP) project at 6200 – 6206 Cunningham Highway, Kalbar, Queensland (the site). This report is specific to the proposed Environmental Relevant Activity (ERA) 53(b) - organic material processing - operating a facility for processing more than 200 t of organic material in a year by anaerobic digestion.

The purpose of this report is to provide the administering authority with information required to support the proposed development application to undertake the abovementioned ERA.

Accordingly, this report was prepared with the following key objectives based on Section 125 of the Environmental Protection (EP) Act 1994:

- To describe the proposed activity and context of the activity as part of the SRAIP
- To describe the land use and environmental setting of the site and its surrounds, in particular potential sensitive receptors (PSR) and associated environmental values (EVs) and public health risks which may be affected by the activity
- To provide details of emissions or releases (potential contaminants) which may be generated by the activity
- To describe the risk and likely magnitude of impacts on EVs and public health
- To describe the management practices proposed to be implemented to prevent or minimise adverse impacts
- To describe how the land will be rehabilitated after the activity ceases
- To describe the proposed measures for minimising and managing waste generated by the activity
- To details of any site management plan that relates to the land the subject of the project.

1.2 Site properties

The SRAIP will consist six allotments as detailed below:

- Lot 1 RP216694
- Lot 2 SP192221
- Lot 3 SP192221
- Lot 4 SP192221
- Lot 2 RP44024
- Lot 2 RP20974.

The anaerobic digester and digestate irrigation area will be situated on Lot 3 SP192221. The digestate storage will be situated across Lots 3 and 4 SP1922211. The subject allotments and respective site areas are shown in Attachment A, Figures 1a and 1b (SmartMaps). The concept layouts are shown in Attachment A, refer RPS Plan References: 142489-05M and 142489-06L. The site layout and environmental receptors are shown in Attachment A, Figure 2 and a flow process diagram is provided in Attachment A, Figure 3. The proposed digestor layout and associated components are shown in Attachment A, Weltec Biopower Plan Ref: 219-009-LG-ANGES-01.

The requirements for the proposed ERA 53(b) are as follows:

1. To provide a facility to covert waste to energy using imported feedstocks including raw and dewatered grease trap waste supplied by Cleanaway, and corn silage, chicken and pig manure and sludge, and ruminant waste from the locale.
2. To generate a digestate liquid fraction fertiliser that can be irrigated across a designated 18 hectare area of Lot 2 RP20974 with the balance sold for offsite agricultural use within the locale
3. To generate a digestate solid fraction fertiliser for incorporation in onsite composting, direct application across site properties with any balance sold for offsite agricultural use within the locale.

1.3 Background

PE understands from review of the Interim Advice Statement by I Cubed Consulting (2019) and the Scope of work for a draft impact assessment report by the Coordinator General (2019) that the SRAIP aims to create a formal hub for fresh and frozen food production in a highly-productive agricultural region 84 km south-west of the Brisbane CBD. The proposed Rural Enterprise Precinct will enable Australian food businesses to base themselves where the raw ingredients are grown, allowing fresh food to be delivered to customers faster, reducing food miles, improving operational efficiencies, and responding to market demand for trusted, value-add food and beverage products. High value cropping land will be maintained surrounding the site to the east, north and south of the site. The development site will span across 39.2 hectares of land fronting the Cunningham Highway at Kalbar in the Scenic Rim.

The parent parcel of the proposed SRAIP land is currently utilised for a mix between cropping purposes and an isolated rural industrial development partially over three (3) lots and supports the current rural production and processing industries of Kalfresh's existing operations. The land is relatively flat falling gently away from the Cunningham Highway before rising sharply to the rear of the property, being intersected by an overland flow path which is subject to periodic flooding events, none of which have affected the current operation of built infrastructure onsite.

The project area is mostly clear of native vegetation, with some scattered vegetation found to the rear of the area and is not mapped as state significant. Services available to the site and the current operations by Kalfresh are electricity and telecommunications.

The proposed land use for the precinct will be further refined in consultation with market experts and scoping of potential operators. Once designation is finalised, it is proposed that the project area will be further reconfigured into viable rural industrial lots through a reconfiguration of a lot application as per the specific requirements of the operators ranging from 4,000 m^2 – 20ha.

1.4 Scope of work

The following scope of work was undertaken to meet the objectives:

- A desktop review of the characteristics of the site and surrounding environment through published information including geology sheets, soil maps and notes, registered groundwater bores, environmental values specified under the Environmental Protection (Water) Policy 1999, and other environmental datasets available through Queensland Globe and MinesOnlineMaps
- A desktop review of the local land uses and catchment sensitivity
- A detailed site inspection to observe the physical characteristics of the site and surrounding environment, and to complete soil characterisation within the digestated irrigation area (DIA) through sampling / observation and laboratory analysis
- Overview of the anerobic digestion process
- Preliminary groundwater monitoring

- A preliminary hydraulic loading and nutrient impact assessment using the Model for Effluent Disposal Using Land irrigation (MEDLI) to size a DIA and wet weather storage tank (WWST) to assess the sustainability of digestate (liquid fraction) irrigation. The input data was based on the daily volume of digestate to be generated including the addition of bore and/or creek water to dilute the digestate nutrient concentrations for sustainable land irrigation. Information is accordingly provided with regards the proportion of digestate to be irrigated within the bounds of the site vs the proportion to be used offsite.
- A strategy for the management and use of solid phase digestate
- Assessment of emissions or releases which may be generated by the activity based on the proposed feedstocks, including contaminants of potential concern (CoPC), and risk of adverse impacts to EVs and public health
- Development of management strategies and general control measures to mitigate risk of adverse impacts which can be utilised in the preparation of conditions of approval
- A preliminary strategy for the rehabilitation of the subject area following cessation of the activity
- Identification of constraints which may limit the sustainability of the activity.

1.5 Relevant environmental legislation

Key legislation relevant to the activity is detailed below:

- Biosecurity Act 2015
- Environmental Protection Act 1994
- Environmental Protection Regulation 2019
- Environmental Protection (Water and Wetland Biodiversity) Policy 2019
- Bremer River environmental values and water quality objectives Basin No 143 (part) including all tributaries of the Bremer River 2010
- Environmental Protection (Air) Policy 2019
- Environmental Protection (Noise) Policy 2019
- Environmental Protection (Regulated Waste) Amendment Regulation 2018
- Land Protection (Pest and Stock Route Management) Act 2002
- Nature Conservation Act 1992
- Public Health Regulation 2005 (QPC 2010)
- Vegetation Management Act 1999
- Waste Reduction and Recycling Act 2011
- Work Health and Safety Act 2011.

1.6 Relevant standards and guidelines

The following documents describe standard and guidelines applicable to the activity:

Erosion & Sediment Control

- Best Practice Erosion and Sediment Control (IECA 2008)

Environmental Management Systems

- AS ISO 14001: 2016 – Environmental Management Systems
- AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines

Hazardous materials

- AS 1940: 2004 – The storage and handling of flammable and combustible liquids
- Managing risks of hazardous chemicals in the workplace – Code of Practice (SWA 2012)

Noise

- Noise Measurement Manual (ESR/2016/2195, EHP 2013)

Department of Environment and Science (DES) technical guidelines – application / activity requirements

- Guideline: Open windrow composting under environmentally relevant activity 53(a) - organic material processing by composting (ESR/2015/1813, Version 2.00, Effective 23 November 2018)
- Guideline: Application requirements for activities with waste impacts (ESR/2015/1836, Version 5.01, Effective 4 February 2019)
- Guideline: Application requirements for activities with impacts to water (ESR/2015/1837, Version 4.02, Effective 6 March 2017)
- Guideline: Application requirements for activities with noise impacts (ESR/2015/1838, Version 3.03, Effective 6 March 2017)
- Guideline: Application requirements for activities with impacts to land (ESR/2015/1839, Version 4.02, Effective 6 March 2017)
- Guideline: Application requirements for activities with impacts to air (ESR/2015/1840, Version 4.03, Effective 6 March 2017)
- Guideline: Noise Control - Planning for Noise Control (DEHP 2015)
- Guideline: Odour Impact Assessment from Developments (DEHP 2013)

Water quality

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018 & ANZECC/ARMCANZ 2000)
- Australia and New Zealand Standard: Water quality – Sampling (AS/NZS 5667)
- Monitoring and Sampling Manual (EHP 2018)
- Queensland Water Quality Guidelines (EHP 2013).

Wastewater (reference use only)

- Guidelines for Sewerage Systems - Use of Reclaimed Water (ARMCANZ, ANZECC & NHMRC 2000)
- Planning Guidelines for Water Supply & Sewerage (DERM 2010)
- Public Health Regulation 2005 (QPC 2010)
- Queensland Plumbing and Wastewater Code (DHPW 2013)
- Queensland Water Recycling Guidelines (EPA 2005)
- Water Quality Guidelines for Recycled Water Schemes (NR&W 2008).

1.7 Development application details

As proponents of the SRAIP Kalfresh are in the process of seeking a coordinated development approval(s) for commercial / industrial land development component of the proposal along with new environmental authority approvals for the following ERAs:

- 53(a) - Organic material processing more than 200 t of organic material in a year by composting the organic material
- 53(b) - Organic material processing more than 200 t of organic material in a year by anaerobic digestion (i.e. the subject activity)
- 63 1(b)(i) - Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of more than 100 but not more than 1,500 equivalent persons - where treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme.

Environmental Authority approval for 63 1(b)(i) - organic material processing requires a site-specific application which will be lodged by Kalfresh, which also proposes to submit an application to be the Registered Suitable Operator.

1.8 Limitations

The findings of this report are based on the objectives and scope of work outlined above. PE performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties or guarantees, express or implied, are made. Subject to the scope of work, PE's assessment is limited strictly to identifying typical environmental conditions associated with the subject property, and does not include evaluation of any other issues.

This report does not comment on any regulatory obligations based on the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of work stated, and does not relate to any other works undertaken for the client. The report and conclusions are based on the information obtained at the time of the assessment. Changes to the surface and subsurface conditions may occur subsequent to the investigation described herein, through natural processes or through the intentional or accidental addition of contaminants, and these conditions may change with space and time.

The results of this assessment are based upon site inspection and fieldwork conducted by PE personnel and information provided by the client and site management. All conclusions regarding the property area are the professional opinions of the PE personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, PE assumes no responsibility or liability for errors in any data obtained from regulatory agencies, information from sources outside of PE, or developments resulting from situations outside the scope of this project.

2 SITE CHARACTERISTICS AND SURROUNDING ENVIRONMENT

2.1 Site detail

Site / property details are provided in Table 1.

Table 1. Site / property details.

Aspect	Detail					
Local Government:	Scenic Rim Regional Council (SRRC)					
Zoning:	Rural					
Address:	6200 – 6206 Cunningham Highway, Kalbar, Queensland					
Real property description:	Lot 1 RP216694	Lot 2 SP192221	Lot 3 SP192221	Lot 4 SP192221	Lot 2 RP44024	Lot 2 RP20974
Area in hectares (ha)	0.624	2.876	48.93	61.16	75.277	59.744
Current land use and site structures:	The primary use of the site is farmland for growing and processing vegetables and cattle grazing. The main structures located along Cunningham Highway operate as a distribution centre to wash, sort and process vegetables for bulk sale.					
New land use:	The site is proposed to expand operations to other local growers forming a mini commercial sub-division. The site use will remain the same, but the volume of production and distribution will increase.					
Surrounding land uses:	Rural land use, farmland and cattle grazing. A quarry is located to the northwest.					
Former contaminating land uses (identified during site inspection):	Former cattle dip located in Lot 2 RP20974. Former service station located in Lot 2 SP192221 - canopy, bowser, fill points and underground storage tanks (USTs) remain in-situ. DES was notified of these activities on 13 February 2020.					

2.2 Site characteristics

A summary of the site characteristics is provided in Table 2. Site photographs are attached in Attachment B.

Table 2. Site characteristics within the proposed DIA.

Aspect	Detail
Site elevation	Google Earth reports the site at elevations at 96 - 113 m AHD.
Presence of fill:	Not identified.
Slope (%):	Gently to moderately inclined (3-10 %).
Slope configuration:	Linear divergent
Slope aspect:	Downward to the northeast.
Vegetation:	Short grass, exposed soil
Exposure:	High sun and wind exposure.
Presence of shelter belts:	Nil
Erosion potential:	Low - moderate
Requirement for soil amelioration to establishment of pasture:	Yes

2.3 Soil characteristics

A site inspection was conducted on 21 October 2019 which included the sampling of soils within the proposed DIA, and dispatch of the samples to the DES Chemistry Centre which holds NATA accreditation. Observed soil characteristics are provided in Table 3 and laboratory results are discussed further in Section 3.5.

Table 3. Soil characteristics in the proposed DIA.

Soil profiles:	Two boreholes (BH1 and BH2) were constructed by PE using a hand auger to a maximum depth of 0.9 m in the area proposed for effluent irrigation. Encountered soil profiles were as follows:	
	BH1 0.0 – 0.1 m (Natural) Silty Sand, fine to medium grained sand, grey brown, moist. 0.1 – 0.6 m Clayey Gravelly Sand, fine to medium sized angular gravel, fine to medium grained sand, yellow brown, moist. 0.6 m – Borehole terminated in extremely weathered granite.	BH2 0.0 – 0.6 m (Natural) Light to Medium Clay, grey with orange mottles, moist. 0.6 – 0.9 m Clayey Sand, fine to medium grained sand, yellow brown, moist. 0.9 m – Borehole terminated extremely weathered rock.
	Two boreholes (BH3 and BH4) were constructed by PE using a hand auger to a maximum depth of 0.6 m in the area proposed for digestate irrigation. Encountered soil profiles were as follows:	
	BH3 0.0 – 0.6 m (Natural) Light to Medium Clay, with trace of fine to medium grained sand, orange, moist. 0.6 m Extremely weathered bedrock (granite).	BH4 0.0 – 0.4 m (Natural) Light to Medium Clay, with trace of fine to medium grained sand, orange, moist. 0.4 – 0.8 m Medium Clay, with trace of fine to medium grained sand, occasional gravel and weather granite fragments, brown, moist. 0.8 m Extremely weathered bedrock (granite).

Note: The borehole information is consistent with observation within the DIA by PE. Refer to extraction zone identified in close proximity to the DIA in Attachment B, Photograph 3. Soil amelioration will be required in the DIA prior to establishing a pasture crop and digestate irrigation. Soil physico-chemical conditions will improve as a result of this process.

2.4 Geology and hydrology

Geology details for the site and surrounds are provided in Table 4.

Table 4. Regional geology.

Aspect	Detail
Acid sulfate soil:	There is no acid sulfate soil mapping associated with this site.
Geology:	The geology across the site is mapped as 1:500,000 as Quaternary: Flood plains, river terraces (Geological Survey of Queensland, Moreton Geology 1978). Local soil mapping 1:25,000 shows the site classified as Bromelton (eroded phase) with soils comprising dark clay loam or light clay with neutral or alkaline structured clay subsoil (Qld Department of Primary Industries 1979).

Hydrology characteristics are detailed in Table 5. Mapping is provided in Attachment C.

Table 5. Hydrology details for the site and surrounding area.

Aspect	Detail
Direction of stormwater drainage:	Stormwater is expected to follow the natural contour of the gullies flowing northeast from the DIA. Stormwater is then expected to flow northeast toward Warrill Creek.
Flooding:	The site is mapped as low to high flood hazard. The southern portion of the DIA is adjacent to a mapped high flood hazard area. The bioenergy facility is mapped within a medium flood hazard area.
Onsite surface waters:	Numerous ephemeral gullies are located on the site which are expected to flow seasonally or in a heavy rain event – which flows to Warrill Creek ~2.4 m northeast. The DIA is located from 30 m the ephemeral gully which enters the southwest site boundary. There are a number of dams located in the northern portion of the site. The closest dam to the digestate irrigation area is 670 m north east.
Onsite groundwater wells / bores:	A registered sub artesian bore (RN138334) exists on the site and historically used for agricultural purposes. There are five unregistered operational bores within the bounds of Lot 2 SP192221 which are located a minimum distance of: • 480 m from digestate irrigation area • 115 m from bioenergy facility • 575 m from digestate storage area. There is one unregistered bore within the bounds of Lot 3 SP192221 which is non-operational. During the site inspection PE collected a sample from a production bore known as 'little bore wash shed'. The laboratory results are provided in Attachment D. A summary of the results are as follows: <u>Characteristics (Source: Bore Cleaning Services):</u> • Total depth – 16.3 m • Screen depth – 9 to 15 m • Water level – 10 m.

Aspect	Detail
Onsite groundwater wells / bores:	Field results: • pH – 7.72 units • Electrical conductivity – 1.158 mS/cm • Turbidity – 0.07 NTU Key laboratory results: • Total dissolved solids – 750 mg/L • Hardness – 464 mg/L • Total nitrogen – 7,300 µg/L • Total phosphorus – 160 µg/L. The existing electrical conductivity and nitrogen concentration of this bore must be considered if being utilised to dilute digestate. Information recorded for this bore on the shed wall by Bore Cleaning services notes a standing water level at 10 m and total well depth of 16.3 m.

Registered groundwater bores in the locale (Queensland Globe)

Nearest bores to proposed DIA with relevant information	RN138334 – within Lot 2 DIA: 530 m southeast Bioenergy facility: 250 m southeast Digestate storage area: 690 m southeast	RN14310270 DIA: 1.45 km northeast Bioenergy facility: 1.25 km northeast Digestate storage area: 1.4 km northeast	RN124727 DIA: 810 m southeast Bioenergy facility: 530 m southeast Digestate storage area: 1 km southeast
Status	Existing	Existing	Existing
Use / past use	Water supply	Sub-artesian monitoring	Water supply
Borehole depth (m)	141.7 m	17.3 m	518.0 m
Screen depth (m)	129.5 – 141.7 m	14.9 – 15.9 m	No data
Soil profiles	Varying clay gravel profiles from 0.0 – 15.8 m. The underlying material comprised granite, basalt and shale to the total drill depth.	0.0 – 12.1 m clay; underlain by gravel to 15.8 m. Basal from 15.8 – 17.3 m.	0.0 – 15.0 m clay; 15.0 – 36.0 sandstone and tuff. 36.0 – 518.0 m mixture of basalt, coal, sandstone and shale.
Water bearing zone / upper aquifer depth	134.7 m	12.1 m	36.0 m
SWL (m)	17.7 m	2.05 - 6.24	10.0 m
Upper aquifer status	Confined in basalt	The pressure head indicates this is a confined / semi-confined aquifer.	Semi-confined to confined.
Quality detail provided on bore card	EC 1800 µS/cm (saline)	No data	Described as 'Potable' in aquifer section

Table notes:

SWL = standing water level

EC = electrical conductivity

2.5 Sensitive environments / environmental values

The closest sensitive environments to the site as mapped by various regulatory authorities and government agencies are detailed in Table 6. An overlay of the environmental receptors is provided in Attachment A, Figure 2. Environmental mapping is provided in Attachment C.

Table 6. Closest sensitive environment details.

Sensitive environment mapping	Approximate distance from digestate irrigation area
Queensland Globe mapping	
Watercourse/dam; including matters of state environmental significance (MSES):	Digestate Irrigation Area Watercourse – 30 m north and south Dam – 660 m northeast. Bioenergy facility Watercourse – 10 m north Dam – 600 m north. Digestate storage area Watercourse – 200 m southeast Dam – 620 m north east.
Fish habitat and marine parks	None mapped within a 5 km radius of the DIA.
Wetland protection area:	None mapped within a 5 km radius of the DIA.
Vegetation; including matters of state environmental significance (MSES):	Digestate Irrigation Area Warrill Creek (MSES defined watercourse vegetation) – 825 m southeast MSES defined watercourse vegetation – 30 m north and south Remnant vegetation – 410 m west (it is noted the remnant vegetation is not present as the land has been developed as a quarry). MSES endangered or of concern – 765 m southwest. Bioenergy facility Warrill Creek (MSES defined watercourse vegetation) – 550 m southeast MSES defined watercourse vegetation – 50 m north east MSES endangered or of concern – 945 m southwest. Digestate storage area Warrill Creek (MSES defined watercourse vegetation) – 1 km southeast MSES defined watercourse vegetation – 220 m north east MSES essential habitat – 1.25 km northwest.
Groundwater dependant ecosystem	The onsite watercourse (ephemeral gully) and Warrill Creek are mapped as moderate confidence alluvial aquifers with near permanent connection between surface water and groundwater.
Mines Online Maps (DNRM 2017)	
Mining lease permit	~ 17.9 km northeast of the site.
National Parks	Moogerah Peaks National Park ~ 5.1 km southeast of the site. Main Range National Park ~ 13.7 km west of the site.
World Heritage Area (WHA)	Main Range National Park ~ 13.7 km west of the site.
Native Title	960 m south of the DIA.

Sensitive environment mapping	Approximate distance from digestate irrigation area
Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP) waterway mapping	
The section of Warrill Creek is mapped as lowland freshwaters. DES has published guidelines values for the protection of Bremer River in the Environmental Protection (Water and Wetland Biodiversity) Policy 2019.	
Environmental values (EVs) for groundwater in the Bremer River catchment	Aquatic ecosystem, irrigation, farm supply/use, stock and drinking water.
EVs for middle Warrill Creek – lowland freshwater	Aquatic ecosystem, irrigation, farm supply/use, stock water, human consumer, primary/secondary/visual recreation, drinking water and cultural/spiritual values.
Water quality guidelines and water quality objectives (WQOs) suited to the identified EVs	WQOs within the EPP 2009 stipulate the following WQOs for Warrill Creek – lowland freshwater: • Turbidity: <5 NTU • Total suspended solids: <6 mg/L • Chlorophyll a: <5 µg/L • Total nitrogen: <500 µg/L • Oxidised N: <60 µg/L • Ammonia: <20 µg/L • Organic N: <420 µg/L • Total phosphorus: <50 µg/L • Filterable reactive phosphorus: <20 µg/L • Dissolved oxygen: 85 – 110% saturation • pH: 6.5 – 8.0 units • Conductivity: <500 µS/cm.

The key receptors that could potentially be affected are as follows:

- Air quality has the potential to be degraded
- Surface waters (dams and creeks) have the potential to be impacted by digestate runoff and infiltration
- Groundwater has the potential to be impacted by digestate runoff and infiltration
- MSES vegetation could be impacted by digestate runoff
- Nearby wetlands could be impacted by digestate runoff and infiltration
- People and wildlife have the potential to impacted by excessive noise generating activities
- Land contamination can occur as a result of improper application of digestate (solid and liquid) and inappropriate management of wastes.

Environmental objectives and performance outcomes to mitigate the risks have been addressed with reference to the Queensland Government Environmental Protection Regulation (2019), Schedule 5, Part 3, Table 1, and is provided in Attachment E. Section 5 provides further information regarding design and management controls to prevent impact to receptors.

2.6 Local meteorology

A summary of the rainfall and evaporation data for Kalbar (which has been utilised in the MEDLI model) (latitude 27.95°S, longitude 152.62°E) for the period 1 January 1889 to 31 December 2018 (130 years). This data is referenced in Table 7.

Table 7. Annual rainfall and evaporation summary (MEDLI).

Annual Totals	5th percentile	50th percentile	95th percentile
Rainfall mm/year	503	867	1,219
Pan Evap mm/year	1,483	1,633	1,804

Average rainfall from the Bureau of Meteorology (BOM) for Amberley AMO (Weather station 40004) from 1941 10 October 2019 are detailed in Table 8.

Table 8. Mean monthly rainfall and temperature summary (BOM).

MONTHLY	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall (mm)	115.4	119.9	85.7	54.2	52.4	46.8	37.2	28.3	33.1	73.4	80.9	119.3
Ave max. temp (ºC)	31.2	30.5	29.4	27.2	24.1	21.6	21.3	22.9	25.7	27.8	29.6	30.8
Ave min. temp (ºC)	19.6	19.5	17.8	14.0	10.0	7.1	5.3	6.2	9.5	13.3	16.3	18.4

3 ANEROBIC DIGESTION PROCESS AND MANAGEMENT

Information regarding the anaerobic digestion process is provided in the following sections, including methods for the management and use of digestate.

This information has largely been derived from the Kalfresh reports listed below which should be read in conjunction with this report as they provide a high level of detail:

- Kalfresh. 2019a. Kalfresh Bio-Energy Facility: Substrate & Digestate Analysis
- Kalfresh. 2019b. Kalfresh Bio-Energy Facility: Control and Compliance Plan for Odours, Nutrient Leaching, Irrigation and Composting (Draft report)
- Kalfresh. 2019c. Kalfresh Bio-Energy Facility Overview of Digestate Management Plan
- Kalfresh. 2019d. Kalfresh Bio-Energy Facility: Digestate Quality Control & Compliance.

Additional information which should be read in conjunction with this report is provided in the Waste to Energy proposal prepared by Aquatec Maxcon dated 21 November 2019, which incorporates a proposal by Weltec Biopower dated 18 November 2019. The proposals incorporate a list of components for the waste to energy facility, a process flow diagram and plan view drawing.

3.1 Feedstock quantity/quality

The total volume of feedstock material to be utilised at the site per day is estimated to be 95 to 110 tonnes. The proposed feedstock will typically consist raw and dewatered grease trap waste supplied by Cleanaway (≈10,000 tonnes per year [t/year] and ≈15,000 t/year respectively), corn silage (≈3,650 t/year), chicken litter (≈3,650 t/year), and ruminant waste (≈5,110 t/year). The feedstock utilised may change from time to time in terms of material types and mixing ratios as part of the ongoing refinement and development process.

Feedstock material will be sourced from known suppliers under written agreement between Kalfresh and its suppliers. Only raw materials that can be converted to energy will be used as feedstock. Strict quality control procedures will be adopted to ensure that unsuitable feedstock is not brought onto the site. Specifically, suppliers of feedstock will demonstrate to Kalfresh as part of the ongoing quality management system that material is not contaminated with compounds that cannot be readily converted to energy. Contaminants that will not be permitted in the feedstock include: heavy metals, dioxins, furans, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), petrogenic derived petroleum hydrocarbons, pesticides and per- and poly-fluoroalkyl substances (PFAS). Plant based organic materials will be additionally free of fungus and diseases, and manures and ruminant waste disease and hormone free.

Where there is insufficient information available to certify the feedstock as being suitable for use in the site anaerobic digestor, the material will be rejected prior to receival onsite. Volume/batch-based chemical testing would typically form part of the quality control procedure for verification of feedstock suitability. The limits in Section 4, Tables 14 and 15, will be referenced for this purpose in addition to other approved methods to the satisfaction to DES, noting that pathogens are expected to exist in some animal and plant derived feedstock, hence the incorporation of the pasteurisation process. Routine inspections of the supply source sites, inspection of specific materials prior to importation on site, and a risk assessment of the potential contaminants of potential concern associated with each supply site and specific media (e.g. grease trap waste, plant matter, ruminant waste). This information to be updated and detailed in the site environmental management plans. All feedstock will be inspected when it is received at the site and rejected if is not deemed suitable for use.

3.2 Water supply

The water supply at the site will be obtained from a combination of sources that may include onsite bores, roof water harvesting, piped creek water. Water used for direct drinking is currently harvested from the roofs of select site buildings and this process is likely to continue with the proposed expansion and supplemented by tanker imports on an as required basis. The bore water is currently used for process purposes (i.e. washing of root vegetables). It is anticipated that both bore water and/or piped creek water will be used for process water and for the dilution of the digestate (liquid fraction) for onsite irrigation.

3.3 Anerobic digestion process

The key steps in the anaerobic digestion process are summarised as following:

- Feedstock collection / storage and processing facility
- Anerobic digestion plant
- Biogas produced by the anaerobic decomposition of putrescible organic material will be forwarded to the biogas plant for production of electricity and useable heat
- Pasteurisation of digestate to eliminate pathogens and seeds
- Initial storage of digestate
- Solid-liquid separation of digestate
- Storage of liquid fraction digestate
- Temporary storage of solid fraction digestate
- The separated solid fraction will be used as follows:
  - windrow composting for onsite reuse as a soil conditioner/fertiliser
  - drying and pelletising for on and offsite application as fertiliser.
- The separated liquid fraction will be used as follows:
  - onsite irrigation
  - windrow composting
  - offsite application following road transport and tractor application
  - offsite irrigation via a pipe and storage system (future).

3.4 Air and noise emissions

Max Winders & Associates Pty Ltd has conducted modelling to assess noise and air emissions likely to be generated from the proposed activity during the anerobic digestion process, including the feedstock and digestate storage facilities, and onsite reuse of the solid and liquid digestate fractions within the bounds of the site, refer Draft Impact Assessment Report:

- Appendix P Noise Impact Assessment (MWAa Environmental, 2020)
- Appendix Q Air Quality Assessment (MWAb Environmental, 2020).

In relation to noise, the modelling concluded: 'On the basis of the noise impact assessment conducted, the proposed SRAIP industrial development, anaerobic digester / biogas plant and composting facility can comply with appropriate noise criteria at surrounding sensitive land uses'. It is noted that the assessment undertaken is based upon certain assumptions that warrant review through the application phase and for future development applications as per Section 2.3.4 of the assessment report.

In relation to air, the modelling concluded: 'Detailed air pollutant dispersion modelling of the proposed activities based upon currently available design information demonstrates that compliance with the relevant air quality guidelines can be achieved at sensitive receptors with the implementation of appropriate controls and management measures'.

3.5 Digestate (Liquid fraction)

The liquid fraction is estimated to be 65 to 80 tonnes/day following separation from the solid phase. The liquid will be utilised for a combination of purposes including onsite irrigation, windrow composting and offsite application and irrigation. Refer to Kalfresh reports for further information regarding the separation, management and reuse of this material.

To assess the reuse opportunities for land irrigation, MEDLI modelling was undertaken at various dilution ratios until a sustainable irrigation scenario could be predicted. It was determined that in order to minimise the potential for environmental harm (e.g. excessive deep drainage of nitrogen), the liquid fraction would need a 1:25 dilution with water (i.e. sourced from bore or creek) for onsite land irrigation at the subject site.

The digestate may be pre-mixed in a tank or dam immediately prior to irrigation occurring or via direct injection into the dilutant as irrigation is occurring. Both methods would be conducted in a controlled manner. This mixing strategy will reduce storage volume requirements when irrigation is not permitted (i.e. during rain or facility maintenance).

A DIA of 160 ha was determined to be a sustainable following a multiple MEDLI run to simulate a 100% mixed stream (i.e. a total area per day for on- and-offsite irrigation assuming similar conditions). Given that an 18 hectare DIA will be utilised within the subject site, and additional 148 hectares of offsite land may be required for the balance of daily liquid digestate application. The actual required offsite area, dilution requirements and application methodology would be subject to ongoing evaluation by an appropriately qualified person (i.e. soil scientist or agronomist) to meet site-specific conditions and nutrient requirements for specific crops. The appropriately qualified person must additionally ensure that the offsite liquid digestate application does not cause overland runoff of nutrients to other lands, surface waters and deep drainage of nutrients to groundwater. Digestate that is not irrigated across the 18 hectare DIA will not be pre-diluted to minimise storage requirements, and to reduce the volume of liquid to be transported via a future piped network or via road transport.

Digestate characteristics following dilution (i.e. the modelled characteristics) are provided in Table 9.

Table 9. Digestate characteristics.

Parameter	Pre-dilution	1:25 dilution
Volume (kL)	80	2,000
Total nitrogen (mg/L)	3,700	148
Total phosphorus (mg/L)	340	13.6
Electrical conductivity (µS/cm)	1,600	1,600

It is acknowledged that the electrical conductivity (EC) has not been diluted, as it is assumed that the EC of the dilution water will remain at 1,600 µS/cm if utilising bore water sourced from onsite.

Ideally, the application rate of any component (hydraulic loading, salts, nitrogen or phosphorus) of irrigated digestate should not exceed:

- The rate at which it is taken up by the plants and removed from the site
- Safe storage in the soil
- Allowable losses into the environment.

Soil analysis results which allowed for customisation of MEDLI are provided below in Table 10. Laboratory certificates are provided in Attachment D.

Table 10. Soil laboratory results.

Parameter	BH1 0.0 – 0.25 m	BH2 0.0 – 0.6 m	BH3 0.3 – 0.6 m
pH (units)	6.36	6.23	7.87
EC (µS/cm)	40	50	300
Nitrate nitrogen (mg/kg)	5	2	11
Phosphorus (mg/kg)	131	5	16
Organic carbon (%)	0.933	1.4	0.688
Air dry moisture content (%)	4.1	8.3	3.7
ESP (%)	-	-	6.6
Cation exchange capacity (cmol/kg)	-	-	27
Coarse sand (%)	32.3	8.4	11.0
Fine sand (%)	37.1	16.8	35.8
Silt (%)	21.9	15.4	9.5
Clay (%)	14.0	57.9	45.1
Field capacity moisture (%)	35.7	48.1	40.7
Permanent wilting point (%)	13.2	25.1	19.9

Note: BH1 and BH2 data was derived from boreholes on an adjacent ridge associated with the proposed effluent irrigation area. BH3 data was derived from a borehole constructed in the proposed DIA. The combined data was utilised in the model in establishing a range in physical and chemical composition of the site sites. This will be revised and revaluated following site soil amelioration as soil conditions are expected to considerably improve following completion of this process.

Customisation of the soil parameters component of MEDLI was completed using components of the soil analysis results above to form a user defined 'Kalbar low permeability red brown earth'. The climatic data was sourced online using SILO from Englesberg Village (Kalbar) weather station (40104).

Soil input parameters are provided in Table 11 and other MEDLI input parameters are provided in Table 12. The default MEDLI input values used in the absence of specific soil data were derived from the range of values from Table 3.11 of the MEDLI user manual (DSITI 2016). These values were selected based on those which most closely represented the soil texture information provided in Table 3.

Table 11. Soil input parameters.

Soil input	Layer 1	Layer 2	Layer 3	Layer 4
Soil type	Kalbar low permeability red brown earth			
Soil layer thickness (mm)	100	500	600	300
Air dry (%v/v)	8.3	0.1	0.1	0.1
Lower storage limit (%v/v)	25.1	20.1	25.6	26.2

Soil input	Layer 1	Layer 2	Layer 3	Layer 4
Drained upper limit (%v/v)	44	32	33.9	32.2
Available water capacity (mm)	18.9	59.5	49.8	18.3
Saturated water content (%v/v)	45	43.5	44.8	42.3
Bulk density (g/cm^3)	1.38	1.47	1.44	1.49
Porosity (%v/v)	47.92	44.53	45.66	43.77
Saturated hydraulic conductivity (mm/hr)	20	10	2	0.5

Table 12. MEDLI input.

Parameter	Input
Digestate characteristics	
Daily volume (kL)	2,000
Run period	1 January 1889 to 31 December 2018
Nitrogen concentration (mg/L)	148
Phosphorus concentration (mg/L)	13.6
EC (µS/cm)	1,600
WWST	
WWST capacity (kL)	10,000 kL
WWST characteristics	Closed pond (i.e. no evaporation or rainfall input) with full draw-down depth
DIA	
Size of DIA	160 ha
Soil	Site specific
Crop	Continuous Lucerne (Winter Active) pasture
Irrigation method	
Irrigation system	Fixed sprinkler
Irrigation trigger (maximum)	Once daily to fixed depth of 10 mm A maximum nominal pump rate of 3 ML/day has been set based on the advice of DES – without this setting, the model will not irrigate water unless a complete irrigation event can occur. Rather, by setting this purposely high maximum, irrigation will trigger regardless of whether the fixed depth of 10 mm can be reached.
Ammonia volatilisation	20% (default setting)

Table 13 summarises the model output. MEDLI output files are attached in Attachment F.

Table 13. MEDLI output.

Parameter	Output
Digestate re-use	
Reuse (%)	100
Over-topping (kL/year)	0

Parameter	Output
Water balance	
Irrigated digestate (mm/day)	10
Irrigated digestate (mm/year)	456.5
Rainfall volume (mm/year)	863.8
Transpiration (mm/year)	747
Irrigation runoff (mm/year)	0
Deep drainage (mm/year)	69
Crop performance	
Annual yield (kg/ha/year)	25,695.23
Average monthly plant cover	0.65
Average crop deaths (no/year)	0.65
Average number of normal harvests (per year)	13.48 (4.00 – 18.00)
Average monthly water stress (coefficient)	0.17
No. days without crop per year	9.32
Average annual nitrogen deficiency (coefficient)	0.08
Nutrient balance	
Average annual digestate nitrogen added (kg/ha/year)	675.69
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	709.70
Average annual soil nitrogen leached (kg/ha/year)	3.96
Average nitrate-N concentration of deep drainage (mg/L)	5.74
Maximum annual nitrate-N concentration of deep drainage (mg/L)	59.32
Average annual digestate phosphorus added (kg/ha/year)	62.09
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	64.40
Average annual soil phosphorus leached (kg/ha/year)	0.01
Average phosphate-P concentration of deep drainage (mg/L)	0.02
Maximum annual phosphorus-P concentration of deep drainage (mg/L)	0.07
P storage life (years)	70.78
Salt balance	
Salinity of infiltrated water (µS/cm)	608.09
Average annual salt added & leached at steady state (kg/ha/year)	4,827.29
Relative crop yield expected due to salinity (%)	100

MEDLI modelling summary and assessment of risk

The modelling indicates a re-use rate of 100 % with no overtopping year round based on the design input data. Nitrogen and phosphorus uptake was greater than the amount added. The modelled salt application does not appear to be impacting crop yield.

The modelled volume of deep drainage is 69 mm/year. DES typically accept a deep drainage value <200 mm/year to minimise risk to groundwater users. Given the nearest groundwater bore (unregistered) is 480 m from the proposed DIA, the risk to this bore is considered to be low.

It is proposed to use ~ 11.25% (i.e. 9 kL) of the pasteurised digestate as a high-grade fertiliser for onsite crop applications (i.e. the winter active Lucerne crop modelled). The subsequent DIA size based on this following 1:25 dilution would be 18 ha. A reduced wet weather storage volume would be required where there is no pre-mixing with the diluent and proportional to the diluted volume irrigated per day. The five day wet weather storage volume required for pre-diluted digestate would be 400 KL. A pre-mixing tank or dam capacity of not less than 2,000 kL would be required where the liquid digestate is not directly injected into the dilutant as irrigation is occurring.

The balance (~ 71 kL/day) of the raw pasteurised digestate will be distributed and used on crops at other sites managed by Kalfresh in the locale in accordance with conditions specified in the environmental authority. Any distribution of the digestate shall be subject to a suitably detailed management plan.

3.6 Digestate (solid fraction)

The solid fraction is estimated to be 25 to 35 tonnes/day following separation from the liquid phase. The solid will be partly utilised for windrow composting for onsite reuse as a soil conditioner/fertiliser with the balance dried and pelletised for offsite application as a fertiliser. Site composting will be managed under a licence for ERA 53(a)—Organic material processing by composting. Refer to the Kalfresh reports for further information regarding the separation, management and reuse of this material.

4 DIGESTATE QUALITY CONTROL

4.1 Digestate characteristics (liquid fraction)

The proposed reuse characteristics and test validation frequencies for liquid digestate are detailed in Table 14. It is expected that the majority of the specified chemical compounds will not be detected in the digestate from the commencement of the activity as only high quality feedstock will be brought onto the site. Where this is confirmed (e.g. following 12 months of validation testing), an application can be made to DES to reduce the chemical compounds to be tested. Amendments can also be made to the specified monitoring frequency where sufficient justification is provided. Likewise, where an unexpected risk is identified, the program should be modified and approved by DES.

Table 14. Irrigation water quality / quantity limits and testing frequency.

Quality/quantity characteristic	Unit	Release limits				Monitoring frequency
		Minimum	Median	95th percentile	Maximum	
Physico-chemical						
Electrical conductivity*	µS/cm	-	-	-	1,600	Weekly
pH*	units	6	-	-	8.5	Weekly
Total suspended solids*	mg/L	-	30	-	45	Weekly
*E. coli**	cfu/100 mL	-	<100	-	150	Weekly
5-day biochemical oxygen demand (inhibited)*	mg/L	-	20	-	30	Weekly
Volume via flow meter (or equivalent for offsite irrigation or direct injection)						
Raw digestate volume	kL/day	-	-	-	80	Daily
Raw digestate volume for site irrigation	kL/day	-	-	-	9	Daily
Dilutant volume	kL/day	-	-	-	216	Daily
Total site irrigation volume	kL/day	-	-	-	225	Daily
Raw digestate volume for offsite irrigation or direct injection	kL/day	-	-	-	71	Daily
Key nutrients						
Total nitrogen (TN)	mg/L	-	-	-	148	Fortnightly
Total phosphorus (TP)	mg/L	-	-	-	13.6	Fortnightly
Metals and metalloids						
Aluminium	µg/L	-	-	-	55	Monthly
Arsenic	µg/L	-	-	-	13	Monthly
Cadmium	µg/L	-	-	-	0.2	Monthly
Chromium (VI)	µg/L	-	-	-	0.4	Monthly
Copper	µg/L	-	-	-	1.4	Monthly
Lead	µg/L	-	-	-	3.4	Monthly
Mercury (inorganic)	µg/L	-	-	-	0.6	Monthly

Quality/quantity characteristic	Unit	Release limits				Monitoring frequency
		Minimum	Median	95th percentile	Maximum	
Nickel	µg/L	-	-	-	11	Monthly
Zinc	µg/L	-	-	-	8	Monthly
Organochlorine pesticides						
Chlordane	µg/L	-	-	-	0.08	Monthly
DDT	µg/L	-	-	-	0.01	Monthly
Endosulfan (total)	µg/L	-	-	-	0.2	Monthly
Endrin	µg/L	-	-	-	0.02	Monthly
Heptachlor (total)	µg/L	-	-	-	0.09	Monthly
Lindane	µg/L	-	-	-	0.2	Monthly
Toxaphene	µg/L	-	-	-	0.2	Monthly
Organophosphorus pesticides						
Chlordane	µg/L	-	-	-	0.08	Monthly
DDT	µg/L	-	-	-	0.01	Monthly
Endosulfan (total)	µg/L	-	-	-	0.2	Monthly
Endrin	µg/L	-	-	-	0.02	Monthly
Heptachlor (total)	µg/L	-	-	-	0.09	Monthly
Lindane	µg/L	-	-	-	0.2	Monthly
Toxaphene	µg/L	-	-	-	0.2	Monthly
Carbamate and other pesticides						
Carbofuran	µg/L	-	-	-	1.2	Monthly
Methomyl	µg/L	-	-	-	3.5	Monthly
Pyrethroids						
Esfenvalerate	µg/L	-	-	-	0.001	Monthly
Bypyridilium herbicides						
Diquat	µg/L	-	-	-	1.4	Monthly
Phenoxyacetic acid herbicides						
2,4-D	µg/L	-	-	-	280	Monthly
2,4,5-T	µg/L	-	-	-	36	Monthly
Thiocarbamate herbicides						
Molinate	µg/L	-	-	-	3.4	Monthly
Thiobencarb	µg/L	-	-	-	2.8	Monthly
Thiram	µg/L	-	-	-	0.2	Monthly
Triazine herbicides						
Atrazine	µg/L	-	-	-	13	Monthly
Simazine	µg/L	-	-	-	3.2	Monthly
Urea herbicides						

Quality/quantity characteristic	Unit	Release limits				Monitoring frequency
		Minimum	Median	95th percentile	Maximum	
Tebuthiuron	µg/L	-	-	-	2.2	Monthly
Miscellaneous herbicides						
Glyphosate	µg/L	-	-	-	1,200	Monthly
Trifluralin	µg/L	-	-	-	4.4	Monthly
Microbiological						
Legionella	cfu / 100 mL	-	-	-	10[L]	Monthly
BTEXN						
Benzene	µg/L	-	-	-	950	Monthly
Toluene	µg/L	-	-	-	180	Monthly
Ethylbenzene	µg/L	-	-	-	80	Monthly
Xylenes	µg/L	-	-	-	75	Monthly
Naphthalene	µg/L	-	-	-	16	Monthly
PAHs						
Phenanthrene	µg/L	-	-	-	0.6[#]	Monthly
Anthracene	µg/L	-	-	-	0.1	Monthly
Fluoranthene	µg/L	-	-	-	0.1[#]	Monthly
Benzo(a)pyrene	µg/L	-	-	-	0.1[#]	Monthly

Table notes:

Sampling to be undertaken directly from the irrigation stream or mixed storage tank as applicable.

* Determined with reference to the water quality specifications for Class B quality effluent in Table 6.2b. Recommended water quality specifications for Class A-D recycled water and Table 6.3. Recycled water uses, recommended class and recommended monitoring - the Queensland Water Recycling Guidelines (EPA 2005).

Other criteria derived from ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality – (Freshwater) 95 % species protection.

[L] Queensland Government (2018) Guide to Legionella control in cooling water systems, including cooling towers

[#] Criteria less than standard limit of reporting, therefore the use of standard NATA detection limits need be considered.

4.2 Digestate characteristics (solid fraction)

The proposed reuse characteristics and test validation frequencies for solid digestate are detailed in Table 15.

As per the liquid digestate, it is expected that the majority of the specified chemical compounds will not be detected in the digestate from the commencement of the activity (refer methods to amend the validation strategy as detailed for the liquid digestate based on a low and/or unexpected risk).

Table 15. Solid fraction quality limits.

Quality/quantity characteristic	Unit	Reuse limit (maximum)
Volume	tonnes/day	35
Metals and inorganics		
Arsenic	mg/kg	<20 AS
Boron		<100 AS
Cadmium	mg/kg	<1 AS
Chromium (total	mg/kg	20 NEPM
Copper	mg/kg	<150 AS
lead	mg/kg	60 NEPM
Mercury (total)	mg/kg	<1 AS
Nickel	mg/kg	<60 AS
Selenium	mg/kg	<5 AS
Zinc	mg/kg	<300 AS
Total Petroleum Hydrocarbons		
F1 C_6-C_{10}	mg/kg	36 NEPM
F2 >C_{10}-C_{16}	mg/kg	24 SGC
F3 >C_{16}-C_{36}	mg/kg	60 SGC
F4 >C_{34}-C_{40}	mg/kg	560 SGC
Benzene	mg/kg	10 NEPM
Toluene	mg/kg	17 NEPM
Ethylbenzene	mg/kg	14 NEPM
Xylenes	mg/kg	21 NEPM
Benzo(a)pyrene	mg/kg	0.14 NEPM
Polycyclic aromatic hydrocarbons (PAHs)		
Carcinogenic PAHs (as BaP TEQ)	mg/kg	0.6 NA
PAH (total)	mg/kg	60 NA
Phenols		
Phenol	mg/kg	600 NEPM
Pentachlorophenol	mg/kg	20 NEPM
Cresols	mg/kg	80 NEPM
Organochlorine pesticides		
DDT+DDD+DDE	mg/kg	<0.5 AS
Aldrin, dieldrin, chlordane, heptachlor, HBC, lindane, BHC	mg/kg	<0.02 AS
Endosulfan	mg/kg	54 NEPM
Endrin	mg/kg	2 NEPM
Methoxychlor	mg/kg	60 NEPM
Mirex	mg/kg	2 NEPM
Topaphene	mg/kg	4 NEPM

Quality/quantity characteristic	Unit	Reuse limit (maximum)
Herbicides		
2,4,5-T	mg/kg	120 NEPM
2,4-D	mg/kg	180 NEPM
MCPA	mg/kg	120 NEPM
MCPB	mg/kg	120 NEPM
Mecoprop	mg/kg	120 NEPM
Picloram	mg/kg	900 NEPM
Other pesticides		
Atrazine	mg/kg	64 NEPM
Chlorpyrifos	mg/kg	32 NEPM
Bifenthrin	mg/kg	120 NEPM
Other organics		
Polychlorinated Bisphenols	mg/kg	<0.2 AS
PBDE Flame Retardants (Br1-Br9)	mg/kg	0.2 NEPM
Other		
Dioxins and furans	pg/g	Not detected (<0.5-10 for specific compounds) NEPM
PFOS	mg/kg	0.01 HEPA
PFOA	mg/kg	10 HEPA
pH	Units	>5 AS
Electrical conductivity	dS/m	<10 AS
Soluble phosphorus in solution	mg/L	<5 AS
Ammonium-N dry mass equivalent	mg/kg	<200 AS
Sodium	%	<1 AS
Phosphorus	%	≤0.1 AS
Salmonella	number/50 g	Absent AS
E. coli	cfu/gm	<100 AS
Faecal coliforms	mpn/g	<1,000 AS
Plastics Light Flexible or film >5mm	%	≤0.05 AS
Stones and Lumps of Clay >5mm	%	≤5 AS
Glass, metal and rigid plastic > 2mm	%	≤0.5 AS
Viable plant propagules	Count at 7, 14 &21 days	Nil AS

Tables notes:

The above analysis shall be conducted per 250 tonnes of solid digestate generated for the first two million tonnes generated and reduced to 1 sample per 500 tonnes thereafter if compliant with the specified reuse limits.

Sources:

AS = AS4454-2012 Composts, Soil Conditioners and Mulches.

NEPM = NEPM (2013) Schedule B1 Guideline on Investigation levels for Soil and Groundwater - Table 1A(1) Health investigation levels for soil contaminants, adjusted to 20% of the specific health-based investigation level

HEPA = HEPA (2018).

[SGC] – limit applicable following silica gel clean-up.

NA – may not be applicable to grease trap feedstock as it may contain high concentrations of cooking oils etc. that may skew the results.

Standard NATA detection limits may be considered acceptable where the adjusted health-based investigation level is lower than the detection limit.

5 DESIGN AND OPERATIONAL REQUIREMENTS

5.1 General requirements

A summary of the general design and operational requirements for the key components of the anaerobic digestor (AD) facility are provided in Table 16. General design and operational requirements. The table is not exhaustive, and the manufacturer of the AD should be consulted for any additional requirements at the detailed design phase prior to the commencement of the activity.

Table 16. General design and operational requirements.

Component	Requirements
All components	Alarms: Provide alarms including a visual strobe light and telemetry capabilities in case of system failure.
	Backup power: Diesel generator/s as required.
	Noise: All components should be maintained to avoid nuisance noise to any nearby sensitive receptors (e.g. patrons, staff and nearby properties).
	Odour: All components must be maintained to avoid nuisance odours.
	Signage: All components must have warning signs displayed in prominent locations in English and any other language applicable to the sub-community using the site (e.g. non English speaking) stating RECYCLED WATER – DO NOT DRINK. All signage will comply with AS 1319 – 1994 Safety Signs for the Occupational Environment.
	Access: Will be restricted via fencing and lockable doors and gates to prevent unauthorised access.
	Supplier: A reliable manufacturer / supplier will be engaged for the construction, installation and maintenance (where maintenance is not conducted internally) of all components of the AG. The supplier should be able to provide costing on all servicing, maintenance and warranty requirements for the system. All servicing / maintenance records will need to be made available by (or as applicable to the supplier / manufacturer in the event that this information is requested.
	Design: All components are to be fully enclosed to prevent/minimise odours and noise and any openings (e.g. overflow points) and are to be suitably screened to restrict ingress by persons/wildlife/ livestock (Note: livestock can directly graze the DIA when required).
	Construction: All components are to be suitable for the environment and secured (where required) to minimise the potential for vandalism or entry of unauthorised personnel.
	Certification: Certification is to be provided ensuring that cross-connections have not occurred within the system.
	Records: All servicing and maintenance documents/records must be kept for at least five years.
AD	Storage of solid and liquid feedstock: All facilities used to store and receive feedstock will be fully contained/bunded to prevent rain/stormwater ingress. Any leachate generated in these facilities will be directed to the AG with no environmental release to land or waters permitted. The facilities will be designed to minimise noise and odours.
	Inspections and maintenance: Inspection and maintenance requirements should be undertaken in accordance with manufacturer specifications.
	Air emissions from the bio-gas plant will comply with the approved limits.

Component	Requirements
	All storage tanks/dams will be enclosed/covered and fit for purpose to avoid any unapproved releases (solid, liquid, air) to the environment. Any onsite dams will be fully lined to prevent release to land and waters. Dam design and construction will be certified by a Registered Professional Engineers of Queensland (RPEQ).
	Pasteurisation: Pasteurisation of digestate will be conducted to reduce pathogens in plant and animal derived feedstock and kill weed seeds before digestate is irrigated or incorporated in compost for site application, and sale for use as a fertiliser/soil conditioner.
	Flow meter: A flow meter is to be installed at the AD inlet to the storage tanks. The daily volume of solid digested generated will be recorded.
WWST	Rainfall: When rainfall prevents the irrigation of digestate, the liquid digestate will be stored in the WWST. Not less than 5 days of wet weather storage will be provided for any raw or diluted digestate. As liquid digestate will likely be directly injected into the bore or creek irrigation supply water (dilutant) at a rate 1:25 (digestate/dilutant), the actual WWST may be small (i.e. 9 kL raw digestate to be used onsite, so ≥40 kL storage). The site requirement for raw produced digestate of 80 kL /day is 400 kL. Much greater storage is required were raw digestate is pre-mixed with the dilutant in advance of irrigation (225 kL for every day of rain). It is noted that this WWST is in addition to the proposed storage for the generated digestate which will be 2.4 ML (30 days storage).
	Pump out: The WWST must be pumped out in the event of excessive rain (when the WWST reaches 80% capacity), which prevents the irrigation of digestate for extended periods. This may be diverted to the main digestate storage tank/dam.
	Flow meter: A flow meter is to be installed at the WWST outlet.
	Alarm: The WWST must be fitted with a high level alarm capable of providing sufficient time to diverted liquid to the main digestate storage tank/dam prior to any overflows occurring (to trigger at 80% capacity).
	Pumps: A circulation pump will be installed within the WWST to prevent stratification (where beneficial).
Digestate irrigation area	Irrigation: Digestate will be irrigated across the designated area via coarse droplet irrigation methods that do not produce aerosols (e.g. via centre pivot or similar).
	Distribution: Digestate must be evenly distributed within the designated digestate irrigation area.
	Size: The irrigation area must be a minimum of 18 hectares.
	Crop: The irrigation area must be planted with lucerne pasture.
	Harvesting: The irrigation area must be regularly harvested or directly consumed as fodder. MEDLI specifies average number of normal harvests per year of 13.48 (4.00 - 18.00).
	Construction: The irrigation area must be constructed to ensure there is no ponding and/or run-off and ensure there is no spray drift or excessive deep drainage to groundwater. The irrigation system is to be monitored dally for the 1 month of operation. Weekly inspections to be undertaken thereafter to confirm no ponding, runoff and spray drift occurring. The irrigation consultant and/or AG operator must be responsible for these inspections and all observations and corrective measures documented accordingly.
	Sprinklers: Sprinklers must produce heavy droplets with low trajectory angle nozzles where required.
	Construction: As applicable any pipelines and fittings will be in supplied and fitted with reference to AS/NZS 1547:2000 On-site domestic-wastewater management and AS/NZS 3500

Component	Requirements
	Plumbing and Drainage (specifically Part 2. Sanitary plumbing and drainage). Pipeline and fittings associated with the digestate irrigation system will be distinctively and permanently colour coded deep purple or lilac with reference to AS/NZS 3500.1:2003, Section 9 and AZ/NZS 1345 – Identification of the contents of pipes, conduits and ducts. The centre pivot irrigator does not need to be colour coded purple or lilac provided signage is erected across the irrigation area to notify staff and visitors that the irrigated water is sourced from the anerobic digestor.
	Release pipes: Lockable valves or removable handles will be fitted to any release pipes situated in public access areas (not likely to be applicable).
	Irrigation scheduling: Undertake irrigation daily at no greater than 10 mm – to be automatically determined using soil moisture meters or alternative measures considered appropriate by the AD operator. All irrigation pumps and flow meters to be calibrated to ensure the design irrigation rates are not exceeded and can be scaled back if impacts are identified. The irrigation will not be fenced, and irrigation can occur anytime of the day. Livestock will be permitted to directly graze the lucerne pasture on an as required basis with no minimum holding time following irrigation.
	Soil amelioration: Soil amelioration will be undertaken prior to planting the pasture crop and installation of the irrigation system to make the soil suitable for the establishment of pasture and for sustainable digestate irrigation. This process will require detailed input from an appropriately qualified person familiar with the site soils and proposed pasture crop to ensure the viability of the irrigation system as a whole. In the event that designated irrigation area cannot be ameliorated to suite the proposed crop, an alternative area/s must be identified and approved by DES before the commencement of the activity. Gypsum should be added at a rate to be determined by an appropriately qualified person (typically 1-2 kg/m^2) and incorporated into the soil with a rotary hoe or tine following deep ripping to improve the soil structure. The gypsum will improve the quality of the soil, making it better suited for digestate irrigation. This in turn will improve conditions for crop establishment and longevity. In addition, it is recommended that organic material be added to the soil and good quality imported topsoil (where required) to further improve the soil texture. The proposed irrigation area will be established with lucerne pasture in advance of the irrigation area being operational. In conjunction with input from an appropriately qualified person, PE can assist with the soil amelioration process and provide certification that the area is suitable for digestate irrigation once the pasture is established.
Collection and distribution system	Pump stations: Any pump stations must be fitted with stand-by pumps and pump failure alarms as well as high level alarms to warn of imminent pump station overflow - all alarms and pumps must be able to operate without mains power (backup power available to prevent overflow). The locations of any pumping stations and overflow points are to be prepared and updated as required for the life of the system.
	Concentrated waste: The anaerobic digestor must not receive concentrated liquids or other solid wastes from other site facilities unless approved to do so as feedstock under the Environmental Authority.
Digestate (solid fraction)	Separated digestate solids will be stored in a bunded/cover facility until transferred to the designated composting area.
Lucerne pasture	**Source (extract):** https://www.agric.wa.gov.au/pasture-establishment/lucerne-plant-and-its-establishment

Component	Requirements
	Lucerne general characteristics: • Provides a high quality feed for livestock • Is a deep-rooted, temperate, perennial pasture legume which is suited to the region • Will reduce groundwater recharge • Will improve soil fertility and structure • Will reduce weed burden and manage herbicide resistance for cropping • Has a high water demand and will establish deep roots • Has the ability to respond quickly to significant summer rainfall (>10 millimetres) but requires 20-25 millimetres (mm) to produce substantial growth • Produces between 4-8 tonnes (t) of dry matter per hectare per year (DM/ha/yr) • Has good drought tolerance and is well suited to irregular rainfall patterns • Grows in areas receiving as little as 325 mm annual rainfall but also provides good summer production in areas up to 700 mm rainfall • Produces high quality green feed. It has high energy — digestibility of 65-72% with a metabolisable energy of 8-11 megajoules per kilogram (MJ/kg) DM — and high protein (12-24%) • The quality of feed remains relatively constant throughout the year while it is active. Lucerne is also a source of calcium, magnesium, phosphorus and vitamins A and D • Can be grown as a pasture phase, removed and followed by a crop phase or it can be over sown with crops (pasture cropped) • Fixes between 10 and 20 kg/ha of nitrogen for every tonne of dry matter produced, increasing soil nitrogen levels for subsequent crops • Once established, it can help manage herbicide resistant weeds with its competitiveness and tolerance of some broad-spectrum herbicides. • Effective weed management will increase the legume component and nitrogen accumulation from a lucerne based pasture • The principles for integrating lucerne into broadacre dryland farming systems are described in the Department of Agriculture and Food, Western Australia's (DAFWA) Bulletin 4785 - Lucerne Guidelines for Western Australia. Lucerne's limitations • The cost, and slow rate (6-12 months) of establishment • Low winter production (typically) • Requirement for rotational grazing for long-term persistence • Greater monitoring for insects and susceptibility to being over-grazed • Variable out-of-season production • The pasture phase needs to be at least three years to overcome the high upfront costs of establishment • Can be difficult/costly to remove if going into a crop phase • Can reduce crop yields in the year following the lucerne phase due to a dry soil. Soil-climate adaptation • Rainfall: >325 mm • Drought tolerance: very high • Frost tolerance: moderate to high • Soil type: grows well on a wide range of well drained soils including deep loams,

Component	Requirements
	deep yellow and brown sands, loamy sands over clay or gravel, deep sandy duplex soils and uniform clays. It is not suited to deep pale sands and shallow soils (hence requirement for soil amelioration) • Soil fertility requirements: moderate to high • Soil pH ($CaCl_2$): 4.8 to 8.0 in the top 30 centimetres (cm) — note optimum pH >5.5 • Aluminium tolerance: low • Waterlogging tolerance: low • Salt tolerance: moderately low (if not waterlogged).
Other	Chemical storage: Storage and handling of chemicals to meet appropriate standards including Australian Standard AS1940-2004 *The Storage and Handling of Flammable and Combustible Liquids,* NOHSC:1015 (2001) *National Standard for the Storage and Handling of Workplace Dangerous Goods*, *Australian Code for the Transport of Dangerous Goods by Road and Rail*, *Dangerous Goods Safety Management Act 2001* - typically this is to include bunding for chemicals incorporating a capacity of at least 110% of the largest storage tank in each bunded area. Loading / unloading areas for chemicals and waste are to be capable of containing any spillage resulting from loading / unloading of vehicles.
	Spill kit: An appropriate spill kit, personal protective equipment and relevant operator instructions / emergency procedure guides for the management of wastes and chemicals associated with the STP must be located in close vicinity to the system.
	Disease vectors: The control of disease vectors such as insects and rodents will be conducted for the maintenance of health and conditions in the AD and compost storage and processing areas. In particular, insects such as cockroaches, flies, lice, mosquitoes, fleas, and other animals such as rats, mice and birds are all capable of transmitting disease.

The site owner/occupier/management staff will have a suitable understanding of the operational requirements and limitations of the anerobic digestor, and all plant operators will be trained (written training records essential) by the manufacturer / supplier or another suitably qualified person. In addition, validation and ongoing monitoring of the system, irrigation area and surrounding environment are required as described briefly below.

Attachment E, Table A and Table B provides site related environmental objectives, performance outcomes and land rehabilitation requirements for the proposed activity.

5.2 Monitoring

The below sections detail typical monitoring requirements for the site. DES may impose additional monitoring requirements for the site as part of the EA at their discretion. A detailed list of the requirements for ongoing monitoring of digestate and other components of the anerobic digestor including noise and odour monitoring and reporting should be documented in a Site Based Management Plan (SBMP), or equivalent, and may form part of the EA conditions of approval. All instruments and devices used for the measurement or monitoring of any parameter will be calibrated, and appropriately operated and maintained.

5.2.1 Baseline monitoring (surface waters)

The surface water monitoring shall incorporate the following elements:

- Methodologies based on Monitoring and Sampling Manual (DES 2018a) and AS/NZS 5667-1998: Water quality – Sampling
- Development of site-derived WQOs based on select locations immediately upstream and downstream compost activity area with reference to Guideline: Environmental Protection (Water) Policy 2009 - Deciding aquatic ecosystem indicators and local water quality guidelines (DES 2018b)
- Routine and event based monitoring at select upstream (background) and downstream (impact) locations to monitor potential adverse impacts on downstream waters
- Assessment of water quality results against relevant WQOs for Warrill Creek and 'other freshwater tributaries' as specified in the Bremer River environmental values and water quality objectives, until such time as site-derived WQOs have been established
- Adoption of Guideline: Environmental Protection (Water and Wetland Biodiversity) Policy 2019 - Deciding aquatic ecosystem indicators and local water quality guidelines (DES 2018b) for the assessment of potential water quality impacts, and guidance from Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) where further investigation of potential water quality impacts is identified.

The Environmental Risk Assessment Register and SBMP (where appropriate) shall be reviewed on an as required basis guided by the environmental monitoring and corrective action request processes, yet no greater than every two years, to ensure the SBMP remains effective in achieving environmental objectives and performance targets.

5.2.2 Baseline monitoring (groundwater)

Baseline water quality data is not currently available. The mitigated risk of adverse impacts to groundwater has been assessed as low (Refer Section 4) based on the following:

- Low permeability leachate barriers to be incorporated in construction of the compost pads, feedstock holding bays, finished product storage and leachate collection system
- Clayey soil profile and relatively shallow bedrock expected across the subject area based on information for the adjacent land
- Depth to the upper water bearing zone (WBZ) and depth of overlying confining strata based on records for registered bores located on the low-lying adjacent land, which indicate the depth to local WBZ is at least 10 m BGL and confined below bedrock and/or > 10 m of clay soil (Refer Table 5) – additional bores the aquifer is much deeper
- Local GDE are mapped as surface expression GDE – i.e. Potential contaminant pathways are groundwater to surface water (not vice versa) which is mitigated by the leachate barrier and containment system
- Proposed reuse of leachate in the SRAIP anaerobic digestor.

Accordingly, the specific requirements for baseline testing of groundwater shall be negotiated with DES.

5.2.3 Baseline testing of proposed feedstock

Baseline testing of feedstock materials and inspection of the premises where feedstock shall be sourced shall commence at least 12 months prior to the commencement of the activity to meet the requirements specified in Section 3.1. The information obtained through this process will provide assurance to Kalfresh that a reliable and sustainable supply of feedstock can be provided in terms of both quality and quantity. Where uncertainty exists due to the information obtained during this process, modifications will be made to proposed feedstock materials and suppliers. This process will

occur on an ongoing basis following the commencement of the activity as detailed in the following sections.

5.2.4 Baseline testing of soil in the DIA

A detailed soil assessment shall be conducted in the DIA to determine the specific requirements for soil amelioration to assure long term crop viability. Post soil amelioration, a follow up soil assessment shall be conducted to determine a baseline for soil to be referenced as part of the ongoing soil operational monitoring program (details of which shall be incorporated in the SBMP).

5.2.5 Commissioning phase monitoring

For the initial 'commissioning' phase when the system is first installed, the sampling regime will include five samples for E. coli on day 1 followed by one sample per day thereafter for the duration of the 'commissioning' phase (typically four consecutive weeks). Irrigation and/or re-use is not to occur until five consecutive samples (taken at not less than 30 minutes apart) are taken that meet both the median and maximum criteria in Table 14.

Following this 'commissioning' phase, testing for E. coli is required on a weekly basis as a single sample. During any sampling for E. coli, should a single sample return a result greater than the maximum value in Table 14, a follow up sample must be taken immediately. Should this follow-up sample return a value greater than the criterion value in Table 14, the 'commissioning' phase will recommence, and land irrigation must cease. For other parameters in Table 14, the commissioning phase shall occur for a period of not less than 2 months before digestate irrigation can commence.

5.2.6 Monitoring of digestate irrigation

Monitoring of irrigated digestate will be undertaken in accordance with the parameters and frequencies in Table 14 to confirm that digestate is suitable for site use. All determinations of the quality of contaminants released will be:

- Sampled in accordance with methods prescribed in the latest edition of the Monitoring and Sampling Manual - Environmental Protection (Water) Policy 2009 (DES 2018)
- Carried out on samples that are representative of the discharge.

Furthermore, the inflow and outflow volumes must be recorded daily, including confirmation of the instantaneous peak flow (where relevant) via use of data loggers.

5.2.7 Noise monitoring

When requested by the administering authority, noise monitoring will be undertaken to investigate any complaint of noise nuisance, and the results notified within 14 days to the administering authority. Monitoring will include:

- Background noise level
- LA, max adj, T
- LA 10, adj, 10 mins
- LA 1, adj, 10 mins
- The level and frequency of occurrence of impulsive or tonal noise
- Atmospheric conditions including wind speed and direction
- Effects due to extraneous factors such as traffic noise
- Location, date and time of recording.

The method of measurement and reporting of noise levels will comply with the latest edition of the administering authority's Noise Measurement Manual.

5.3 Management plans and procedures

5.3.1 Site Based Management Plan

A SBMP or similar may be a condition of the EA approval by DES. If required, the SBMP should include:

- Environmental commitments - a commitment by senior management to achieve environmental goals
- Identification of environmental issues and potential impacts
- Control measures for routine operations to minimise likelihood of environmental harm
- Contingency plans and emergency procedures for non-routine situations
- Organisational structure and responsibility
- Effective communication
- Monitoring of the contaminant releases
- Conducting environmental impact assessments
- Staff training
- Record keeping
- Periodic review of environmental performance and continual improvement.

5.3.2 Onsite irrigation management plan

An irrigation area management plan (IAMP) may also be a condition of the EA approval by DES. If required, the IAMP should include:

- Local climatic conditions and estimation of correct crop water requirements or irrigation demand
- Buffer zones and security for the protection of sensitive receptors and public safety
- Irrigation infrastructure and its maintenance
- Soil properties and details of an ongoing soil monitoring program
- Irrigation rate and frequency required to avoid surface runoff, ponding, excessive deep drainage, optimise evapotranspiration, nutrient uptake and the reduction of build-up of salts and toxicants in the soil
- Crop selection and management
- Monitoring of local receiving environment, including surface and groundwater, and
- Contingency plans for managing overflows when irrigation is not possible.

5.3.3 Supply of digestate products to 3rd party users

Kalfresh shall only provide liquid or solid digestate products to a 3rd Party for use as a soil conditioner, fertiliser, or as feedstock to a licensed organic material processor.

When used as a soil conditioner and/or fertiliser, Kalfresh shall undertake the land application of digestate products on behalf of the 3rd Party user in accordance with a documented management plan or standard operating procedure. This activity shall be undertaken by Kalfresh directly, or an appropriately qualified and experienced sub-contractor overseen by Kalfresh, as part of the overall AD operations.

Where digestate products are used as a fertiliser and/or a soil conditioner:

- product must only be applied to agricultural land under the direction of an appropriately qualified person
- product application must be conducted at an agronomic loading rate which considers the product composition, crop nutritional demand and soil characteristics
- pooling and/or runoff of the product must be minimised
- percolation of the product beyond the plant root zone
- all reasonable and practicable measures must be taken to prevent or minimise environmental harm caused by use of the product.
- the product must not be released directly or indirectly to land, air, or waters.

Kalfresh shall maintain the following records for all applications of the product to land:

- batch traceability and quality records detailed in Section 5.3.4
- business name, ABN and address for the person purchasing or receiving the product
- quantity (in tonnes or litres) of the product supplied
- details of the land on which application occurs (e.g. soil pH, farm map block/paddock details and/or GPS coordinates)
- date of application of the product
- actual application rate (expressed as the quantity e.g. tonnes or litres per hectare per application) for each application (solid and liquid digestate)
- water dilution (shandying) ratios for liquid digestate
- any baseline and operational monitoring (e.g. soil)
- application method.

5.3.4 Digestate product quality and traceability records

The following records shall be maintained by Kalfresh for a minimum of 5 years, for all internal or 3rd Party use of liquid or solid digestate product:

- unique identification of each batch of product
- test results of batch quality, as per Section 4, Table 14 (liquid) or Table 15 (solids)
- batch identification, date, method and quantity of each load dispatched for internal or 3rd Party use
- land application records detailed in Section 5.3.3.

5.3.5 Annual monitoring report

An annual monitoring report must be provided to DES with the annual return and provide details relevant to the site's compliance with the EA each year.

6 REFERENCES

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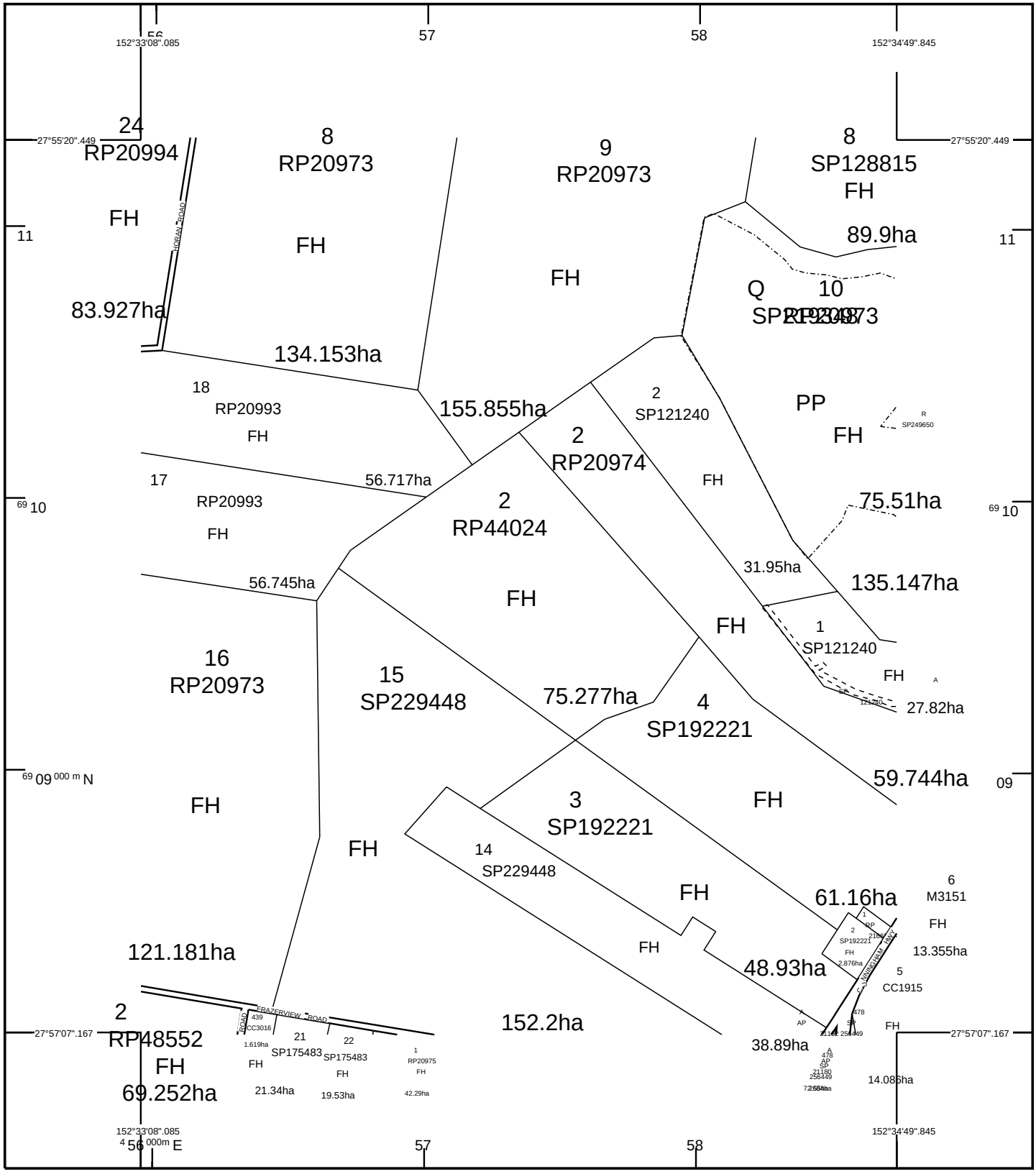
ATTACHMENTS

ATTACHMENT A: FIGURES

Figure 1A



STANDARD MAP NUMBER
9442-33133

0 400 800 1200 1600 2000 m

HORIZONTAL DATUM:GDA94 ZONE:56 SCALE 1 : 20000

MAP WINDOW POSITION & NEAREST LOCATION

152°33'58".965
27°56'13".808
FASSIFERN
2.97 KM

GDA

SUBJECT PARCEL DESCRIPTION

DCDB

Lot/Plan	2/RP44024
Area/Volume	75.277ha
Tenure	FREEHOLD
Local Government	SCENIC RIM REGIONAL
Locality	FRAZERVIEW
Segment/Parcel	14936/59

CLIENT SERVICE STANDARDS

PRINTED (dd/mm/yyyy) 21/10/2019

DCDB 20/10/2019 (Lots with an area less than 3000m² are not shown)

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For further information on SmartMap products visit http://nrw.qld.gov.au/property/mapping/blinmap

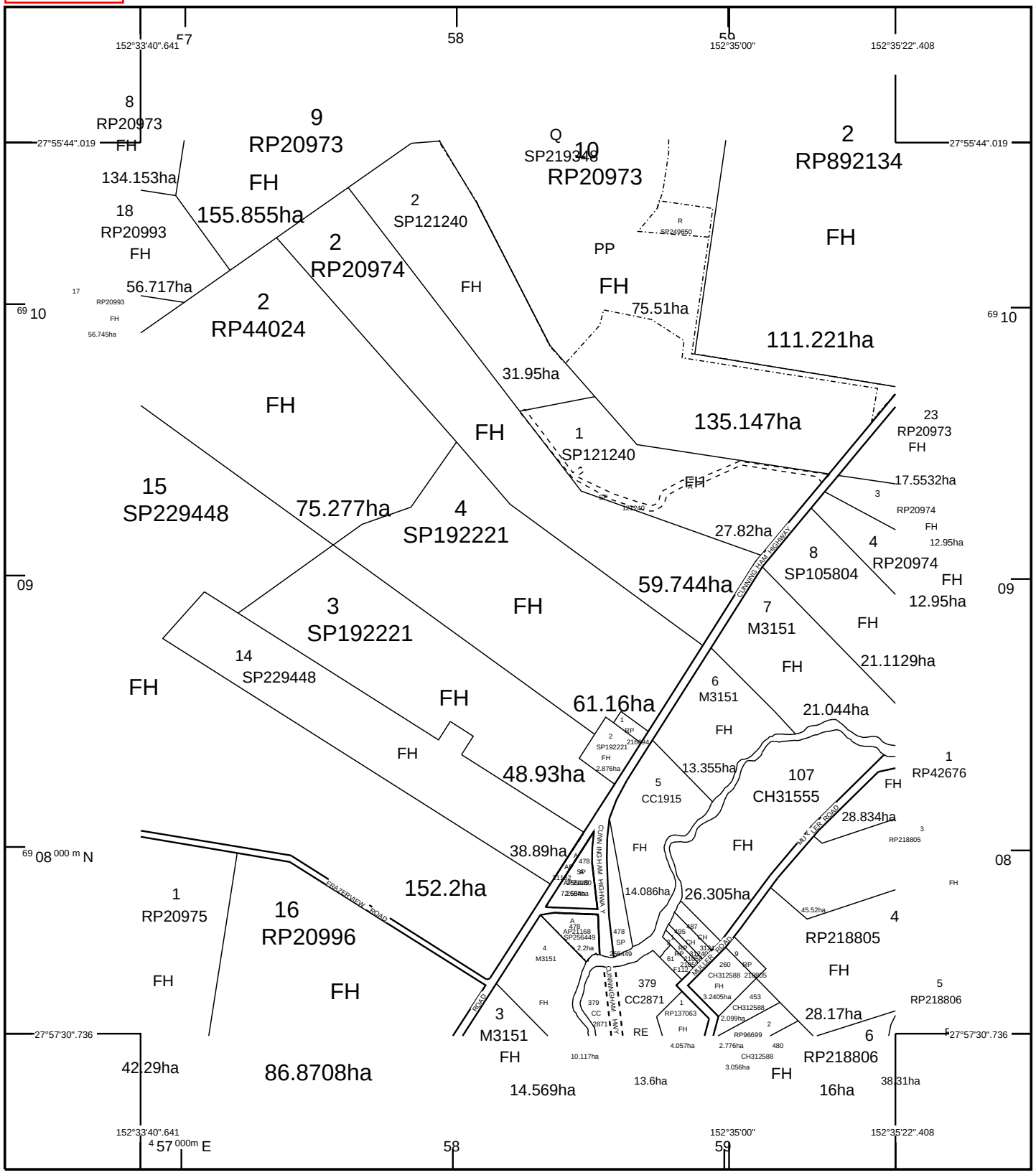
SmartMap

An External Product of SmartMap Information Services

Based upon an extraction from the Digital Cadastral Data Base

Queensland Government

Figure 1B



STANDARD MAP NUMBER
9442-33244

0 400 800 1200 1600 2000 m

HORIZONTAL DATUM:GDA94 ZONE:56 SCALE 1 : 20000

MAP WINDOW POSITION & NEAREST LOCATION

GDA

SUBJECT PARCEL DESCRIPTION

DCDB

Lot/Plan	4/SP192221
Area/Volume	61.16ha
Tenure	FREEHOLD
Local Government	SCENIC RIM REGIONAL
Locality	KALBAR
Segment/Parcel	14936/160

CLIENT SERVICE STANDARDS

PRINTED (dd/mm/yyyy) 24/10/2019

DCDB 23/10/2019 (Lots with an area less than 3000m² are not shown)

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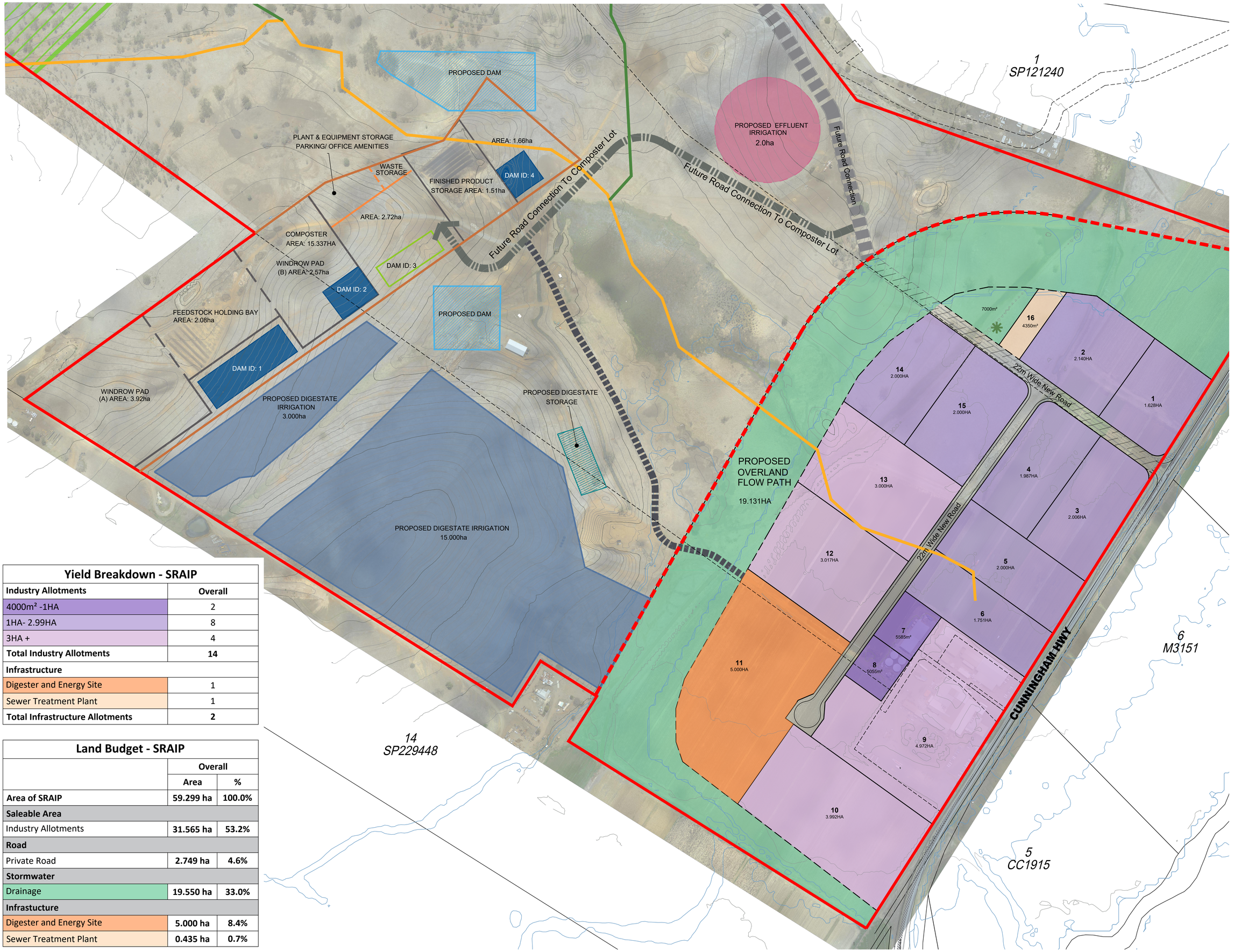


Yield Breakdown - SRAIP

Industry Allotments	Overall
4000m² -1HA	2
1HA- 2.99HA	8
3HA +	4
Total Industry Allotments	**14**
Infrastructure	
Digester and Energy Site	1
Sewer Treatment Plant	1
Total Infrastructure Allotments	**2**

Land Budget - SRAIP

	Overall	
	Area	%
Area of SRAIP	**59.299 ha**	**100.0%**
Saleable Area		
Industry Allotments	**31.565 ha**	**53.2%**
Road		
Private Road	**2.749 ha**	**4.6%**
Stormwater		
Drainage	**19.550 ha**	**33.0%**
Infrastucture		
Digester and Energy Site	**5.000 ha**	**8.4%**
Sewer Treatment Plant	**0.435 ha**	**0.7%**

0 10 20 40 60 80 1 : 2,500 @ A1

SCENIC RIM AGRICULTURAL INDUSTRIAL PRECINCT

6200 CUNNINGHAM HWY KALBAR CONCEPT LAYOUT

PLAN REF: 142489-05M
DATE: 16 MARCH 2020
CLIENT: KALFRESH
DRAWN BY: LZ
CHECKED BY: PHE

Legend

- Site Boundary
- SRAIP Industrial Precinct
- 0.25m Contours
- Existing Boundaries
- Existing Easement
- Drainage
- Proposed Overland Flow Path
- Proposed Flow Path Q100
- Proposed Bio Basin
- Proposed Effluent Irrigation
- Proposed Digestate Irrigation
- Proposed Dam
- Proposed Digestate Storage
- Proposed Composting Area
- Lechate Pond
- Proposed Composter Lot Road Access
- Proposed Plant & Equipment
- Proposed Windrow & Finished Product
- Proposed Stormwater Basin
- Proposed Wagner Quarry Access - *(not part of the SRAIP proposal and subject to separate development approval)*
- Environmental Protection Area *(clearing within the Environmental Protection Area is subject to future investigation/approvals)*
- Low Order Queensland Waterway
- Medium Order Queensland Waterway
- Road Connection to Composter Area
- Access Easement for Wagners Road Alignment

Note:
All Lot Numbers, Dimensions and Areas are approximate only, and are subject to survey and Council approval.

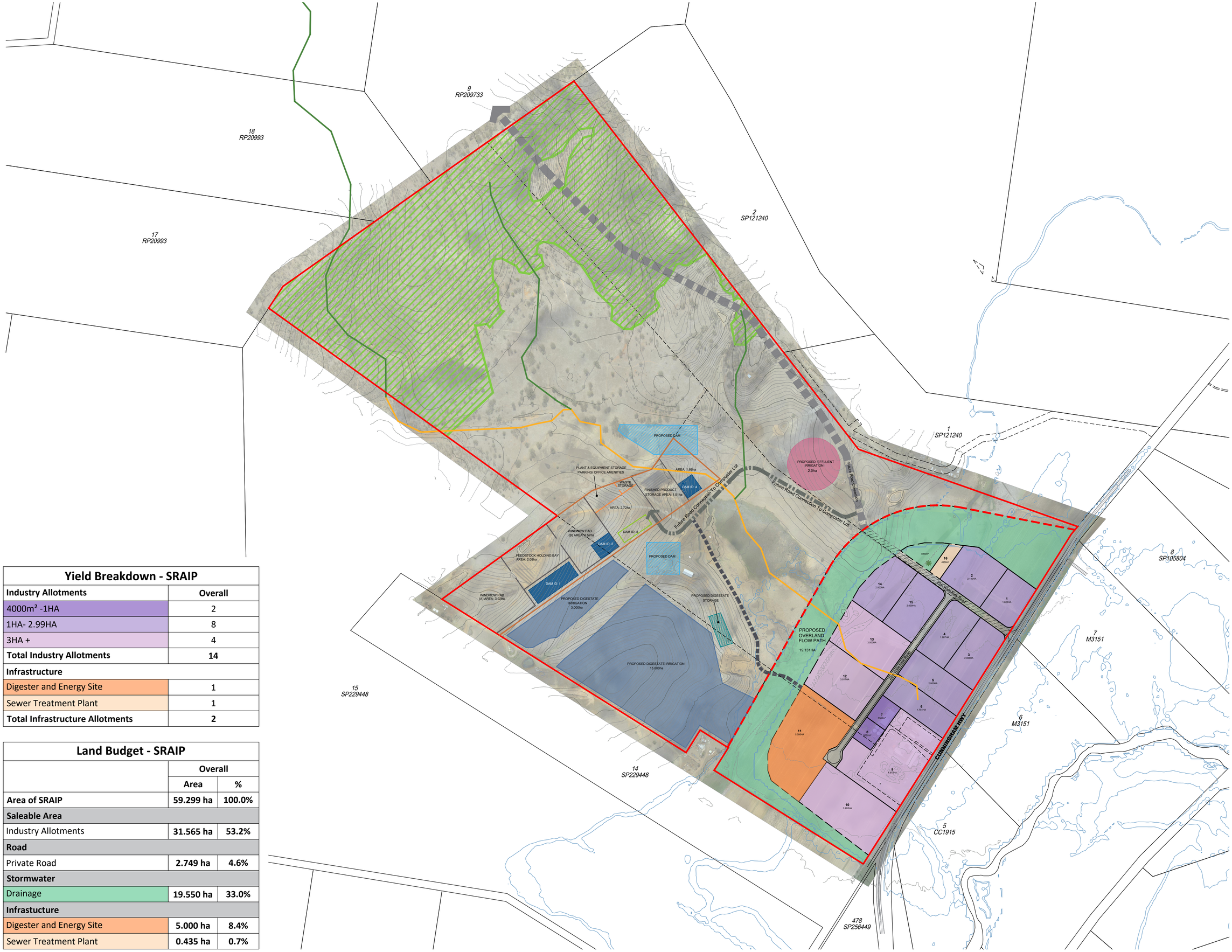
Dimensions have been rounded to the nearest 0.1 metres.

Areas have been rounded down to the nearest 5m².

The boundaries shown on this plan should not be used for final detailed engineers design.

Source Information:
Site boundaries: DCDB
Adjoining information: DCDB.
Contours: RPS Survey
Aerial photography: RPS Survey
Overland Flow Path: Aurecon

URBAN DESIGN
Level 4 HQ South
520 Wickham Street
PO Box 1559
Fortitude Valley QLD 4006
T +61 7 3539 9500
W rpsgroup.com



0 25 50 75 100 150 1 : 5,000 @ A1

SCENIC RIM AGRICULTURAL INDUSTRIAL PRECINCT

6200 CUNNINGHAM HWY KALBAR CONCEPT OVERALL

PLAN REF: 142489-06L
DATE: 16 MARCH 2020
CLIENT: KALFRESH
DRAWN BY: LZ
CHECKED BY: PHE

Legend

- Site Boundary
- SRAIP Industrial Precinct
- 0.25m Contours
- Existing Boundaries
- Existing Easement
- Drainage
- Proposed Overland Flow Path
- Proposed Flow Path Q100
- Proposed Bio Basin
- Proposed Effluent Irrigation
- Proposed Digestate Irrigation
- Proposed Dam
- Proposed Digestate Storage
- Proposed Composting Area
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Infrastucture		
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Sewer Treatment Plant	**0.435 ha**	**0.7%**

URBAN DESIGN
Level 4 HQ South
520 Wickham Street
PO Box 1559
Fortitude Valley QLD 4006
T +61 7 3539 9500
W rpsgroup.com

LEGEND

- Allotment boundary
- Watercourse (Water Act 2000)
- Unmapped watercourse
- MSES vegetation (defined watercourse)
- MSES high ecological significance wetlands
- MSES Endangered or of concern
- Remnant vegetation
- MSES Essential Habitat
- Registered groundwater bores
- Onsite groundwater bores

All locations indicative only

Image sourced and modified from Queensland Globe, Queensland Government, Department of Natural Resources, Mines and Energy (2019)

138337 (abandoned)

14310270

Existing dam

Proposed effluent irrigation area

Existing dam

Future Road Connection To Composter Lot

Sewage Treatment Plant

Mapped remnant vegetation no longer present due to quarry activity

Proposed composting area

DAM ID: 4

DAM ID: 3

DAM ID: 2

DAM ID: 1

DIGESTATE IRRIGATION AREA (3 ha)

30 m

30 m

DIGESTATE IRRIGATION AREA (15 ha)

Proposed digestate storage dam

PROPOSED OVERLAND FLOW PATH

ANAEROBIC DIGESTOR (Bioenergy Facility)

Cunningham Highway

Little bore wash shed

138334

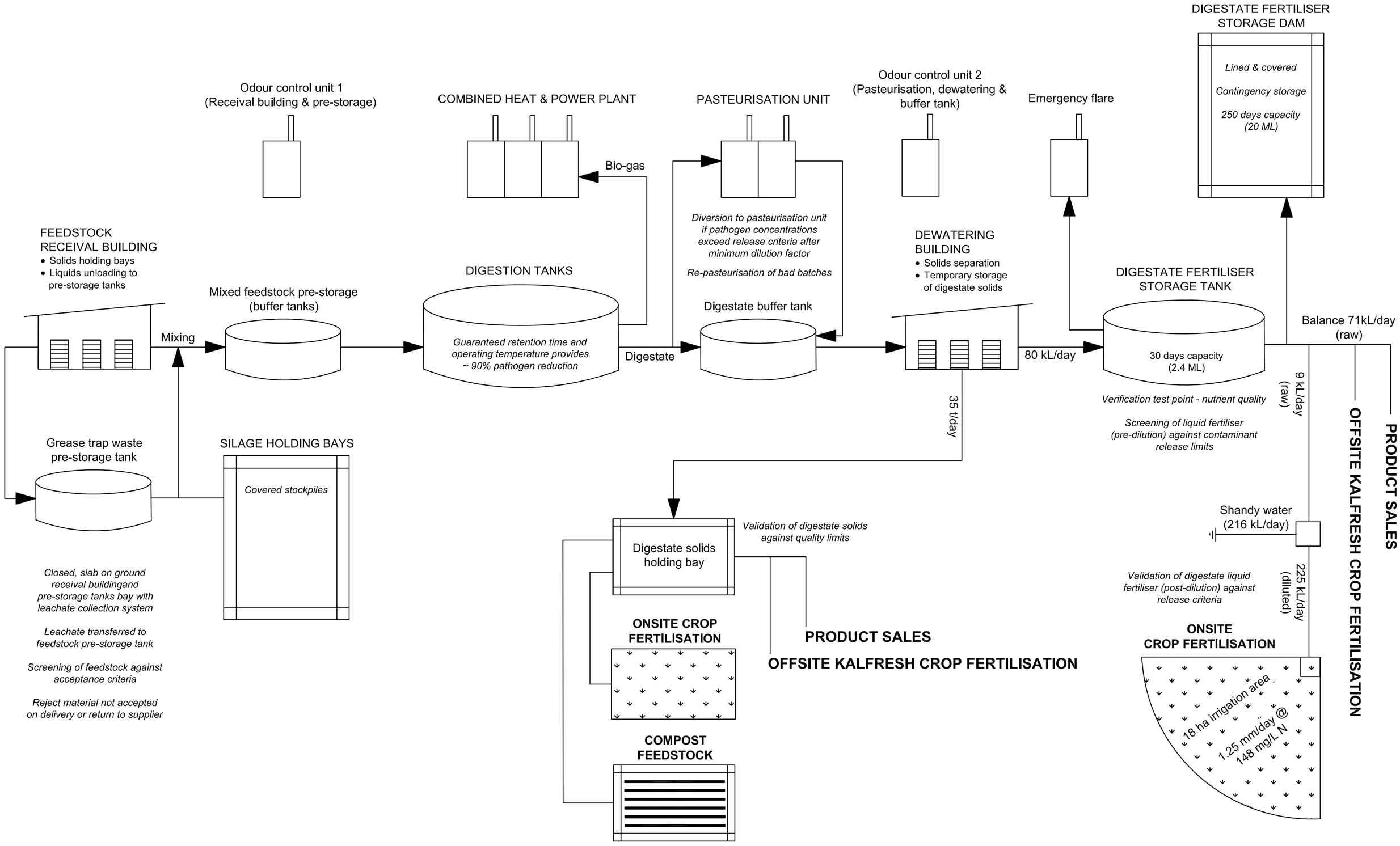
Warril Creek

124727

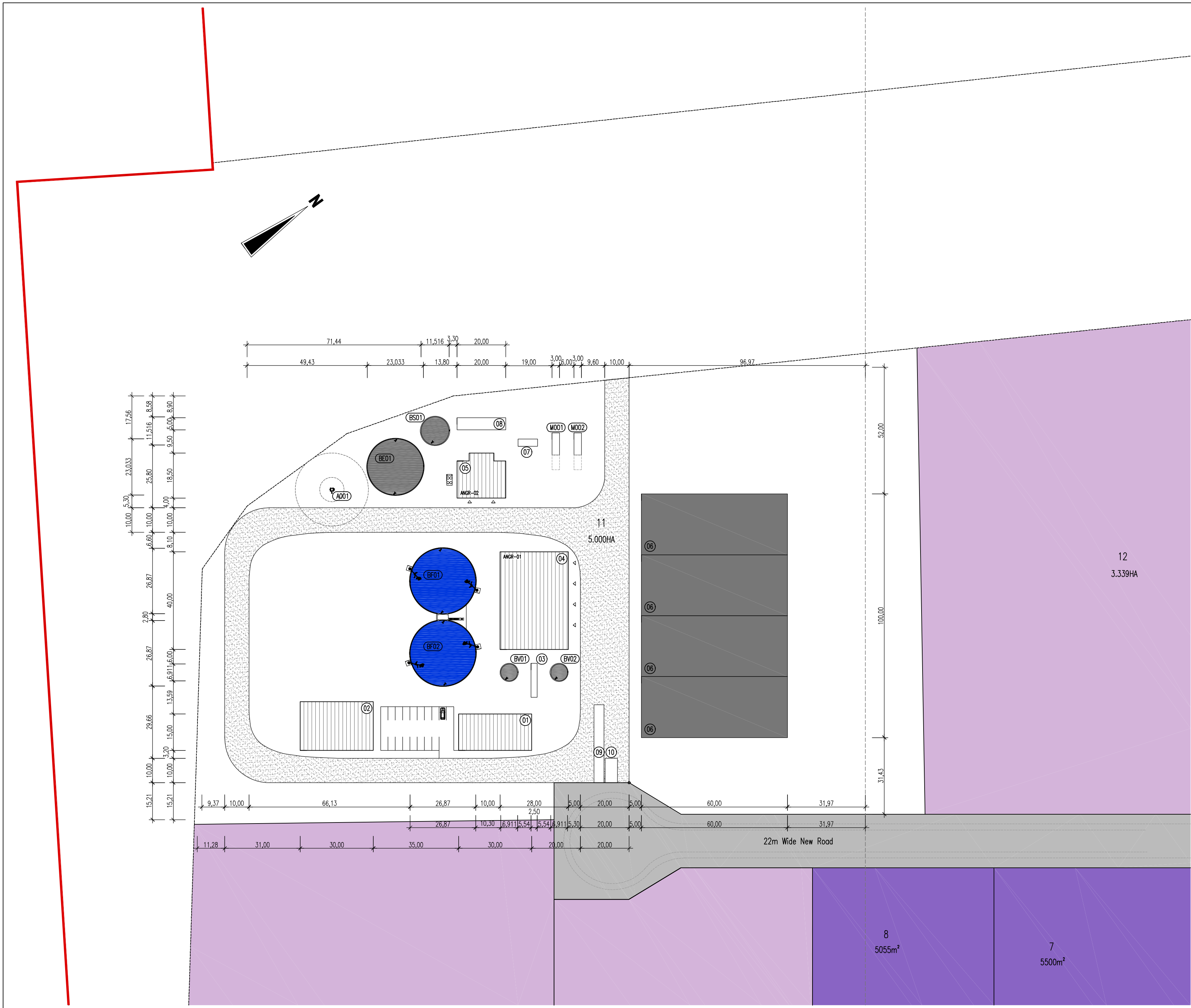
250 m

Client: KALFRESH PTY LTD	Site location: 6200 - 6206 CUNNINGHAM HIGHWAY, KALBAR, QUEENSLAND		Real property description: VARIOUS		Drawing number: FIGURE 2 Drawing version: B	
Project: PROPOSED ERA 53(b)	Project number: PE2898.19	Scale: AS SHOWN	Drawn by: SG Date drawn: 06.03.2020	Reviewed by: AG Approved: AG	Drawing title: SITE LAYOUT LAND-BASED SENSITIVE RECEPTORS	N

PRECISE ENVIRONMENTAL
Consulting Environmental Scientists
Unit 7 / 14 Fremantle Street, Burleigh Heads, Qld, 4220
PO Box 4424, Robina Town Centre, Qld 4230
Ph: (07) 5593 7848 Fax: (07) 5593 7020
mail@preciseenvironmental.com.au



Client: KALFRESH	Site location: 6206 CUNNINGHAM HIGHWAY, KALBAR QLD		Real property description: LOT 3 SP192221		Drawing number: FIGURE 3 Drawing version: A	PRECISE ENVIRONMENTAL Consulting Environmental Scientists Unit 7 / 14 Fremantle Street, Burleigh Heads, Qld, 4220 PO Box 4424, Robina Town Centre, Qld 4230 Ph: (07) 5593 7848 Fax: (07) 5593 7020 mail@preciseenvironmental.com.au
Project: SRAIP ANAEROBIC DIGESTOR - ERA53(b)	Project number: PE2898.19	Scale: NOT TO SCALE	Drawn by: AG Date drawn: 07.02.20	Reviewed by: CB Approved: CB	Drawing title: ANAEROBIC DIGESTOR FLOW PROCESS - ENVIRONMENTAL CONTROL MEASURES OVERVIEW	



Legend

BF01	Fermenter ø26,872m, h=6,30m, gross volume 3573m³
BF02	Fermenter ø26,872m, h=6,30m, gross volume 3573m³
BE01	Digestate Storage Tank ø23,033m, h=6,30m, gross volume 2625m³
BV01	Pre-Storage Tank ø6,911m, h=5,03m, gross volume 189m³
BV02	Pre-Storage Tank ø6,911m, h=5,03m, gross volume 189m³
BS01	Buffer Tank ø11,516m, h=5,03m, gross volume 524m³
M001	Container 30' with CHP
M002	Container 30' with CHP
A001	Emergency Flare
01	Office, 30,00m x 15,00m on site
02	Workshop Building, 30,00m x 20,00m
03	Biofilter 14,00m x 2,50m
04	Waste Processing Building with MultiMix and BigMix 28,00m x 40,00m
05	Building with Hygienization and Separation 20,00m x 20,00m
06	Silage Bays 25,00m x 60,00m
07	Gas Pre-Treatment 8,00m x 3,00m
08	Biofilter 5,00m x 20,00m
09	Weighbridge 32,00m x 4,00m
10	Wheel wash 10,00m x 5,00m

PRELIMINARY

index	revision	date	name	check	
h					
g					
f					
e	BV01 and BV02, tank size changed	04.02.20	SP	GO	
d	Layout revised, Tank size changed from BE01 and BS01	29.01.20	SP	GO	
c	Layout revised, Pos. 09, 10 and A001 moved, Pos.05 changed	17.01.20	SP	GO	
b	Layout adapted	07.01.20	SP	GO	
a	Layout adapted	06.01.20	SP	GO	

WELTEC BIOPOWER GmbH
Zum Langenberg 2, 49377 Vechta
Tel. (+49) 04441/99978-0
Fax. (+49) 04441/99978-8
info@weltec-biopower.de / www.weltec-biopower.de

projekt: AQM Kalfresh
AU

plan: Layout

date:	current status:	sheet dimension:	scale:	client number:
12.12.19	first draft	DIN A2	1:500	103742

name: SP | check: PK | plan number.: 219-009-LG-ANGES-01

ATTACHMENT B: SITE PHOTOGRAPHS

Photograph 1: View southwest across proposed digestate irrigation area (hill area).

Photograph 2: typical soil profile in DIA.

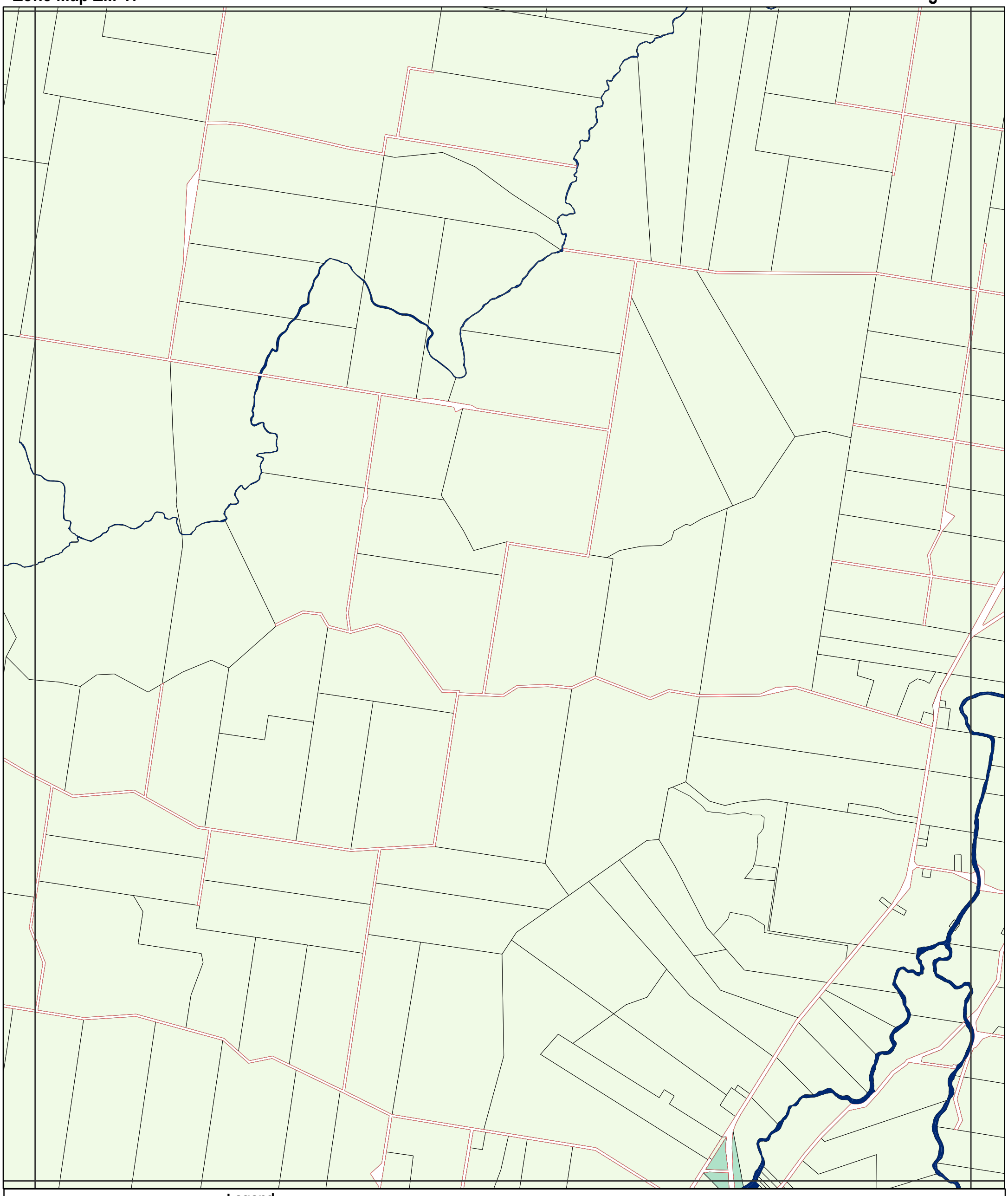
Photograph 3: Soil and bedrock exposed in excavation adjacent to the DIA.

Photograph 4: Disused cattle tick dip located on Lot 2 RP20974.

Photograph 5: Aerial view to north of existing Kalfresh development footprint and surrounding agricultural land use.

Photograph 6: Aerial view to east of existing Kalfresh development footprint and surrounding agricultural land use.

ATTACHMENT C: ENVIRONMENTAL MAPPING AND REGISTERED GROUNDWATER BORES



Legend

Zones

- Community Facilities
- Conservation
- District Centre
- Emerging Community
- Industry
- Limited Development
- Local Centre
- Low Density Residential
- Low-medium Density Residential
- Major Centre
- Major Tourism
- Minor Tourism
- Mixed Use
- Neighbourhood Centre
- Recreation & Open Space
- Rural
- Rural Residential
- Special Purpose
- Township

General Information

- Cadastral Boundary
- Road Reserve
- Waterway or Waterbody

Precincts

- BSDA — Bromelton State Development Area
- BW — Bulk Water Storage
- CI — Commercial Industrial
- FL — Flood Land
- HS — Historical Subdivision
- MR — Mountain Residential
- RE — Rural Escarpment Protection
- RREA — Rural Residential A
- TMR — Tamborine Mountain Rural
- TR — Township Residential
- PR — Passive Recreation

DRAFT Scenic Rim Planning Scheme

Datum: GDA 1994 MGA Zone 56

SECOND CONSULTATION DRAFT 2019

Approx Scale @ A3 1:30000

0 0.4 0.8 1.6 KM

N

Map Sheet Reference

			01	02	03	04						
05	06	07	08	09	10	11	12			13	14	
15	16	17	18	19	20	21	22	23	24	25		
26	27	28	29	30	31	32	33	34	35	36		
37	38	39	40	41	42	43	44	45	46	47		
	48	49	50	51	52	53	54	55	56	57		
	58	59	60	61	62	63	64	65	66	67		
		68	69	70	71	72	73	74	75			

SCENIC RIM Regional Council


4
SP192221
3
SP192221
2
SP192221
7
M3151
6
M3151
5
CC1915
107
CH31555
lat: -27.94950
long: 152.58282
1:6319
2D
3D
360
Previous
Next
Highway
Muller Road
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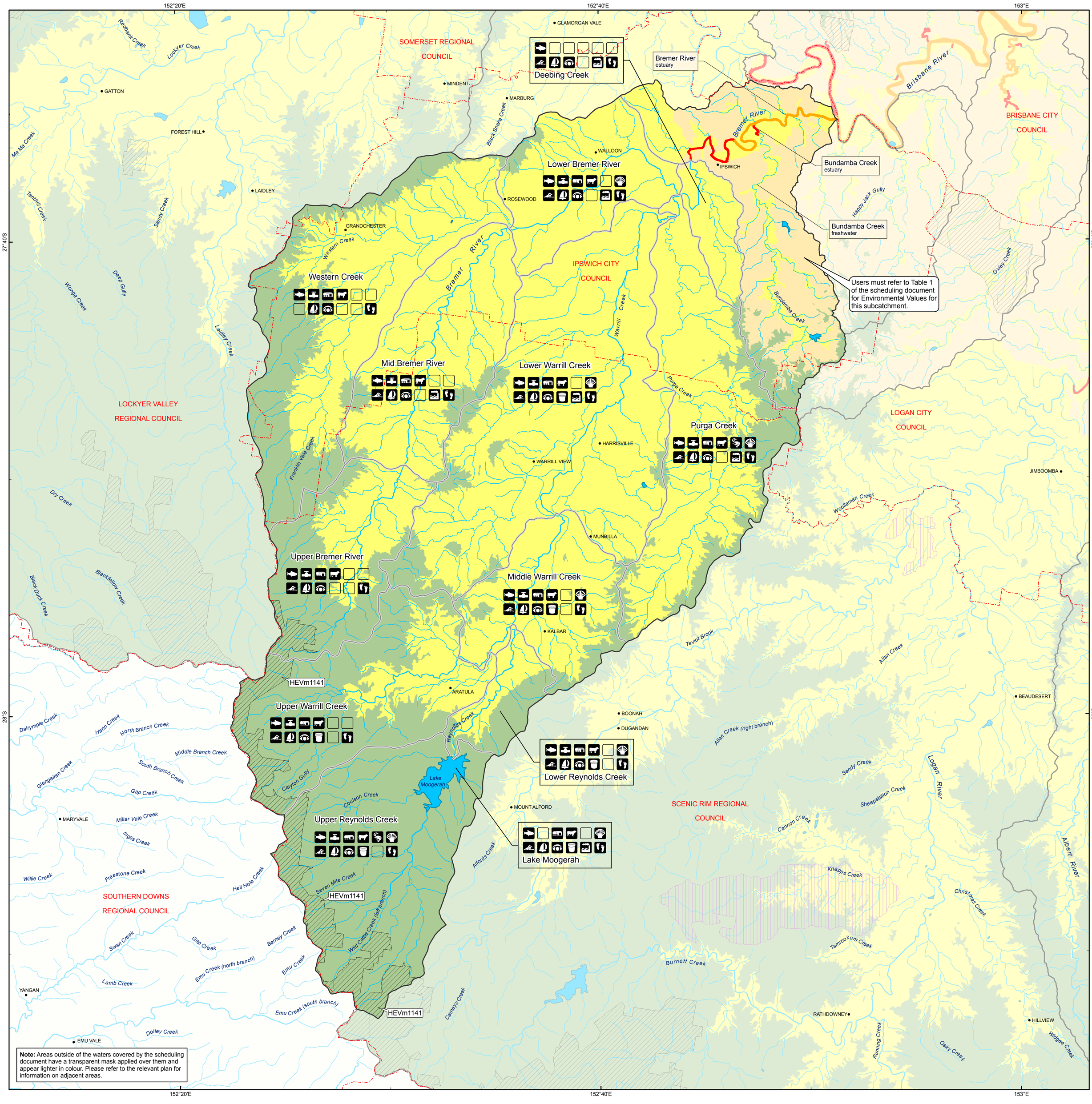
BREMER RIVER, INCLUDING ALL TRIBUTARIES OF THE RIVER

Part of Basin 143



Note: Areas outside of the waters covered by the scheduling document have a transparent mask applied over them and appear lighter in colour. Please refer to the relevant plan for information on adjacent areas.

Key to Environmental Values

Aquatic Ecosystems · Irrigation · Farm Supply · Stock Water · Aquaculture · Human Consumer

Primary Recreation · Secondary Recreation · Visual Recreation · Drinking Water · Industrial Use · Cultural & Spiritual Values

Legend

- Town
- River / creek
- Sub-catchment boundary
- Boundary of waters covered by the scheduling document
- Local government boundary

Management Intent for Waters

- High ecological value freshwaters (maintain)
- Highly disturbed freshwaters (achieve)

Water Types

Marine / estuarine waters

- Middle estuary
- Upper estuary

Freshwaters

- Lowland freshwaters
- Wallum / tannin freshwaters
- Coastal freshwaters
- Upland freshwaters
- Lakes / reservoirs

Note for users: Areas of the catchment that are not shown on this map as having a management intent of high ecological values, slightly disturbed or highly disturbed, have a **management intent of moderately disturbed.**

Environmental Protection (Water) Policy 2009
South-east Queensland Map Series
PLAN WQ1436

Publication date: July 2010

This plan forms part of the Bremer River Environmental Values and Water Quality Objectives scheduling document, prepared pursuant to the *Environmental Protection (Water) Policy 2009*.

Queensland Government

N

Projection: Map Grid of Australia (MGA) Zone 56

Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

0 5 10 15 20

Kilometres

Scale of 1:150,000 when printed @ A1

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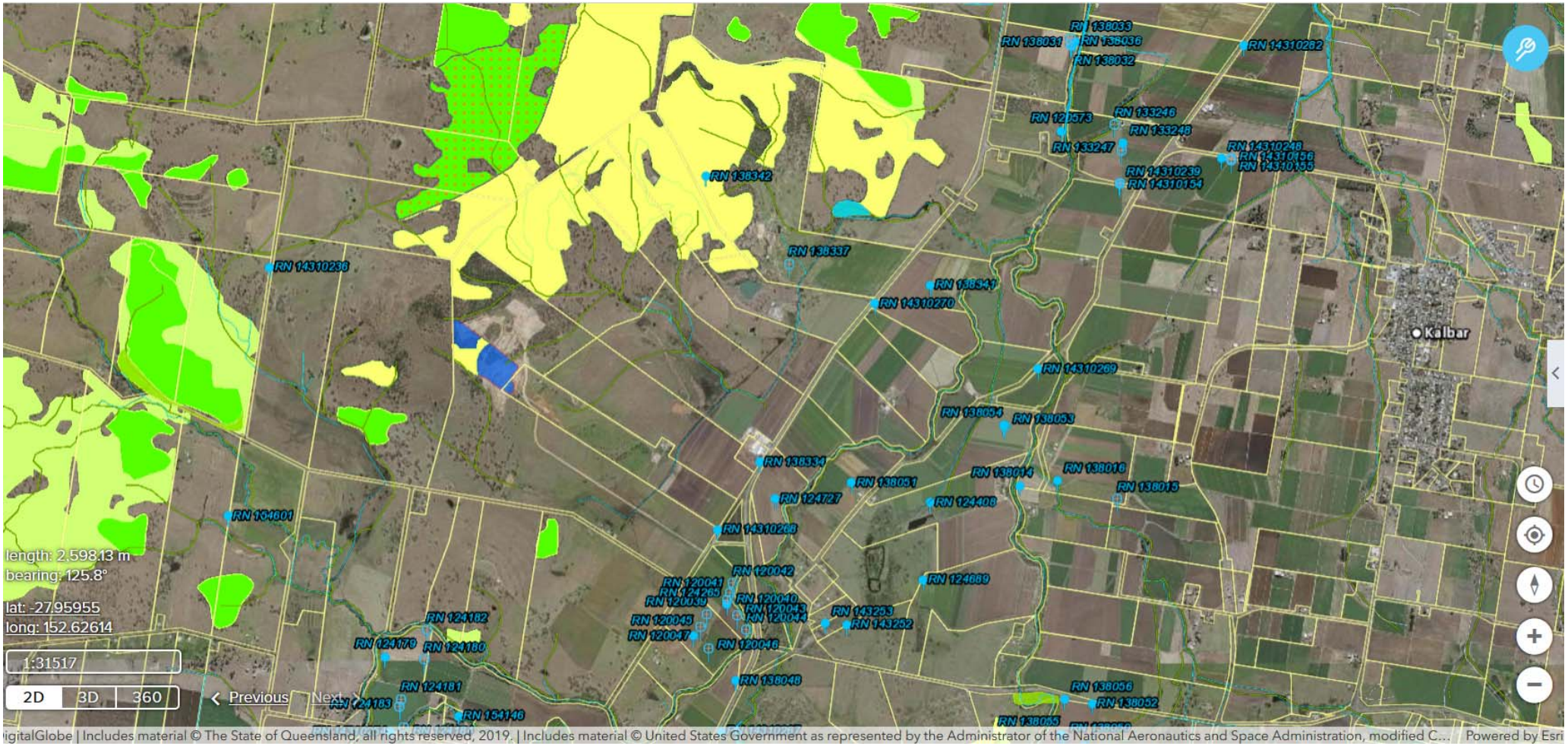
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RN 138031
RN 138036
RN 14310282
RN 138032
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RN 14310155
RN 14310239
RN 14310154
RN 138342
RN 138337
RN 14310236
RN 138341
RN 14310270
Kalbar
RN 14310269
RN 138034
RN 138053
RN 138334
RN 138014
RN 138016
RN 138051
RN 138015
RN 124727
RN 124408
RN 164801
RN 14310268
RN 120042
RN 124689
RN 120041
RN 124265
RN 120039
RN 120040
RN 120043
RN 120044
RN 143253
RN 143252
RN 120045
RN 120047
RN 120046
RN 124182
RN 124179
RN 124180
RN 124181
RN 124183
RN 164146
RN 138048
RN 138056
RN 138052
RN 138055
length: 2.598.13 m
bearing: 125.8°
lat: -27.95955
long: 152.62614
1:31517
2D
3D
360
Previous
Next
igitalGlobe | Includes material © The State of Queensland, all rights reserved, 2019. | Includes material © United States Government as represented by the Administrator of the National Aeronautics and Space Administration, modified C...
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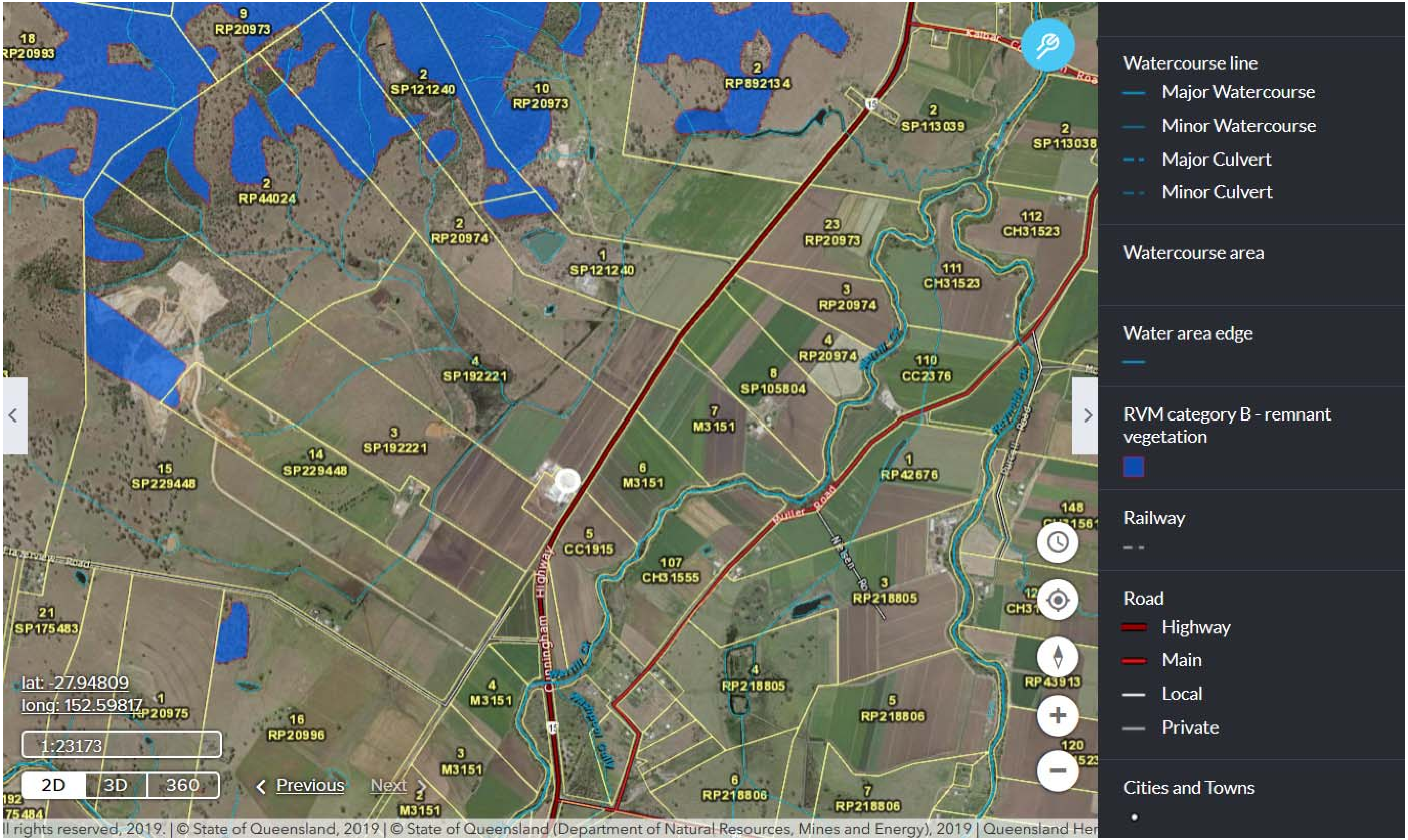
Watercourse line
Major Watercourse
Minor Watercourse
Major Culvert
Minor Culvert
Watercourse area
Water area edge
RVM category B - remnant vegetation
Railway
Road
Highway
Main
Local
Private
Cities and Towns
lat: -27.94809
long: 152.59817
1:23173
2D
3D
360
Previous
Next
Cunningham Highway
Muller Road
9 RP20973
18 RP20993
2 SP121240
10 RP20973
2 RP892134
2 SP113039
2 SP113038
2 RP44024
2 RP20974
1 SP121240
23 RP20973
112 CH31523
111 CH31523
3 RP20974
4 RP20974
8 SP105804
110 CC2376
4 SP192221
7 M3151
3 SP192221
14 SP229448
15 SP229448
6 M3151
1 RP42676
5 CC1915
107 CH31555
3 RP218805
21 SP175483
4 M3151
4 RP218805
5 RP218806
1 RP20975
16 RP20996
3 M3151
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6 RP218806
7 RP218806
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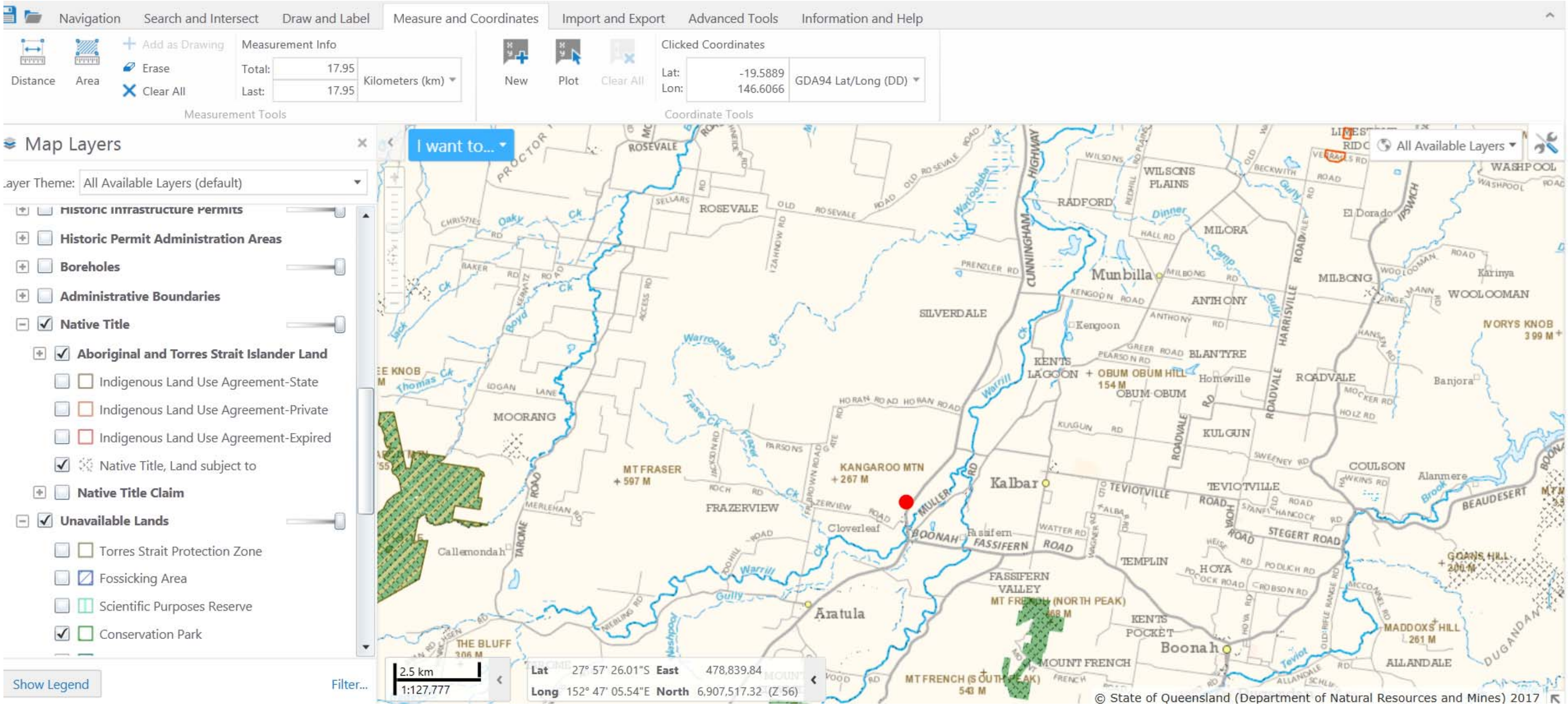
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Search and Intersect
Draw and Label
Measure and Coordinates
Import and Export
Advanced Tools
Information and Help
Distance
Area
Add as Drawing
Erase
Clear All
Measurement Info
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Last: 17.95
Kilometers (km)
Measurement Tools
New
Plot
Clear All
Clicked Coordinates
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Lon: 146.6066
GDA94 Lat/Long (DD)
Coordinate Tools
Map Layers
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Historic Infrastructure Permits
Historic Permit Administration Areas
Boreholes
Administrative Boundaries
Native Title
Aboriginal and Torres Strait Islander Land
Indigenous Land Use Agreement-State
Indigenous Land Use Agreement-Private
Indigenous Land Use Agreement-Expired
Native Title, Land subject to
Native Title Claim
Unavailable Lands
Torres Strait Protection Zone
Fossicking Area
Scientific Purposes Reserve
Conservation Park
Show Legend
Filter...
I want to...
All Available Layers
2.5 km
1:127,777
Lat 27° 57' 26.01"S East 478,839.84
Long 152° 47' 05.54"E North 6,907,517.32 (Z 56)
© State of Queensland (Department of Natural Resources and Mines) 2017

Bore Report

From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
124727	Sub-Artesian Facility	Existing	12/07/2005	Gatton	6510 - SCENIC RIM REGIONAL

Details

Description			
Parish	1854 - FASSIFERN		
Original Name			
Driller Name	HOFFMANN, SCOTT BRADLEY		
Drill Company	ABUNDANT WATER SOLUTIONS		
Const Method	ROTARY AIR & ROTARY MUD		
Bore Line			
D/O File No	515/000/0163	**Polygon**	
R/O File No		**Equipment**	
H/O File No		**RN of Bore Replaced**	
Log Received Date	08/08/2005	**Data Owner**	
Roles	Water Supply		

Location

Latitude	27-57-06	**Basin**	1431
Longitude	152-34-50	**Sub-area**	
GIS Latitude	-27.9518043	**Lot**	5
GIS Longitude	152.5804708	**Plan**	CC1915
Easting	458732		
Northing	6908066	**Map Scale**	
Zone	56	**Map Series**	
Accuracy	GPS	**Map No**	9442.33
GPS Accuracy	10	**Map Name**	
Checked	Yes	**Prog Section**	

Casing

7 ***records for RN*** **124727**

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	12/07/2005	1	1.00	40.00	Steel Casing	9.500	WT - Wall Thickness	335
A	12/07/2005	2	1.00	268.00	Steel Casing	8.800	WT - Wall Thickness	273
A	12/07/2005	3	268.00	512.00	Steel Casing	7.100	WT - Wall Thickness	219
A	12/07/2005	4	460.00	510.00	Stainless Steel	2.500	AP - Aperture Size	219
A	12/07/2005	5	10.00	518.00	Gravel Pack	4.000	GR - Gravel Size	

Bore Report

From Year:

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	12/07/2005	6	0.00	40.00	Grout			406
A	12/07/2005	7	0.00	10.00	Grout			315

Strata Logs

10 *records for RN* **124727**

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	10.00	TOP SOIL
2	10.00	15.00	SILTY CLAY
3	15.00	23.00	MUDSTONE SANDSTONE
4	23.00	36.00	CRUMBLY TUFF *
5	36.00	40.00	DECO BASALT
6	40.00	162.00	BASALT * WATER IN BASALT
7	162.00	272.00	COAL SHALE SOFT MUDSTONE *
8	272.00	363.00	SOFT COAL TURN INTO HARD SANDSTONE *
9	363.00	454.00	HARD/SOFT SANDSTONE BANDS *
10	454.00	518.00	HARDER CONSISTANT SANDSTONE

Stratigraphies

0 *records for RN* **124727**

Aquifers

1 *records for RN* **124727**

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	36.00	454.00	COAL - Coal SDST - Sandstone SHLE - Shale	12/07/2005	-10.00	N	POTABLE	4.00	Y	SC	

Pump Tests Part 1

0 *records for RN* **124727**

Bore Report

From Year:

Pump Tests Part 2

0 *records for RN* **124727**

Bore Conditions

0 *records for RN* **124727**

Elevations

0 *records for RN* **124727**

Water Analysis Part 1

0 *records for RN* **124727**

Water Analysis Part 2

0 *records for RN* **124727**

Water Levels

1 *records for RN* **124727**

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project		Quality
A	12/07/2005		-10.00	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality

Wire Line Logs

0 *records for RN* **124727**

Field Measurements

1 *records for RN* **124727**

Pipe	Date	Depth (m)	Conduct (uS/cm)	pH	Temp (C)	NO3 (mg/L)	DO2 (mg/L)	Eh (mV)	Alkalinity (mV)	Samp	Method	Samp	Source
A	12/07/2005			7.6						AI	Air Lifting	GB	Groundwater - from Bore

Special Water Analysis

0 *records for RN* **124727**

Bore Report

From Year:

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Bore Report

From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
138334	Sub-Artesian Facility	Existing	15/10/2008	Gatton	6510 - SCENIC RIM REGIONAL

Details

Description			
Parish	1854 - FASSIFERN		
Original Name	KALFRESH		
Driller Name	HARCH, RUSSELL KEVIN		
Drill Company	HARCH DRILLING		
Const Method	ROTARY AIR		
Bore Line			
D/O File No	515 000 0163	**Polygon**	
R/O File No		**Equipment**	
H/O File No		**RN of Bore Replaced**	
Log Received Date	07/11/2008	**Data Owner**	
Roles	Water Supply		

Location

Latitude	27-56-59	**Basin**	1431
Longitude	152-34-46	**Sub-area**	
GIS Latitude	-27.9496203	**Lot**	2
GIS Longitude	152.5794043	**Plan**	SP192221
Easting	458627		
Northing	6908307	**Map Scale**	
Zone	56	**Map Series**	
Accuracy	GPS	**Map No**	9442-33
GPS Accuracy	10	**Map Name**	
Checked	Yes	**Prog Section**	

Casing

6 ***records for RN*** **138334**

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	15/10/2008	1	0.00	15.80	Steel Casing	8.000	WT - Wall Thickness	275
A	15/10/2008	2	0.00	141.70	Polyvinyl Chloride			177
A	15/10/2008	3	129.50	141.70	Perforated or Slotted Casing	4.000	AP - Aperture Size	177
X	15/10/2008	4	0.00	6.10	Grout			324
X	15/10/2008	5	0.00	91.40	Grout			242

Bore Report

From Year:

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
X	15/10/2008	6	91.40	141.70	Gravel Pack	5.000	GR - Gravel Size	242

Strata Logs

10 *records for RN* **138334**

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	12.20	TOPSOIL CLAY & LOAM
2	12.20	14.00	GRAVEL
3	14.00	15.80	CLAY BOUND GRAVEL
4	15.80	38.10	GRANITE
5	38.10	42.70	BASALT
6	42.70	50.30	HARD BLACK SHALE
7	50.30	67.70	BLACK SHALE
8	67.70	76.20	BASALT
9	76.20	134.70	VERY HARD BASALT
10	134.70	141.70	SMALL FRACTURED BASALT

Stratigraphies

0 *records for RN* **138334**

Aquifers

1 *records for RN* **138334**

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	134.70	141.70	INTR - Intrusive	15/10/2008	-17.70	N	1800 US/CM	25.20	Y	FR	VOLCANICS - UNDIFF.

Pump Tests Part 1

0 *records for RN* **138334**

Pump Tests Part 2

0 *records for RN* **138334**

Bore Report

From Year:

Bore Conditions

0 *records for RN* **138334**

Elevations

0 *records for RN* **138334**

Water Analysis Part 1

0 *records for RN* **138334**

Water Analysis Part 2

0 *records for RN* **138334**

Water Levels

1 *records for RN* **138334**

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project	Quality
A	15/10/2008		-17.70	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded	130	Data is of unknown quality

Wire Line Logs

0 *records for RN* **138334**

Field Measurements

1 *records for RN* **138334**

Pipe	Date	Depth (m)	Conduct (uS/cm)	pH	Temp (C)	NO3 (mg/L)	DO2 (mg/L)	Eh (mV)	Alkalinity (mV)	Samp	Method	Samp	Source
A	15/10/2008		1800							AI	Air Lifting	GB	Groundwater - from Bore

Special Water Analysis

0 *records for RN* **138334**

Bore Report

From Year:

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Bore Report

From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
14310270	Sub-Artesian Facility	Existing	07/06/2011	Gatton	6510 - SCENIC RIM REGIONAL

Details

Description			
Parish	1854 - FASSIFERN		
Original Name			
Driller Name	HANNANT, GRAHAM WILLIAM		
Drill Company	GW & JJ HANNANT		
Const Method	CABLE TOOL		
Bore Line			
D/O File No	520 000 0051	**Polygon**	
R/O File No		**Equipment**	NE
H/O File No		**RN of Bore Replaced**	
Log Received Date	09/06/2011	**Data Owner**	DNR
Roles	WR Investigation Sub-Artesian Monitoring		

Location

Latitude	27-56-25	**Basin**	1431
Longitude	152-35-14	**Sub-area**	
GIS Latitude	-27.94025842	**Lot**	
GIS Longitude	152.5871179	**Plan**	
Easting	459382		
Northing	6909347	**Map Scale**	253 - 1: 25 000
Zone	56	**Map Series**	M - Metric Series
Accuracy	GPS	**Map No**	9442-33
GPS Accuracy	2	**Map Name**	
Checked	Yes	**Prog Section**	

Casing

8 ***records for RN*** **14310270**

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	07/06/2011	1	0.00	16.00	Polyvinyl Chloride	6.000	WT - Wall Thickness	80
A	07/06/2011	2	14.90	15.90	Perforated or Slotted Casing	4.000	AP - Aperture Size	80
X	07/06/2011	3	0.00	5.00	Grout			160
X	07/06/2011	4	5.00	8.00	Cuttings or other fill between casing and hole wall			160
X	07/06/2011	5	8.00	11.00	Cuttings or other fill between casing and hole wall			145

Bore Report

From Year:

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
X	07/06/2011	6	11.00	12.00	Bentonite Seal			145
X	07/06/2011	7	12.00	17.20	Gravel Pack	5.000	GR - Gravel Size	145
X	07/06/2011	8	8.00	15.90	Centraliser			

Strata Logs

8 *records for RN* **14310270**

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	0.40	DARK GREY TOPSOIL
2	0.40	2.90	GREY CLAY
3	2.90	6.00	BROWN CLAY
4	6.00	12.10	BROWN WITH SOME LIGHT GREY CLAY
5	12.10	13.30	CLAYBOUND GRAVEL & ROCKS
6	13.30	15.00	RIVER GRAVEL
7	15.00	15.80	CLAYBOUND GRAVEL & LARGE ROCKS
8	15.80	17.30	BASALT

Stratigraphies

2 *records for RN* **14310270**

Source	Rec	Top (m)	Bottom (m)	Strata Description
DNR	1	0.00	15.80	WARRILL CREEK ALLUVIUM
DNR	2	15.80	17.30	VOLCANICS - UNDIFF.

Aquifers

1 *records for RN* **14310270**

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	12.10	15.80	GRAV - Gravel	07/06/2009	-2.50	N			Y	UC	WARRILL CREEK ALLUVIUM

Bore Report

From Year:

Pump Tests Part 1

0 *records for RN* **14310270**

Pump Tests Part 2

0 *records for RN* **14310270**

Bore Conditions

0 *records for RN* **14310270**

Elevations

2 *records for RN* **14310270**

Pipe	Date	Elevation (m)	Precision		Datum	Meas	Point	Survey Source
A	01/01/1900	80.50	EST	Estimate Using Contours	AHD - Aust. Height Datum	R	Reference Point	ESTIMATED FROM MAPINFO
X	01/01/1900	80.00	EST	Estimate Using Contours	AHD - Aust. Height Datum	N	Natural Surface	ESTIMATED FROM MAPINFO

Water Analysis Part 1

1 *records for RN* **14310270**

Pipe	Date	Rec	Analyst	Analysis No	Depth (m)	Meth	Src	Cond (uS/cm)	pH	Si (mg/L)	Total Ions (mg/L)	Total Solids (mg/L)	Hard	Alk	Fig. of Merit	SAR	RAH
A	11/07/2011	1	GCL	303317		PH	GB	1920	7.7	44	1210.00	1000.00	668	410	2.5	2.0	0.00

Water Analysis Part 2

1 *records for RN* **14310270**

Pipe	Date	Rec	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	11/07/2011	1	121.0	1.5	127.0	85.0	<0.01	496.0	<0.01	1.8	360.0	0.26	3.2	12.0	<0.01	<0.05	0.02	<0.03

Water Levels

84 *records for RN* **14310270**

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project	Quality
A	07/06/2011		-2.50	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded	130	Data is of unknown quality
A	15/06/2011		-3.41	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded	130	Data is of unknown quality
A	14/07/2011		-3.27	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded	130	Data is of unknown quality
A	22/08/2011		-3.75	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded	130	Data is of unknown quality

Bore Report

From Year:

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project		Quality
A	14/09/2011		-3.68	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	01/11/2011		-3.39	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	01/12/2011		-3.48	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	02/02/2012		-2.70	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	02/03/2012		-2.06	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	17/04/2012		-2.78	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	13/06/2012		-2.99	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	11/07/2012		-3.09	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	15/08/2012		-3.36	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	25/09/2012		-3.85	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	25/10/2012		-4.21	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	22/11/2012		-4.19	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	11/12/2012		-4.67	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	15/01/2013		-4.61	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	27/03/2013		-2.64	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	26/07/2013		-3.53	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	26/09/2013		-4.38	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	05/11/2013		-4.60	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	18/12/2013		-4.35	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	04/02/2014		-4.61	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	19/03/2014		-5.11	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	08/05/2014		-4.89	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	17/06/2014		-4.76	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	16/07/2014		-5.00	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	19/08/2014		-5.28	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality

Bore Report

From Year:

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project		Quality
A	10/09/2014		-4.98	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	21/10/2014		-5.25	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	19/11/2014		-5.43	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	20/01/2015		-4.82	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	18/02/2015		-4.56	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	19/03/2015		-4.50	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	21/04/2015		-3.88	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	25/05/2015		-3.86	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	19/06/2015		-3.98	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	27/07/2015		-4.49	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	25/08/2015		-4.68	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	21/09/2015		-4.57	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	02/11/2015		-4.59	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	30/11/2015		-4.66	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	23/12/2015		-4.72	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	27/01/2016		-4.81	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	23/02/2016		-4.76	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	22/03/2016		-5.07	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	27/04/2016		-5.03	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	25/05/2016		-5.16	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	22/06/2016		-4.58	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	28/07/2016		-4.69	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	14/09/2016		-4.63	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	12/10/2016		-4.74	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	15/11/2016		-4.99	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements

Bore Report

From Year:

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project		Quality
A	08/12/2016		-5.18	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	05/01/2017		-5.00	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	28/02/2017		-5.11	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	03/04/2017		-4.78	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	08/05/2017		-4.92	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	13/06/2017		-4.28	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	17/07/2017	1603	-4.27	R	Reference Point		ACT	Actual	DH	DL	Data Logger		1	Good - Actual Manual Measurements
A	15/08/2017	1327	-4.52	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	12/09/2017	1027	-5.14	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	18/10/2017	0944	-4.80	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	23/11/2017		-4.52	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	21/02/2018		-4.54	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	15/03/2018		-3.50	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	17/04/2018		-4.16	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	15/05/2018		-4.28	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	06/06/2018		-4.68	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	16/07/2018		-4.80	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	14/08/2018		-5.07	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	25/09/2018		-5.31	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	22/10/2018		-4.88	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	26/11/2018		-5.27	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	19/12/2018		-5.09	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	18/01/2019		-5.34	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	12/03/2019		-5.60	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements
A	11/04/2019		-5.24	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand		1	Good - Actual Manual Measurements

Bore Report

From Year:

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project	Quality
A	15/05/2019		-5.46	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand	1	Good - Actual Manual Measurements
A	21/06/2019		-5.35	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand	1	Good - Actual Manual Measurements
A	16/07/2019		-5.81	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand	1	Good - Actual Manual Measurements
A	20/08/2019		-5.97	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand	1	Good - Actual Manual Measurements
A	18/09/2019		-6.24	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand	1	Good - Actual Manual Measurements

Wire Line Logs

0 ***records for RN*** **14310270**

Field Measurements

1 ***records for RN*** **14310270**

Pipe	Date	Depth (m)	Conduct (uS/cm)	pH	Temp (C)	NO3 (mg/L)	DO2 (mg/L)	Eh (mV)	Alkalinity (mV)	Samp	Method	Samp	Source
A	08/07/2011		1899							PU	Pump - Other or Flowing Bore	GB	Groundwater - from Bore

Special Water Analysis

0 ***records for RN*** **14310270**

Bore Report

From Year:

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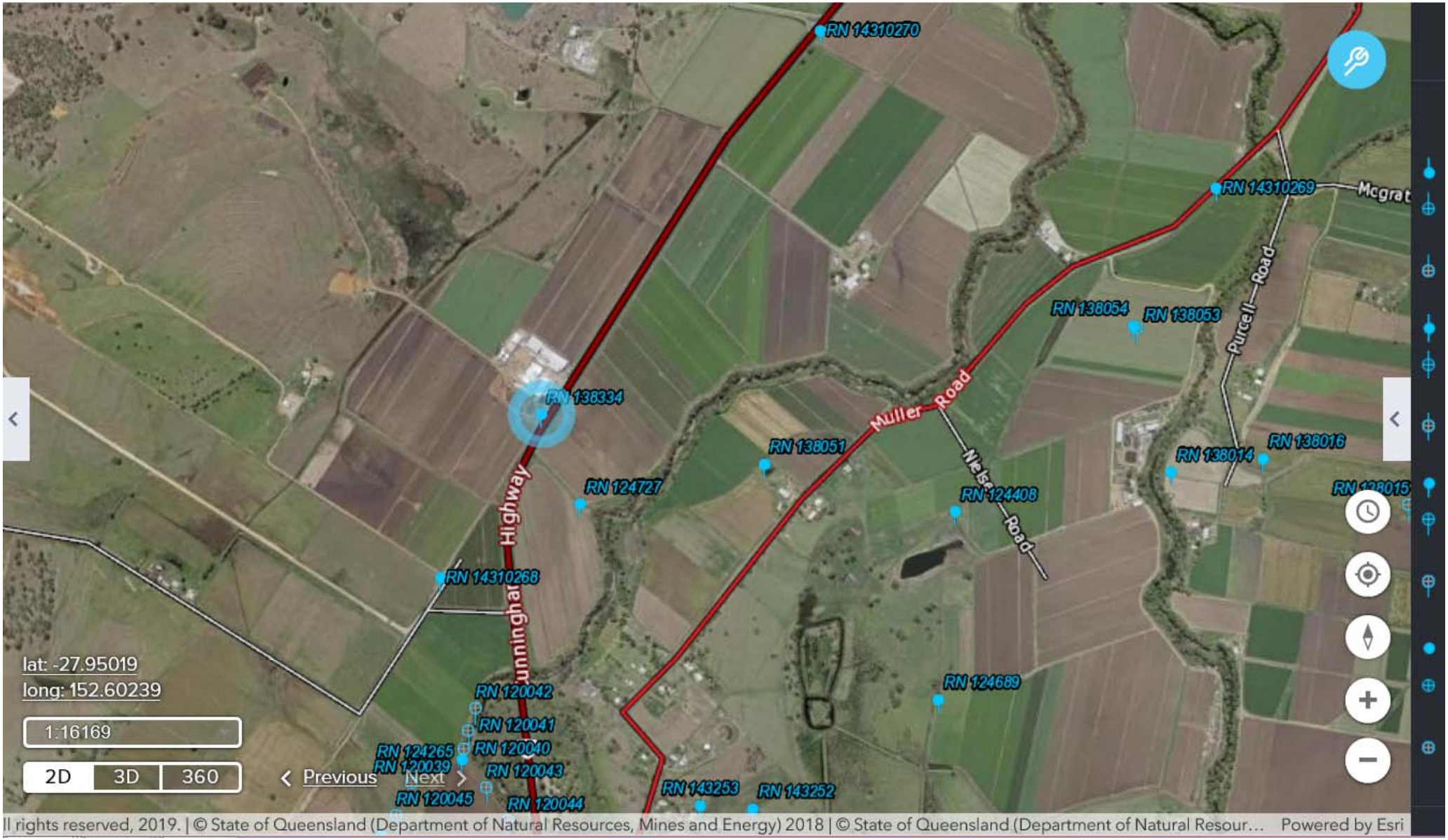
RN 14310270
RN 14310269
Mcgrat
Purcell Road
RN 138054
RN 138053
RN 138334
Muller Road
RN 138051
RN 124727
RN 124408
Nels Road
RN 138014
RN 138016
RN 138015
Highway
RN 14310268
lat: -27.95019
long: 152.60239
1:16169
2D
3D
360
Previous
Next
RN 120042
RN 120041
RN 120040
RN 124265
RN 120039
RN 120043
RN 120045
RN 120044
RN 124689
RN 143253
RN 143252
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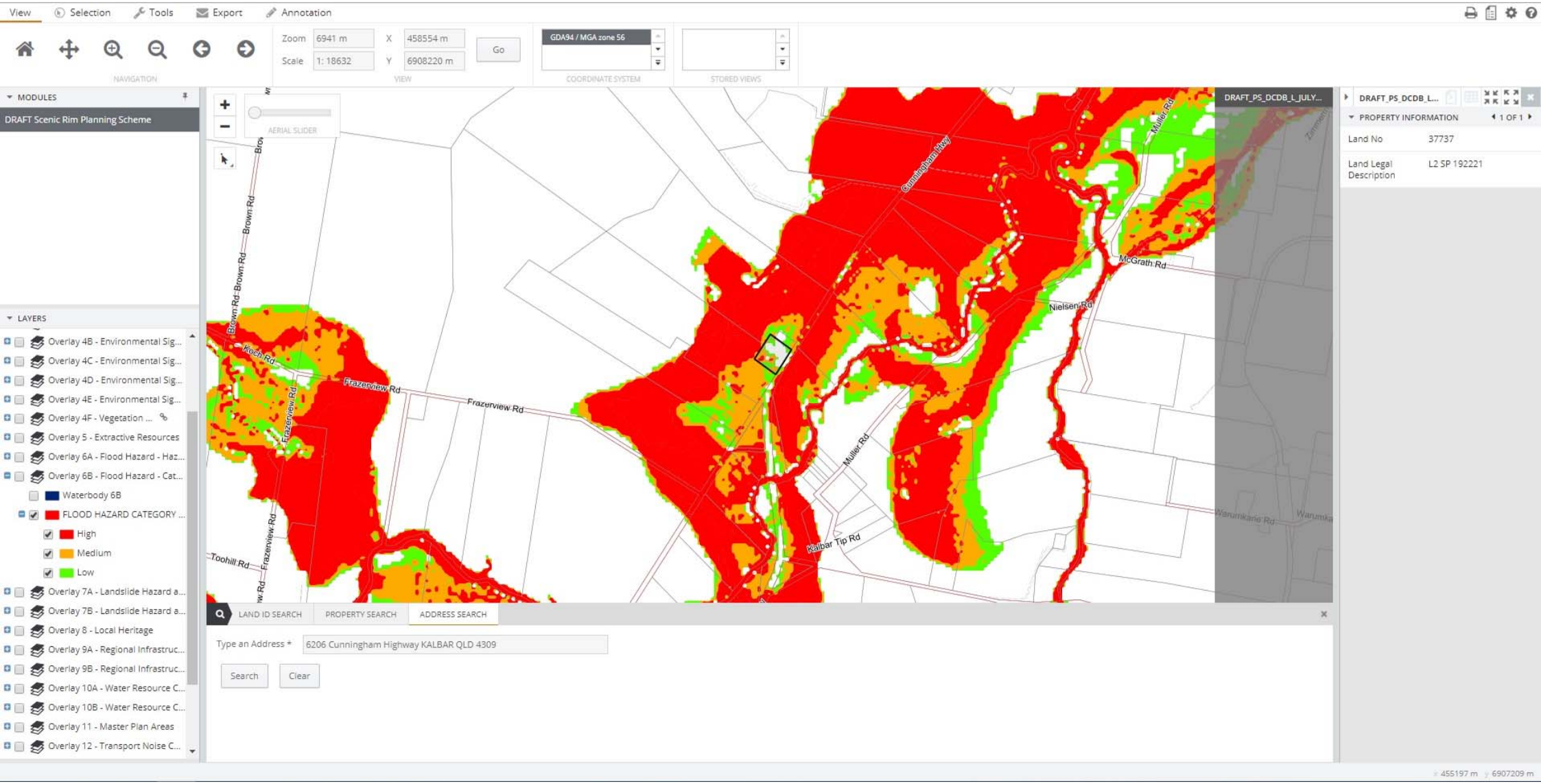
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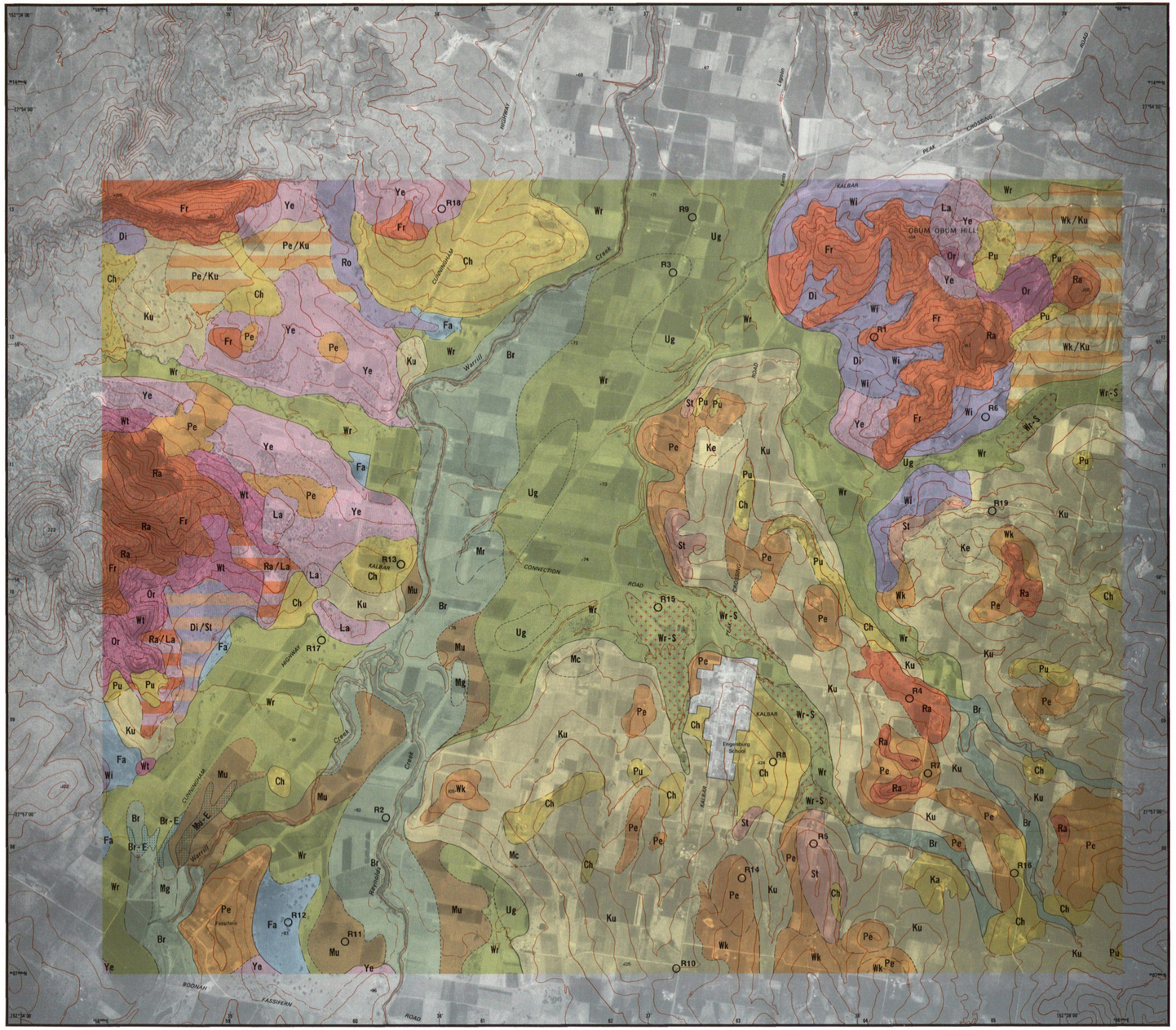
Selection
Tools
Export
Annotation
NAVIGATION
Zoom 6941 m
Scale 1: 18632
X 458554 m
Y 6908220 m
Go
VIEW
GDA94 / MGA zone 56
COORDINATE SYSTEM
STORED VIEWS
MODULES
DRAFT Scenic Rim Planning Scheme
AERIAL SLIDER
LAYERS
Overlay 4B - Environmental Sig...
Overlay 4C - Environmental Sig...
Overlay 4D - Environmental Sig...
Overlay 4E - Environmental Sig...
Overlay 4F - Vegetation ...
Overlay 5 - Extractive Resources
Overlay 6A - Flood Hazard - Haz...
Overlay 6B - Flood Hazard - Cat...
Waterbody 6B
FLOOD HAZARD CATEGORY ...
High
Medium
Low
Overlay 7A - Landslide Hazard a...
Overlay 7B - Landslide Hazard a...
Overlay 8 - Local Heritage
Overlay 9A - Regional Infrastruc...
Overlay 9B - Regional Infrastruc...
Overlay 10A - Water Resource C...
Overlay 10B - Water Resource C...
Overlay 11 - Master Plan Areas
Overlay 12 - Transport Noise C...
Brown Rd
Koch Rd
Frazerview Rd
Toohill Rd
Cunningham Hwy
Muller Rd
McGrath Rd
Nielsen Rd
Kalbar Tip Rd
Warumkarie Rd
DRAFT_PS_DCDB_L_JULY...
DRAFT_PS_DCDB_L...
PROPERTY INFORMATION
1 OF 1
Land No 37737
Land Legal Description L2 SP 192221
LAND ID SEARCH
PROPERTY SEARCH
ADDRESS SEARCH
Type an Address *
6206 Cunningham Highway KALBAR QLD 4309
Search
Clear
x 455197 m y 6907209 m



REFERENCE

MAP UNIT		MAJOR CHARACTERISTICS OF DOMINANT SOIL	GREAT SOIL GROUP †	PPF**
SOILS OF THE ALLUVIAL PLAINS				
DARK CLAY LOAMS				
Mr	MOORE	Dark clay loam to 30cm over dark sand	Alluvial soil	Um1.44
Mg	MOOGERAH	Dark clay loam with dark or brown neutral massive clay loam or light clay subsoil	No provision	Gn2.42 Gn2.02
Br	BROMELTON*	Dark clay loam or light clay with neutral or alkaline structured clay subsoil	Prairie soil - Chernozem	Um6.32 Gn3.42
DARK WEAKLY SELF-MULCHING SEASONALLY CRACKING CLAYS				
Mu	MULLER	Dark weakly self-mulching cracking clay with dark or brown neutral subsoil	Black earth	Ug5.15 Ug5.17
DARK MODERATELY SELF-MULCHING SEASONALLY CRACKING CLAYS				
Wr	WARRILL	Dark moderately self-mulching cracking clay with dark or grey alkaline subsoil	Black earth	Ug5.16 Ug5.17
Ug	UGARAPUL	Dark moderately self-mulching cracking clay with brown neutral subsoil	Black earth	Ug5.15 Ug5.17
GILGAIED MOTTLED DARK SEASONALLY CRACKING CLAYS				
Fa	FASSIFERN*	Gilgaied mottled dark weakly or non self-mulching cracking clay with grey alkaline subsoil	Weisenboden - Grey clay	Ug5.16 Ug5.24
SOILS OF THE UNDULATING PLAINS				
SHALLOW RED SANDY CLAY LOAMS				
St	STIBBES	Shallow red friable sandy loam to sandy clay loam	Red earth	Um5.51
FRIABLE NON-CRACKING CLAY LOAMS / CLAYS				
Ka	KALAMBA	Shallow grey friable gravelly clay with brown acid subsoil	No provision	Um6.31
Ch	CHURCHBANK*	Shallow dark or brown friable clay loam / clay with red or brown neutral clay subsoil	Prairie soil	Um6.31 Gn3.22
Pu	PURDON	Deep dark friable clay loam/clay with dark or brown calcareous subsoil	Chernozem	Um6.31 Db3.13 Gn3.43
SHALLOW SELF-MULCHING SEASONALLY CRACKING CLAYS				
Wk	WARUMKARIE	Shallow dark to grey self-mulching clay with dark or grey alkaline calcareous subsoil	Black earth - Grey clay	Ug5.12 Ug5.22
Pe	PENNELL	Shallow dark to brown self-mulching clay with brown neutral subsoil	Black earth - Brown clay	Ug5.13 Ug5.32
DEEP SELF-MULCHING SEASONALLY CRACKING CLAYS				
Ku	KULGUN*	Deep dark to grey self-mulching clay loam / clay with grey alkaline calcareous subsoil	Black earth - Grey clay	Ug5.14 Ug5.24 Gn3.93
Ke	KELLY	Deep dark to grey self-mulching clay with yellow alkaline calcareous subsoil	Black earth - Grey clay	Ug5.23 Ug5.32
Mc	McGRATH	Deep dark to brown self-mulching clay with red to brown neutral or alkaline subsoil	Black earth - Brown clay	Ug5.15 Ug5.34 Ug5.37
SANDY DUPLEX SOILS				
Ro	ROSEVALE*	Dark to grey hard sandy loam 12-30 cm with bleached A_2 - horizon over red to brown acid to neutral deep clay subsoil	Soloth	Dr2.41 Db1.42
Di	DIECKMANN	Dark to grey friable fine sandy loam to loam 20-40 cm with bleached A_2 - horizon over manganiferous mottled grey to brown neutral deep clay subsoil	Soloth	Dy5.42 Db4.32
Wi	WISS	Brown hard sandy loam 45-70 cm with thick pale A_2 - horizon over red acid to neutral deep clay subsoil	Red podzolic	Dr2.51 Gn2.14
CLAY LOAM DUPLEX SOILS				
La	LANCE	Dark to brown hard clay loam 20-25 cm with pale A_2 - horizon over mottled yellow or brown acid deep clay subsoil	Soloth	Dy2.21 Dy3.41
Ye	YELLUNGA	Dark to grey hard clay loam 10-20 cm with thin bleached A_2 - horizon over brown alkaline calcareous deep clay subsoil	Solodic	Db1.33 Dt2.43
SOILS OF THE LOW HILLS				
SHALLOW GRAVELLY LOAMS / CLAY LOAMS				
Ra	RANGEVIEW	Shallow dark cobbly loam / clay loam	Lithosol	Um6.21 Gn2.81
Fr	FRAZER*	Shallow red gravelly sandy loam / loam	Lithosol	Um4.1 Gn2.11 Uc1.44
SHALLOW GRAVELLY DUPLEX SOILS				
Or	ORTELS	Dark to grey gravelly loam / clay loam 25 cm with bleached A_2 - horizon over brown or grey alkaline shallow clay subsoil	Solodic	Db1.43 Dy4.43
Wt	WATTERS	Dark to brown gravelly loam 15 cm with bleached A_2 horizon over mottled red acid shallow clay subsoil	Soloth	Dr2.41 Dr3.41

SEVERELY DEGRADED SOILS

Br-E	BROMELTON	- ERODED PHASE
Mu-E	MULLER	- ERODED PHASE
Wr-S	WARRILL	- SALINE PHASE

DISCLAIMER:

This is a scanned image and some detail may be illegible or lost. While every care is taken to ensure the accuracy of this product, the Department of Natural Resources and Mines makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way for any reason.

QUEENSLAND
DEPARTMENT OF PRIMARY INDUSTRIES

REFERENCE AREA — KALBAR
SOILS

by B.Powell

SCALE 1:25 000

500 0 500 1000 1500 Metres

Drawn by P.Zande

CONTOUR INTERVAL 10 METRES
WITH SELECTED 5 METRE AUXILIARY CONTOURS
GRID LINES ARE 1000 METRE INTERVALS OF THE AUSTRALIAN MAP GRID ZONE 56
GRID VALUES ARE SHOWN IN FULL ONLY AT THE SHEET CORNERS OF THE MAP
HORIZONTAL DATUM AUSTRALIAN GEODETIC DATUM 1966
VERTICAL DATUM AUSTRALIAN HEIGHT DATUM
TRANSVERSE MERCATOR PROJECTION
ELEVATIONS IN METRES

GRID CONVERGENCE 0°11'
GRID MAGNETIC ANGLE 11°00'

TRUE NORTH, GRID NORTH AND MAGNETIC NORTH ARE SHOWN DIAGRAMMATICALLY FOR THE CENTRE OF THE MAP. MAGNETIC NORTH IS CORRECT FOR 1975, AND MOVES EASTERLY AT THE RATE OF 10' ANNUALLY. THIS PREDICTED RATE OF CHANGE IS VALID UNTIL 1980.

NOTE

* This soil is identified as a soil described by Paton (1971) and is given the Paton name.

** Principal Profile Forms (Northcote, 1971)

† Piper Stace et al (1968), 'A Handbook of Australian Soils'.

clear boundary
gradual boundary
diffuse boundary

Map units are named after the dominant soil.

Dominant soil occupies >70% of a map unit area.

Deep soils are usually greater than 70 cm deep.

Bleached A_2 - horizons have a whitish colour and are much paler than the surface soil and subsoil.

Duplex soils: soils which have strongly contrasting texture profiles with a lighter textured surface soil (clay loam or lighter) over a heavier textured (more clayey) subsoil.

R9 Soil Sample Site R9

LOCALITY PLAN

COMPILED by B.Powell, Agricultural Chemistry Branch, Department of Primary Industries, Brisbane.

PREPARED by Drafting Section, Division of Land Utilisation, Department of Primary Industries, Brisbane.

BASE MAP supplied by Department of Mapping and Surveying, Brisbane.

PRINTED by the Government Printer, Brisbane, 1979.

ATTACHMENT D: LABORATORY CERTIFICATES

Queensland Government

Department of Environment and Science - Chemistry Centre
Eco Sciences Precinct
Level 3, Block A, 41 Boggo Rd
Dutton Park Qld 4102
Telephone: 07 3170 5696
Facsimile: 07 3170 5801

Analysis Report

Job Number: 19-0928

Precise Environmental
7/14 Fremantle Street
Burleigh Heads

QLD 4220

Attn : Danae Bragg

Date Sampled:	21-Oct-2019 to 21-Oct-2019
Date Received:	25-Oct-2019 to 25-Oct-2019
Date Tested:	25-Oct-2019 to 1-Dec-2019
Date Reported:	1-Dec-19

Final Report

Report ID: 19-0928-F-V2

This report supersedes report : 19-0928-I-V1 issued on 26-Nov-2019.

MISCEX , Miscellaneous External

PE2898.19

NOTE: Results pertain to samples as received by this laboratory and relate to the items tested

Additional Notes

Queensland Government

Department of Environment and Science - Chemistry Centre

Soil Analysis Report

Job No: **19-0928**
Report ID: **19-0928-F-V2**

Sample No	Customer's ID	Description	Depth (m)	Method / Component / Units	S_AQ4_EL pH -	S_AQ4_EL EC dS/m	S_AQ4_AA Cl mg/kg	S_AQ4_AA NO3-N mg/kg	S_COLWELL P mg/kg	* S_PBI PBI col	* S_PBI PBI unadj	S_DUM_CN TC %	S_DUM_CN TN %	S_DUM_TOC OC %	S_KJ_AA TKN %
19-0928-0001	1	BH1 0.1 - 0.25	0.10-0.25		6.36	0.04	<20	5	131	73	50	0.94	0.085	0.933	0.072
19-0928-0002	2	BH2 0.0 - 0.6	0.00-0.60		6.23	0.05	23	2	5	184	182	1.44	0.110	1.40	0.094
19-0928-0003	3	BH3 0.3 - 0.6	0.30-0.60		7.87	0.30	257	11	16	195	191	0.69	0.065	0.688	0.054

Sample No	Customer's ID	Description	Depth (m)	Method / Component / Units	S_KJ_AA TKP %	S_KC2_AA_D NH4-N air dry mg/kg	S_KC2_AA_D NO3-N air dry mg/kg	S_CAT_EQ Ca cmol_c/kg	S_CAT_EQ Mg cmol_c/kg	S_CAT_EQ K cmol_c/kg	S_CAT_EQ Na cmol_c/kg	S_CAT_EQ Na corr cmol_c/kg	S_CAT_ALC Ca cmol_c/kg	S_CAT_ALC Mg cmol_c/kg
19-0928-0001	1	BH1 0.1 - 0.25	0.10-0.25		0.038	3	4	6.83	3.58	0.588	0.166	0.166	-----	-----
19-0928-0002	2	BH2 0.0 - 0.6	0.00-0.60		0.018	3	<2	18.9	9.38	0.414	1.42	1.36	-----	-----
19-0928-0003	3	BH3 0.3 - 0.6	0.30-0.60		0.092	9	12	-----	-----	-----	-----	-----	15.8	8.26

Sample No	Customer's ID	Description	Depth (m)	Method / Component / Units	S_CAT_ALC K cmol_c/kg	S_CAT_ALC Na cmol_c/kg	S_CAT_ALCC Base sat %	S_CAT_ALCC CEC:Clay	S_CAT_ALCC Ca:CEC	S_CAT_ALCC ESP %	S_CAT_ALCC Ca:Mg	S_CAT_ALCC K:CEC	S_CAT_ALCC Mg:CEC	S_CAT_ALCC Mg:Ca
19-0928-0001	1	BH1 0.1 - 0.25	0.10-0.25		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
19-0928-0002	2	BH2 0.0 - 0.6	0.00-0.60		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
19-0928-0003	3	BH3 0.3 - 0.6	0.30-0.60		0.350	1.79	97	0.6	0.582	6.6	1.91	0.0129	0.304	0.523

Sample No	Customer's ID	Description	Depth (m)	Method / Component / Units	S_CAT_ALCC Mg:K	S_CAT_ALCC Na:K	* S_CEC CEC cmol/kg	S_ADM_105 ADMC %	S_PSA Coarse sand %	S_PSA Fine sand %	S_PSA Silt %	S_PSA Clay %	S_03_BAR 1/3 Bar %	S_15_BAR 15 Bar %
19-0928-0001	1	BH1 0.1 - 0.25	0.10-0.25		-----	-----	-----	4.1	32.3	37.1	21.9	14.0	35.7	13.2
19-0928-0002	2	BH2 0.0 - 0.6	0.00-0.60		-----	-----	-----	8.3	8.4	16.8	15.4	57.9	48.1	25.1
19-0928-0003	3	BH3 0.3 - 0.6	0.30-0.60		23.6	5.12	27	3.7	11.0	35.8	9.5	45.1	40.7	19.9

Name : Angus McElnea
Title : Team Leader Soil and Plant

NATA Accredited Laboratory
Number: 5072

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance ISO/IEC 17025 - Chemical testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Queensland Government

Department of Environment and Science - Chemistry Centre

Sample Details

Job No: **19-0928**
Report ID: **19-0928-F-V2**

Soil

Sample No	Customer's ID	Description	Date Sampled	Site	Obs	SNo	Depth (m)
19-0928-0001	1	BH1 0.1 - 0.25	21-Oct-2019		0	0	0.10-0.25
19-0928-0002	2	BH2 0.0 - 0.6	21-Oct-2019		0	0	0.00-0.60
19-0928-0003	3	BH3 0.3 - 0.6	21-Oct-2019		0	0	0.30-0.60

Queensland Government

Department of Environment and Science - Chemistry Centre

Methods of Analysis

Job No: **19-0928**
Report ID: **19-0928-F-V2**

Method	Analyte	Name	ALHS	Uncertainty ±%	PQL	Unit	Method Description	Reporting Basis	Method Notes
S_03_BAR v1	1/3 Bar	Field capacity moisture (1/3 Bar)	2E2	15	1.500	%	Soil: Moisture 1/3 Bar pressure plate	Oven dry (24 hours at 105°C)	
S_15_BAR v1	15 Bar	Permanent wilting point (15 Bar)	2E1	15	1.500	%	Soil: Moisture 15 Bar pressure plate	Oven dry (24 hours at 105°C)	
S_ADM_105 v1	ADMC	Air dry moisture content (105ºC)	2A1	8	1.500	%	Soil: Moisture air dry	Oven dry (48 hours at 105°C)	
S_AQ4_AA v2	Cl	Chloride	5A2	10	20.000	mg/kg	Soil: Cl NO3-N Aqueous (1:5)	Oven dry (48 hours at 40°C)	
S_AQ4_AA v2	NO3-N	Nitrate nitrogen	7B1	15	1.000	mg/kg	Soil: Cl NO3-N Aqueous (1:5)	Oven dry (48 hours at 40°C)	
S_AQ4_EL v1	EC	Electrical conductivity	3A1	10	0.010	dS/m	Soil: pH EC Aqueous (1:5)	Oven dry (48 hours at 40°C)	
S_AQ4_EL v1	pH	pH	4A1	5	0.100	-	Soil: pH EC Aqueous (1:5)	Oven dry (48 hours at 40°C)	
S_CAT_ALC v1	Ca	Calcium	15C1_Ca	10	0.600	cmol_c/kg	Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALC v1	K	Potassium	15C1_K	12	0.050	cmol_c/kg	Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALC v1	Mg	Magnesium	15C1_Mg	8	0.070	cmol_c/kg	Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALC v1	Na	Sodium	15C1_Na	10	0.070	cmol_c/kg	Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALCC v1	Base sat	Base saturation	15L1	10	1.000	%	Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALCC v1	CEC:Clay	Cation exchange capacity:clay	15Z1_CEC/clay	0	0.000		Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALCC v1	Ca:CEC	Calcium to cation exchange capacity ratio	15M1_Ca/CEC	10	0.000		Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALCC v1	Ca:Mg	Calcium to magnesium ratio	15M1_Ca/Mg	10	0.000		Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALCC v1	ESP	Exchangable sodium percentage	15N1	0	0.000	%	Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALCC v1	K:CEC	Potassium to cation exchange capacity ratio	15M1_K/CEC	10	0.000		Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALCC v1	Mg:CEC	Magnesium to cation exchange capacity ratio	15M1_Mg/CEC	10	0.000		Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALCC v1	Mg:Ca	Magnesium to calcium ratio	15M1_Mg/Ca	10	0.000		Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALCC v1	Mg:K	Magnesium to potassium ratio	15M1_Mg/K	10	0.000		Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_ALCC v1	Na:K	Sodium to potassium ratio	15M1_Na/K	10	0.000		Soil: Cations exchangeable alcoholic NH4Cl pH 8.	Oven dry (48 hours at 40°C)	
S_CAT_EQ v3	Ca	Calcium	15A1_Ca	10	0.140	cmol_c/kg	Soil: Cations extractable NH4Cl pH 7 ICP	Oven dry (48 hours at 40°C)	
S_CAT_EQ v3	K	Potassium	15A1_K	10	0.030	cmol_c/kg	Soil: Cations extractable NH4Cl pH 7 ICP	Oven dry (48 hours at 40°C)	
S_CAT_EQ v3	Mg	Magnesium	15A1_Mg	10	0.030	cmol_c/kg	Soil: Cations extractable NH4Cl pH 7 ICP	Oven dry (48 hours at 40°C)	
S_CAT_EQ v3	Na	Sodium	15A1_Na	10	0.080	cmol_c/kg	Soil: Cations extractable NH4Cl pH 7 ICP	Oven dry (48 hours at 40°C)	
S_CAT_EQ v3	Na corr	Exchangeable Sodium	15A3_Na	0	0.080	cmol_c/kg	Soil: Cations extractable NH4Cl pH 7 ICP	Oven dry (48 hours at 40°C)	
* S_CEC v2	CEC	Cation exchange capacity	15C1_CEC	15	2.000	cmol/kg	Soil: CEC alcoholic NH4Cl pH 8.5 AA	Oven dry (48 hours at 40°C)	
S_COLWELL v2	P	Phosphorus (Colwell)	9B2	10	2.000	mg/kg	Soil: P extractable 0.5M NaHCO3 AA	Oven dry (48 hours at 40°C)	
S_DUM_CN v5	TC	Total carbon	6B2a	5	0.050	%	Soil: C N total Dumas	Oven dry (48 hours at 40°C)	
S_DUM_CN v5	TN	Total nitrogen	7A5	10	0.005	%	Soil: C N total Dumas	Oven dry (48 hours at 40°C)	
S_DUM_TOC v3	OC	Organic carbon	6B5	10	0.050	%	Soil: Total Organic Carbon; Combustion	Oven dry (48 hours at 40°C)	
S_KC2_AA_D v1	NH4-N air dry	Ammonium nitrogen	7C2_NH4-N	10	2.000	mg/kg	Soil: Air dry sample| NO3-N NH4-N 2M KCl extrac	Air dry (48 hours at 40°C)	Soil: Air dry sample, NO3-N NH4-N 2M KCl extractable AA
S_KC2_AA_D v1	NO3-N air dry	Nitrate nitrogen	7C2_NO3-N	10	2.000	mg/kg	Soil: Air dry sample| NO3-N NH4-N 2M KCl extrac	Air dry (48 hours at 40°C)	Soil: Air dry sample, NO3-N NH4-N 2M KCl extractable AA
S_KJ_AA v3	TKN	Kjeldahl Nitrogen	7A2	10	0.013	%	Soil: Total N and P Kjeldahl digest AA	Air dry (48 hours at 40°C)	Soil: Total N and P Kjeldahl digest AA
S_KJ_AA v3	TKP	Kjeldahl Phosphorus	9A3a	10	0.013	%	Soil: Total N and P Kjeldahl digest AA	Air dry (48 hours at 40°C)	Soil: Total N and P Kjeldahl digest AA
* S_PBI v5	PBI col	Phosphorus buffer index (Colwell)	9I2	15	1.000		Soil: Phosphorus Single Point Buffer Index	Oven dry (48 hours at 40°C)	
* S_PBI v5	PBI unadj	Phosphorus buffer index (unadjusted)	9I4	15	1.000		Soil: Phosphorus Single Point Buffer Index	Oven dry (48 hours at 40°C)	
S_PSA v1	Clay	Clay: hydrometer <2 µm	2Z2_Clay	5	1.000	%	Soil: Particle size analysis	Oven dry (48 hours at 105°C)	
S_PSA v1	Coarse sand	Coarse sand: Sieve 0.2 – 2.0 mm	2Z2_CS	10	1.000	%	Soil: Particle size analysis	Oven dry (48 hours at 105°C)	
S_PSA v1	Fine sand	Fine sand: Sieve 0.02 – 0.2 mm	2Z2_FS	8	1.000	%	Soil: Particle size analysis	Oven dry (48 hours at 105°C)	
S_PSA v1	Silt	Silt: hydrometer 2 – 20 µm	2Z2_Silt	8	1.000	%	Soil: Particle size analysis	Oven dry (48 hours at 105°C)	

Analyses marked '*' are not NATA accredited

Analyses prefixed by 'X_' have been sub-contracted to an external laboratory listed in 'Method Description'.
The sub-contracted laboratory report will be sent as an attachment to this report.

The minimum Practic

Codes appearing in this report:

Key	Meaning
CO	Sample contaminated
DA	Sample damaged in transit
FL	Sample flocculated
IS	Insufficient sample
LS	Sample lost
NA	Not analysed
ND	Not detected
NR	Not received

Measurement of uncertainty is applicable between 10 times the PQL and 90% of the linear range

ATTACHMENT E: ENVIRONMENTAL OBJECTIVES, PERFORMANCE OUTCOMES AND LAND REHABILITATION

ENVIRONMENTAL OBJECTIVES AND PERFORMANCE OUTCOMES

Risk assessment – Environmental Protection Regulation Schedule 5, Part 3, Table 1.

Table A. Environmental objectives and performance outcomes.

Environmental objective	***Performance outcomes***	***Possible impacts and associated risks to environmental values***	***How the proposal meets the environmental objective and performance outcomes*** Include other EPP considerations where relevant (*Management hierarchy, environmental values, quality objectives, management intent)*
AIR			
EO1 The activity will be operated in a way that protects the environmental values of air.	**PO1.1** There is no discharge to air of contaminants that may cause an adverse effect on the environment from the operation of the activity. **PO1.2** All of the following— 1. Fugitive emissions of contaminants from storage, handling and processing of materials and transporting materials within the site are prevented or minimised; 2. Contingency measures will prevent or minimise adverse effects on the environment from unplanned emissions and shut down and start up emissions of contaminants to air; 3. Releases of contaminants to the atmosphere for dispersion will be managed to prevent or minimise adverse effects on environmental values.	Air quality has the potential to be degraded if noxious and/or offensive odours are permitted to emanate from the AD, associated infrastructure and/or irrigation area; with the potential to impact the environment and/or the neighbouring users (staff, customers, residents).	The AD plant will be contained on a concrete slab in shed, and individual tank and associated digestate storage components will be fully enclosed. As such, the AD and associated infrastructure is not expected to cause any nuisance odours to any nearby sensitive receptors dur to the strict control measures proposed by Kelfresh. The irrigation system will distribute digestate above ground via centre-pivot which will minimise spray drift, aerosols and odours. The irrigation area has been appropriately distanced from sensitive receptors to minimise health and environmental impacts. Composting of solid digestate will be conducted in a controlled manner to minimise impact to air quality and accordingly sensitive receptors. No nuisance odours are expected to leave the site boundary. <u>*Management*</u> • All systems, machinery and tools used on the system, will be fitted with appropriate emission reduction controls in accordance with the legal requirements. • Odorous systems and equipment will be removed from the site for repair/replacement. • Specific environmental monitoring for air quality (dust/odours/other contaminant emissions) will be conducted to ensure the operation of the AD does not generate nuisance odours or unauthorised emissions. <u>*Corrective action – if required*</u> • Cease any activities that cause an offensive odour and /or unauthorised emissions until levels have reduce. • A suitably qualified person will determine the source of the odour or the reason for the non-compliance and investigate the failure. • Undertake maintenance work if possible, in accordance with the manufacturer's maintenance guidelines or contact the service agent. • Ensure that the source of the odour is repaired or replaced. • Review the reason for the failure and the procedures to prevent re-occurrence. Further details can be provided following approval in an operational management plan (if required).
WATER			
EO2 The activity will be operated in a way that protects environmental values of waters.	**PO2.1** There is no actual or potential discharge to waters of contaminants that may cause an adverse effect on an environmental value from the operation of the activity. **PO2.2** All of the following— 1. The storage and handling of contaminants will include effective means of secondary containment to prevent or minimise releases to the environment from spillage or leaks; 2. Contingency measures will prevent or minimise adverse effects on the environment due to unplanned releases or discharges of contaminants to water; 3. The activity will be managed so that stormwater contaminated by the activity that may cause an adverse effect on an environmental value will not leave the site without prior treatment; 4. The disturbance of any acid sulfate soil, or potential acid sulfate soil, will be managed to prevent or minimise adverse effects on environmental values; 5. Acid producing rock will be managed to ensure that the production and release of acidic waste is prevented or minimised, including impacts during operation and after the environmental authority has been surrendered;	Surface water and groundwater could be impacted by digestate runoff or infiltration if the facility is not managed appropriately.	The irrigation and compost area are located a sufficient distance from dams and surface waters (refer Appendix C, Figure 4). In the unlikely event that runoff occurs, it will be captured in catch drains and directed to a dam for reuse in the AD. The irrigation area has been specifically designed using MEDLI to maximise evapotranspiration in order to prevent ponding and runoff of digestate to surface waters. <u>*Management*</u> • Regular monitoring of the AD, irrigation area and composing area will be undertaken to minimise the potential impact on water quality. • Water quality monitoring will be undertaken for the parameters outlined in the approved conditions (where applicable) set for the site where a risk is identified. • The AD and associated infrastructure, irrigation and compost areas will be maintained in accordance with design specifications. • No ponding or runoff of digestate or compost leachate on/from the irrigation and composting areas. • Flow meters to be installed on inflow point of the digestate irrigation storage/mixing tank to ensure that the design volume of digestate being irrigated is not exceeded. • Regular monitoring to be conducted to confirm that there is no ingress of uncontrolled stormwater into the AD system, digestate irrigation and compost areas. • Flow meters to be installed on the out flow point of the wet weather storage tank/dam. • When conditions prevent the irrigation of digestate to land (such as during or following rain events), the digestate will be stored in a wet weather storage tank. <u>*Corrective action – if required*</u> • Cease any activities that are impacting water quality. • A suitably qualified person will determine the source of the impact or the reason for the non-compliance and investigate the failure. • Provide additional temporary storage or pump out digestate if required, until system is repaired. • Undertake maintenance work in accordance with the manufacturer's maintenance guidelines or contact the service agent. • Review the reason for the failure and the procedures to prevent re-occurrence. • Commission an Environmental Consultant to assess any requirement for remediation.

	6. Any discharge to water or a watercourse or wetland will be managed so that there will be no adverse effects due to the altering of existing flow regimes for water or a watercourse or wetland; 7. For a petroleum activity, the activity will be managed in a way that is consistent with the coal seam gas water management policy, including the prioritisation hierarchy for managing and using coal seam gas water and the prioritisation hierarchy for managing saline waste; 8. The activity will be managed so that adverse effects on environmental values are prevented or minimised.		
WETLANDS			
EO3 The activity will be operated in a way that protects the environmental values of wetlands.	**PO3.1** There will be no potential or actual adverse effect on a wetland as part of carrying out the activity. **PO3.2** The activity will be managed in a way that prevents or minimises adverse effects on wetlands.	Nearby wetlands could be impacted by digestate runoff or infiltration if the facility is not managed appropriately.	MEDLI modelling has predicted the hydraulic loading which the irrigation area is able to sustainably receive which should mitigate risk to the closest wetland. However, the activity will be maintained with reference to the below management strategies and corrective actions taken if any non-compliances occur. *Management* • All components of the AD and irrigation system must be maintained in accordance with manufacturer's specification • If ponding and/or runoff of digestate is observed throughout the life of the irrigation system, digestate irrigation must cease until such time as ponding and/or runoff is appropriately managed. DES must be notified if runoff offsite occurs *Corrective action – if required* • Cease any activities in the event that digestate runoff migrates beyond the approved areas. • A suitably qualified person will determine the reason for the runoff and provide recommendations to avoid any re-occurrence. • Undertake corrective/maintenance/remedial work, in accordance with the manufacturer's maintenance guidelines or contact the service agent to rectify the situation. • Reduce the daily irrigation rate where ponding or runoff occurs. Further details can be provided following approval in an operational management plan (if required).
GROUNDWATER			
EO4 The activity will be operated in a way that protects the environmental values of groundwater and any associated surface ecological systems.	**PO4.1** Both of the following apply— 1. There will be no direct or indirect release of contaminants to groundwater from the operation of the activity; 2. There will be no actual or potential adverse effect on groundwater from the operation of the activity. **PO4.2** The activity will be managed to prevent or minimise adverse effects on groundwater or any associated surface ecological systems.	The activity may have the potential to contact nearby groundwater receptors (i.e. particularly if the site is within an unconfined aquifer) if not managed appropriately.	The risk of groundwater impacts caused by the irrigation is low given that the proposed application rate is less than 69 mm/year and given the regional aquifer is predominantly sub-artesian. The same risk applies to the application of the solid digestate fraction which will be applied to land at a rate that does not exceed the nutrient assimilation capacity of the specific crop. *Management* • Regular monitoring of the AD and digestate application areas will be undertaken to minimise the potential impact on water quality. • No ponding or runoff of digestate on/from the irrigation and other storage/processing areas. • Flow meters to be installed on inflow and out flow points of the AD to ensure that the design volume of digestate being irrigated is not exceeded and that infiltration of groundwater and stormwater is detected and minimised. Groundwater monitoring wells can be installed as a condition of approval if considered to be required by DES. Any wells would be installed to target perched aquifers that may exist along the down gradient irrigation boundary, low-lying areas.
NOISE			
EO5 The activity will be operated in a way that protects the environmental values of the acoustic environment.	**PO5.1** Sound from the activity is not audible at a sensitive receptor. **PO5.2** The release of sound to the environment from the activity is managed so that adverse effects on environmental values including health and wellbeing and sensitive ecosystems are prevented or minimised.	AD can cause excessive noise if they are not correctly designed, operated and maintained.	The AD will not cause a noise to any nearby sensitive receptors, e.g. staff, contractors, adjacent properties, flora or fauna. The AD is to be fully enclosed (if practical) to avoid any excessive noise emanating from the facility. *Management* • All systems and machinery will be efficient, operated appropriately, and maintained in good order. • All systems, machinery and equipment used are to be fitted with appropriate noise reduction controls in accordance with the EA conditions. • Non-conforming systems and equipment are to be removed from the site for repair/replacement. • All noise related complaints will be recorded in a complaints register. If complaints are received regarding noise, the site manager will take all reasonable actions to prevent further complaints. Monitoring may be required based on the degree of complaints and/or council/DES concerns. • Where noise monitoring is required at the operational phase, the monitoring program will be undertaken in accordance with AS1055, AS2991.2 and the latest edition of DES's Noise Management Manual (EPA, 2000). *Corrective action – if required* • Cease any activities that cause excessive or nuisance noise levels. • A suitably qualified person will determine the source of the noise or the reason for the non-compliance, and investigate the failure. • Undertake maintenance work if possible, in accordance with the manufacturer's maintenance guidelines or contact the service agent.

			• Have the source of the noise repaired or replaced. • Review the reason for the failure and the procedures to prevent re-occurrence. • Review the speed limit of the access roads and consult access road users.
WASTE			
EO6 Any waste generated, transported, or received as part of carrying out the activity is managed in a way that protects all environmental values.	**PO6.1** Both of the following apply— 1. Waste generated, transported or received is managed in accordance with the waste and resource management hierarchy in the *Waste Reduction and Recycling Act 2011*; 2. If waste is disposed of, it is disposed of in a way that prevents or minimises adverse effects on environmental values.	The potential sources of waste may include: • Unwatered inorganic constituents in the feedstock and digestate that cannot be converted to energy • Unwanted anthropogenic continents in feedstock and digestate • Other processing wastes and general maintenance related waste materials	Waste generated from the operation of the AD will not cause impact to human health or the surrounding environment. <u>*Management*</u> • Waste materials will be fully separated and contained to prevent any environmental releases and removed to landfill or liquid waste facility as relevant. • Generated leachate will be collected and transferred to the AD for reprocessing. • Waste material is not to be disposed of by burning or burying onsite. • All wastes temporarily stored onsite will be confined to dedicated areas and managed to prevent the occurrence of environmental harm or nuisance. • Where storage of oils and other hazardous liquids is required, the liquids are to be shelved in catch trays within a bunded area. Any spillages are to be cleaned up as soon as possible and disposed of offsite at an approved facility. • A dedicated feedstock receiving facility will be the likely place where raw waste materials not suitable for anerobic digestion are generated, although tight quality controls should minimise the volume of unsuitable material brought to the site. • A spill clean-up kit/bin/hopper will be located within the storage areas. • A licensed contractor as required will undertake removal of sludge from the AD. <u>*Corrective action – if required*</u> • Should a spillage occur, the spillage will be cleaned up immediately in an appropriate manner. • All materials transported to and from the site will be suitably contained to prevent the occurrence of environmental harm or nuisance
LAND			
EO7 The activity is operated in a way that protects the environmental values of land including soils, subsoils, landforms, and associated flora and fauna.	**PO7.1** There is no actual of potential disturbance or adverse effect to the environmental values of land as part of carrying out the activity. **PO7.2** All of the following— 1. Activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the environmental values of land; 2. Areas disturbed will be rehabilitated or restored to achieve sites that are— a) safe to humans and wildlife; b) non-polluting; and c) stable; and d) able to sustain an appropriate land use after rehabilitation or restoration; 3. The activity will be managed to prevent or minimise adverse effects on the environmental values of land due to unplanned releases or discharges, including spills and leaks of contaminants; 4. The application of water or waste to the land is sustainable and is managed to prevent or minimise adverse effects on the composition or structure of soil and subsoils.	Land contamination could occur as a result of the following: • Feedstock or digestate overflowing from the storage facilities • Substandard digestate being discharged to the irrigation area • Over application of digestate on the land • Sludge spillages during desludging • Offsite migration of contaminants to adjacent properties and waterways.	Land contamination as a result of the application of digestate will be prevented by controlling the quality of digestate, compliance with the design application rates, and ongoing monitoring of digestate quality and routine inspections of the irrigation and storage areas. A site based management plan and/or contaminant release area monitoring program (or similar) may be conditioned by the administering authority as part of the EA approval. <u>Management</u> • Contaminants from the activity must not be released to land except as authorised in the Environmental Authority. • Digestate is permitted to be released to land provided that the activity is conducted in accordance with the EA conditions and that ensures: a) infiltration to groundwater and subsurface flows of contaminants to surface waters are minimised (water course flowing though digestate irrigation area will be dammed and the water fed back into the AD or re-irrigated across the designated area b) surface ponding and run-off of digestate is prevented c) degradation of soil structure is minimised d) soil sodicity and the build-up of nutrients and heavy metals in the soil and subsoil are minimised e) digestate disposal areas are maintained with an appropriate crop in a viable state for transpiration and nutrient uptake f) the irrigated crop is regularly harvested and removed from the area for livestock fodder. • When weather conditions or soil conditions preclude the release of digestate to land, irrigation must not occur. • A designated digestate irrigation area of 18 hectares has been provided for the design application volume of 9 kL/day • Digestate release limits to comply with those specified in the Environmental Authority. • Digestate applied to land will comply with the conditions of the Environmental Authority. • The digestate irrigation system to be maintained in accordance with manufacturers specifications. • Flow meters to be installed at irrigation tank outlets to ensure that the proposed volume of digestate being irrigated is not exceeded. • In the unlikely event that the wet weather storage capacity is exceeded, digestate will be diverted to the AD for re-processing. • All chemicals to be stored in appropriately bunded areas. A soil monitoring program will be developed as a condition of approval as required by DES. <u>*Corrective action – if required*</u> • Cease any activities that cause possible land contamination. • A suitably qualified person will determine the source of the land contamination or the reason for the non-compliance and investigate the failure.

			• Provide additional temporary storage or pump out of sewage if required, until system is repaired. • Undertake maintenance work if possible, in accordance with the manufacturer's maintenance guidelines or contact the service agent. • Review the reason for the failure and the procedures to prevent re-occurrence. • Commission a suitably qualified Environmental Consultant to assess any requirement for remediation. • All chemical/fuel spills to be contained within an appropriate system.

LAND REHABILITATION

Land rehabilitation strategy for Kalfresh

A rehabilitation strategy for cessation of the proposed ERA 53(b) is presented in Table B.

Table B. Land rehabilitation strategies.

Aspect	Strategy	
Site details	6200 – 6206 Cunningham Highway, Kalbar, Queensland.	
Current site use	The site is currently used for cropping and cattle grazing.	
Proposed site use	Agricultural Industrial Precinct	
Description of ERA activity	ERA 53(b) - organic material processing - operating a facility for processing more than 200t of organic material in a year by anaerobic digestion. Land application of liquid and solid digestate for fertiliser and soil conditioner.	
Site use following ERA activity ceases	The proposed activity does not have an anticipated 'end date' so accordingly it will remain being used and an agricultural/industrial precinct.	
Rehabilitation goal	To make the site suitable for agricultural land use at the cessation of the ERA. In addition, the site will be made: - Safe to humans, livestock, cropping, wildlife - Non-polluting - Stable - Able to sustain an agreed post ERA land use.	
Contaminants of concern associated with the proposed ERA	Nutrients (nitrogen and phosphorus accumulation) Salt (salt accumulation) Pathogens. Other potential contaminants to be restricted from coming onto the site.	
Potential environmental receptors/impacts	**Land / soil:** - Degradation in the physical and chemical properties of soil.	**Surface waters:** - Contaminants reaching surface waters (including all matters of state environmental significance) - Overland runoff causing flooding of waterways and sediment deposits - Eutrophication of waterways (algal blooms, reduction in dissolved oxygen and fish kills).
	Health impacts: - Impacts to human health via inhalation, ingestion or dermal contact with contaminants (i.e. pathogens and air emissions).	**Digestate:** - Accidental release of digestate in areas not approved for release.
	Groundwater: - Contaminants reaching groundwaters and impacting nearby groundwater users.	**Waste:** - Accidental release of waste otherwise designated for landfill (i.e. inorganic contaminants).

Aspect	Strategy
Actions to mitigate potential environmental impacts	Conduct the ERA 53(b) in accordance with the conditions specified in the Environmental Authority including ongoing monitoring of feedstock, and digestate (solid and liquid fractions), and noise and air emissions.
Remediation steps to be supervised by suitably qualified persons	- Remove any solid waste to licenced landfill and any liquid waste to a licenced liquid waste facility. - Remove and appropriately dispose/recycle the AG infrastructure. - Conduct representative sampling of soil in the irrigation area and adjacent to the AG infrastructure and analysis of the samples for parameters including nitrogen, phosphorus, salt/electrical conductivity, pH, pathogens (e.g. *E. coli*), anions, cations and permeability, heavy metals. - Conduct representative sampling and analysis of groundwater for potential contaminants of concern. - The number, location and depth of soil samples will be determined by a suitably qualified scientist with reference to current Queensland Government made and/or approved guidelines. - Relevant land use criteria to be derived from current Queensland Government made and/or approved guidelines - In the unlikely circumstance that contamination is identified, remediate soil as required under the guidance of a suitably qualified scientist. This may include removal of soil to landfill and replacement with clean soil or onsite remediation of soil using a variety of techniques (e.g. addition of gypsum for stabilisation, ploughing, addition of organic material, lime addition for pathogen reduction). - Infill any depressions with clean soil or other engineered material and compact to site specific engineer density - Conduct representative sampling of any waters if present (surface and or groundwater) within the bounds of the site (for parameters including nitrogen, phosphorus, biochemical oxygen demand, electrical conductivity, pH, pathogens (e.g. *E. coli*), anions, cations, turbidity, and suspended solids, free and residual chlorine. - The number and location of samples will be determined by a suitably qualified scientist with reference to current Queensland Government made and/or approved guidelines - Remediate waters as required under the guidance of a suitably qualified scientist. Guidance considered in conducting the above scope (unless superseded) will include: - Australian Standard: *Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds* - (AS 4482.1-2005) - Australian Standard: *Guide to sampling and investigation of potentially contaminated soil, Part 2: Volatile substances* - (AS 4482.2 1999) - *National Environmental Protection (Assessment of Site Contamination) Measure 1999* (NEPC 2013). - *Environmental Protection Regulation 2019.*

ATTACHMENT F: MEDLI OUTPUT

MEDLI REPORT - FULL RUN

Enterprise: **Kalbar**

Description:
Rural Enterprise Precinct

Client: **Kalfresh Pty Ltd**

MEDLI User: PRECISE-LAP02\Main

Scenario Details:
Digestor Model
TN - 148 mg/L
TP - 13.6 mg/L
Total volume - 2000 kL
Area - 160 ha

DESCRIPTION

Climate Data: Kalbar, -27.95°, 152.62°

Run Period: 01/01/1889 to 31/12/2018 130 years, 0 days

Climate Statistics:

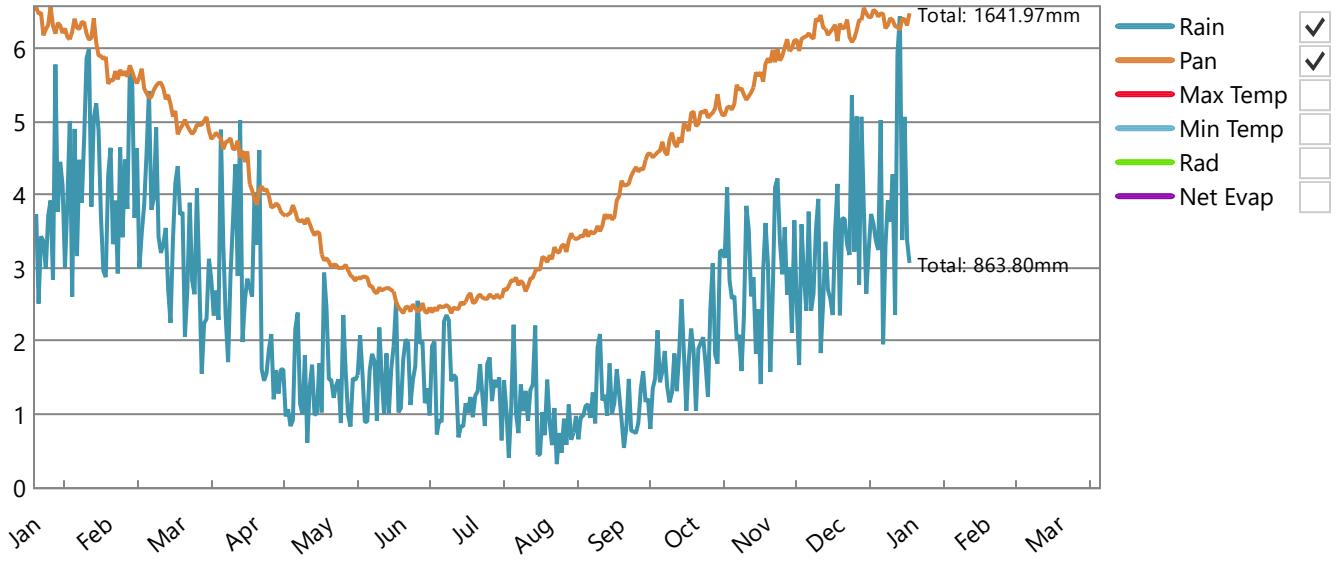
	5th Percentile	50th Percentile	95th Percentile
Rainfall (mm/year)	503	867	1219
Pan Evaporation (mm/year)	1483	1633	1804

Climate Data:

Chart Table

Monthly Daily

Daily Average Across Run Period

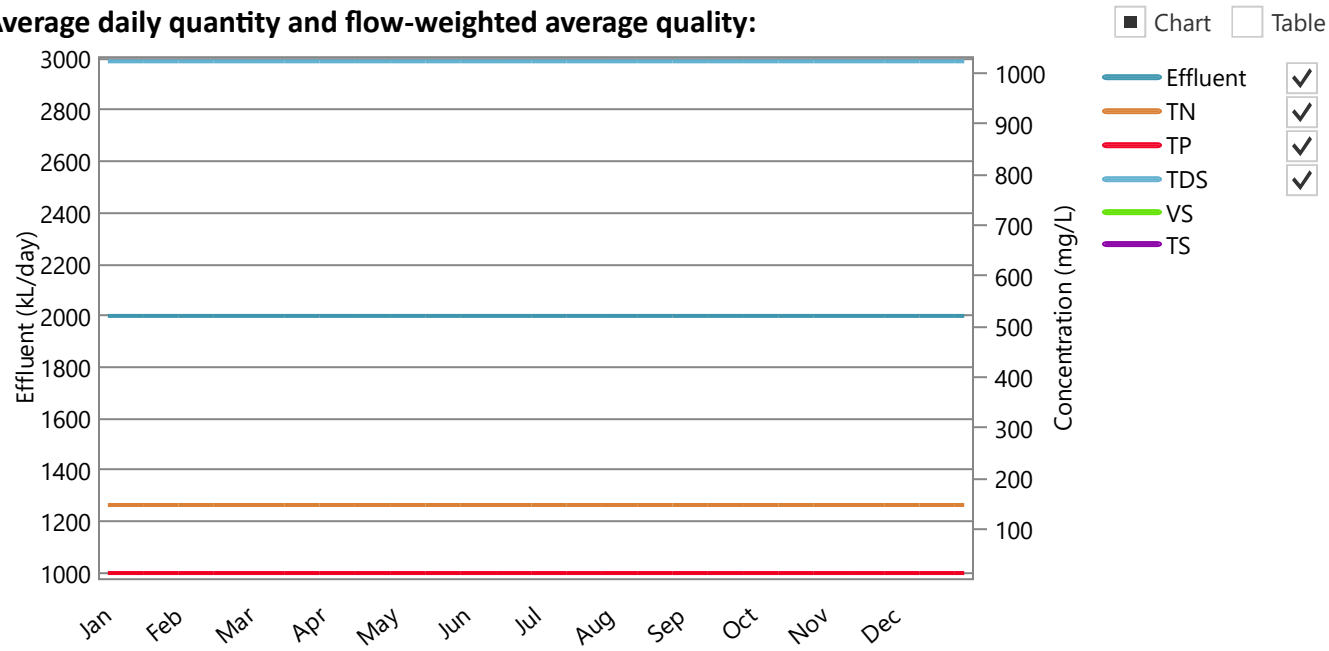


DESCRIPTION

Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: 730476.92 kL/year or 2000.00 kL/day (Min-Max: 2000.00 - 2000.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

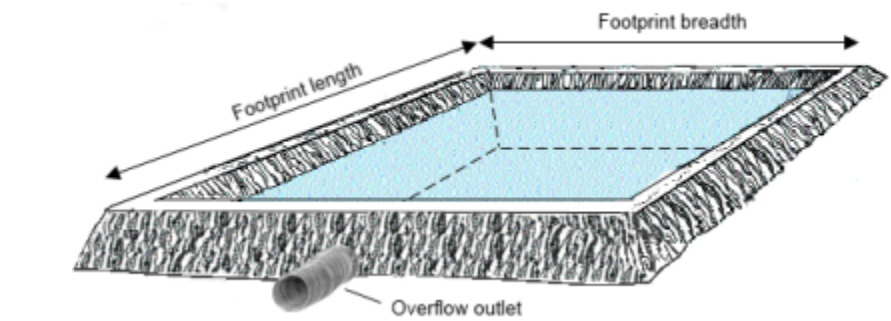
	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	148.00 (148.00 - 148.00)	108110.58 (108040.00 - 108336.00)
Total Phosphorus	13.60 (13.60 - 13.60)	9934.49 (9928.00 - 9955.20)
Total Dissolved Salts	1024.00 (1024.00 - 1024.00)	748008.37 (747520.00 - 749568.00)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

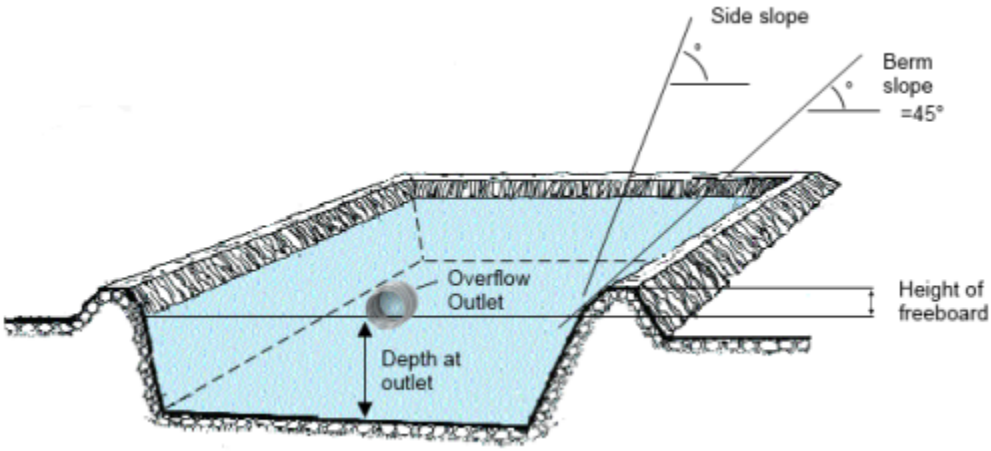
DESCRIPTION

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	10000.00
Minimum allowable pond volume (kL)	0.00
Pond depth at overflow outlet (m)	2.00
Maximum water surface area (m2)	5000.00
Pond footprint length (m)	70.71
Pond footprint width (m)	70.71
Pond catchment area (m2)	5000.00
Average active volume (kL)	0.00





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	3.00

Shandying water:

Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (uS/cm)	0.00
Minimum shandy water is used	False

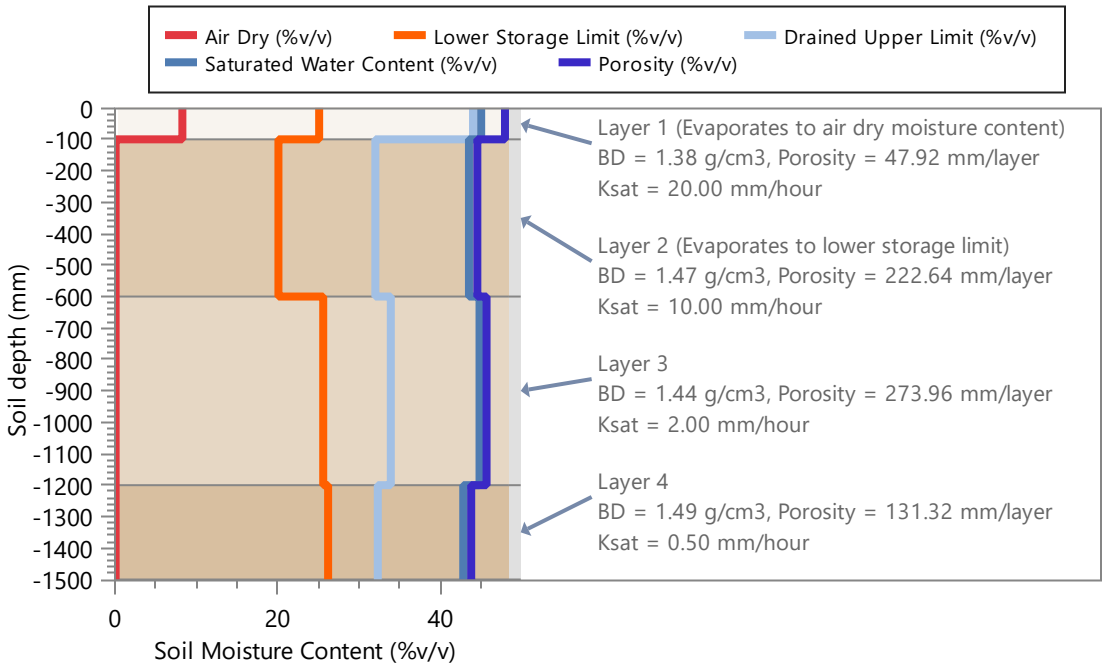
DESCRIPTION

Land: New Paddock

Area (ha): 160.00

Soil Type: Kalbar Low Permeability Red Brow, 1500.00 mm defined profile depth

Profile Porosity (mm)	675.85
Profile saturation water content (mm)	659.70
Profile drained upper limit (or field capacity) (mm)	504.30
Profile lower storage limit (or permanent wilting point) (mm)	357.80
Profile available water capacity (mm)	146.50
Profile limiting saturated hydraulic conductivity (mm/hour)	0.50
Surface saturated hydraulic conductivity (mm/hour)	20.00
Runoff curve number II (coefficient)	75.00
Soil evaporation U (mm)	10.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Lucerne (Winter Active) Pasture

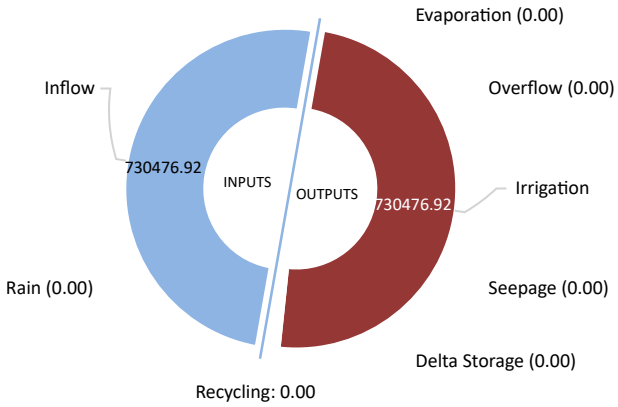
Average monthly cover (fraction) (minimum - maximum)	0.65 (0.58 - 0.70)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.9 x Pan coefficient 1)	0.90
Total plant cover (both green and dead) left after harvest (fraction)	0.75
Maximum potential root depth in defined soil profile (mm)	1500.00
Salt tolerance	Moderately sensitive
Salinity threshold EC sat. ext. (uS/cm)	1500.00
Proportion of yield decrease per dS/m increase (fraction/uS/cm)	0.00

PERFORMANCE

Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: **10000 kL**

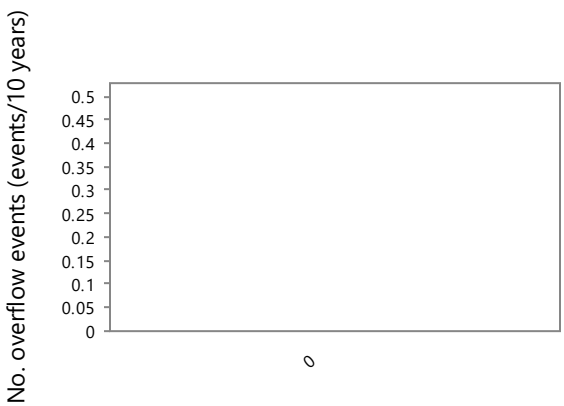
Pond System Water Balance (kL/year)



Name	Value
Rain	0.00
Inflow	730476.92
Recycling	0.00
Evaporation	0.00
Overflow	0.00
Irrigation	730476.92
Seepage	0.00
Delta Storage	0.00

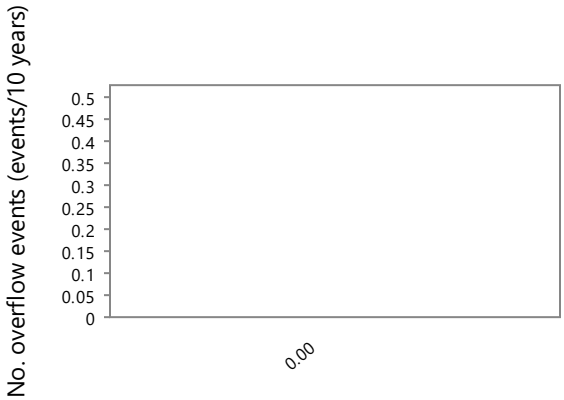
Overflow Diagnostics

Volume of overflow (kL/year)	0.00
No. days pond overflows (days/year)	0.00
Average duration of overflow (days)	0.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	1.00
Probability of at least 90% reuse (fraction)	1.00



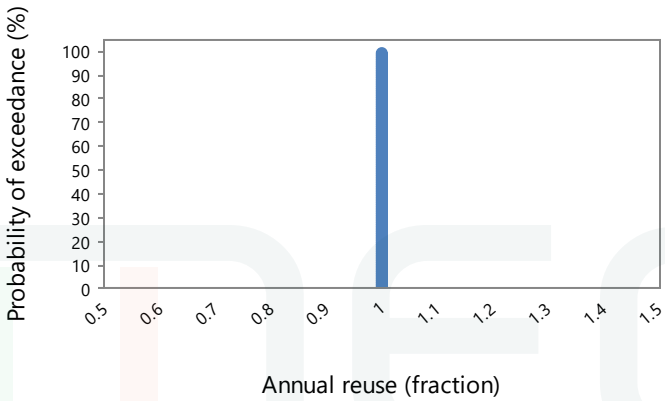
Overflow event duration exceeded (days)

Export plot



Overflow volume exceeded (kL)

Export plot



Annual reuse (fraction)

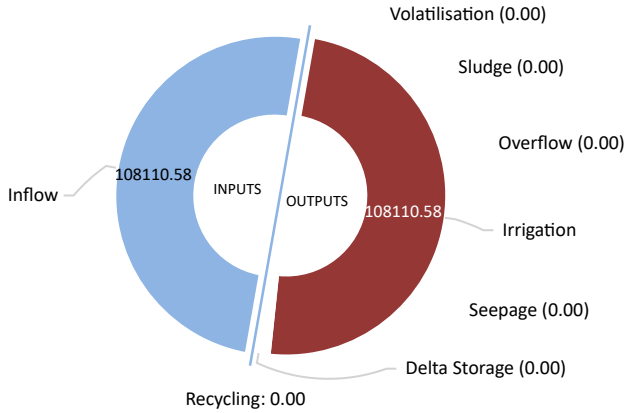
Export plot

PERFORMANCE

Pond System Performance - Nutrient: 1 closed storage tank

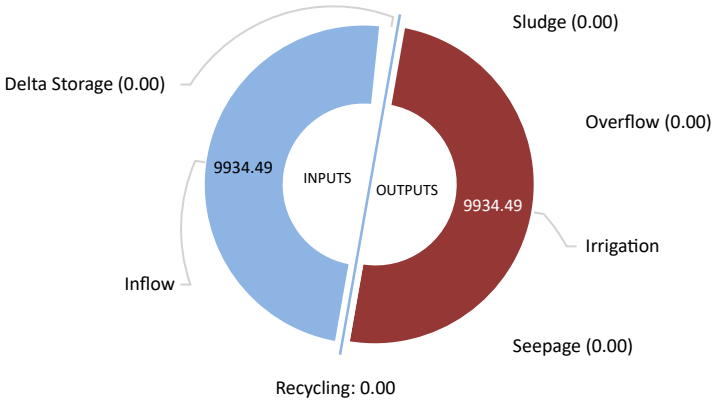
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



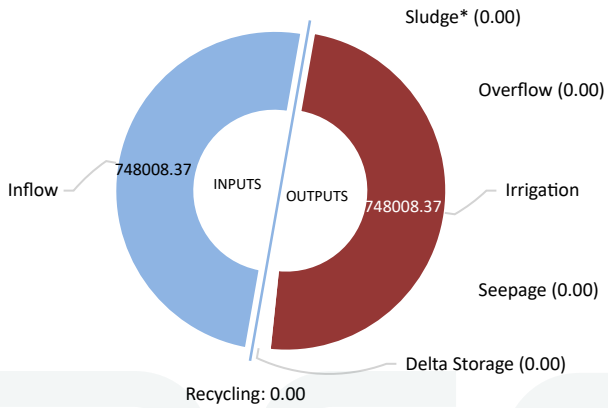
Name	Value
Inflow	108110.58
Recycling	0.00
Volatilisation	0.00
Sludge	0.00
Overflow	0.00
Irrigation	108110.58
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	9934.49
Recycling	0.00
Sludge	0.00
Overflow	0.00
Irrigation	9934.49
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	748008.37
Recycling	0.00
Sludge*	0.00
Overflow	0.00
Irrigation	748008.37
Seepage	0.00
Delta Storage	0.00

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

PERFORMANCE

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	148.00
Average phosphorus concentration of pond liquid (mg/L)	13.60
Average salinity of pond liquid (uS/cm)	1600.00

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	N.D.*
Final phosphorus concentration of pond liquid (mg/L)	N.D.*
Final salinity of pond liquid (uS/cm)	N.D.*

* Not determined. Pond is empty.

PERFORMANCE

Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	730476.92
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	730476.92
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	148.00
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	148.00
Average phosphorus concentration of irrigation water (mg/L)	13.60
Average salinity of irrigation water (uS/cm)	1600.00

Irrigation Diagnostics:

Proportion of Days irrigation occurs (fraction)	1.00

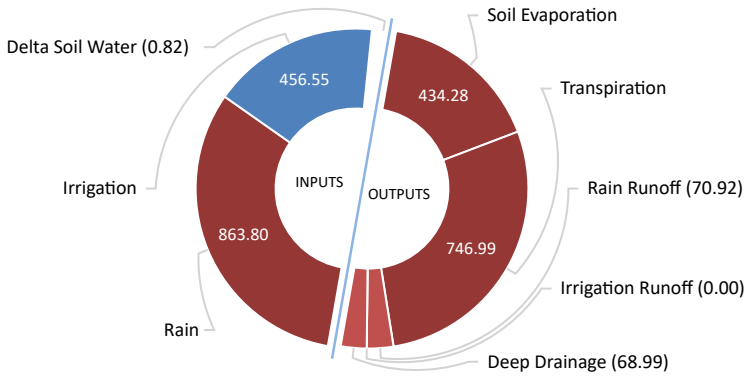
PERFORMANCE

Land Performance - Soil Water

Paddock: New Paddock, 160 ha
Soil Type: Kalbar Low Permeability Red Brow, 146.50 mm PAWC at maximum root depth

Land Water Balance (mm/year):

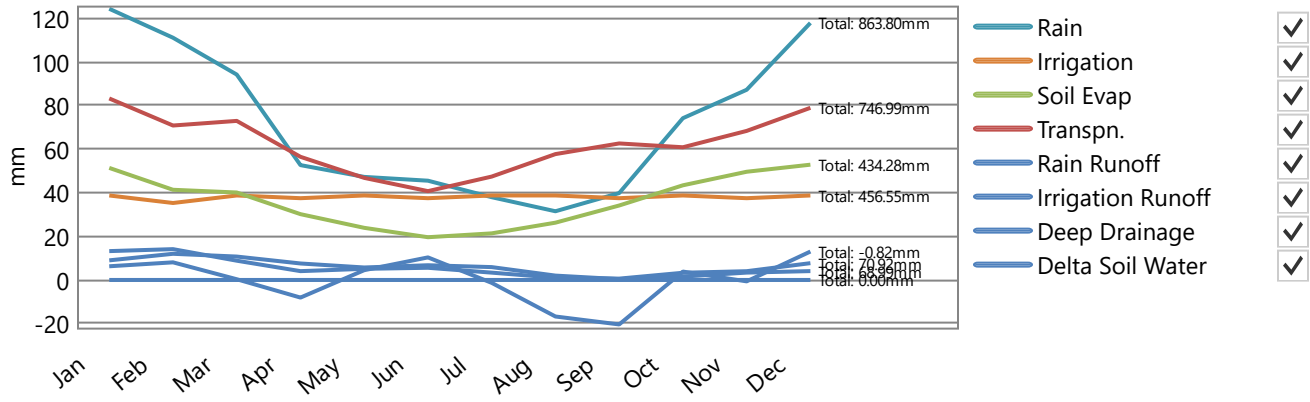
mm/year % Total inputs



Name	Value
Rain	863.80
Irrigation	456.55
Soil Evaporation	434.28
Transpiration	746.99
Rain Runoff	70.92
Irrigation Runoff	0.00
Deep Drainage	68.99
Delta Soil Water	-0.82

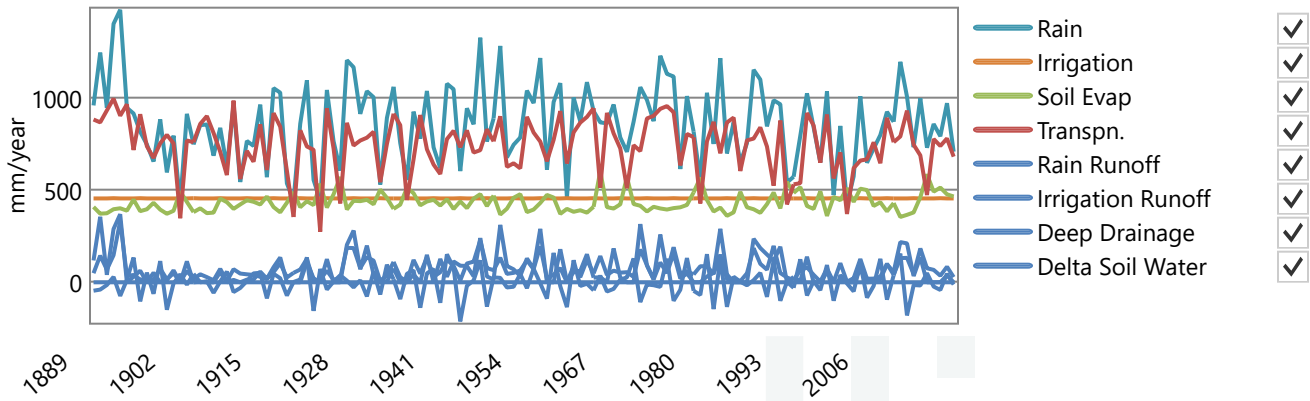
Average Monthly Totals (mm):

Chart Table



Average Annual Totals (mm/year):

Chart Table



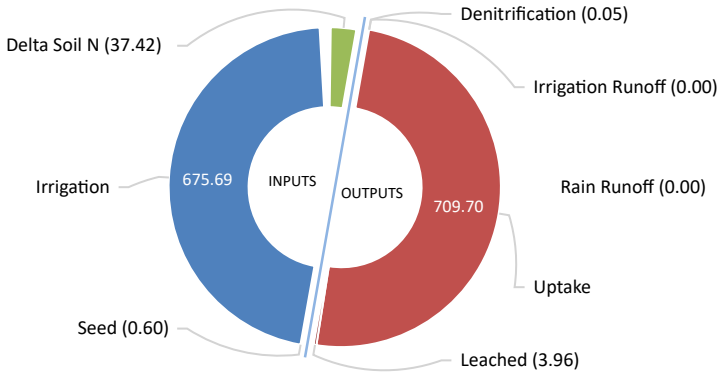
PERFORMANCE

Land Performance - Soil Nutrient

Paddock: New Paddock, 160 ha **Soil Type**: Kalbar Low Permeability Red Brow

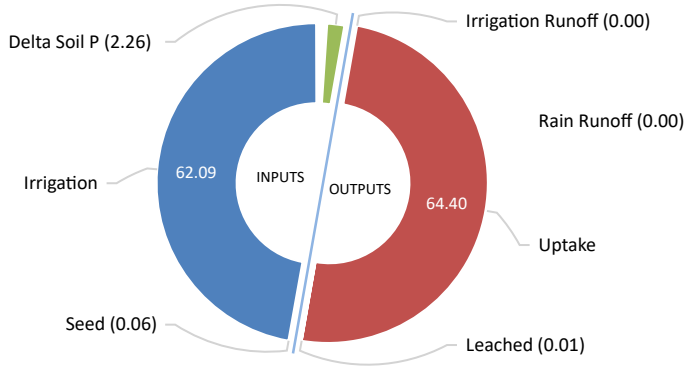
Irrigation ammonium volatilisation losses (kg/ha/year): 0.00
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.00

Land Nitrogen Balance (kg/ha/year)



Name	Value
Seed	0.60
Irrigation	675.69
Denitrification	0.05
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	709.70
Leached	3.96
Delta Soil N	-37.42

Land Phosphorus Balance (kg/ha/year)



Name	Value
Seed	0.06
Irrigation	62.09
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	64.40
Leached	0.01
Delta Soil P	-2.26

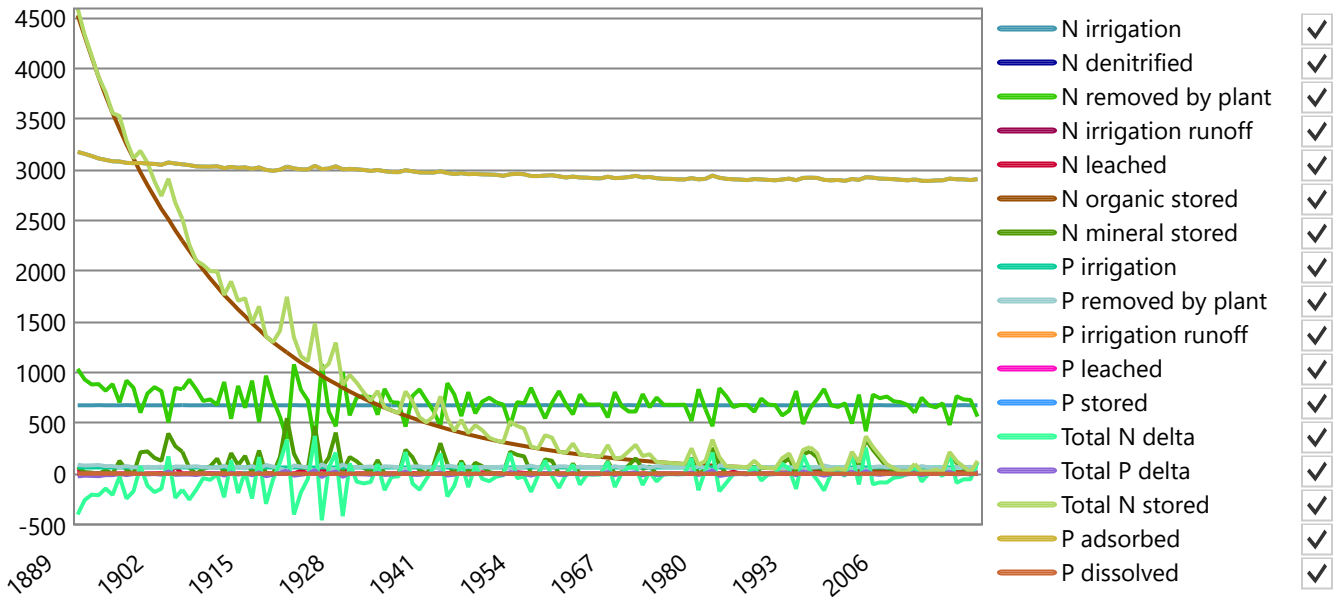
PERFORMANCE

Land Performance - Soil Nutrient

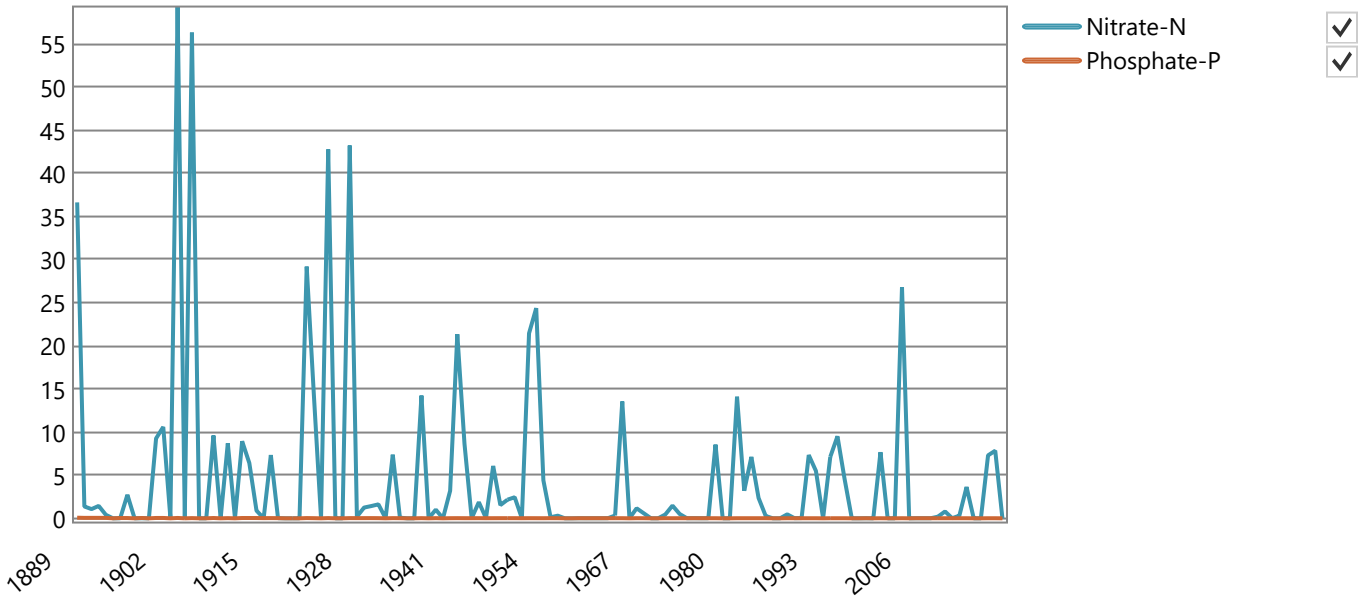
Paddock: New Paddock, 160 ha

Soil Type: Kalbar Low Permeability Red Brow

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE

Plant Performance and Nutrients

Paddock: New Paddock, 160 ha

Soil Type: Kalbar Low Permeability Red Brow

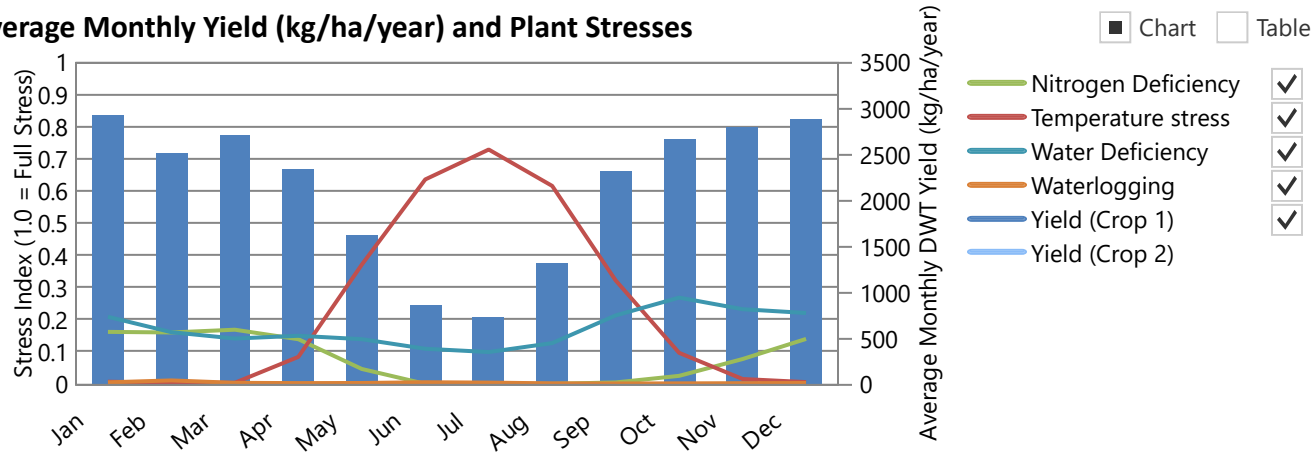
Plant: Continuous Lucerne (Winter Active) Pasture

Average annual shoot dry matter yield (kg/ha/year)	25695.23 (9560.29 - 34948.72)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.65 (0.58 - 0.70)
Average monthly root depth (mm) (minimum - maximum)	1395.84 (1265.14 - 1487.34)

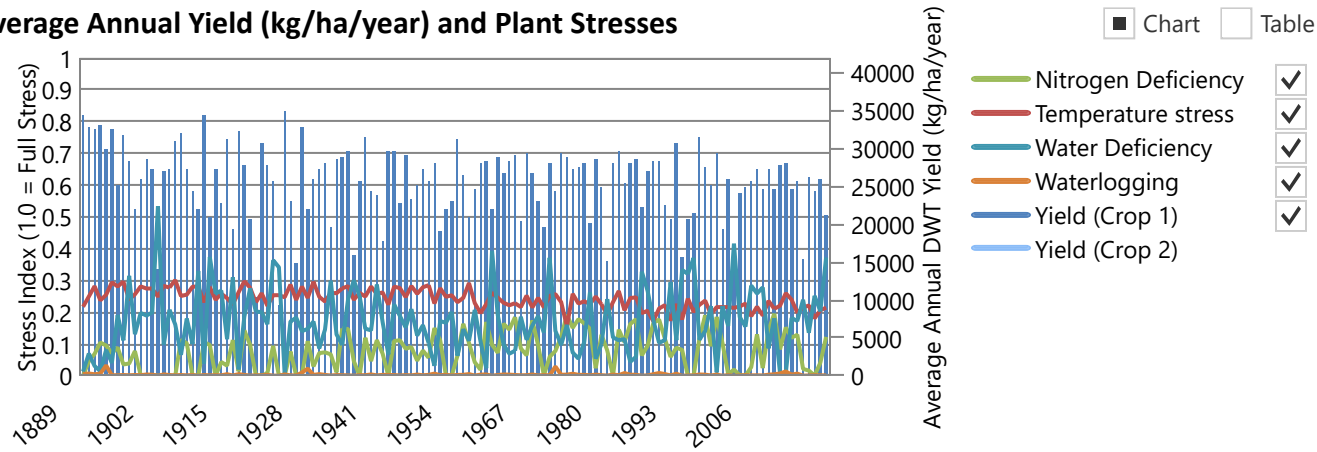
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	709.70 (304.57 - 1081.90)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	64.40 (26.96 - 94.01)
Average annual shoot nitrogen concentration (fraction dwt)	0.03 (0.02 - 0.04)
Average annual shoot phosphorus concentration (fraction dwt)	0.003 (0.002 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 13.48 (normal), 0.65 (forced by crop death due to water stress (0.65))
No. days without crop/year (days/year): 9.32 due to water stress (9.32)

PERFORMANCE

Land Performance

Paddock: New Paddock, 160 ha **Soil Type**: Kalbar Low Permeability Red Brow

Plant: Continuous Lucerne (Winter Active) Pasture

Salt tolerance	Moderately sensitive
Salinity threshold EC sat. ext. (uS/cm)	1500.00
Proportion of yield decrease per dS/m increase (fraction/uS/cm)	0.00
No. years assumed for leaching to reach steady-state (years)	10.00

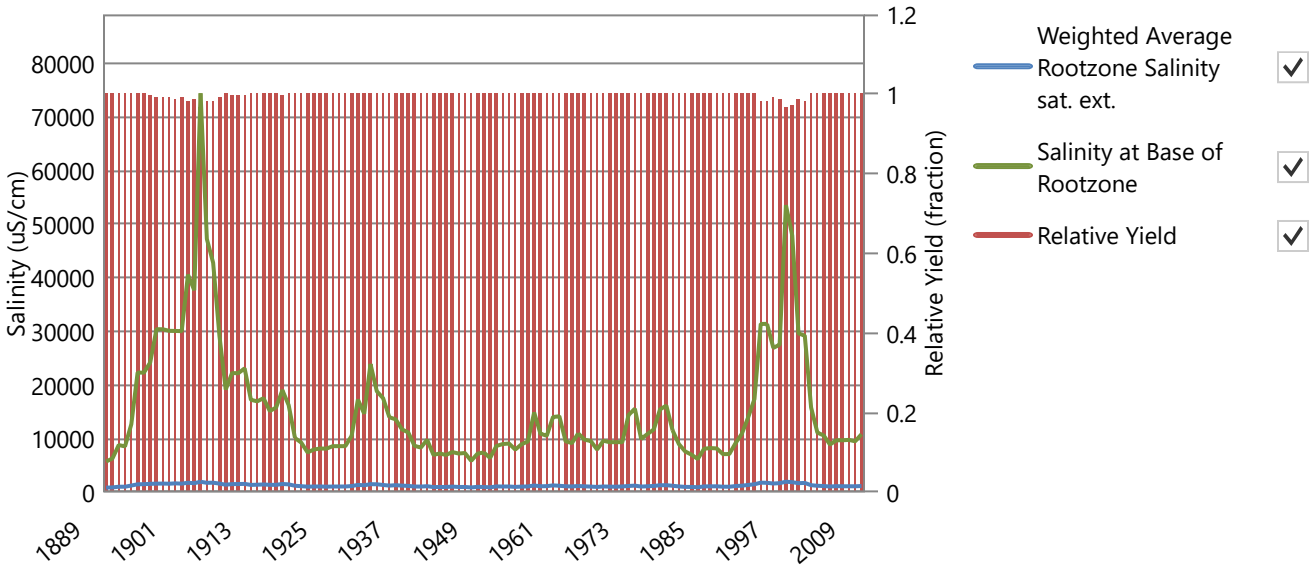
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (uS/cm)	608.09
Salt added by rainfall (kg/ha/year)	152.23
Average annual effluent salt added & leached at steady state (kg/ha/year)	4827.29
Average leaching fraction based on 10 year running averages (fraction)	0.23
Average water-uptake-weighted rootzone salinity sat. ext. (uS/cm)	1261.72
Salinity of the soil solution (at drained upper limit) at base of rootzone (uS/cm)	15509.81
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

Chart Table

All values based on 10 year running averages



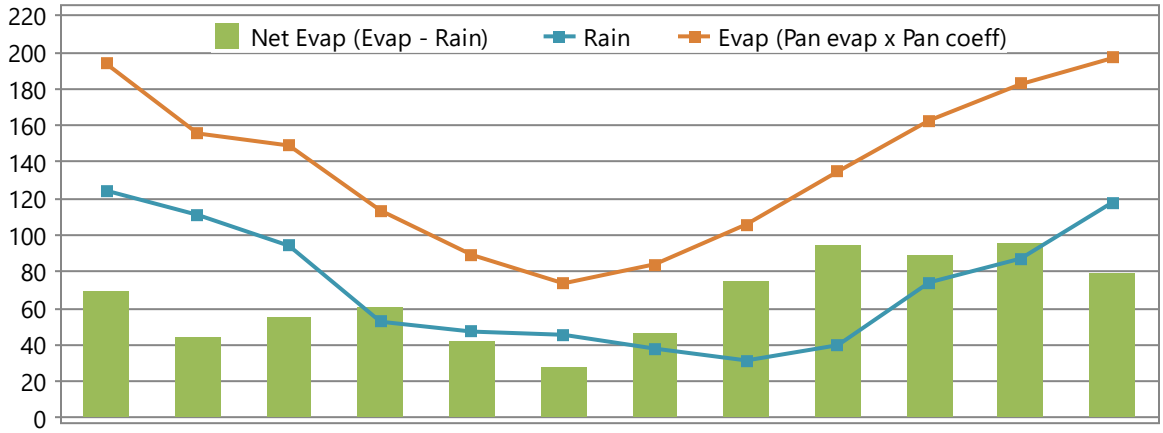
DIAGNOSTICS

Sustainability Diagnostics: Kalbar

Averaged Historical Climate Data Used in Simulation (mm)

Location: Kalbar, -27.95°, 152.62°

Run Period: 01/01/1889 to 31/12/2018 130 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	124.4	111.1	94.2	52.7	47.3	45.5	38.0	31.5	39.8	74.2	87.2	117.9	863.8
Evap	193.8	155.6	149.0	113.5	89.2	73.7	84.1	105.9	134.8	162.8	182.6	196.8	1642.0
Net Evap	69.4	44.5	54.8	60.8	41.9	28.1	46.2	74.4	95.0	88.6	95.4	78.9	778.2
Net Evap/day	2.2	1.6	1.8	2.0	1.4	0.9	1.5	2.4	3.2	2.9	3.2	2.5	2.1

DIAGNOSTICS

Sustainability Diagnostics: Kalbar

Pond System: 1 closed storage tank

New Generic System - 730476.92 kL/year or 2000.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	148.00 (148.00 - 148.00)	108110.58 (108040.00 - 108336.00)
Total Phosphorus	13.60 (13.60 - 13.60)	9934.49 (9928.00 - 9955.20)
Total Dissolved Salts	1024.00 (1024.00 - 1024.00)	748008.37 (747520.00 - 749568.00)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

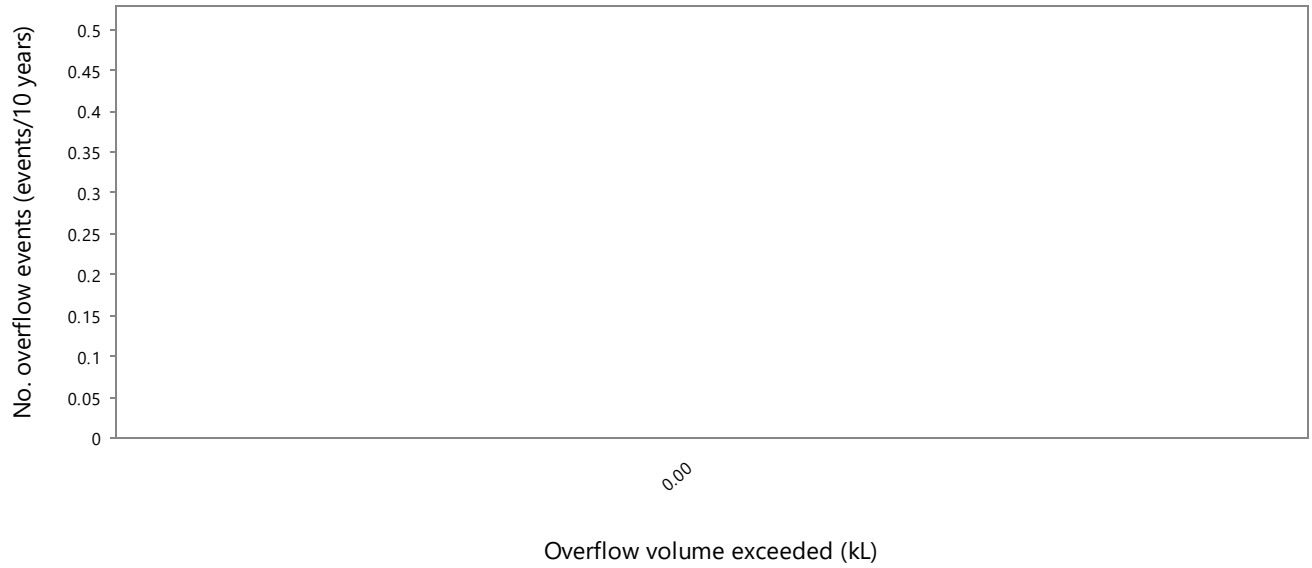
Last pond (Wet weather store): 10000.00 kL

Theoretical hydraulic retention time (days)	5.00
Average volume of overflow (kL/year)	0.00
No. overflow events per year exceeding threshold* of 5.00 kL (no./year)	0.00
Average duration of overflow (days)	0.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	1.00
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (uS/cm)	1600.00
Salinity of last pond on final day of simulation (uS/cm)	1600.00
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kalbar

Irrigation Information

Irrigation: 160 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	730476.92	4565.48
Total nitrogen applied (kg)	108110.58	675.69
Total phosphorus applied (kg)	9934.49	62.09
Total salts applied (kg)	748008.37	4675.05

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation occurs (fraction)	1.00

DIAGNOSTICS

Sustainability Diagnostics: Kalbar

Paddock Land: New Paddock: 160 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered every 1 days
Irrigate a fixed amount of 10.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Kalbar Low Permeability Red Brow, 146.50 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	124.4	111.1	94.2	52.7	47.3	45.5	38.0	31.5	39.8	74.2	87.2	117.9	863.8
Irrigation	38.8	35.3	38.8	37.5	38.8	37.5	38.8	38.8	37.5	38.8	37.5	38.8	456.5
Soil Evap	51.4	41.4	40.1	30.2	23.9	19.6	21.4	26.3	34.1	43.4	49.6	52.9	434.3
Transpn.	83.2	70.8	73.0	56.5	46.8	40.7	47.4	57.7	62.6	60.9	68.4	79.0	747.0
Rain Runoff	13.2	14.1	8.8	4.0	5.1	5.6	3.4	1.0	0.6	3.3	4.0	7.7	70.9
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	9.0	12.0	10.7	7.6	5.7	6.8	5.9	2.0	0.4	1.5	3.4	4.1	69.0
Delta	6.3	8.1	0.3	-8.1	4.5	10.4	-1.3	-16.8	-20.4	3.8	-0.6	13.0	-0.8

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	675.69
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	709.70
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.05
Average annual soil nitrogen leached (kg/ha/year)	3.96
Average annual nitrate-N loading to groundwater (kg/ha/year)	3.96
Soil organic-N kg/ha (Initial - Final)	4752.00 - 14.59
	240.24 - 112.54
Average nitrate-N concentration of deep drainage (mg/L)	5.74
Max. annual nitrate-N concentration of deep drainage (mg/L)	59.32

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	62.09
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	64.40
Average annual soil phosphorus leached (kg/ha/year)	0.01
Dissolved phosphorus (kg/ha) (Initial - Final)	0.50 - 0.29
Adsorbed phosphorus (kg/ha) (Initial - Final)	3201.01 - 2907.13
Average phosphate-P concentration in rootzone (mg/L)	0.05
Average phosphate-P concentration of deep drainage (mg/L)	0.02
Max. annual phosphate-P concentration of deep drainage (mg/L)	0.07
Design soil profile storage life based on average infiltrated water phosphorus concn. of 4.97 mg/L (years)	70.78

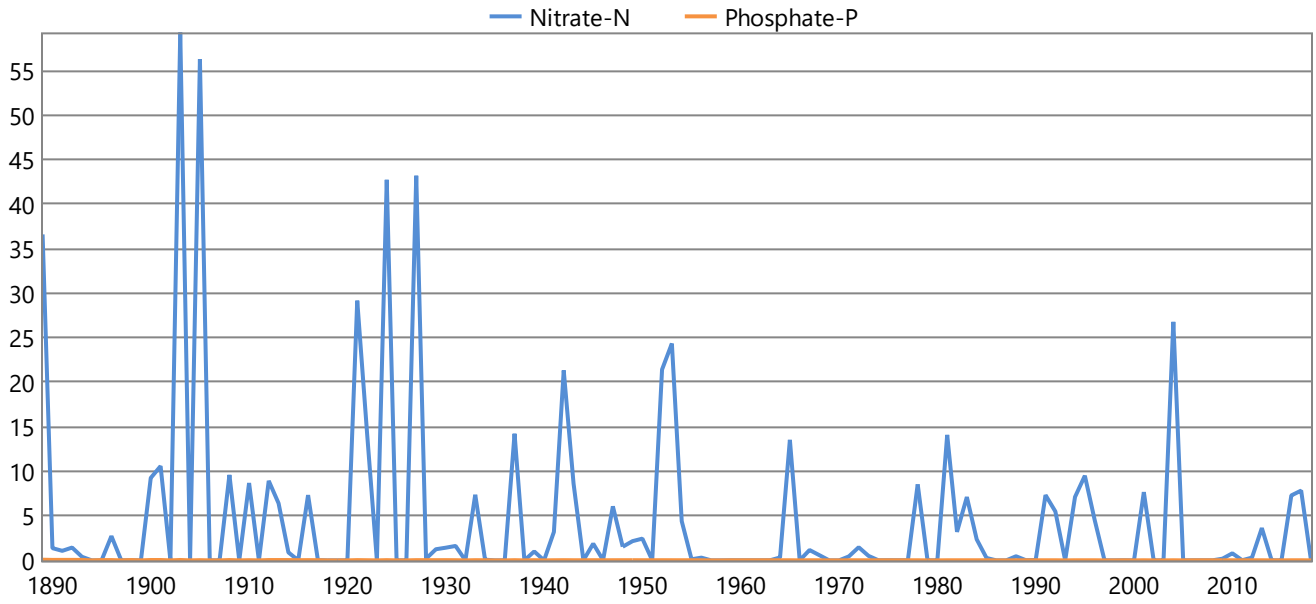
DIAGNOSTICS

Sustainability Diagnostics: Kalbar

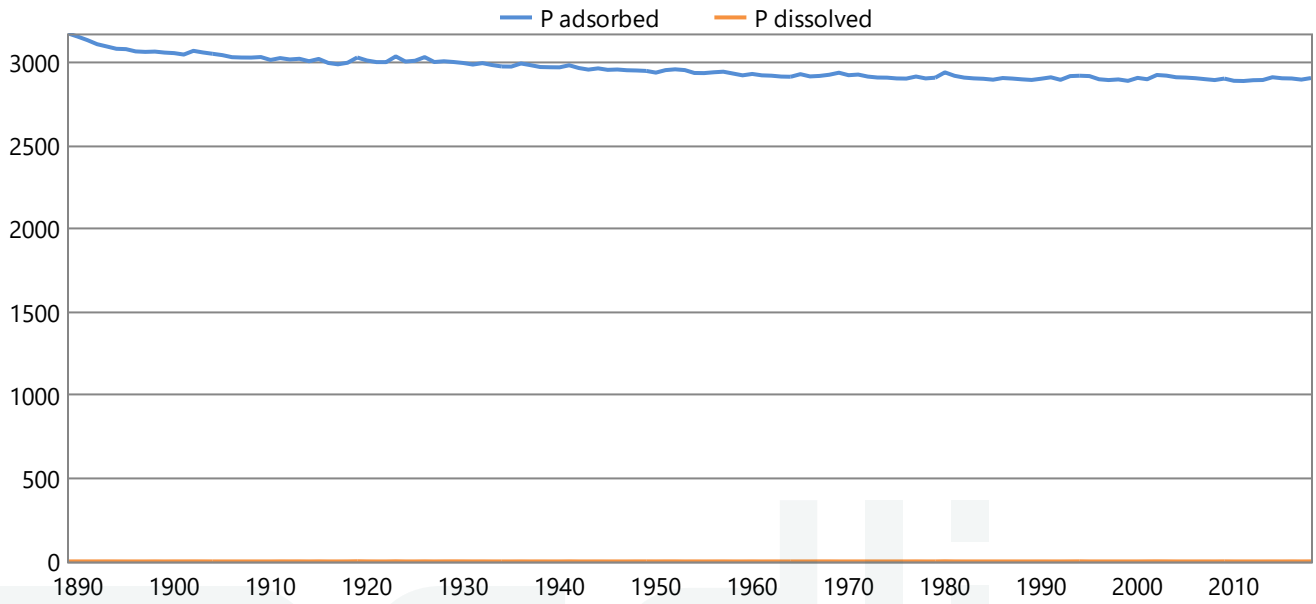
Paddock Land: New Paddock: 160 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



DIAGNOSTICS

Sustainability Diagnostics: Kalbar

Paddock Plant Performance: New Paddock: 160 ha

Average Plant Performance (Minimum - Maximum): Continuous Lucerne (Winter Active) Pasture

Average annual shoot dry matter yield (kg/ha/year)	25695.23 (9560.29 - 34948.72)
Average monthly plant (green) cover (fraction)	0.65 (0.58 - 0.70)
Average monthly crop factor (fraction)	0.59 (0.52 - 0.63)
Total plant cover (both green and dead) left after harvest (fraction)	0.75
Average monthly root depth (mm)	1395.84 (1265.14 - 1487.34)
Average number of normal harvests per year (no./year)	13.48 (4.00 - 18.00)
Average number of normal harvests for last five years only (no./year)	11.40
Average number of crop deaths per year (no./year)	0.65 (0.00 - 3.00)
Average number of crop deaths for last five years only (no./year)	1.40
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.08 (0.00 - 0.20)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.06)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.73 (0.37 - 0.94)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.17 (0.10 - 0.27)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
No. days without crop/year (days)	9.32

Soil Salinity - Plant salinity tolerance: Moderately sensitive

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (uS/cm)	608.09
Salt added by rainfall (kg/ha/year)	152.23
Average annual effluent salt added & leached at steady state (kg/ha/year)	4827.29
Average leaching fraction based on 10 year running averages (fraction)	0.23
Average water-uptake-weighted rootzone salinity sat. ext. (uS/cm)	1261.72
Salinity of the soil solution (at drained upper limit) at base of rootzone (uS/cm)	15509.81
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen