# Appendix H

## ERA 63 (Sewerage Treatment Plant) Report

PRECISE ENVIRONMENTAL
Consulting Environmental Scientists

# ONSITE WASTEWATER MANAGEMENT REPORT

6200 – 6206 Cunningham Highway,
Kalbar, Queensland

Kalfresh Pty Ltd

Version 4, April 2020

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## Details

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| | | | |
|---|---|---|---|
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| ***Client:*** | Kalfresh Pty Ltd | | |
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# 1 INTRODUCTION

Precise Environmental (PE) was commissioned by Kalfresh Pty Ltd (the client) to prepare an Onsite Wastewater Management Report (OWMR) for the Scenic Rim Agricultural Industrial Precinct (SRAIP) project at 6200 – 6206 Cunningham Highway, Kalbar, Queensland (the site). The site occupies six allotments as detailed below:

- Lot 1 RP216694
- Lot 2 SP192221
- Lot 3 SP192221
- Lot 4 SP192221
- Lot 2 RP44024
- Lot 2 RP20974 (lot designated for effluent irrigation).

The site location is shown in Attachment A, Figures 1a and 1b (SmartMaps) and Figure 2.

Kalfresh Pty Ltd is an integrated company which supply and distribute vegetables to the major supermarkets such as Coles and Woolworths. It is understood that Kalfresh wish to expand their current processing precinct located in Kalbar, to create a Scenic Rim Agricultural Industrial Precinct (SRAIP). The SRAIP will create a place where primary rural activities and secondary rural industry activities are located within close proximity to each other and transport links. This will create a hub for all facades of the food production industry.

The proposed expansion will trigger an environmentally relevant activity (ERA) 63 for sewage treatment under the Environmental Protection Act 1994. Sewage treatment works with a peak design capacity of 21 equivalent persons (EP) or more are considered by the Queensland Government to be ERA 63 due to the potential to cause environmental harm.

This report has been prepared to accompany an application to the Department of Environment and Science (DES) for an ERA 63.

## 1.1 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. A registered sub artesian

bore (RN138334) exists on the site and historically used for agricultural purposes. Six additional unregistered bores are present on the site and used for agricultural purposes. Sewerage is treated onsite with disposal to land. Stormwater drains towards the overland flow path which traverses the rear of the site.

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.

### 1.2 Objectives

The objectives of this report are to:

- Describe the most practical options for on-site sewage treatment with irrigation to land
- Outline management commitments to undertaking sewage treatment works
- Describe a system for the management and use of recycled water (effluent)
- Provide details of the sewage treatment plant and irrigation system to be supplied by others
- Provide the documentation to accompany a development application to the Department of Environment and Science (DES) to obtain development approval for undertaking ERA 63 sewage treatment works.

### 1.3 Scope of work

To meet the above mentioned objectives, the following scope of work was undertaken:

- 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 proposed irrigation area (IA) through sampling / observation and laboratory analysis
- Modelling using MEDLI to size an IA and wet weather storage tank (WWST) for the sustainable re-use of effluent on the site - the input data was based on the estimated sewage flow, effluent quality and the site and soil conditions
- Identification of constraints which may limit the sustainability of onsite sewage management
- Provision of suitable options for the sustainable treatment and re-use of wastewater
- Provision of recommendations regarding the wastewater treatment process
- Preparation of this onsite wastewater management report and prepare an application to be submitted to DES.

The investigation was undertaken with reference to the following guidance documents:

- AS/NZS 1547:2000. On-site Domestic-Wastewater Management
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000)
- Environmental Protection Regulation (Qld Gov 2019)

- 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 Version 1 (Qld Gov 2019)
- Queensland Water Recycling Guidelines (EPA 2005)
- Water Quality Guidelines for Recycled Water Schemes (NR&W 2008).

### 1.4 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 and allotment detail

Site and allotment details are provided in Table 1.

**Table 1.** Site and allotment detail.

| 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 low-intensity 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.<br>A quarry is located to the northwest. | | | | | |
| Former contaminating land uses (identified during site inspection): | Former cattle dip located in Lot 2 RP20974 approximately 50 m east of the proposed Irrigation Area (IA).<br>Former service station located in Lot 2 SP192221 - canopy, bowser, fill points and underground storage tanks (USTs) remain in-situ.<br>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 IA.

| Aspect | Detail |
|---|---|
| Site elevation | Google Earth reports the IA at elevation at ~ 90 - 99 m AHD. |
| Presence of fill: | Not identified. |
| Slope (%): | Gently inclined (~6 %). |
| Slope configuration: | Linear planar to linear divergent. |
| Slope aspect: | Variable. |
| Vegetation: | Short grass. |
| Exposure: | High sun and wind exposure. |
| Presence of shelter belts: | Nil. |
| Erosion potential: | Low. |

## 2.3 Soil characteristics

A site inspection was conducted on 21 October 2019 which included the sampling of soils within the proposed IA, 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 3.4.

**Table 3.** Soil characteristics in the proposed IA.

| Aspect | Detail | |
|---|---|---|
| Soil profiles: | Two boreholes were constructed by PE using a hand auger to a maximum depth of 0.9 m. Encountered soil profiles were as follows: | |
| | BH1<br>0.0 – 0.1 (Natural) Silty Sand, fine to medium grained sand, grey brown, moist.<br>0.1 – 0.6 Clayey Gravelly Sand, fine to medium sized angular gravel, fine to medium grained sand, yellow brown, moist.<br>0.6 – Borehole terminated in extremely weathered granite. | BH2<br>0.0 – 0.6 (Natural) Light to Medium Clay, grey with orange mottles, moist.<br>0.6 – 0.9 Clayey Sand, fine to medium grained sand, yellow brown, moist.<br>0.9 – Borehole terminated extremely weathered rock. |

## 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).<br>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 B.

**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 southwest from the irrigation area. Stormwater is then expected to flow northeast toward Warrill Creek. |
| Flooding: | The area to the southeast of the proposed irrigation area is designated as a high flood hazard. The proposed IA is not mapped in a flood hazard area. |
| Onsite surface waters: | Numerous gullies which are expected to flow seasonally or in a heavy rain event – which flows to Warrill Creek 1.6 m northeast.<br>There are also a number of dams located in the northern portion of the site. The closest dams to the IA are 15 m north and 200 m southeast. |

| Aspect | Detail |
|---|---|
| Onsite groundwater wells / bores: | A registered sub artesian bore (RN138334) exists on the site and historically used for agricultural purposes.<br>There are five unregistered operational bores within the bounds of Lot 2 SP192221 which are located a minimum distance of:<br>• 600 m from digestate irrigation area<br>• 175 m from bioenergy facility<br>• 525 m from digestate storage area.<br>There is one unregistered bore within the bounds of Lot 3 SP192221 which is non-operational.<br>During the site inspection PE collected a sample from a production bore known as 'little bore wash shed'. The bore is shown in Attachment A, Figure 3. The laboratory results are attached in Attachment D. A summary of the results are as follows:<br>Characteristics (Source: Bore Cleaning Services):<br>• Total depth – 16.3 m<br>• Screen depth – 9 to 15 m<br>• Water level – 10 m.<br>Field results:<br>• pH – 7.72 units<br>• Electrical conductivity – 1.158 mS/cm<br>• Turbidity – 0.07 NTU<br>Key laboratory results:<br>• Total dissolved solids – 750 mg/L<br>• Hardness – 464 mg/L<br>• Total nitrogen – 7,300 µg/L<br>• Total phosphorus – 160 µg/L. |

| **Registered groundwater bores in the locale** (Queensland Globe) | | | |
|---|---|---|---|
| Nearest bores to proposed IA with relevant information | RN138334 – within Lot 2 (900 m south of IA) | RN14310270 – 980 m east of the IA | RN124727 – 1.2 km southeast of IA |
| 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 | 2.5 m | 10.0 m |

| Aspect | Detail | | |
|---|---|---|---|
| Upper aquifer status | Confined in basalt | The pressure head indicates this is a confined / semi-confined aquifer. | Semi-confined. |
| Quality detail provided on bore card | EC 1800 µS/cm (saline) | No data | Described as 'Potable' in aquifer section |

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 4 and sensitive environment maps are provided in Attachment C.

**Table 6.** Closest sensitive environment details.

| **Sensitive environment mapping** | **Approximate distance from Irrigation Area** |
|---|---|
| **Queensland Globe waterway mapping** | |
| Watercourse: | Warrill Creek – 1.2 km southeast of the IA.<br>An ephemeral gully runs through the centre of the site and flows northeast to Warrill Creek. At its closest point the gully is mapped 100 m west of the IA.<br>Closest Dam – 75 m northwest of the IA. |
| Fish habitat and marine parks | None mapped within a 5 km radius of the IA. |
| Wetland protection area: | None mapped within a 5 km radius of the IA. |
| Remnant vegetation: | Category B remnant vegetation – 185 m north of the IA. |
| Matters of state environmental significance (MSES): | 185 m north of the IA – MSES regulated vegetation – essential habitat<br>1.6 km southwest of the IA – MSES regulated vegetation – endangered or of concern<br>165 m west of the IA (ephemeral gully) – MSES regulated vegetation defined watercourse<br>1.2 km southeast of the IA (Warrill Creek) – MSES regulated vegetation defined watercourse |
| Queensland waterways for waterway barrier works | Low priority waterway mapped 180 m west of the IA<br>Medium priority waterway mapped 225 m west of the IA. |
| Groundwater dependant ecosystem | The 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.<br>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 | ~ 1 km south of the IA. |
| **Environmental Protection (Water) Policy 2009 (EPP) waterway mapping** | |
| The section of Warrill Creek is mapped as lowland freshwaters.<br>DES has published guidelines values for the protection of Bremer River in the Environmental Protection (Water) Policy 2009 | |
| 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. |

| Sensitive environment mapping | Approximate distance from Irrigation Area |
|---|---|
| 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:<br>• Turbidity: <5 NTU<br>• Total suspended solids: <6 mg/L<br>• Chlorophyll a: <5 µg/L<br>• Total nitrogen: <500 µg/L<br>• Oxidised N: <60 µg/L<br>• Ammonia: <20 µg/L<br>• Organic N: <420 µg/L<br>• Total phosphorus: <50 µg/L<br>• Filterable reactive phosphorus: <20 µg/L<br>• Dissolved oxygen: 85 – 110% saturation<br>• pH: 6.5 – 8.0 units<br>• 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 effluent runoff and infiltration
- Groundwater has the potential to be impacted by effluent runoff and infiltration
- MSES vegetation could be impacted by effluent runoff
- Nearby wetlands could be impacted by effluent 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 effluent 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 D. Section 3 provides design input parameters (i.e. via MEDLI modelling and risk assessment) to mitigate impacts 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 | 5 percentile | 50 percentile | 95 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 HYDRAULIC LOADING AND SIZING OF SEWAGE MANAGEMENT INFRASTRUCTURE

## 3.1 Water supply and water reduction strategy

Water used for potable use is currently harvested from the roofs of select site buildings. Bore water is currently used for process purposes (i.e. washing of root vegetables). It is anticipated that both bore water and roof water will be utilised for the future expansion as necessary. This may be substituted with tanker imports and other sources as required.

PE recommends the installation of full water-reduction fixtures (where possible) which include the combined use of reduced flush 6/3 litre toilets, waterless urinals, shower-flow restrictors, aerator faucets, and flow/pressure control valves on water-use outlets. Timed flow tapware incorporating 6-star 5.6 litre per minute rated (3 – 6 second time flow) is recommended.

## 3.2 Design flows and associated requirements

The estimated daily sewage flows are provided below in Table 9. The flows for the rural precinct were based on the maximum predicted number of staff at the site predicted by the client with a daily flow rate allowance per person determined with reference to AS/NZS 1547:2000 Appendix 4.2D Typical Domestic-Wastewater Flow Design Allowances (Rural Factories). Table A of QWSR, WSSS & DEWS (2010) was also considered during this process.

**Table 9.** Estimated sewage generation from the rural enterprise precinct upgrade.

| Site use | Persons/day | Sewage generation rate (L/day) | | Calculated sewage generation (L/day) | |
|---|---|---|---|---|---|
| | | Minimum | Maximum | Minimum | Maximum |
| Maximum occupancy | 800 | 25 | 50 | 20,000 | 40,000 |
| **Total** | - | - | - | - | **40,000** |

A sewage generation rate of 40,000 L/day has been used for the design of the sewage treatment system and irrigation area. It is possible that this could vary (daily flows to be monitoring once the site is operational) so accordingly any increase in flows will require a system upgrade and an amendment to the future ERA 63 approval conditions. If the development is to be staged, a smaller sewage treatment facility may be initially installed and this increased in capacity as the site becomes populated. It is noted that process water (i.e. waste water generated from washing of root vegetables) and waste water (i.e. digestate generated from the proposed anaerobic digestor) is not permitted to enter the waste water treatment system.

## 3.3 Preliminary irrigation area sizing

Calculation of the IA was initially assessed using AS/NZS 1547:2012 using a design irrigation rate (DIR) based on the observed site soil conditions, and the estimated hydraulic loading for the site.

The formula used is as follows:

Ai = Qd ÷ DIR

Where

Ai = minimum irrigation area required ($m^2$)

Qd = litres of sewage generated per day

DIR = design irrigation rate in mm/day

Estimated IA sizing:

Ai = 40,000 L/day ÷ 2 mm/day

= **20,000 m².**

According to the Australian Standard calculation, a minimum irrigation area of 20,000 m² is required to sustainably irrigate 40,000 L/day with a DIR of 2 mm/day (i.e. indicative of Category 6 soils – medium to heavy clay, with consideration of the identified bedrock and proposed soil amelioration program).

The standard conditions DES impose for sizing of an irrigation area is based on rainfall volume and a nominated maximum irrigation rate (see standard condition D3 in Table 19). For this site the applicable irrigation area is 1,000 m² per m³ of treated effluent where rainfall is > 1,000 mm/year and a maximum irrigation rate of 1 mm/day. The total irrigation area required under this scenario is 40,000 m².

Whilst there is significant area available within the bounds of the site to meet this requirement, a custom irrigation area size has been determined via MEDLI modelling. Refer to Section 3.5 which notes that PE has modelled using a 20,000 m² area which must be made available as a minimum area based on the design flow allowance in Section 3.2.

### 3.4 MEDLI modelling

The mass balance modelling program recommended by DES for ERA 63 applications is MEDLI. The MEDLI modelling program is a computer-based mathematical model that was developed jointly by the Queensland Department of Primary Industries (DPI) and the Cooperative Research Centre for Waste Management and Pollution Control.

MEDLI replicates the operation of a treated effluent irrigation scheme over an extended period of time. MEDLI simulates the natural processes that take place daily, by performing material balance calculations using the volume of incoming sewage, the constituents (nitrogen, phosphorus, dissolved salts, etc.), details of the sewage treatment / management system, and climatic data for the particular location.

Ideally, the application rate of any component (hydraulic loading, salts, nitrogen or phosphorus) of irrigated effluent 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 allow for customisation of MEDLI are provided below in Table 10. Laboratory certificates are provided in Attachment E.

**Table 10.** Soil laboratory results.

| | | | | |
|---|---|---|---|---|
| Physical / chemical characteristics: | **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 (%) | 0.833 | 1.4 | 0.688 |
| | Air dry moisture content (%) | 4.1 | 8.3 | 3.7 |
| | Cation exchange capacity (cmol/kg) | - | - | - |
| | 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 |

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), and multiple preliminary runs were used with an irrigation area ranging from 2 ha to 3 ha. An IA of 2 ha was chosen plus modelling of the following:

- Zero flow run – all factors are entered, though effluent volumes to be irrigated on a daily basis are set to zero so that the natural effects of the climate on the crop and water entering deep drainage can be determined
- Peak flow run – a peak flow of 40 kL was set each day, and does not account for lower daily flows

Soil input parameters for both scenarios are provided in Table 11 and other MEDLI input parameters for each scenario 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 |
| 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 | |
|---|---|---|
| | Zero run | 2 ha |
| **Effluent characteristics** | | |
| Daily volume (kL) | 0 | 40 |
| Run period | 1 January 1889 to 31 December 2018 | |
| Nitrogen concentration (mg/L) | 60 | |
| Phosphorus concentration (mg/L) | 10 | |
| EC (µS/cm) | 1,600 | |
| **WWST** | | |
| WWST capacity (kL) | 200 (5 days x 40 kL/day) | |
| WWST characteristics | Closed pond (i.e. no evaporation or rainfall input) with full draw-down depth | |
| **IA** | | |
| Size of IA | 2 ha | |
| Soil | As per Table 11 | |
| Crop | Lucerne (winter active) pasture | |
| **Irrigation method** | | |
| Irrigation system | Fixed sprinkler | |
| Irrigation trigger (maximum) | Once daily to fixed depth of 5 mm<br>A maximum nominal pump rate of 1 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 5 mm can be reached. | |
| Ammonia volatilisation | 20% (default setting) | |

Table 13 below summaries the model output for each of the scenarios. MEDLI output files are attached in Attachment F.

**Table 13.** Staged MEDLI results.

| Parameter | Zero run | 2 ha |
|---|---|---|
| **Effluent re-use** | | |
| Reuse (%) | - | 100 |
| Over-topping (kL/year) | - | 0 |
| **Water balance** | | |
| Irrigated effluent (mm/day) | - | 5 |
| Irrigated effluent (mm/year) | - | 730.48 |
| Rainfall volume (mm/year) | 863.80 | |
| Transpiration (mm/year) | 325.49 | 935.55 |
| Irrigation runoff (mm/year) | - | 0 |
| Deep drainage (mm/year) | 27.77 | 163.76 |

| Parameter | Zero run | 2 ha |
|---|---|---|
| Deep drainage less zero run (mm/year) | - | 135.99 |
| **Crop performance** | | |
| Annual yield (kg/ha/year) | 4,478.37 | 23,697.39 |
| Average monthly plant cover | 0.36 | 0.71 |
| Average crop deaths (no/year) | 1.64 | 0.04 |
| Average monthly water stress | 0.28 | 0.08 |
| No. days without crop per year | 58.31 | 0.19 |
| Average annual nitrogen deficiency | 0.57 | 0.29 |
| **Nutrient balance** | | |
| Average annual effluent nitrogen added (kg/ha/year) | 0 | 438.29 |
| Average annual soil nitrogen removed by plant uptake (kg/ha/year) | 39.05 | 476.03 |
| Average annual soil nitrogen leached (kg/ha/year) | 3.08E-03 | 0.62 |
| Average nitrate-N concentration of deep drainage (mg/L) | 0.01 | 0.38 |
| Maximum annual nitrate-N concentration of deep drainage (mg/L) | 0.06 | 14.84 |
| Average annual effluent phosphorus added (kg/ha/year) | 0 | 73.05 |
| Average annual soil phosphorus removed by plant uptake (kg/ha/year) | 3.8 | 70.88 |
| Average annual soil phosphorus leached (kg/ha/year) | 4.70E-03 | 0.07 |
| Average phosphate-P concentration of deep drainage (mg/L) | 0.02 | 0.04 |
| Maximum annual phosphorus-P concentration of deep drainage (mg/L) | 0.07 | 0.08 |
| P storage life (years) | - | 59.62 |
| **Salt balance** | | |
| Salinity of infiltrated water (µS/cm) | - | 794.11 |
| Average annual salt added & leached at steady state (kg/ha/year) | - | 7,629.66 |
| Relative crop yield expected due to salinity (%) | - | 100 |

### 3.5 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 uptake was greater compared to the amount added, and phosphorus uptake was only slightly lower than that added. The modelled salt application does not appear to be affecting crop yield.

The modelled volume of deep drainage is 163.76 mm/year, minus the deep drainage for a zero run scenario 27.77 mm/year then the deep drainage is equal to 135.99 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 785 m from the proposed IA, the risk to groundwater users at the site is low.

# 4 ONSITE SEWAGE DESIGN

## 4.1 Sewage characteristics summary

A summary of the sewage characteristic potential is provided below in Table 14.

**Table 14.** Sewage summary characteristics potential.

| Aspect | Detail | |
|---|---|---|
| Flow / STP peak design capacity | 40 kL/day. | |
| WWST capacity | 200 kL | |
| Potential Influent quality range | Parameter | Typical concentrations if site well managed and limited concentrated kitchen liquid waste enters the system. |
| | Total nitrogen | 100 – 150 mg/L |
| | Total phosphorus | 10 – 25 mg/L |
| | $BOD_5$ | 150 – 500 mg/L |
| | Total suspended solids | 150 – 450 mg/L |

It is noted that the above constituent concentrations may vary from time to time which should be considered by the supplier of the wastewater treatment system. It has been determined also that a shallow water supply bore on the site has a baseline total nitrogen concentration of 7.3 mg/L which will further influence the wastewater nutrient concentration. Sampling of influent should be conducted (see Section 5.2.1) to ensure that the water quality specifications in Table 15 can be achieved for Class B effluent in addition to the release limits in the EA for this site (a performance guarantee provided to ensure the system is capable of variable conditions).

## 4.2 Sewage treatment

PE recommends that all sewage be treated to Class B standard for the proposed development. Water quality specifications for Class B quality effluent are provided in Table 15 taken from the Queensland Water Recycling Guidelines (EPA 2005) and the Public Health Regulation 2005 (Qld). It is recognised that the EPA (2005) is now superseded by *Water Quality Guidelines for Recycled Water Schemes* (NR&W 2008), however this remains the best source for effluent class criteria.

**Table 15.** Water quality specifications for Class B effluent.

| Parameter | Criteria |
|---|---|
| ***E. coli*** | < 100 cfu/100 mL (median) |
| **$BOD_5$** | 20 mg/L (median) |
| **Turbidity** | - |
| **Suspended solids** | ≤30 mg/L (median) |
| **TDS / EC** | ≤1,000 mg/L (median) / ≤ 1,600 µS/cm (median) |
| **pH** | 6 – 8.5 |

All Class B water shall be directed from the STP into the WWST prior to irrigation (refer Diagram A).

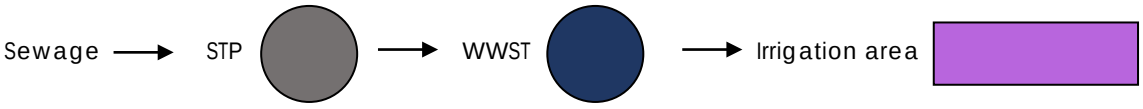


**Diagram A.** Flow process schematic.

### 4.3 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 effluent irrigation. This process will require detailed input from an agronomist familiar with the site soils and proposed pasture crop to ensure the viability of the irrigation system as a whole.

Gypsum should be added at a rate to be determined by an agronomist (typically 1-2 kg/m2) 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 effluent 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 agronomist, PE can assist with the soil amelioration process and provide certification that the area is suitable for digestate irrigation once the pasture is established.

### 4.4 Lucerne pasture

**Source (extract):** https://www.agric.wa.gov.au/pasture-establishment/lucerne-plant-and-its-establishment

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, 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).

# 5 SERVICE, MAINTENANCE AND MONITORING

## 5.1 Service and maintenance

A summary of the general service, maintenance and operational requirements of the core components of the sewage treatment system are provided in Table 16. The table is not exhaustive, and the manufacturer of the sewage treatment system should be consulted for any additional requirements.

**Table 16.** Servicing, maintenance 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: Backup power should be provided in the event of power failure. All plant must be configured to enable the use of a portable generator for temporary power supply during power failure, and a backup generator is to be available (on site or for hire) in case of power failure. |
| | Noise: All components should be maintained to avoid nuisance noise to any nearby sensitive receptors (e.g. patrons, staff and nearby residents). |
| | Odour: All components must be maintained to avoid nuisance odour. |
| | 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 must comply with AS 1319 – 1994 Safety Signs for the Occupational Environment. |
| | Access: Fencing can be erected around the areas of all components to restrict access by unauthorised personnel where applicable. |
| | Supplier: A reliable manufacturer / supplier must be engaged for the construction, installation and maintenance of all components of the sewage treatment system, and must provide a suitable level of detail to demonstrate past performance of similar site systems currently operating in the field (i.e. Queensland). Due to the potential for the wastewater to be moderate to high strength, the supplier must provide a performance guarantee to ensure the system is capable of variable conditions (e.g. quantity and quality).<br>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 the supplier / manufacturer in the event that this information is requested. |
| | Design: All components are to be fully enclosed to prevent odours and any openings (e.g. overflow points) and are to be suitably screened to restrict mosquito ingress. |
| | 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. |
| STP | Disinfection: Utilise an automatic disinfection dosing system suitable for Class B effluent |
| | General: Other maintenance requirements should be undertaken in accordance with manufacturer specifications. |

| Component | Requirements |
|---|---|
| | Flow equalisation: An upfront flow equalisation tank should be installed to ensure that sewage flows entering the STP do not exceed the peak design capacity of the STP.<br><br>The flow equalisation tank is a standard component of an STP (a separate standalone tank or incorporated into the STP itself) to cater for variable daily flows. The purpose is to ensure the flow into the STP does not excess the peak design capacity of the STP and at the same to provide a mechanism for storage of surplus wastewater and to regulate flow. The volume and layout will be dependant to some extent on the selected supplier. It may be appropriate to incorporate a flow equalisation tank of at least 100 kL capacity in consultation with the applicant and other project stakeholders. |
| | Flow meter: A flow meter is to be installed at the STP inlet. |
| WWST | Rainfall: When rainfall prevents the irrigation of effluent, the effluent will be stored in the WWST. |
| | 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 effluent for extended periods. |
| | 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 engage a licensed contractor to pump out the tank prior to any overflows occurring (to trigger at 80% capacity) |
| | Pumps: A circulation pump shall be installed within the WWST to mitigate stratification and uneven chlorine distribution (where applicable) |
| Irrigation area | Irrigation: Effluent will be irrigated across the designated area via coarse droplet irrigation methods that do not produce aerosols. |
| | Distribution: Effluent must be evenly distributed within the designated irrigation area (see Attachment A, Figure 5). Figure 6 shows examples of sprinkler options which may vary subject to client preferences and site risks. |
| | Size: The irrigation area must be a minimum of 2 hectares (20,000 $m^2$). |
| | Crop: The irrigation area must be planted with lucerne pasture. |
| | Harvesting: The irrigation area must be regularly harvested or directly consumed as fodder. |
| | 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.<br><br>The irrigation system is to be monitored dally for the first week of operation. Weekly inspections to be undertaken thereafter to confirm no ponding, runoff and spray drift occurring. The irrigation consultant and/or STP operator must be responsible for these inspections and all observations and corrective measures documented accordingly. |
| | Sprinklers: Effluent rated sprinklers must be fixed in place and produce heavy droplets with low trajectory angle nozzles where required. |
| | Construction: Pipelines and fittings shall be in provided and fitted in accordance with AS/NZS 1547:2000 On-site domestic-wastewater management and AS/NZS 3500 Plumbing and Drainage (specifically Part 2. Sanitary plumbing and drainage).<br><br>Pipeline and fittings associated with the effluent irrigation system must be distinctively and permanently colour coded deep purple or lilac in accordance with AS/NZS 3500.1:2003, Section 9 and AZ/NZS 1345 – Identification of the contents of pipes, conduits and ducts. |
| | Release pipes: Lockable valves or removable handles shall be fitted to any release pipes situated in public access areas (not likely to be applicable). |

| Component | Requirements |
|---|---|
| | Irrigation scheduling: Undertake irrigation daily at no greater than 5 mm – to be automatically determined using soil moisture meters or alternative measures considered appropriate by the STP 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 area can be fenced, and irrigation can occur anytime of the day. |
| 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).<br>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 collection system must not receive concentrated liquids from other site facilities (as applicable). |
| 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.<br>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. |

The site owner/occupier/management staff shall have a suitable understanding of the operational requirements and limitations of the sewage treatment plant, and all plant operators shall 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.

Furthermore, Attachment D, Table A and Table B must also be sourced for other site related environmental objectives, performance outcomes and land rehabilitation requirements.

## 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 effluent and other components of the sewage treatment system, 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 shall be calibrated, and appropriately operated and maintained.

### 5.2.1 Commissioning phase monitoring

For the initial 'commissioning' phase when the system is first installed, the sampling regime will include five samples 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 17.

Following this 'commissioning' phase, testing for *E. coli* is required on a monthly 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 17, a follow up sample must be taken immediately. Should this follow-up sample return a value greater than the criterion value in Table 17, the 'commissioning' phase shall recommence and land irrigation must cease.

### 5.2.2 Monitoring of effluent

Monitoring of effluent shall be undertaken in accordance with the EA conditions and at the frequencies specified in Table 17 below to ensure that effluent complies with the EA release limits and requirements for Class B effluent. All determinations of the quality of contaminants released shall 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 via use of data loggers.

**Table 17.** Effluent quality limits.

| | | Release limit | | | | |
|---|---|---|---|---|---|---|
| **Quality Characteristic** | **Unit** | **Min** | **Median** | **95th Percentile** | **Max** | **Monitoring frequency** |
| *E. coli* | colony forming units/100 mL | - | <100 | - | 150 | Monthly |
| 5-day biochemical oxygen demand (inhibited) | mg/L | - | 20 | - | 30 | Monthly |
| Total suspended solids | mg/L | - | 30 | - | 45 | Monthly |
| Electrical conductivity | µS/cm | - | - | - | 1,600 | Monthly |
| pH | units | 6 | - | - | 8.5 | Monthly |
| **Recommended water quality specifications (Site specific EA conditions)** | | | | | | |
| Total chlorine | mg/L | 1 | - | - | 5 | Daily |
| Total nitrogen (TN) | mg/L | - | - | - | 60 | Monthly |
| Total phosphorus (TP) | mg/L | - | - | - | 10 | Monthly |

**Table notes:**

Sampling to be undertaken at the outlet of the WWST for all parameters

Double disinfection should be considered with the primary method being via chlorine or UV

Total chlorine must not exceed 5 mg/L and should be measured onsite daily using a photometer.

PE recommends that the site specific EA should stipulate a total chlorine range of 1 – 5 mg/L, as opposed to a maximum concentration of 1 mg/L (under standard EA conditions). The release limits for total nitrogen and total phosphorus are supported by the MEDLI model.

It is noted that standard EA conditions stipulate a different pH range (5 – 8.5) when compared against the Queensland Water Recycling Guidelines for Class B effluent. PE recommends the site specific EA stipulate the pH to be 6 – 8.5 units.

### 5.2.3 Infrastructure requirements

Maintenance of the disinfection system shall be undertaken as per manufacturer's specifications, including as a minimum:

- Daily visual inspection and recording of disinfection indicators e.g. total chlorine (UV intensity if applicable)
- Regular lamp cleaning and inspection – if UV
- Lamp changes when required as per manufacturer's specifications – if UV.

Suitable infrastructure shall be incorporated into the STP to allow sewage that is not in accordance with relevant quality criteria specified in Table 15 to be automatically diverted into the start of the treatment system in situations due to plant failure.

If a UV disinfection system is utilised it shall have a dose of at least 140 mJ/cm$^2$ to treat meet Class B effluent requirements. The UV disinfection system shall have an auto-sleeve cleaning system, intensity indicator reading in mw/cm$^2$ and lamp failure detection.

#### 5.2.4 Noise monitoring

When requested by the administering authority, noise monitoring shall be undertaken to investigate any complaint of noise nuisance, and the results notified within 14 days to the administering authority. Monitoring shall 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 shall comply with the latest edition of the administering authority's Noise Measurement Manual.

### 5.3 Reporting

#### 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 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 ERA 63 APPLICATION

Sewage treatment works with a peak design capacity of 21 equivalent persons (EP) or more are considered by the Queensland Government to be an Environmentally Relevant Activity (ERA) 63 due to the potential to cause environmental harm.

The Department of Environmental and Resource Management (DERM – now DES) *Planning Guidelines for Water Supply and Sewerage* (DERM 2010) defines equivalent person to mean:

> *The water supply demand or the quantity and/or quality of sewage discharge for a person resident in a detached house. It is also applied to:*
>
> – *The number of persons who would have a water demand equivalent to the establishment being considered.*
>
> – *The number of persons who would contribute the same quantity and/or quality of domestic sewage as the establishment being considered.*

The Queensland Government defines an EP as the greater of (source):

a) EP = V/200 (where V is the volume, in litres, of the average dry weather flow of sewage that can be treated at the works in a day)

b) EP = M/2.5 (where M is the mass, in grams, of phosphorus in the influent that the works are designed to treat as the inlet load in a day).

Applying an estimated peak 'equalised' daily flow of 40,000 L/day and a phosphorus inlet design loading of 14 mg/L, the following EPs have been calculated:

a) EP = **V** / 200 = 40,000 L/day ÷ 200 = 200 EP

b) EP = **M** / 2.5 = (40,000 L/day) x [(14 mg/L x (1g ÷ 1,000 mg)] ÷ 2.5 = 224 EP.

As such, the more conservative 224 EP is considered most relevant. Both EP scenarios fall under the same ERA category being ERA 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.

## 6.1 ERA 63 eligibility criteria and standard conditions

DES impose eligibility criteria and standard conditions for all ERA 63 applications, and the type of application to be made will be dependent on whether the applicant is able to meet all of these requirements. For a new application, there are three main types of applications which can be made subject to meeting the aforementioned requirements.

1. Standard application - A standard application can be submitted to DES if the applicant **can comply with all** eligibility criteria and standard conditions.
2. Variation application - A variation application can be submitted to DES if the applicant **can comply with all** eligibility criteria but requires a variation of one or more of the standard conditions
3. Site specific application - A site specific application can be submitted to DES if the applicant **cannot comply with all** eligibility criteria.

Table **18** and Table 19 below details the eligibility criteria and standard conditions that the site is able to comply with and are derived from Eligibility criteria and standard conditions for sewage treatment works (ERA 63) – Version 2.

Table 18. Eligibility criteria compliance assessment.

| Eligibility criteria | Detail | Can the site comply |
|---|---|---|
| Activity | The activity is sewage treatment works with a total daily peak design capacity of 21 to 100 equivalent persons (EP), if treated effluent is discharged through an irrigation scheme | ✗ |
| | The activity does not discharge effluent to an infiltration trench | ✓ |
| Location | The effluent disposal area is not within 250 m of any bore used for domestic water supply however an onsite bore is proposed for potable use. | ✓ |
| | The effluent disposal area is not within 1,000 m of any bore used for town water supply. | ✓ |
| | The activity is not carried out in a designated precinct in a strategic environmental area as defined in the Regional planning Interests Regulation 2014 or regional plan. | ✓ |
| | The facility is not within 100 m of any watercourse, wetland or spring | ✓ |
| Water | There is no release of aqueous waste from the activity to waters | ✓ |

**Table 19.** Standard conditions compliance assessment.

| Standard conditions | Detail | Can the site comply |
|---|---|---|
| General | G1: All reasonable steps must be taken to ensure the activity complies with the eligibility criteria. | ✓ |
| | G2: The activity must be undertaken in accordance with written procedures that:<br>• Identify potential risks to the environment from the activity<br>• Establish control measures that minimise the potential for environmental harm<br>• Ensure plant and equipment is maintained and operated in proper and effective condition<br>• Ensure that staff are trained and aware of their obligations under the Environmental Protection Act 1994<br>• Ensure that reviews of environmental performance are undertaken at least annually. | ✓ |
| | G3: The activity must not cause environmental nuisance at a nuisance sensitive place. | ✓ |
| | G4: All documents and records of monitoring required by conditions of this (to be issued) authority must be kept for at least five years. | ✓ |
| | G5: Storage of chemicals and fuels in bulk containers of greater than 15 L must be within a secondary containment system and releases controlled in a manner that prevents environmental harm. | ✓ |
| Land | L1: Contaminants from the activity must not be released to land except as authorised under conditions. | ✓ |

<table>
<tr><th>Standard conditions</th><th>Detail</th><th>Can the site comply</th></tr>
<tr><td rowspan="2">Water</td><td>W1: Stormwater contaminated by the activity must be managed to minimise or prevent any adverse effect on the environmental values of the receiving environment.</td><td>✓</td></tr>
<tr><td>W2: Ponds used for the storage or treatment of effluent or wastes must be constructed, installed and maintained to:<ul><li>Prevent any release of effluent or wastes from the ponds</li><li>Ensure the stability of the pond structure.</li></ul></td><td>✓</td></tr>
<tr><td rowspan="5">Disposal of effluent to land</td><td>D1: Treated effluent is permitted to be released to land provided that it is done in accordance with a written procedure that ensures:<ul><li>Infiltration to groundwater and subsurface flows of contaminants to surface waters are prevented</li><li>Surface pondage and run-off of effluent is prevented</li><li>Degradation of soil structure is minimised</li><li>Soil sodicity and the build up of nutrients and heavy metals in the soil and subsoil are minimised</li><li>Spray drift or overspray do not carry beyond effluent disposal areas</li><li>Effluent disposal areas are maintained with an appropriate crop in a viable state for transpiration and nutrient uptake</li><li>The crop on the disposal area is harvested and removed from the disposal area.</li></ul></td><td>✓</td></tr>
<tr><td>D2: When weather conditions or soil conditions preclude the release of effluent to land, effluent must be directed to wet weather storage or be lawfully removed from the site.</td><td>✓</td></tr>
<tr><td>D3: In addition to the requirements of D1, the treated effluent must be evenly distributed over an area stated in the table below or a greater area.
<table>
<tr><th>Rainfall (mm/year)</th><th>Maximum irrigation rate (mm/day)</th><th>Minimum land required (m² per m³ of treated effluent irrigation)</th></tr>
<tr><td>< 600</td><td>3</td><td>335</td></tr>
<tr><td>> 600 – 1,000</td><td>2</td><td>500</td></tr>
<tr><td>> 1,000</td><td>1</td><td>1,000</td></tr>
</table></td><td>✓</td></tr>
<tr><td>D4: Treated effluent released to land must comply with the limits in the below table.
<table>
<tr><th>Quality characteristics</th><th>Release limit</th><th>Limit type</th></tr>
<tr><td>Total nitrogen*</td><td>60 mg/L</td><td>maximum</td></tr>
<tr><td>Total phosphorus*</td><td>20 mg/L</td><td>maximum</td></tr>
<tr><td>Electrical conductivity</td><td>1,600 µS/cm</td><td>maximum</td></tr>
<tr><td>pH</td><td>5 – 8.5</td><td>range</td></tr>
<tr><td>Total residual chlorine (if used)</td><td>1 mg/L</td><td>maximum</td></tr>
</table></td><td>✗</td></tr>
</table>

| Standard conditions | Detail | | | Can the site comply |
|---|---|---|---|---|
| | E.coli | < 1,000 cfu/100 mL | maximum | |
| | * Limits would typically correspond to long term total nitrogen and total phosphorus concentrations of 30 mg/L and 10 mg/L respectively | | | |
| | Quarterly monitoring of treated effluent must be carried out in accordance with the Monitoring and Sampling Manual 2009 to assess compliance with condition (D4) and records of the results maintained | | | ✓ |
| Waste | Other than effluent released to land in accordance with conditions D1, D3 and D4, all waste generated in carrying out the activity must be reused, recycled or lawfully disposed of offsite. | | | ✓ |

Based on the compliance assessment in Table 18 and Table 19 a site specific application must be made for ERA 63 1(b)(i) – operating a sewage treatment works with a total daily peak design capacity of 100 to 1,500 equivalent persons if treated effluent is discharged to an infiltration trench or through an irrigation scheme. The standard conditions which cannot be complied with are addressed in preceding sections of this report and will be modified to site specific conditions by DES as part of the assessment.

The site specific effluent release characteristics which should be endorsed by the EA are specified in Table 17. DES at their discretion may modify or change the monitoring requirements of this site specific application to form part of the conditions of approval.

In addition to the above application being submitted, an application to be a suitable registered operator must also be submitted concurrently for approval.

## 6.2 Fees

The below information is accurate as of 25 October 2019.

A review of the forms and fees finder for environmental authorities was undertaken on 28 February 2019. Table 20 details the application fee (a one off fee that DES charges to process the application) and an annual fee which is due 20 days after the environmental authority takes effect, and annually on the anniversary date of the EA thereafter.

**Table 20.** Environmental authority fees.

| Fee type | Fee |
|---|---|
| Application fee | $2,910.51 |
| Annual fee | $7,481.70 |

## 7 REFERENCES


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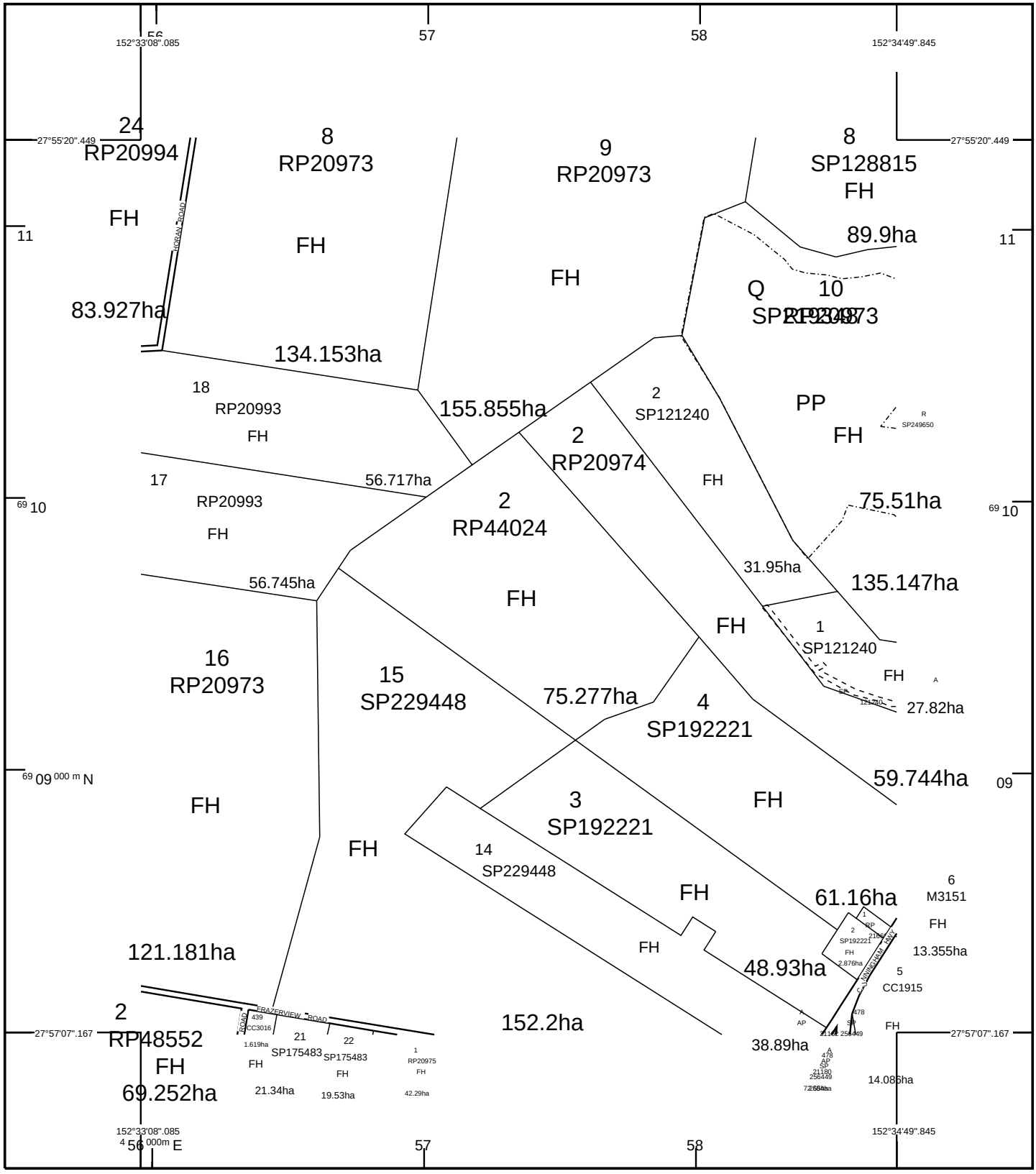
## ATTACHMENT A – FIGURES

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

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

GDA

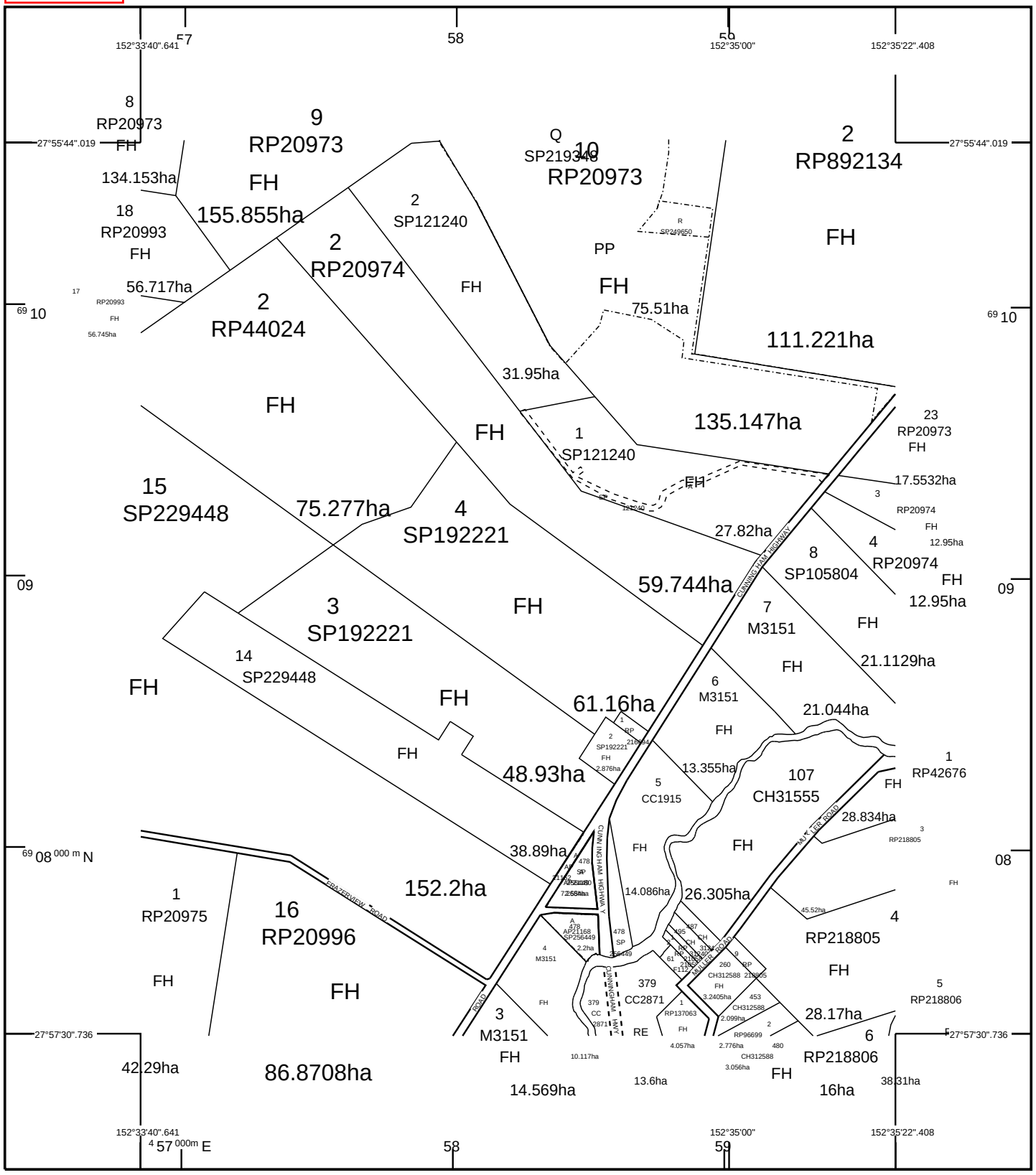
**SmartMap**

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

**SmartMap**

An External Product of
SmartMap Information Services

Based upon an extraction from the
Digital Cadastral Data Base

MAP WINDOW POSITION &
NEAREST LOCATION

152°34'31".525
27°56'37".378
FASSIFERN
1.83 KM

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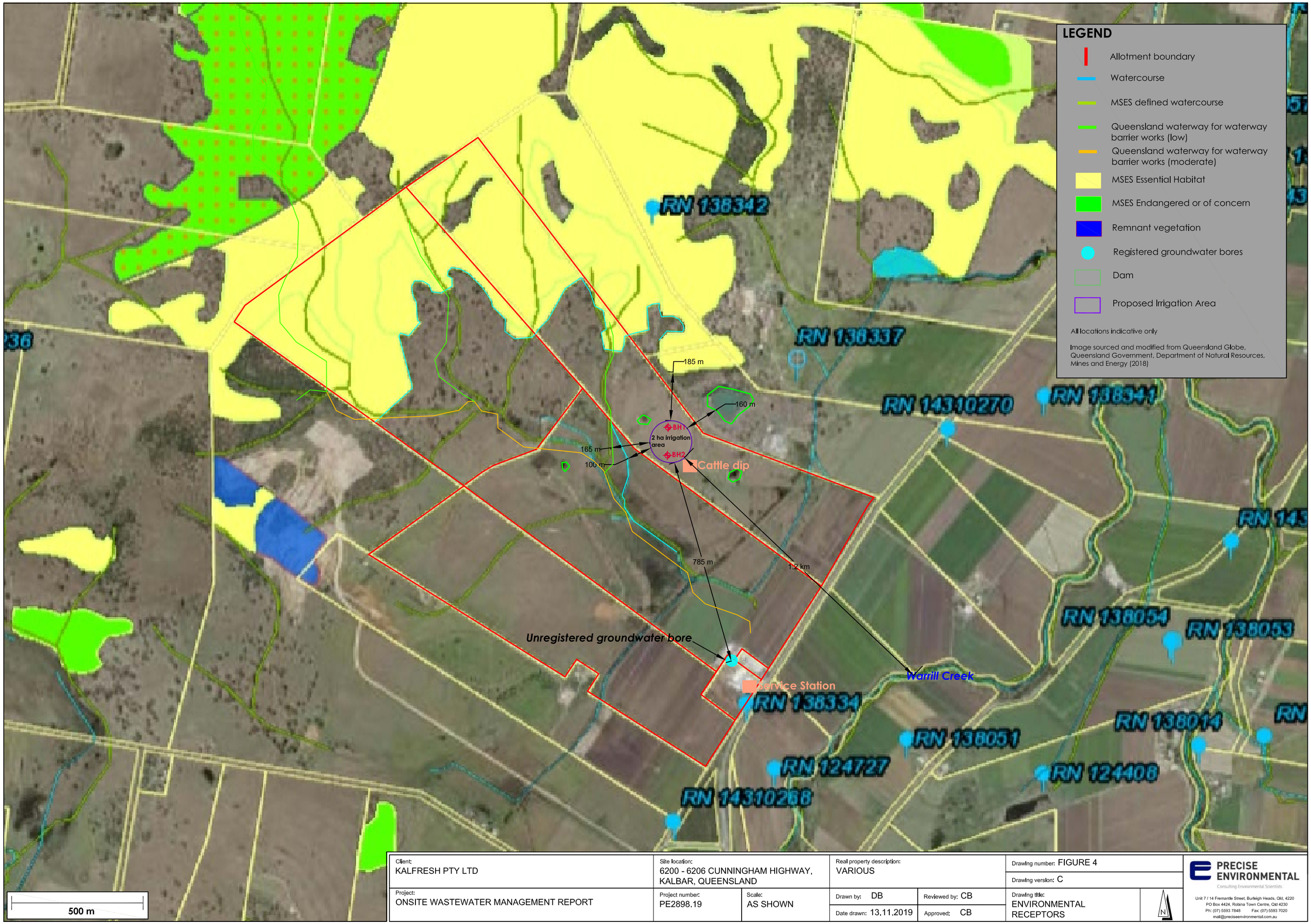
For further information on SmartMap products visit http://nrw.qld.gov.au/property/mapping/blinmap

Queensland Government

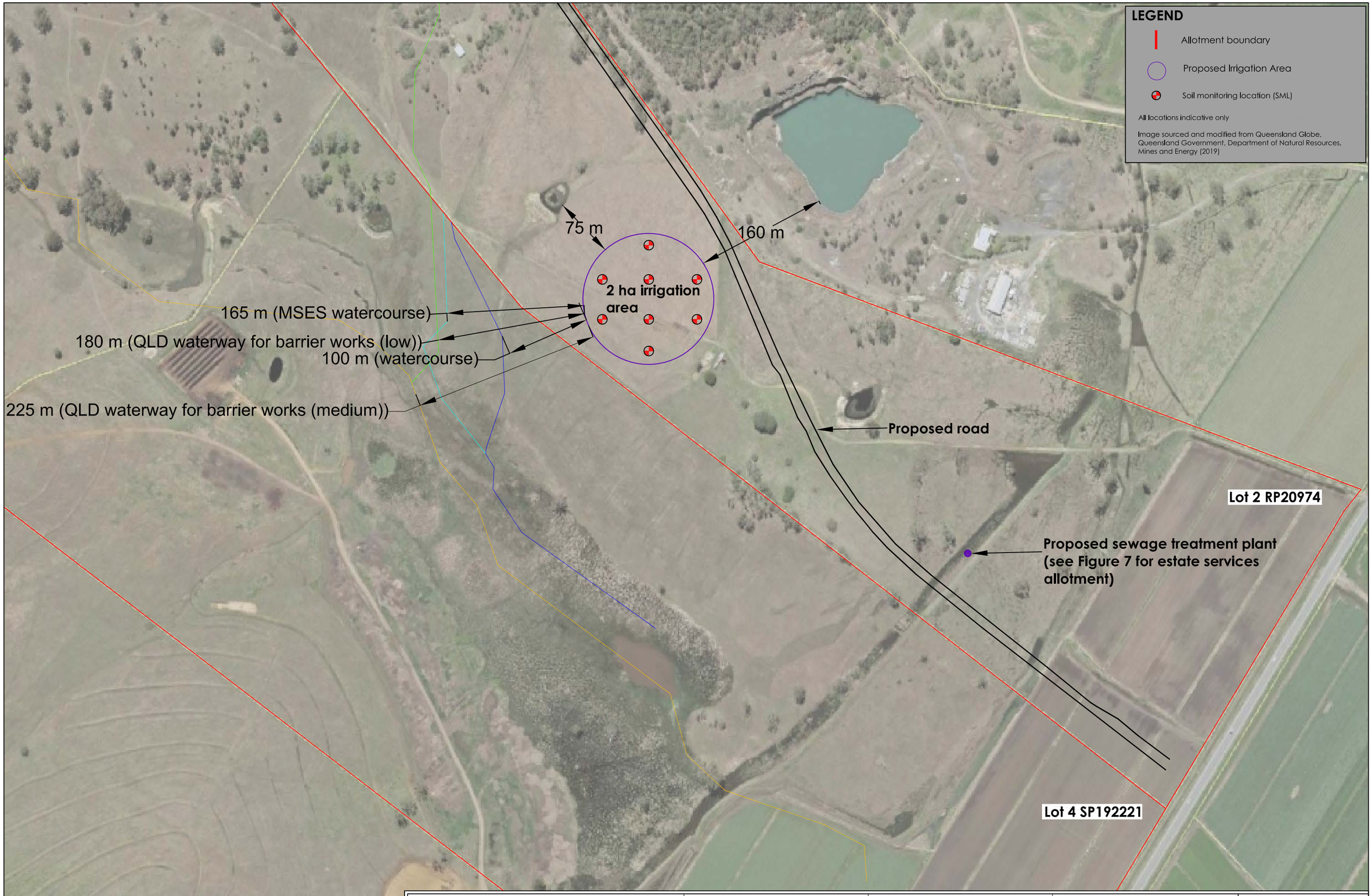

| | | | | | | |
|---|---|---|---|---|---|---|
| Client: KALFRESH PTY LTD | Site location: 6200 - 6206 CUNNINGHAM HIGHWAY, KALBAR, QUEENSLAND | | Real property description: AS SHOWN | | Drawing number: FIGURE 2 | PRECISE ENVIRONMENTAL Consulting Environmental Scientists |
| | | | | | Drawing version: A | |
| Project: ONSITE WASTEWATER MANAGEMENT REPORT | Project number: PE2898.19 | Scale: AS SHOWN | Drawn by: DB | Reviewed by: CB | Drawing title: SITE LOCATION | N |
| | | | Date drawn: 21.10.2019 | Approved: CB | | |

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

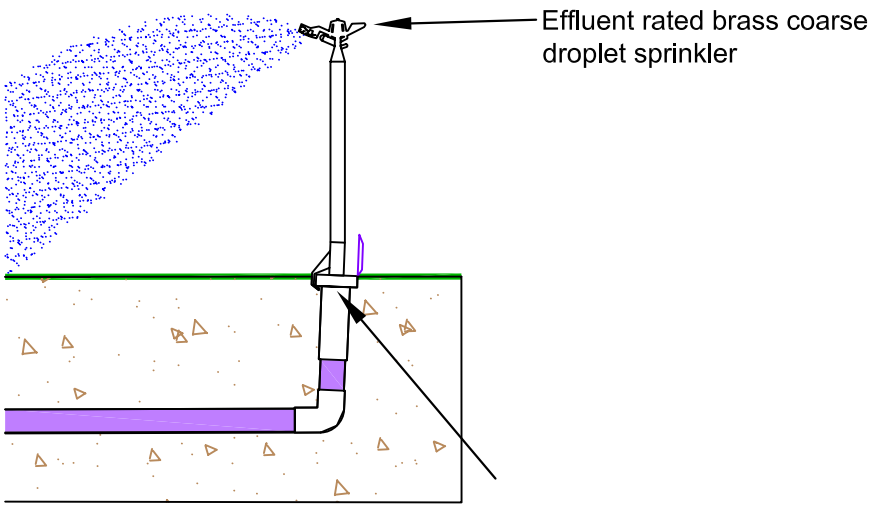

| | | | | | | |
|---|---|---|---|---|---|---|
| Client: KALFRESH PTY LTD | Site location: 6200 - 6206 CUNNINGHAM HIGHWAY, KALBAR, QUEENSLAND | | Real property description: VARIOUS | | Drawing number: FIGURE 3<br>Drawing version: B | PRECISE ENVIRONMENTAL<br>Consulting Environmental Scientists<br>Unit 7 / 14 Fremantle Street, Burleigh Heads, Qld, 4220<br>PO Box 4424, Robina Town Centre, Qld 4230<br>Ph: (07) 5593 7848 Fax: (07) 5593 7020<br>mail@preciseenvironmental.com.au |
| Project: ONSITE WASTEWATER MANAGEMENT REPORT | Project number: PE2898.19 | Scale: AS SHOWN | Drawn by: DB<br>Date drawn: 14.11.2019 | Reviewed by: CB<br>Approved: CB | Drawing title: ONSITE GROUNDWATER BORE LOCATIONS | N |




| | | | | | | |
|---|---|---|---|---|---|---|
| Client: KALFRESH PTY LTD | Site location: 6200 - 6206 CUNNINGHAM HIGHWAY, KALBAR, QUEENSLAND | | Real property description: VARIOUS | | Drawing number: FIGURE 4<br>Drawing version: C | PRECISE ENVIRONMENTAL<br>Consulting Environmental Scientists<br>Unit 7 / 14 Fremantle Street, Burleigh Heads, Qld, 4220<br>PO Box 4424, Robina Town Centre, Qld 4230<br>Ph: (07) 5593 7848 Fax: (07) 5593 7020<br>mail@preciseenvironmental.com.au |
| Project: ONSITE WASTEWATER MANAGEMENT REPORT | Project number: PE2898.19 | Scale: AS SHOWN | Drawn by: DB<br>Date drawn: 13.11.2019 | Reviewed by: CB<br>Approved: CB | Drawing title: ENVIRONMENTAL RECEPTORS | N |




| | | | | | | |
|---|---|---|---|---|---|---|
| Client: KALFRESH PTY LTD | Site location: 6200 - 6206 CUNNINGHAM HIGHWAY, KALBAR, QUEENSLAND | | Real property description: VARIOUS | | Drawing number: FIGURE 5 | PRECISE ENVIRONMENTAL Consulting Environmental Scientists |
| | | | | | Drawing version: B | |
| Project: ONSITE WASTEWATER MANAGEMENT REPORT | Project number: PE2898.19 | Scale: AS SHOWN | Drawn by: DB | Reviewed by: CB | Drawing title: PROPOSED IRRIGATION AREA | 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 |
| | | | Date drawn: 13.11.2019 | Approved: CB | | |




Cannon style sprinkler

Centre-pivot sprinkler

## INSTALLATION NOTES

- Wetted irrigation area to be a minimum of 2 hectares
- System to be maintained and operated as per manufacturers specifications.
- All plumbing and drainage work is to comply with the Plumbing and Drainage Act, AS/NZS 3500, AS/NZS 1547:2000 and the Queensland Plumbing and Wastewater Code.
- Distribution delivery lines must be coloured or fitted with warning tape and must be installed a minimum of 200 mm below the ground surface level.
- All irrigation lines and fittings must be suitable for effluent use.
- The irrigation system must be constructed by a licensed person, following the requirements of AS/NZS 1547:2000.
- The irrigation areas must be established with kikuyu grass and warning signs displayed prior to commissioning the wastewater treatment system.
- All buried pipes shall be indicated using underground marking tape to AS/NZS 2648.1 or be indicated by signage stating the words: Sewage effluent pipework installed below. DO NOT DIG.

| | | | | |
|---|---|---|---|---|
| Client: KALFRESH PTY LTD | Project number: PE2898.19 | Site address: 6200 - 6206 CUNNINGHAM HIGHWAY, KALBAR, QUEENSLAND | | |
| Project: ONSITE WASTEWATER MANAGEMENT REPORT | Scale: NOT TO SCALE | Real property description: VARIOUS | | |
| | Drawn by: SEAN GARDINER | Drawing number: FIGURE 6 | Drawning version: A | Date drawn: 25.10.2019 |
| PRECISE ENVIRONMENTAL Consulting Environmental Scientists | Reviewed by: CHRIS BUTLER | Drawing title: IRRIGATION DETAIL | | |

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www.preciseenvironmental.com.au

## ATTACHMENT B – SITE PHOTOGRAPHS

**Photograph 1:** View northwest across proposed irrigation area.

**Photograph 2:** View north across proposed irrigation area.

**Photograph 3:** Soil and bedrock exposed in excavation on adjacent Lot 4 SP192221 which is typical of site conditions within Lot 2 RP20974.

**Photograph 4:** Disused cattle tick dip located immediately east of proposed effluent irrigation area 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 GROUNDWATER BORE INFORMATION

## 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

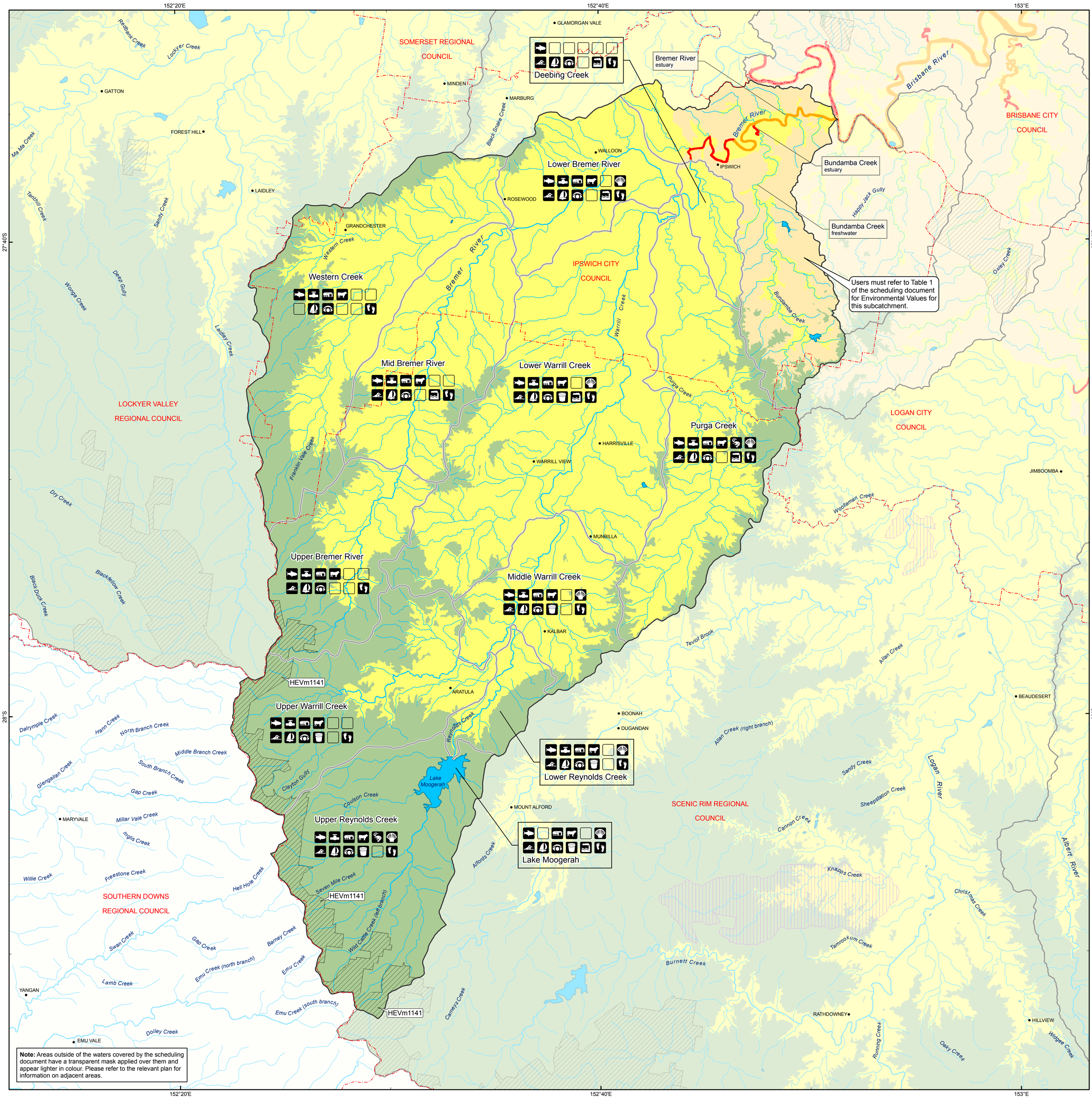
| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 01 | 02 | 03 | 04 | | | | | | |
| 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | | | 13 | 14 | |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | | |
| 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | | |
| 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
rights reserved, 2019. | © State of Queensland (Department of Natural Resources, Mines and Energy) 2018 | © State of Queensland (Department of Natural Resources, Mines ...
Powered by Esri

# BREMER RIVER, INCLUDING ALL TRIBUTARIES OF THE RIVER

## Part of Basin 143




### 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

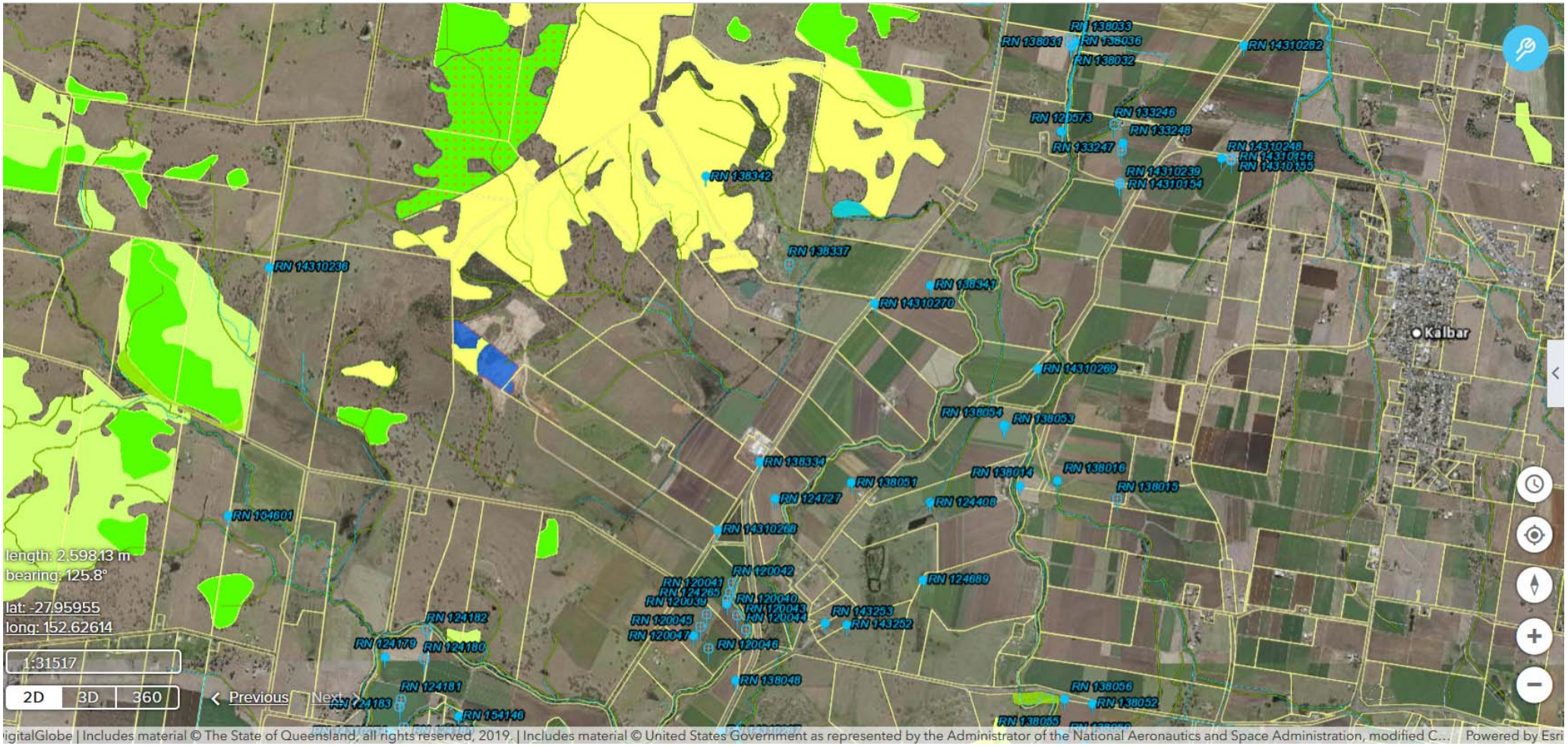
Projection: Map Grid of Australia (MGA) Zone 56

Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

0 5 10 15 20

Kilometres

Scale of 1:150,000 when printed @ A1


RN 138033
RN 138031
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RN 120573
RN 133246
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RN 14310248
RN 14310156
RN 14310155
RN 14310239
RN 14310154
RN 138342
RN 14310236
RN 138337
RN 138341
RN 14310270
Kalbar
RN 14310269
RN 138034
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RN 138334
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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...
Powered by Esri

# 6200 - 6206 Cunningham Highway, Kalbar, Queensland

## Queensland waterway barrier mapping

27°55'39"S 152°33'13"E

27°55'39"S 152°35'39"E

27°57'19"S 152°33'13"E

27°57'19"S 152°35'39"E

A product of Queensland Globe

Legend located on next page

N

0 250 metres

Scale: 1:13546

Printed at: A3

Print date: 4/3/2020

**Datum:** Geocentric Datum of Australia 1994
**Projection:** Web Mercator EPSG 102100

For more information, visit https://qldglobe.information.qld.gov.au/help-info/Contact-us.html



Queensland Government

Department of Natural Resources, Mines and Energy

# 6200 - 6206 Cunningham Highway, Kalbar, Queensland

## Queensland waterway barrier mapping

### Legend

Queensland waterways for waterway barrier works

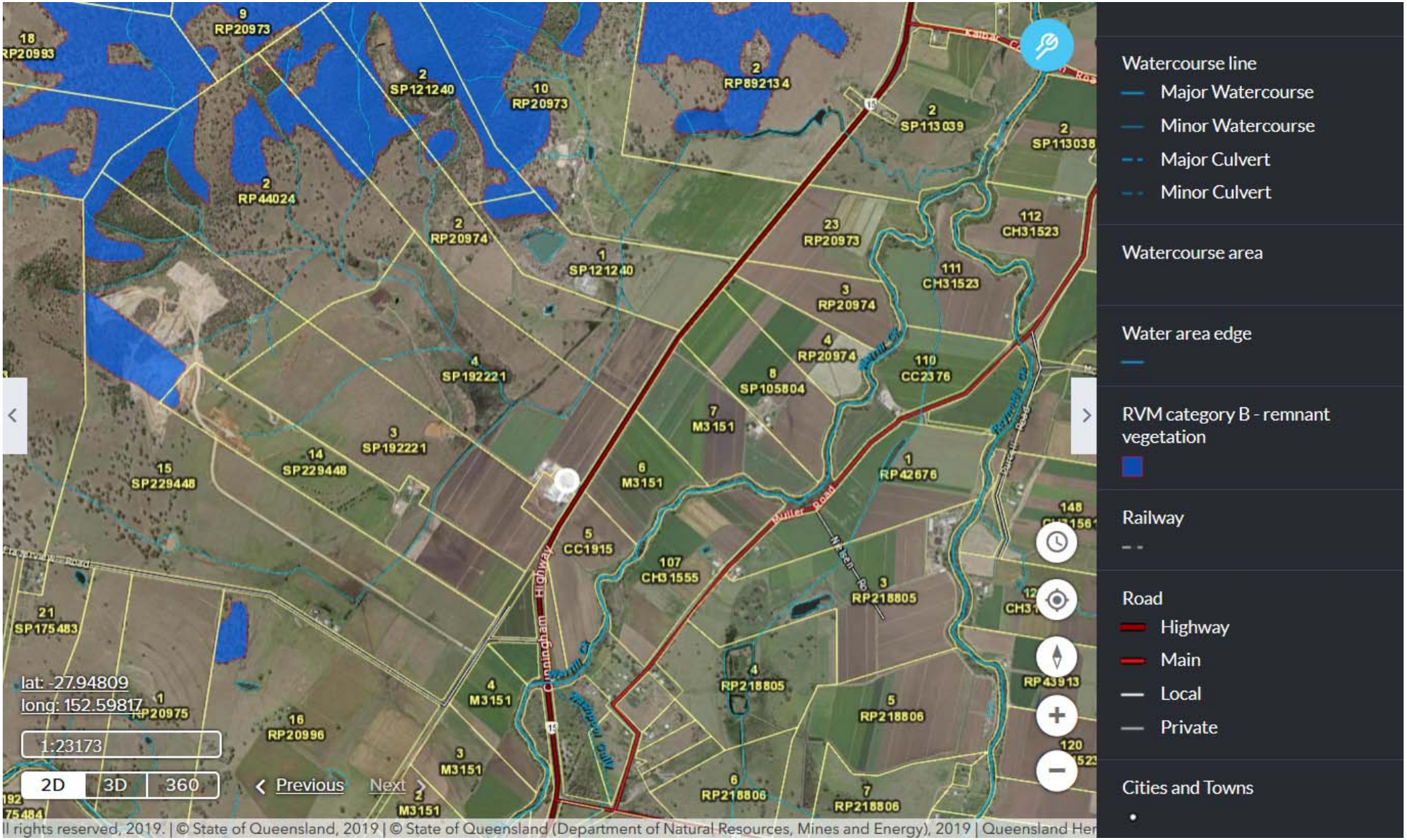
- Major
- High
- Moderate
- Low

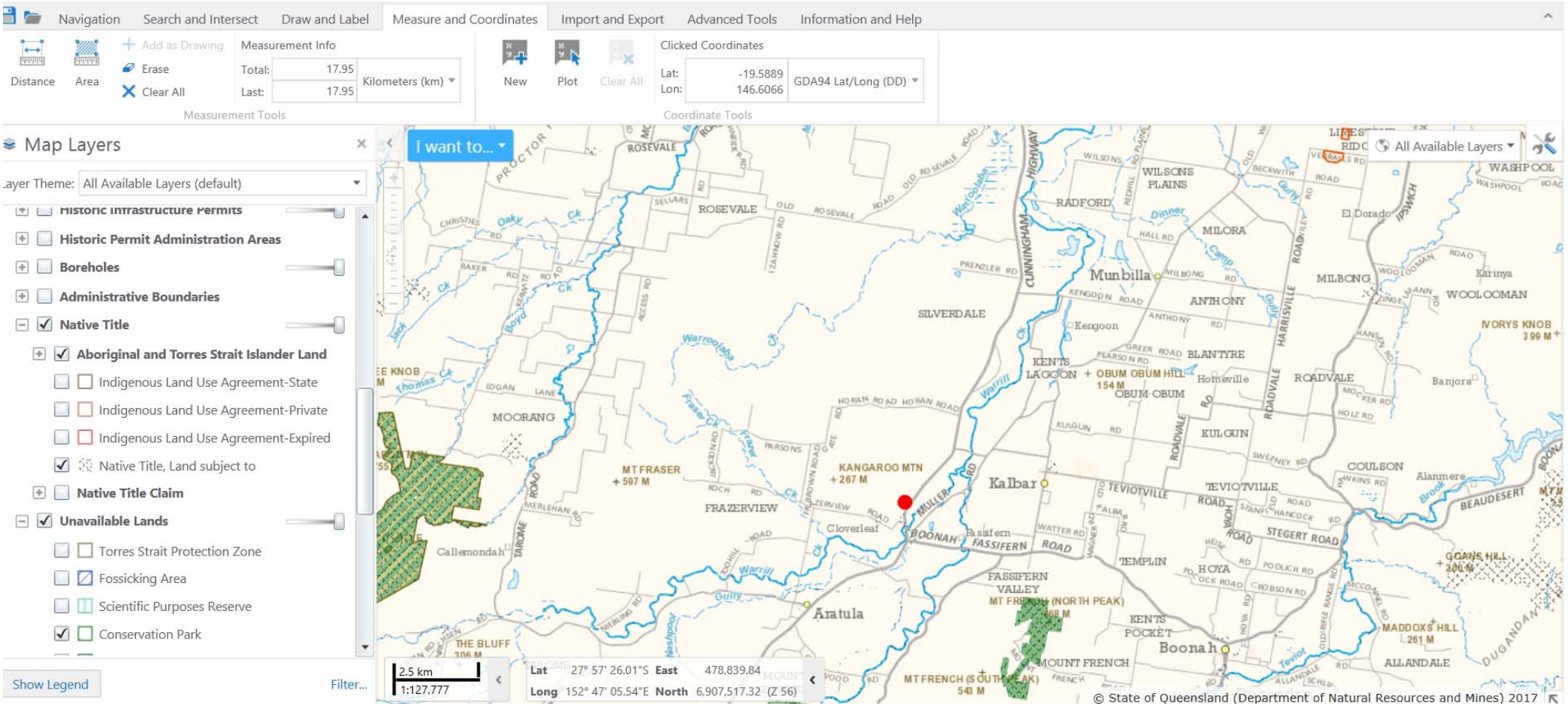
Land parcel

- Parcel

Cities and Towns

### Attribution




Navigation
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
Total: 17.95
Last: 17.95
Kilometers (km)
Measurement Tools
New
Plot
Clear All
Clicked Coordinates
Lat: -19.5889
Lon: 146.6066
GDA94 Lat/Long (DD)
Coordinate Tools
Map Layers
Layer Theme: All Available Layers (default)
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
Munbilla
Kalbar
Boonah
Aratula
Callemondah
Cloverleaf
Fassifern
ROSEVALE
SILVERDALE
MOORANG
FRAZERVIEW
RADFORD
MILORA
MILBONG
ANTHONY
Kengoon
KENTS LAGOON
OBUM OBUM
KULGUN
TEVIOTVILLE
TEMPLIN
HOYA
FASSIFERN VALLEY
KENTS POCKET
MOUNT FRENCH
COULSON
WOOLOOMAN
BLANTYRE
ROADVALE
WILSONS PLAINS
El Dorado
Karinya
Banjora
Alanmere
ALLANDALE
MADDOXS HILL
261 M
IVORYS KNOB
399 M
OBUM OBUM HILL
154 M
KANGAROO MTN
+ 267 M
MT FRASER
+ 597 M
THE BLUFF
306 M
GOANS HILL
200 M
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)
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# 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<br>SDST - Sandstone<br>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<br>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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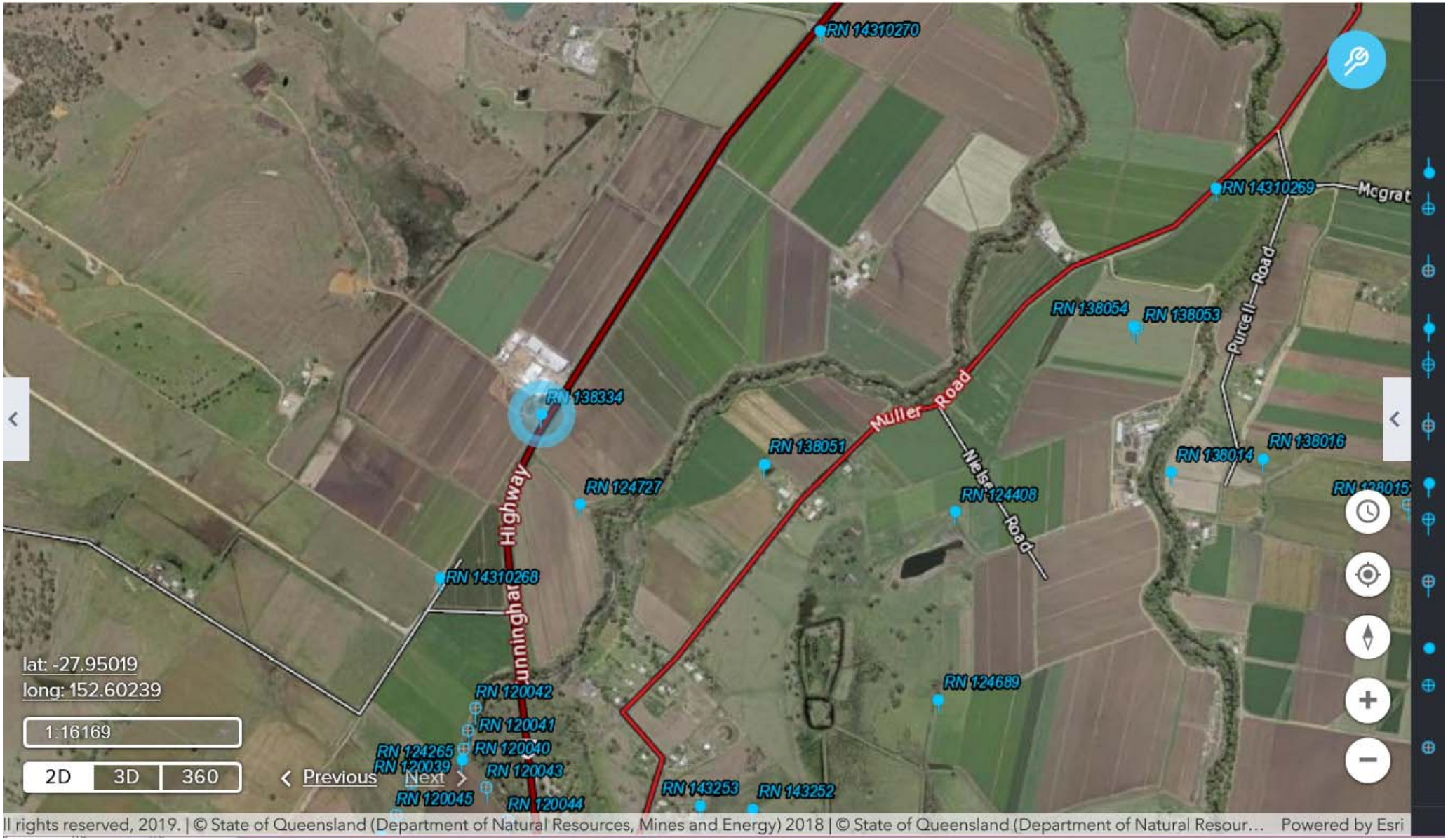
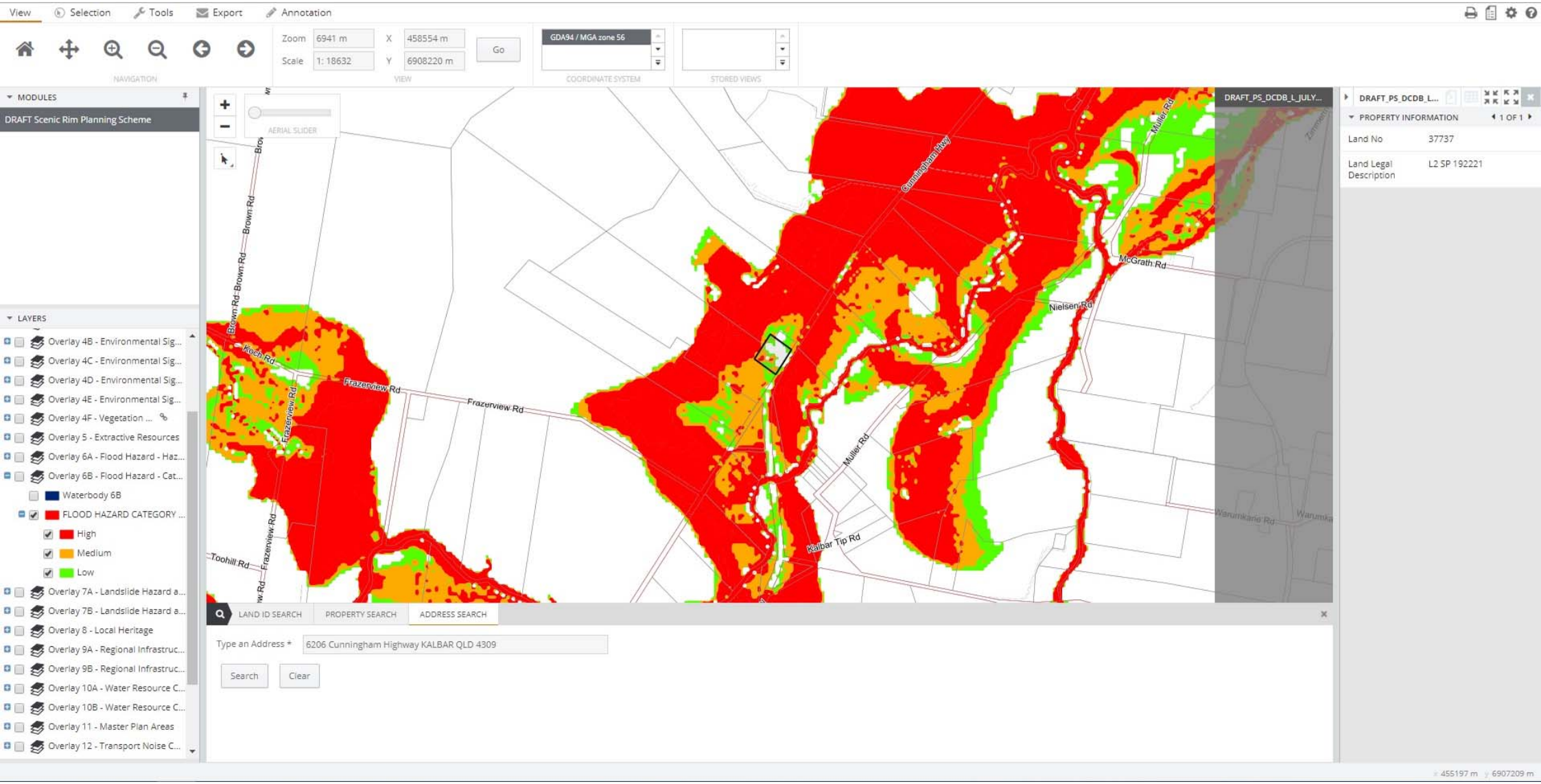

RN 14310270
RN 14310269
Mcgrat
Purcell Road
RN 138054
RN 138053
RN 138334
Muller Road
RN 138051
RN 124727
RN 124408
Nels Road
RN 138014
RN 138016
RN 138015
Highway
RN 14310268
lat: -27.95019
long: 152.60239
1:16169
2D
3D
360
Previous
Next
RN 120042
RN 120041
RN 120040
RN 120043
RN 124265
RN 120039
RN 120045
RN 120044
RN 124689
RN 143253
RN 143252
ll rights reserved, 2019. | © State of Queensland (Department of Natural Resources, Mines and Energy) 2018 | © State of Queensland (Department of Natural Resour… Powered by Esri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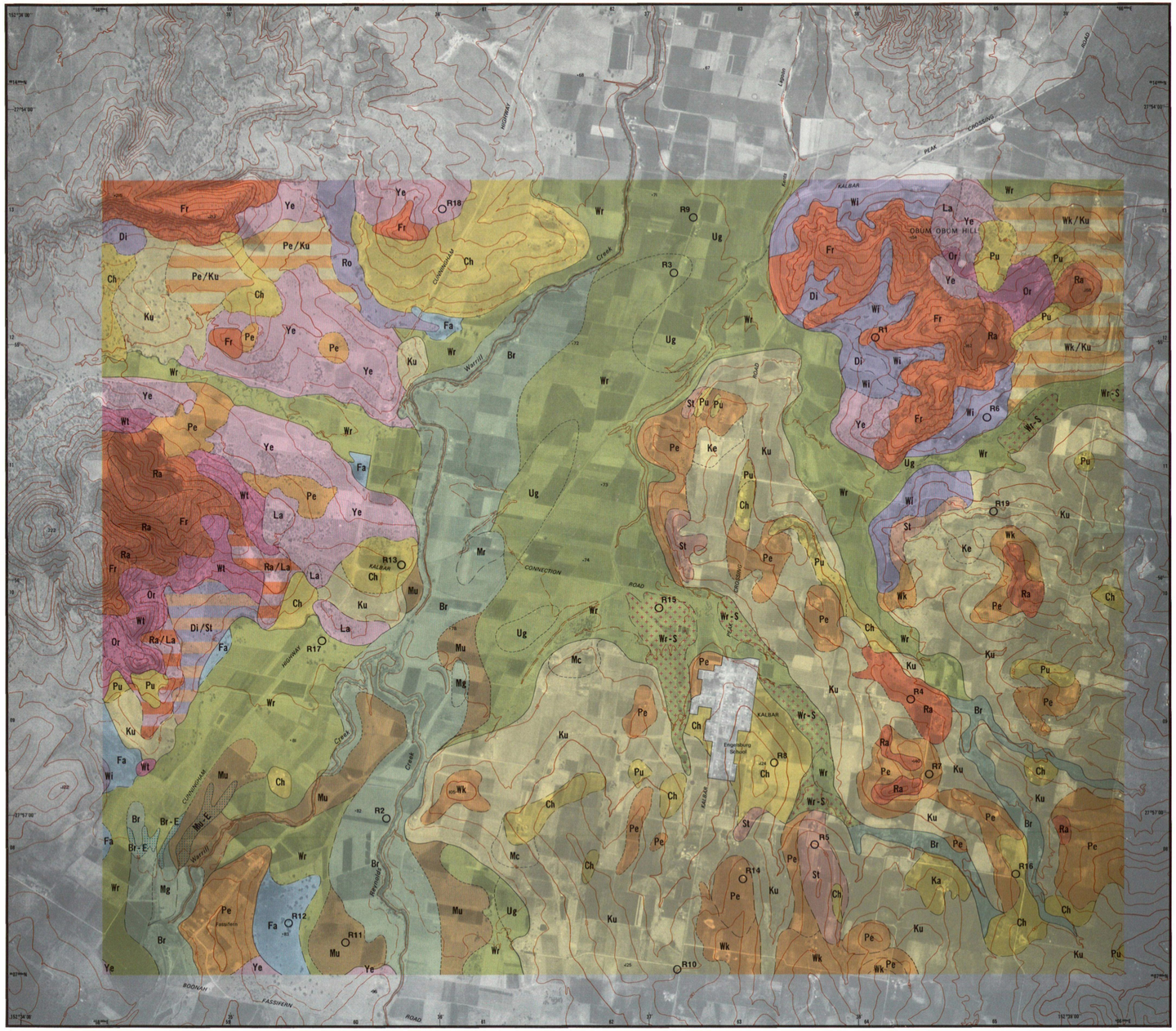
Selection
Tools
Export
Annotation
NAVIGATION
Zoom 6941 m
Scale 1: 18632
X 458554 m
Y 6908220 m
Go
VIEW
GDA94 / MGA zone 56
COORDINATE SYSTEM
STORED VIEWS
MODULES
DRAFT Scenic Rim Planning Scheme
AERIAL SLIDER
LAYERS
Overlay 4B - Environmental Sig...
Overlay 4C - Environmental Sig...
Overlay 4D - Environmental 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
455197 m
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 |

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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 – 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***<br>Include other EPP considerations where relevant (*Management hierarchy, environmental values, quality objectives, management intent)* |
|---|---|---|---|
| **AIR** | | | |
| **EO1**<br>The activity will be operated in a way that protects the environmental values of air. | **PO1.1**<br>There is no discharge to air of contaminants that may cause an adverse effect on the environment from the operation of the activity.<br>**PO1.2**<br>All of the following—<br>1. Fugitive emissions of contaminants from storage, handling and processing of materials and transporting materials within the site are prevented or minimised;<br>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;<br>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 sewage treatment system and/or irrigation area; with the potential to impact the environment and/or the neighbouring users (customers, neighbours, guests). | The STP will most likely be contained on a concrete slab and individual tank components will be fully closed.<br>As such, the STP is not expected to cause any unwanted odours to any nearby sensitive receptors. The irrigation system will distribute effluent above ground via cannon sprinklers, centre-pivot or other. Effluent will be irrigated via coarse droplet irrigation methods that do not produce aerosols. The irrigation area has been appropriately distanced from buildings to avoid any unwanted human contact.<br>No nuisance odours are expected to leave the site boundary (Lot 2 RP20974 is the proposed allotment for the sewage treatment system and effluent irrigation area).<br>*Management*<br>• All systems, machinery and tools used on the system, shall be fitted with appropriate emission reduction controls in accordance with the legal requirements.<br>• Odorous systems and equipment shall be removed from the site for repair/replacement.<br>• Specific environmental monitoring for air quality (dust and/or odours) is not proposed, providing the operation of the treatment system does not generate nuisance odours and the access road for servicing and desludging does not generate dust.<br>*Corrective action – if required*<br>• Cease any activities that cause an offensive odour until odour emission levels have reduced.<br>• A suitably qualified person shall determine the source of the odour or the reason for the non-compliance, and investigate the failure.<br>• Undertake maintenance work if possible, in accordance with the manufacturer's maintenance guidelines or contact the service agent.<br>• Ensure that the source of the odour is repaired or replaced.<br>• Review the reason for the failure and the procedures to prevent re-occurrence.<br>Further details can be provided following approval in an operational management plan (if required). |
| **WATER** | | | |
| **EO2**<br>The activity will be operated in a way that protects environmental values of waters. | **PO2.1**<br>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.<br>**PO2.2**<br>All of the following—<br>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;<br>2. Contingency measures will prevent or minimise adverse effects on the environment due to unplanned releases or discharges of contaminants to water;<br>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;<br>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;<br>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 effluent runoff or infiltration if the facility is not managed appropriately. | The irrigation area is located 100 m east of an ephemeral gully, 75 m southeast of the closest dam and 1.2 km northwest of Warrill Creek as shown in Appendix A, Figures 4 and 5.<br>The irrigation area has been specifically designed using MEDLI to maximise evapotranspiration in order to prevent ponding and runoff of effluent to surface waters.<br>*Management*<br>• Regular monitoring of the sewage treatment system and irrigation area/s will be undertaken to minimise the potential impact on water quality.<br>• Water quality monitoring will be undertaken for the parameters outlined in the approved conditions set for the site.<br>• Sewage treatment and irrigation systems to be maintained in accordance with manufacturers specifications.<br>• No ponding or runoff of effluent on/from the irrigation area/s.<br>• Flow meters to be installed on inflow point of the sewage treatment plant to ensure that the design volume of effluent being irrigated is not exceeded.<br>• Regular monitoring to be conducted to confirm that there is no ingress of stormwater into the sewage treatment plant.<br>• Flow meters to be installed on the out flow point of the wet weather storage tank.<br>• When conditions prevent the irrigation of effluent to land (such as during or following rain events), the effluent will be stored in a 200 kL tank.<br>*Corrective action – if required*<br>• Cease any activities that are impacting the water quality of the sewage treatment system.<br>• A suitably qualified person shall determine the source of the impact or the reason for the non-compliance, and investigate the failure.<br>• Provide additional temporary storage or pump out effluent if required, until system is repaired.<br>• Undertake maintenance work if possible, in accordance with the manufacturer's maintenance guidelines or contact the service agent.<br>• Review the reason for the failure and the procedures to prevent re-occurrence.<br>• Commission an Environmental Consultant to assess any requirement for remediation. |

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| | 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;<br>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;<br>8. The activity will be managed so that adverse effects on environmental values are prevented or minimised. | | |
| **WETLANDS** | | | |
| **EO3**<br>The activity will be operated in a way that protects the environmental values of wetlands. | **PO3.1**<br>There will be no potential or actual adverse effect on a wetland as part of carrying out the activity.<br>**PO3.2**<br>The activity will be managed in a way that prevents or minimises adverse effects on wetlands. | Nearby wetlands could be impacted by effluent runoff or infiltration if the facility is not managed appropriately.<br><br>Not applicable as there are no mapped wetlands within 5 km of the site. | While this condition is redundant in the absence of wetlands in the locale, MEDLI modelling has predicted the loading which the irrigation area is able to sustainably receive. The activity shall be maintained with reference to the below management strategies and corrective actions taken if any non-compliances occur.<br>*Management*<br>• All components of the sewage treatment plant and irrigation system must be maintained in accordance with manufacturer's specification<br>• If ponding and/or runoff of effluent is observed throughout the life of the irrigation system, effluent irrigation must cease until such time as ponding and/or runoff is appropriately managed. DES must be notified if runoff offsite occurs<br>*Corrective action – if required*<br>• Cease any activities in the event that effluent runoff migrates beyond the site boundary or threatens to reach environmental receptors.<br>• A suitably qualified person shall determine the reason for the runoff, and provide recommendations to avoid any re-occurrence.<br>• Undertake maintenance/remedial work if possible, in accordance with the manufacturer's maintenance guidelines or contact the service agent.<br>• Reduce the volume of water directed to the IA if runoff ever occurs.<br>Further details can be provided following approval in an operational management plan (if required). |
| **GROUNDWATER** | | | |
| **EO4**<br>The activity will be operated in a way that protects the environmental values of groundwater and any associated surface ecological systems. | **PO4.1**<br>Both of the following apply—<br>1. There will be no direct or indirect release of contaminants to groundwater from the operation of the activity;<br>2. There will be no actual or potential adverse effect on groundwater from the operation of the activity.<br>**PO4.2**<br>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. | Groundwater will not be impacted by the operation of the STP or the irrigation of effluent to the irrigation area/s.<br>No groundwater dependant ecosystems are mapped within 5 km of the site, furthermore the nearest groundwater bore is 745 m south of the irrigation area.<br>MEDLI modelling has been utilised when developing a sustainable irrigation method for effluent. The concentration of nitrate in deep drainage of irrigated effluent is 0.38 mg/L, while the phosphate deep drainage concentration is 0.04mg/L. Dilution and assimilation of the residual nitrogen and phosphorous in the deep drainage is expected prior to any contact with groundwater. The site has been mapped by DERM as lowland freshwaters, with applicable environmental values listed in Table 6 of this report. Noting baseline total nitrogen in the shallow aquifer has been recorded at 7.3 mg/L.<br>*Management*<br>• Regular monitoring of the sewage treatment system and irrigation area will be undertaken to minimise the potential impact on water quality. This may be substituted with cattle grazing at the subject site.<br>• No ponding or runoff of effluent on/from the irrigation area.<br>• Flow meters to be installed on inflow and out flow points of the sewage treatment plant to ensure that the design volume of effluent being irrigated is not exceeded and that infiltration of groundwater and stormwater is detected and minimised.<br>Groundwater monitoring wells can be installed as a condition of approval if considered to be required by DES. |
| **NOISE** | | | |
| **EO5**<br>The activity will be operated in a way that protects the environmental values of the acoustic environment. | **PO5.1**<br>Sound from the activity is not audible at a sensitive receptor.<br>**PO5.2**<br>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. | Sewage treatment systems can cause excessive noise if they are not correctly serviced and maintained.<br><br>Common sources of noise include pumps, aerators, audible alarms, irrigation sprinklers and maintenance vehicles. Excessive noise can impact work camp residents, staff, site owners, neighbours and fauna. | The STP will not cause a noise to any nearby sensitive receptors, e.g. staff, contractors, nearby occupants, flora or fauna.<br>The STP is to be fully enclosed (if practical) to avoid any excessive noise emanating from the STP.<br>No noise is to leave the site boundary (Lot 2 RP20974).<br>*Management*<br>• All systems and machinery will be efficient, operated appropriately, and maintained in good order.<br>• All systems, machinery and tools used on the systems are to be fitted with appropriate noise reduction controls in accordance with the legal requirements.<br>• Non-conforming systems and equipment are to be removed from the site for repair/replacement.<br>• Specific environmental monitoring for noise is not proposed, providing the operation of the treatment system does not generate excessive or nuisance noise levels.<br>• 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 concerns. |

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| | | | • If 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).<br>*Corrective action – if required*<br>• Cease any activities that cause excessive or nuisance noise levels.<br>• A suitably qualified person shall determine the source of the noise or the reason for the non-compliance, and investigate the failure.<br>• Undertake maintenance work if possible, in accordance with the manufacturer's maintenance guidelines or contact the service agent.<br>• Have the source of the noise repaired or replaced.<br>• Review the reason for the failure and the procedures to prevent re-occurrence.<br>• Review the speed limit of the access roads and consult access road users. |
| **WASTE** | | | |
| **EO6**<br>**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**<br>Both of the following apply—<br>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*;<br>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:<br>• Accumulated general waste which can cause aesthetic issues and impact human health and the environment<br>• Sludge accumulation in the sewage treatment tanks which can cause the carryover of solid material to the irrigation area and fouling or surface pooling<br>• Sludge spillage during desludging operations which can impact human health and the environment. | Waste generated from the operation of the STP, such as sludge, will not cause impact to human health or the surrounding environment.<br>*Management*<br>• When conditions prevent the irrigation of effluent to land (such as during or following rain events), the effluent will be stored in a 200 kL tank.<br>• The effluent can be removed by a licensed liquid waste contractor or irrigated on site when rain ceases and deemed to be appropriate either via daily visual inspection and/or via the use of soil moisture meters.<br>• The tank is to be fitted with a high level alarm capable of providing sufficient time to engage a licensed contractor to pump out the tank prior to any overflows occurring (to trigger at 80% capacity).<br>• A flow meter is to be installed on the outlet to measure irrigation flows on a daily basis.<br>• The collection system must not receive trade waste and water generated as a result of recreational equipment washing.<br>• Waste material is not to be disposed of by burning or burying onsite.<br>• All wastes temporarily stored onsite will be confined to dedicated areas and managed to prevent the occurrence of environmental harm or nuisance.<br>• 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.<br>• A dedicated desludging area will be constructed directly adjacent to the sewage treatment system. The desludging area/s will be bunded and constructed with an impermeable base. This area will also be utilised as a designated wash-down area for cleaning service vehicles and equipment.<br>• A spill clean-up kit will be located within the storage area.<br>• A licensed contractor as required will undertake removal of sludge from the sewage treatment system.<br>• All sludge and wastes transported from the site shall be covered or suitably handled to prevent the occurrence of environmental harm or nuisance<br>• A bag filter or stainless screen will capture solids and these will be appropriately disposed of as solid waste.<br>*Corrective action – if required*<br>• Ensure that the sludge level within the sewage treatment system is monitored regularly to identify when desludging is required.<br>• Increase the frequency of desludging in order to prevent sludge accumulation in the sewage treatment tanks which may cause carry over of solid material to the irrigation area resulting in fouling or surface pooling.<br>• The desludging contractor will be made aware of the location of which the desludging process is to be undertaken.<br>• Should a spillage occur during the desludging process, the spillage will be cleaned up immediately in an appropriate manner.<br>• All sludge and wastes transported from the site will be covered or suitably handled to prevent the occurrence of environmental harm or nuisance. |
| **LAND** | | | |
| **EO7**<br>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**<br>There is no actual of potential disturbance or adverse effect to the environmental values of land as part of carrying out the activity.<br>**PO7.2**<br>All of the following—<br>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;<br>2. Areas disturbed will be rehabilitated or restored to achieve sites that are—<br>a) safe to humans and wildlife; | Land contamination could occur as a result of the following:<br>• Untreated sewage overflowing from the sewage treatment system<br>• Substandard effluent being discharged to the irrigation areas<br>• Sludge spillages during desludging | Land contamination as a result of the treatment and irrigation of effluent will be prevented by appropriate treatment of sewage to the criteria outlined in the EA conditions, and ongoing monitoring of influent/effluent quality and routine inspections of the irrigation area/s. 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.<br>Management<br>• Contaminants from the activity must not be released to land except as authorised in the Environmental Authority.<br>• Effluent (treated) is permitted to be released to land provided that the activity is conducted in accordance with the EA conditions and that ensures:<br>a) infiltration to groundwater and subsurface flows of contaminants to surface waters are prevented<br>b) surface ponding and run-off of effluent is prevented<br>c) degradation of soil structure is minimised<br>d) soil sodicity and the build-up of nutrients and heavy metals in the soil and subsoil are minimised<br>e) runoff caused through trenching does not carry beyond effluent disposal areas |

| | | | |
|---|---|---|---|
| | b) non-polluting; and<br>c) stable; and<br>d) able to sustain an appropriate land use after rehabilitation or restoration;<br>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;<br>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. | • Offsite migration of contaminants to adjacent properties and waterways. | f) effluent disposal areas are maintained with an appropriate crop in a viable state for transpiration and nutrient uptake<br>g) the crop on the disposal area is harvested and removed from the disposal area.<br>• When weather conditions or soil conditions preclude the release of effluent to land, irrigation must not occur.<br>• A total of 20,000 $m^2$ irrigation area shall be utilised for an estimated hydraulic flow of 40,000 L/day and has been confirmed via MEDLI modelling.<br>• Effluent release limits to comply with those specified in the Environmental Authority.<br>• Effluent to comply with the conditions of any Development Permit (past, current or future).<br>• Sewage treatment and irrigation systems to be maintained in accordance with manufacturers specifications.<br>• Flow meters to be installed in sewage treatment system to ensure that the proposed volume of effluent being irrigated is not exceeded.<br>• During wet weather periods (i.e. when wet weather storage capacity will be exceeded) the effluent storage tanks will be pumped out by a licensed contractor and disposed of offsite.<br>• All chemicals to be stored in appropriately bunded areas.<br>A soil monitoring program may be developed as a condition of approval if considered to be required by DES.<br>*Corrective action – if required*<br>• Cease any activities that cause possible land contamination.<br>• A suitably qualified person shall determine the source of the land contamination or the reason for the non-compliance, and investigate the failure.<br>• Provide additional temporary storage or pump out of sewage if required, until system is repaired.<br>• Undertake maintenance work if possible, in accordance with the manufacturer's maintenance guidelines or contact the service agent.<br>• Review the reason for the failure and the procedures to prevent re-occurrence.<br>• Commission a suitably qualified Environmental Consultant to assess any requirement for remediation.<br>• All chemical/fuel spills to be contained within an appropriate system. |

## LAND REHABILITATION

### Land rehabilitation strategy for Lot 2 RP20974.

A rehabilitation strategy for cessation of the proposed ERA 63 is presented in Table B.

**Table B.** Land rehabilitation strategies.

| Aspect | Strategy | |
|---|---|---|
| **Site details** | Lot 2 RP20974, Cunningham Highway, Kalbar, Queensland. | |
| **Current site use** | The site is currently used for cattle grazing. | |
| **Proposed site use** | Agricultural Industrial Precinct | |
| **Description of ERA activity** | Sewage treatment plant (STP), wet weather storage tank (WWST), pump stations (where applicable), surface spray irrigation and associated pipework. Irrigation area is proposed to be a maximum of 20,000 $m^2$. | |
| **Site use following ERA activity ceases** | The proposed activity does not have an anticipated 'end date'. The activity will most likely cease if it becomes connected to the reticulated sewer network (expected to be 30 + years). | |
| **Rehabilitation goal** | To make the site suitable for agricultural land use at the cessation of the ERA. In addition, the site shall be made:<br>- Safe to humans, livestock, cropping, wildlife<br>- Non-polluting<br>- Stable<br>- Able to sustain an agreed post ERA land use. | |
| **Contaminants of concern associated with the proposed ERA 63** | Nutrients (nitrogen and phosphorus accumulation)<br>Salt (salt accumulation)<br>Disinfectants (e.g. Chlorine)<br>Pathogens (*E.coli* and faecal coliforms). | |
| **Potential environmental receptors/impacts** | **Land / soil:**<br>- Degradation in the physical and chemical properties of soil and vegetation within and adjacent to the designated irrigation areas, STP and WWST (i.e. contamination with bacterial and viral pathogens, increased nutrients, salinity, erosion and sedimentation, plant stress, contamination with disinfection chemicals and their derivatives, anions and cations). | **Surface waters:**<br>- Contaminants reaching surface waters (including all matters of state environmental significance)<br>- Overland runoff causing flooding of waterways and sediment deposits<br>- Eutrophication of waterways (algal blooms, reduction in dissolved oxygen and fish kills). |
| | **Health impacts:**<br>- Impacts to human health via inhalation, ingestion or dermal contact with contaminants (i.e. pathogens). | **Waste:**<br>- Overtopping of the STP or WWST or accidental spillage of sludge (i.e. during sludge removal) from the STP onsite causing land contamination. |

| Aspect | Strategy |
|---|---|
| | **Groundwater:**<br>- Contaminants reaching groundwaters and impacting nearby groundwater users. |
| **Actions to mitigate potential environmental impacts** | Conduct the ERA 63 in accordance with the conditions specified in the Environmental Authority including ongoing monitoring of effluent. |
| **Remediation steps to be supervised by suitably qualified persons** | - Remove any sludge and liquid in the STP and associated infrastructure to a licenced landfill or similar.<br>- Remove and appropriately dispose/recycle the sewerage infrastructure including the STP, WWST, irrigation pipe work and any required pump stations.<br>- Conduct representative sampling of soil in the irrigation areas and adjacent to the sewerage infrastructure and analysis of the samples for parameters including nitrogen, phosphorus, salt/electrical conductivity, pH, pathogens (e.g. *E. coli*), anions, cations and permeability.<br>- The number, location and depth of samples shall be determined by a suitably qualified scientist with reference to current Queensland Government made and/or approved guidelines.<br>- Relevant land use criteria to be derived from current Queensland Government made and/or approved guidelines<br>- 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).<br>- Infill any depressions with clean soil or other engineered material and compact to site specific engineer density<br>- 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.<br>- The number and location of samples shall be determined by a suitably qualified scientist with reference to current Queensland Government made and/or approved guidelines<br>- Remediate waters as required under the guidance of a suitably qualified scientist.<br>Guidance considered in conducting the above scope (unless superseded) shall include:<br>- 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)<br>- Australian Standard: *Guide to sampling and investigation of potentially contaminated soil, Part 2: Volatile substances* - (AS 4482.2 1999)<br>- *National Environmental Protection (Assessment of Site Contamination) Measure 1999* (NEPC 2013).<br>- *Environmental Protection Regulation 2019.* |

## ATTACHMENT E – LABORATORY CERTIFICATES OF ANALYSIS

Queensland Government

Department of Environment and Science - Chemistry Centre
Eco Sciences Precinct
Level 3, Block A, 41 Boggo Rd
Dutton Park Qld 4102

# Sample Receival Advice

## Customer Details

| | |
|---|---|
| Customer: | Precise Environmental |
| | 7/14 Fremantle Street |
| | Burleigh Heads |
| | |
| | QLD |
| Contact: | Danae Bragg |
| Phone: | 07 5593 7848 |
| Mobile: | 614 39 973 878 |
| email: | danae@preciseenvironmental.com.au |

## Job Details

| | |
|---|---|
| **Job No:** | **19-0928** |
| No Samples: | 3 |
| Date Sampled: | 21/10/2019 to 21/10/2019 |
| Date Received: | 23/10/2019 to 23/10/2019 |
| Consignor: | |
| Contact: | Angus Mcelnea |
| Phone: | 07 31705648 |
| Fax: | 07 31705801 |
| email: | angus.mcelnea@des.qld.gov.au |

Approx time (working days): _____

## Sample Details

Comment:

| Sample Type | Samples |
|---|---|
| Soil | 3 |

## Water Bottle Details

| A | B | C | D | E | Other | Total |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

19-0928

## CHAIN OF CUSTODY

*DES CHEMISTRY CENTRE - LEVEL 3 EAST, BLOCK A, ECOSCIENCES PRECINCT, 41 BOGGO ROAD, DUTTON PARK, QLD, 4102*

| | | | | | |
|---|---|---|---|---|---|
| CLIENT: | Precise Environmental | TURNAROUND REQUIREMENTS : | ☐ Standard TAT (List due date): | FOR LABORATORY USE ONLY (Circle) | |
| OFFICE: | Unit 7 / 14 Fremantle Street, Burleigh Heads, Qld 4220 | (Standard TAT may be longer for some tests e.g., Ultra Trace Organics) | ☐ Non Standard or urgent TAT (List due date): | Custody Seal Intact? | Yes / No / N/A |
| PROJECT: | PE2898.19 | | COC SEQUENCE NUMBER (Circle) | Free ice / frozen ice bricks present upon receipt? | Yes / No / N/A |
| ORDER NUMBER: | PE2898.19 | | COC: 1 2 3 4 5 6 7 8 9 10 11 | Random Sample Temperature on Receipt: | °C |
| PROJECT MANAGER: | Chris Butler | CONTACT PH: 0431 565 210 | OF: 1 2 3 4 5 6 7 8 9 10 11 | Other comment: | |
| SAMPLER: | Chris Butler | SAMPLER MOBILE: 0431 565 210 | RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: / RECEIVED BY: |
| COC emailed? ( YES / NO) | | EDD FORMAT (or default): | Danae Bragg | S. MORK | |
| Email Reports to: danae@preciseenvironmental.com.au / sean@preciseenvironmental.com.au | | | DATE/TIME: | DATE/TIME: | DATE/TIME: / DATE/TIME: |
| Email Invoice to: danae@preciseenvironmental.com.au / sean@preciseenvironmental.com.au | | | 22.10.19 @ 9 am | 23/10/19 8:45AM | |

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

| LAB USE ONLY | SAMPLE DETAILS | | MATRIX: Solid(S) Water(W) | CONTAINER INFORMATION | | ANALYSIS REQUIRED including SUITES | | | | | | | | | | | | | Additional Information |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LAB ID | SAMPLE ID | DATE / TIME | MATRIX | TYPE & PRESERVATIVE *(refer to codes below)* | TOTAL BAGS | S_AQ4_EL (pH and EC) | S_AQ4_AA | S_COLWELL | Organic nitrogen | Phonsphorus buffer index (PBI) | S_DUM_TOC | S_KJ_AA | S_ADM_105 | S_PSA | S_15_BAR | S_03_BAR | SP_2 | SP_05 | Exchangeable sodium percentage (ESP) | Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc. |
| | BH1 0.1 - 0.25 | 21.10.19 | S | Bag, <4° C | 1 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| | BH2 0.0 - 0.6 | 21.10.19 | S | Bag, <4° C | 1 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| | BH3 0.3 - 0.6 | 21.10.19 | S | Bag, <4° C | 1 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | TOTAL | 3 | | | | | | | | | | | | | | | |

*Water Container Codes:* P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VS = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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.
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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 F – MEDLI OUTPUT

MEDLI REPORT - FULL RUN

**Enterprise**: **Kalbar**

**Description**:
Rural Enterprise Precinct

**Client**: **Kalfresh**

**MEDLI User**: PRECISE-LAP02\Main

**Scenario Details**:

DESCRIPTION

## Climate Data: Kalbar, -27.95°, 152.62°

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

**Climate Statistics**:

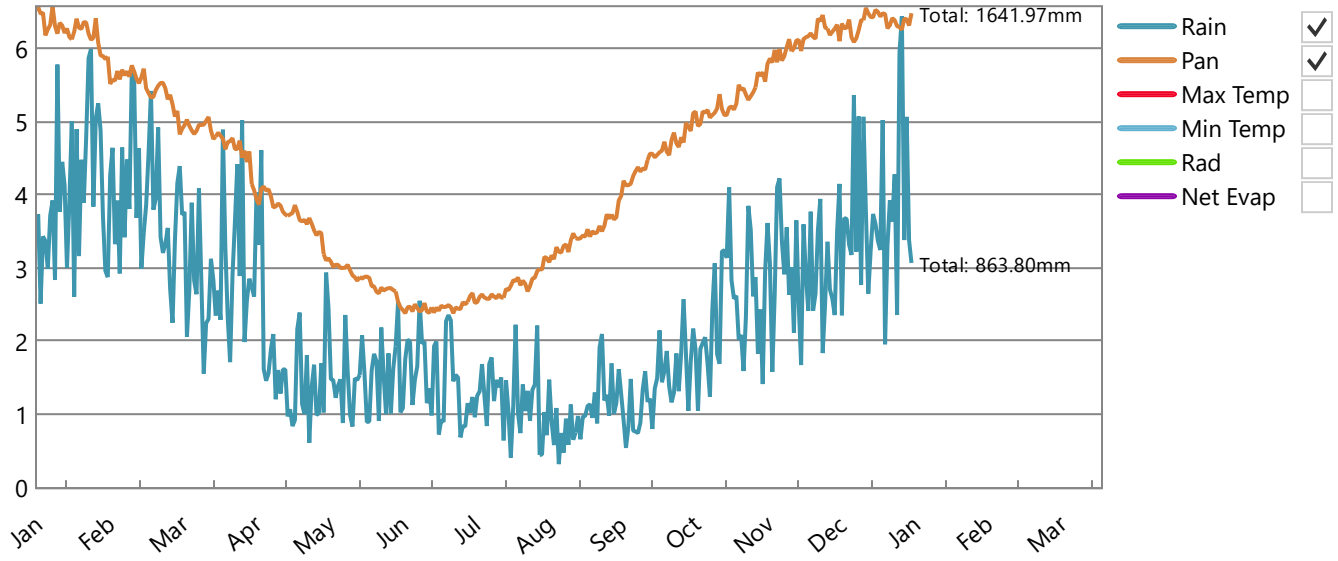
| | 5th Percentile | 50th Percentile | 95th Percentile |
|---|---|---|---|
| Rainfall (mm/year) | 503 | 867 | 1219 |
| Pan Evaporation (mm/year) | 1483 | 1633 | 1804 |

**Climate Data:**

Chart Table

Monthly Daily

**Daily Average Across Run Period**

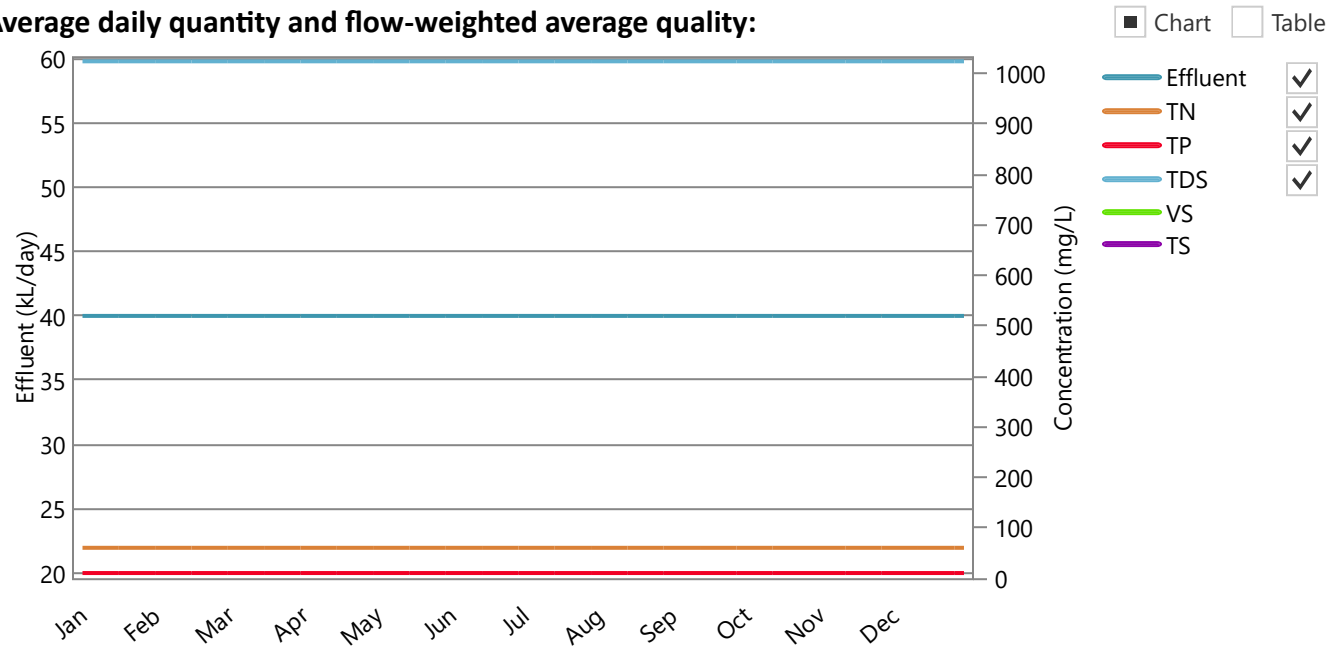


DESCRIPTION

## 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:** 14609.54 kL/year or 40.00 kL/day (Min-Max: 40.00 - 40.00)

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

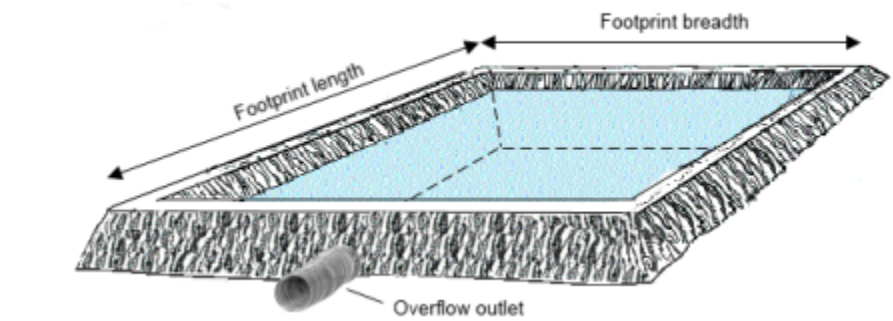
| | Concentration (mg/L) | Load (kg/year) |
|---|---|---|
| Total Nitrogen | 60.00 (60.00 - 60.00) | 876.57 (876.00 - 878.40) |
| Total Phosphorus | 10.00 (10.00 - 10.00) | 146.10 (146.00 - 146.40) |
| Total Dissolved Salts | 1024.00 (1024.00 - 1024.00) | 14960.17 (14950.40 - 14991.36) |
| Volatile Solids | 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) |

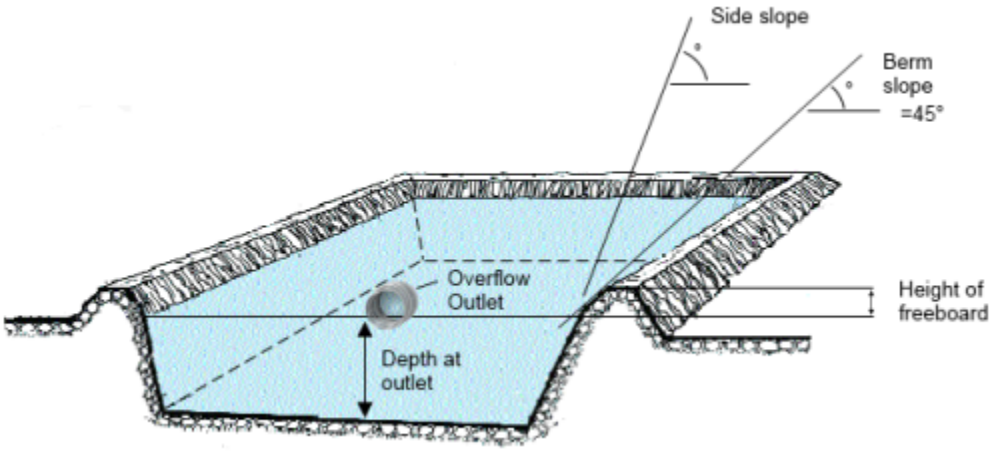
DESCRIPTION

## Pond system: 1 closed storage tank

### Pond system details:

| | Pond 1 |
|---|---|
| Maximum pond volume (kL) | 200.00 |
| Minimum allowable pond volume (kL) | 0.00 |
| Pond depth at overflow outlet (m) | 6.00 |
| Maximum water surface area (m2) | 33.33 |
| Pond footprint length (m) | 5.77 |
| Pond footprint width (m) | 5.77 |
| Pond catchment area (m2) | 33.33 |
| Average active volume (kL) | 0.00 |




### Irrigation pump limits:

| | |
|---|---|
| Minimum pump rate limit (ML/day) | 0.00 |
| Maximum pump rate limit (ML/day) | 1.00 |

### 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 |

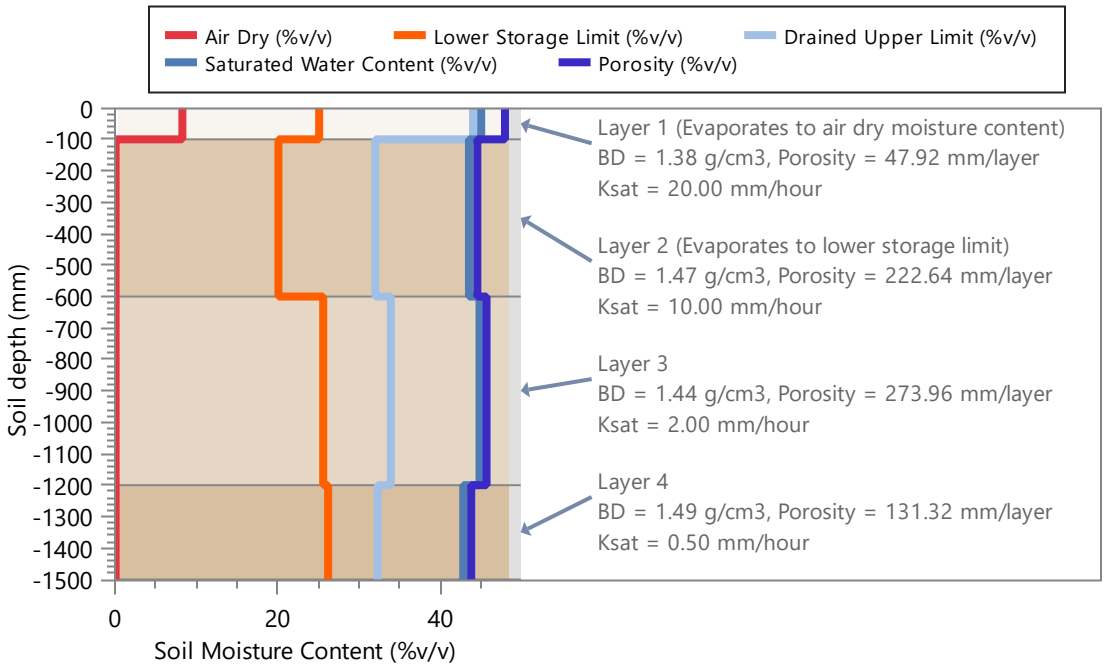
DESCRIPTION

## Land: New Paddock

### Area (ha): 2.00

### 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

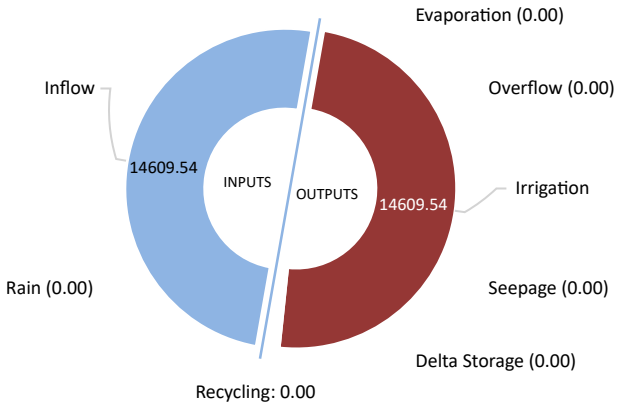
| | |
|---|---|
| Average monthly cover (fraction) (minimum - maximum) | 0.71 (0.70 - 0.71) |
| Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.9 x Pan coefficient 1) | 0.90 |
| Total plant cover (both green and dead) left after harvest (fraction) | 0.75 |
| Maximum potential root 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: **200 kL**

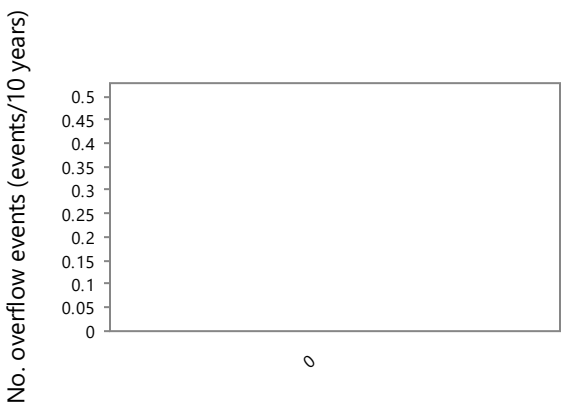
### Pond System Water Balance (kL/year)




| Name | Value |
|---|---|
| **Rain** | 0.00 |
| **Inflow** | 14609.54 |
| **Recycling** | 0.00 |
| **Evaporation** | 0.00 |
| **Overflow** | 0.00 |
| **Irrigation** | 14609.54 |
| **Seepage** | 0.00 |
| **Delta Storage** | 0.00 |

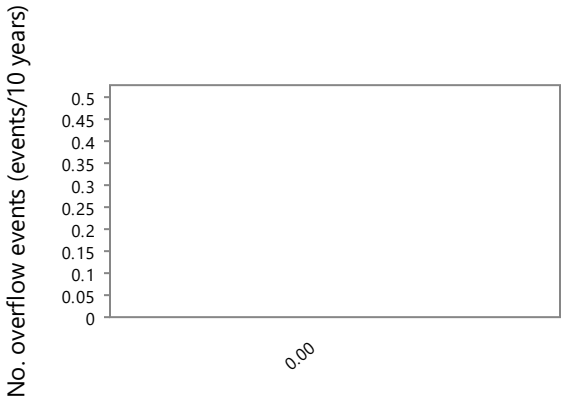
### Overflow Diagnostics

| | |
|---|---|
| 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 |



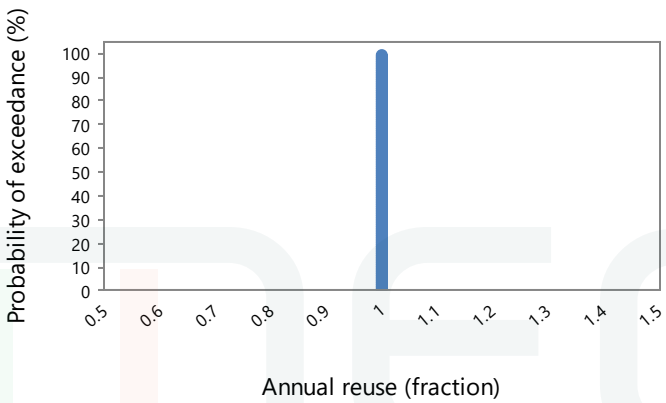

Overflow event duration exceeded (days)

Export plot




Overflow volume exceeded (kL)

Export plot




Annual reuse (fraction)

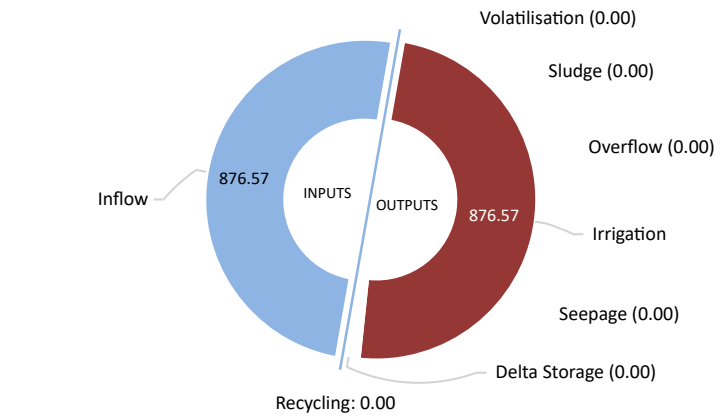
Export plot

PERFORMANCE

# Pond System Performance - Nutrient: 1 closed storage tank

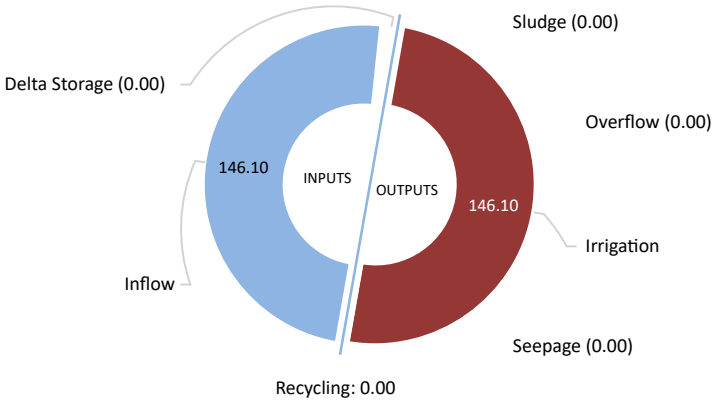
## Pond System Nutrients and Salt Balance:

### Nitrogen Balance (kg/year)



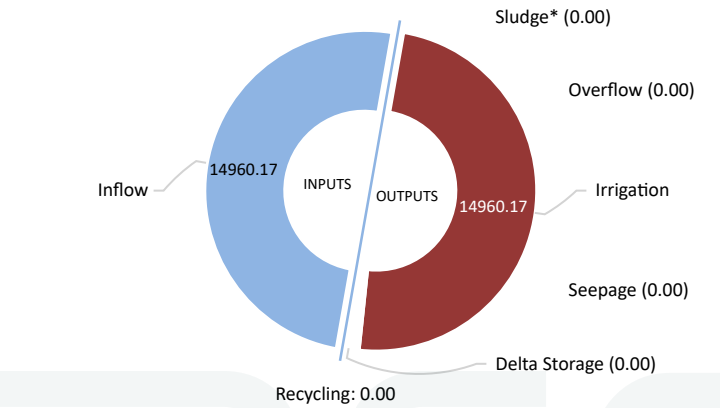

| Name | Value |
|---|---|
| **Inflow** | 876.57 |
| **Recycling** | 0.00 |
| **Volatilisation** | 0.00 |
| **Sludge** | 0.00 |
| **Overflow** | 0.00 |
| **Irrigation** | 876.57 |
| **Seepage** | 0.00 |
| **Delta Storage** | 0.00 |

### Phosphorus Balance (kg/year)




| Name | Value |
|---|---|
| **Inflow** | 146.10 |
| **Recycling** | 0.00 |
| **Sludge** | 0.00 |
| **Overflow** | 0.00 |
| **Irrigation** | 146.10 |
| **Seepage** | 0.00 |
| **Delta Storage** | 0.00 |

### Salt Balance (kg/year)




| Name | Value |
|---|---|
| **Inflow** | 14960.17 |
| **Recycling** | 0.00 |
| **Sludge*** | 0.00 |
| **Overflow** | 0.00 |
| **Irrigation** | 14960.17 |
| **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) | 60.00 |
| Average phosphorus concentration of pond liquid (mg/L) | 10.00 |
| 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) | 14609.54 |
| Average Shandy water irrigation (kL/year) (minimum - maximum) | 0.00 (0.00 - 0.00) |
| Total water irrigated (kL/year) | 14609.54 |
| 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) | 60.00 |
| Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L) | 60.00 |
| Average phosphorus concentration of irrigation water (mg/L) | 10.00 |
| Average salinity of irrigation water (uS/cm) | 1600.00 |

### Irrigation Diagnostics:

| | |
|---|---|
| Proportion of Days irrigation occurs (fraction) | 1.00 |

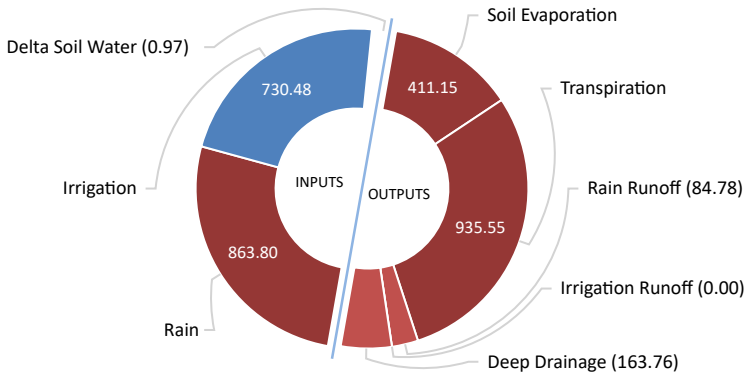
PERFORMANCE

## Land Performance - Soil Water

**Paddock:** New Paddock, 2 ha
**Soil Type**: Kalbar Low Permeability Red Brow, 146.50 mm PAWC at maximum root depth

### Land Water Balance (mm/year):

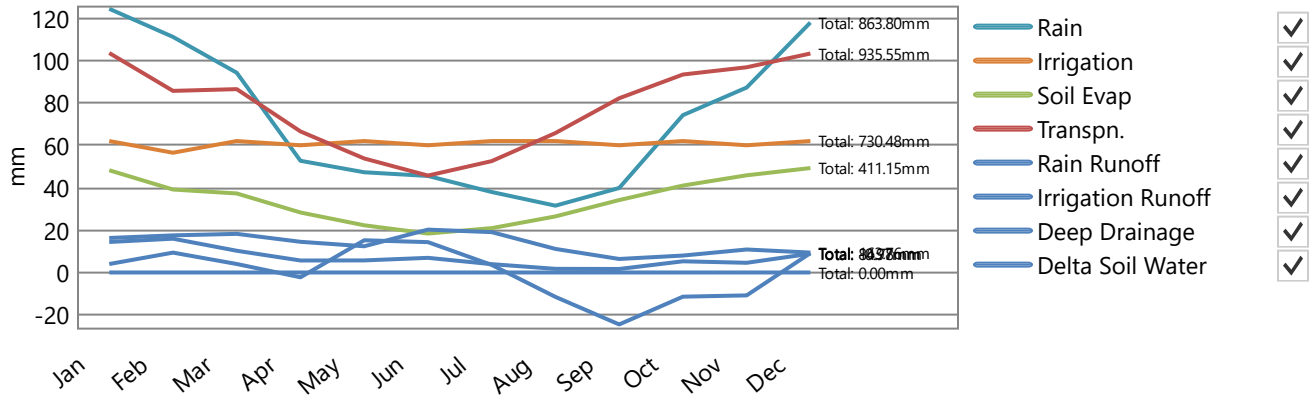
mm/year % Total inputs




| Name | Value |
|---|---|
| **Rain** | 863.80 |
| **Irrigation** | 730.48 |
| **Soil Evaporation** | 411.15 |
| **Transpiration** | 935.55 |
| **Rain Runoff** | 84.78 |
| **Irrigation Runoff** | 0.00 |
| **Deep Drainage** | 163.76 |
| **Delta Soil Water** | -0.97 |

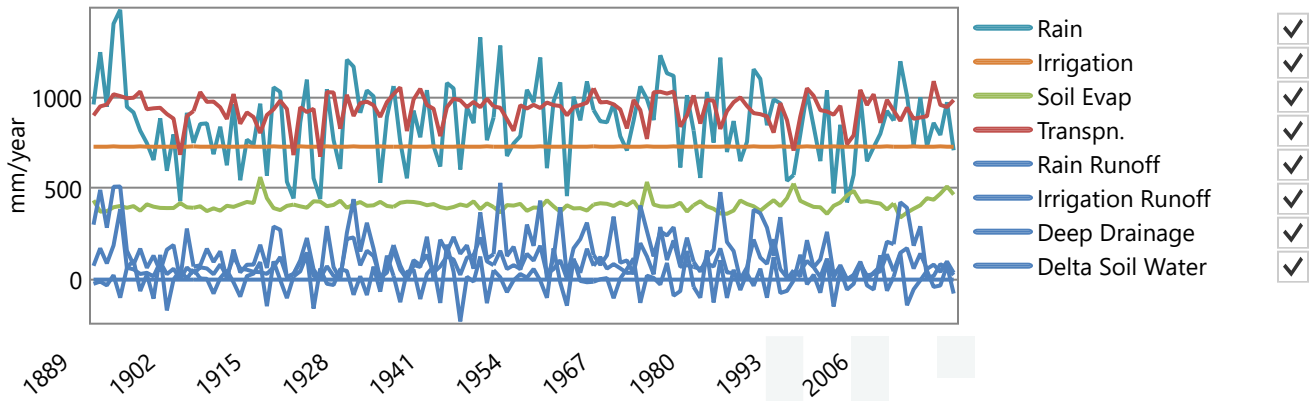
### Average Monthly Totals (mm):

Chart Table




### Average Annual Totals (mm/year):

Chart Table



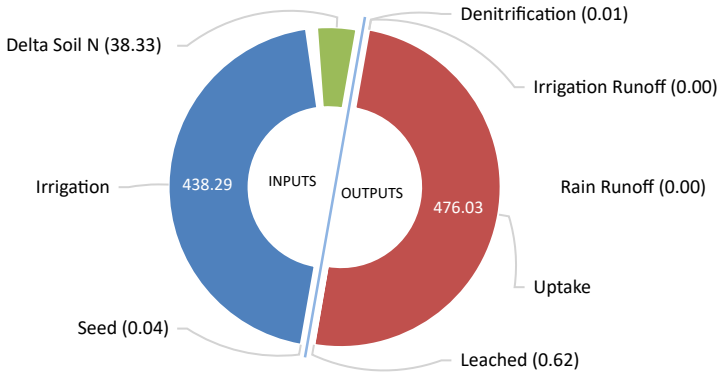
PERFORMANCE

## Land Performance - Soil Nutrient

**Paddock:** New Paddock, 2 ha **Soil Type**: Kalbar Low Permeability Red Brow

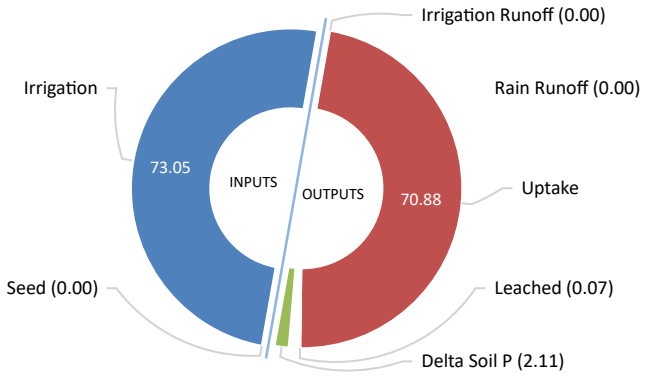
**Irrigation ammonium volatilisation losses (kg/ha/year)**: 0.00
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.00

### Land Nitrogen Balance (kg/ha/year)




| Name | Value |
|---|---|
| **Seed** | 0.04 |
| **Irrigation** | 438.29 |
| **Denitrification** | 0.01 |
| **Irrigation Runoff** | 0.00 |
| **Rain Runoff** | 0.00 |
| **Uptake** | 476.03 |
| **Leached** | 0.62 |
| **Delta Soil N** | -38.33 |

### Land Phosphorus Balance (kg/ha/year)




| Name | Value |
|---|---|
| **Seed** | 4.15E-03 |
| **Irrigation** | 73.05 |
| **Irrigation Runoff** | 0.00 |
| **Rain Runoff** | 0.00 |
| **Uptake** | 70.88 |
| **Leached** | 0.07 |
| **Delta Soil P** | 2.11 |

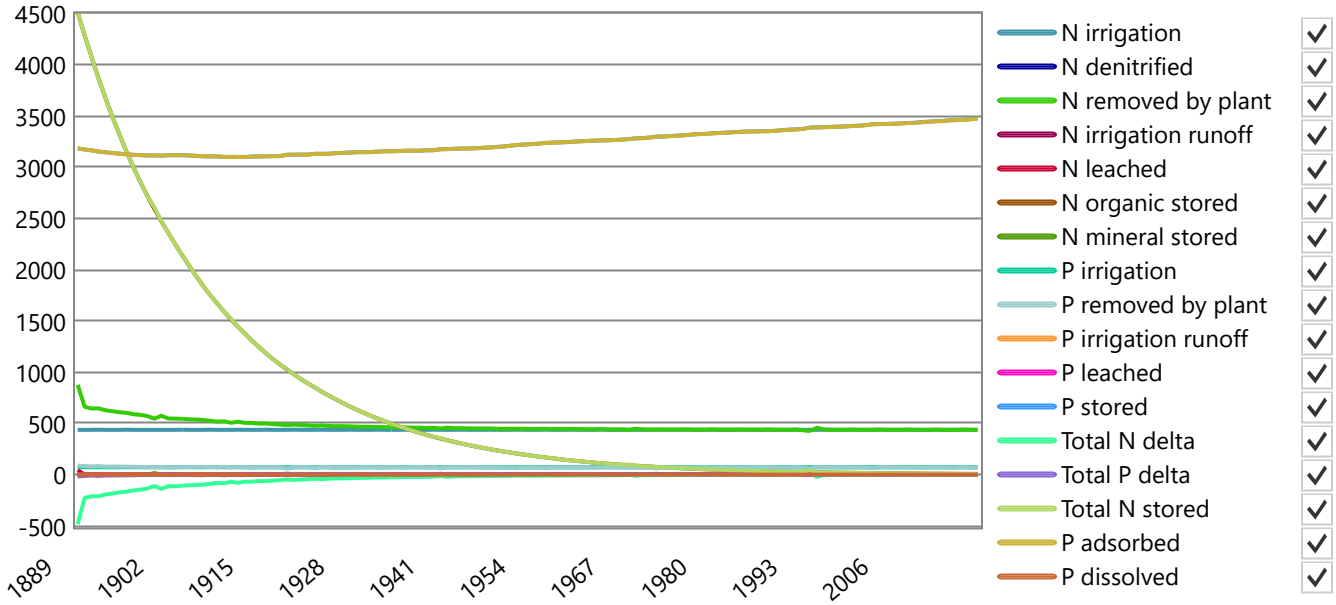
PERFORMANCE

## Land Performance - Soil Nutrient

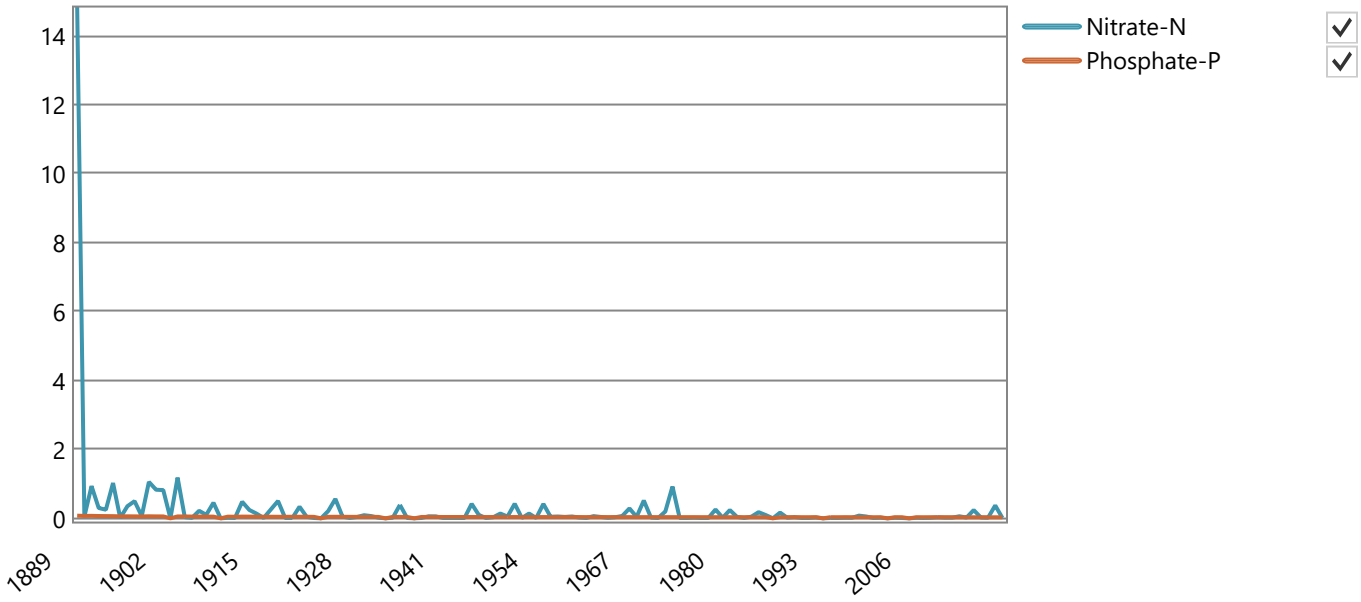
**Paddock:** New Paddock, 2 ha

**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, 2 ha

**Soil Type**: Kalbar Low Permeability Red Brow

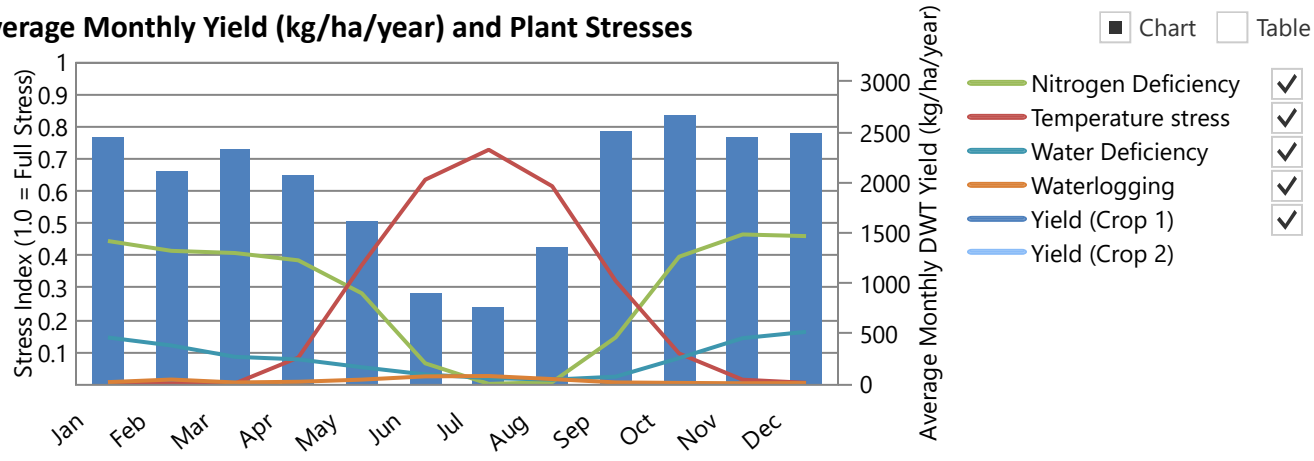
**Plant:** Continuous Lucerne (Winter Active) Pasture

| | |
|---|---|
| Average annual shoot dry matter yield (kg/ha/year) | 23697.39 (19783.96 - 31776.25) |
| Average monthly plant (green) cover (fraction) (minimum - maximum) | 0.71 (0.70 - 0.71) |
| Average monthly root depth (mm) (minimum - maximum) | 1492.41 (1479.69 - 1500.00) |

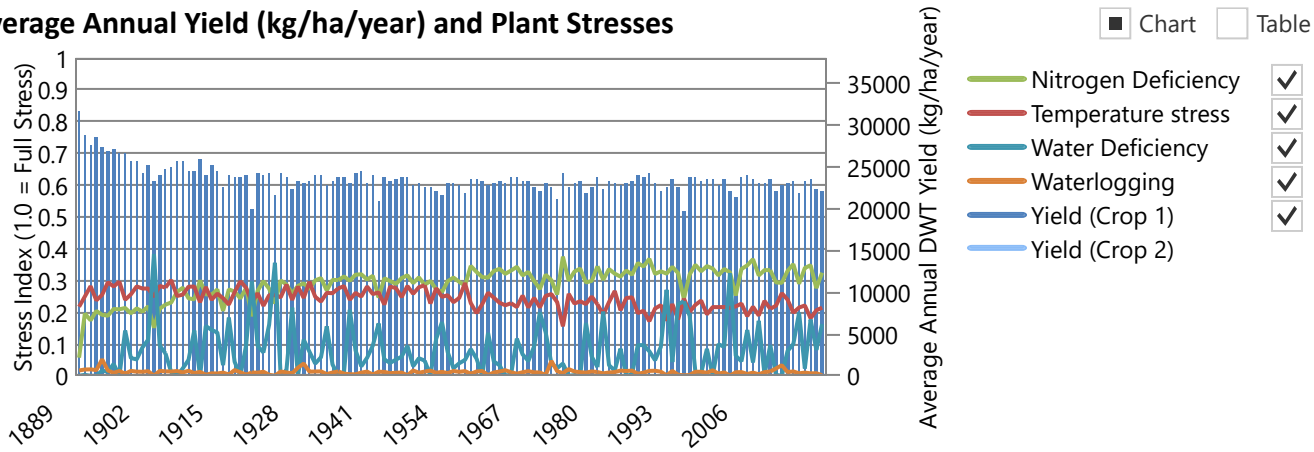
**Nutrient Uptake (minimum - maximum):**

| | |
|---|---|
| Average annual net nitrogen removed by plant uptake (kg/ha/year) | 476.03 (426.39 - 877.09) |
| Average annual net phosphorus removed by plant uptake (kg/ha/year) | 70.88 (59.05 - 90.03) |
| Average annual shoot nitrogen concentration (fraction dwt) | 0.02 (0.02 - 0.03) |
| Average annual shoot phosphorus concentration (fraction dwt) | 0.003 (0.003 - 0.003) |

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




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




**No. of harvests/year**: 12.83 (normal), 0.04 (forced by crop death due to frosting (0.02), water stress (0.02))
**No. days without crop/year (days/year)**: 0.19 due to frosting (0.05), water stress (0.15)

PERFORMANCE

## Land Performance

**Paddock:** New Paddock, 2 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 |

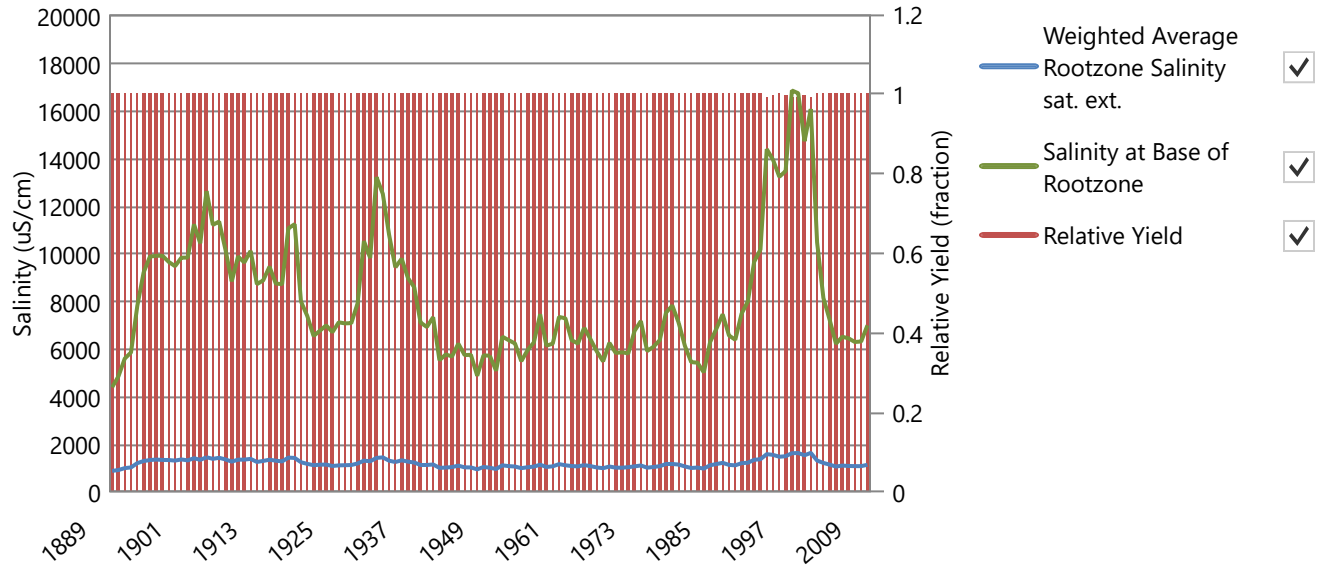
### Soil Salinity:

| | |
|---|---|
| Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (uS/cm) | 794.11 |
| Salt added by rainfall (kg/ha/year) | 149.57 |
| Average annual effluent salt added & leached at steady state (kg/ha/year) | 7629.66 |
| Average leaching fraction based on 10 year running averages (fraction) | 0.30 |
| Average water-uptake-weighted rootzone salinity sat. ext. (uS/cm) | 1213.62 |
| Salinity of the soil solution (at drained upper limit) at base of rootzone (uS/cm) | 8150.45 |
| 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



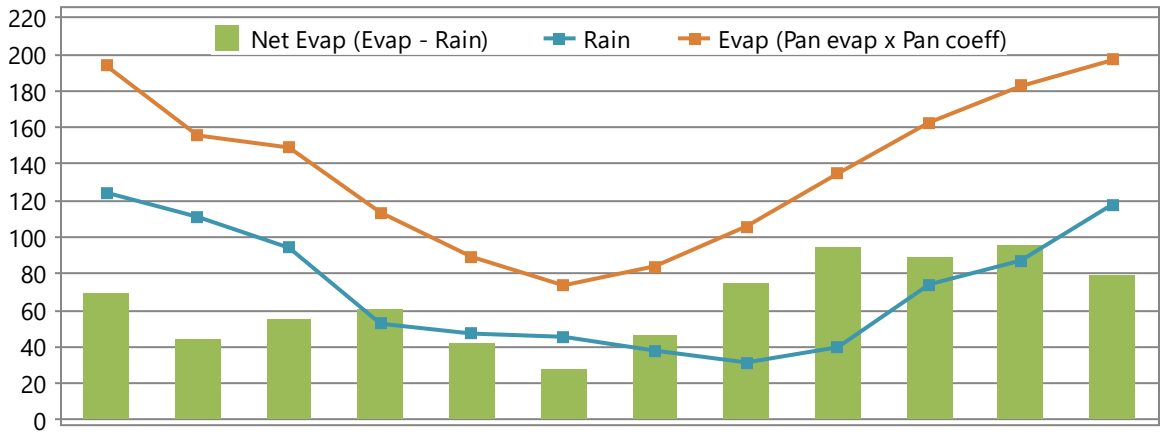
DIAGNOSTICS

## 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 - 14609.54 kL/year or 40.00 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 | 60.00 (60.00 - 60.00) | 876.57 (876.00 - 878.40) |
| Total Phosphorus | 10.00 (10.00 - 10.00) | 146.10 (146.00 - 146.40) |
| Total Dissolved Salts | 1024.00 (1024.00 - 1024.00) | 14960.17 (14950.40 - 14991.36) |
| 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) |

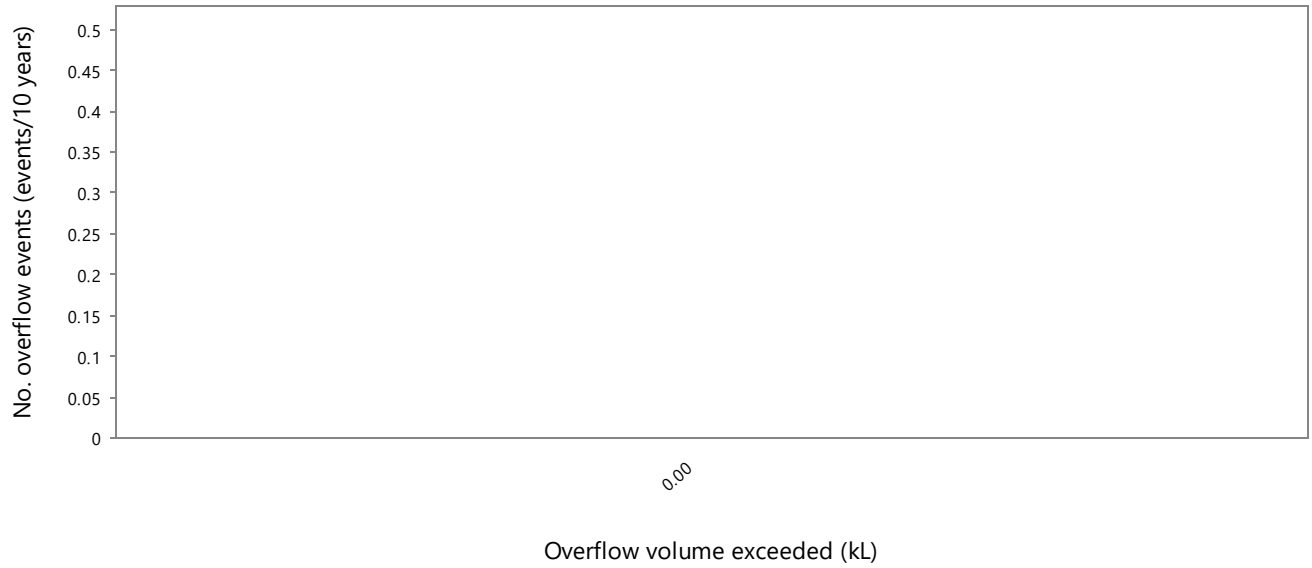
### Last pond (Wet weather store): 200.00 kL

| | |
|---|---|
| Theoretical hydraulic retention time (days) | 5.00 |
| Average volume of overflow (kL/year) | 0.00 |
| No. overflow events per year exceeding threshold* of 0.03 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: 2 ha total area (assumed 100% irrigation efficiency)

| | Quantity/year | Quantity/ha/year |
|---|---|---|
| Total irrigation applied (kL) | 14609.54 | 7304.77 |
| Total nitrogen applied (kg) | 876.57 | 438.29 |
| Total phosphorus applied (kg) | 146.10 | 73.05 |
| Total salts applied (kg) | 14960.17 | 7480.08 |

### 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: 2 ha

### Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

| |
|---|
| Irrigation triggered every 1 days |
| Irrigate a fixed amount of 5.00 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 | 62.0 | 56.5 | 62.0 | 60.0 | 62.0 | 60.0 | 62.0 | 62.0 | 60.0 | 62.0 | 60.0 | 62.0 | 730.5 |
| Soil Evap | 48.2 | 39.1 | 37.3 | 28.3 | 22.3 | 18.4 | 20.9 | 26.4 | 34.2 | 41.0 | 45.8 | 49.3 | 411.2 |
| Transpn. | 103.5 | 85.7 | 86.5 | 66.5 | 53.8 | 45.7 | 52.5 | 65.8 | 82.2 | 93.4 | 96.8 | 103.3 | 935.6 |
| Rain Runoff | 14.4 | 15.9 | 10.2 | 5.7 | 5.7 | 6.9 | 3.9 | 1.7 | 1.6 | 5.3 | 4.6 | 8.9 | 84.8 |
| 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 | 16.3 | 17.5 | 18.2 | 14.5 | 12.4 | 20.2 | 19.0 | 11.1 | 6.4 | 8.0 | 10.8 | 9.4 | 163.8 |
| Delta | 4.0 | 9.4 | 4.0 | -2.3 | 15.2 | 14.3 | 3.6 | -11.5 | -24.5 | -11.4 | -10.8 | 9.1 | -1.0 |

### Soil Nitrogen Balance

| | |
|---|---|
| Average annual effluent nitrogen added (kg/ha/year) | 438.29 |
| Average annual soil nitrogen removed by plant uptake (kg/ha/year) | 476.03 |
| Average annual soil nitrogen removed by denitrification (kg/ha/year) | 0.01 |
| Average annual soil nitrogen leached (kg/ha/year) | 0.62 |
| Average annual nitrate-N loading to groundwater (kg/ha/year) | 0.62 |
| Soil organic-N kg/ha (Initial - Final) | 4752.00 - 7.56 |
| | 240.24 - 1.24 |
| Average nitrate-N concentration of deep drainage (mg/L) | 0.38 |
| Max. annual nitrate-N concentration of deep drainage (mg/L) | 14.84 |

### Soil Phosphorus Balance

| | |
|---|---|
| Average annual effluent phosphorus added (kg/ha/year) | 73.05 |
| Average annual soil phosphorus removed by plant uptake (kg/ha/year) | 70.88 |
| Average annual soil phosphorus leached (kg/ha/year) | 0.07 |
| Dissolved phosphorus (kg/ha) (Initial - Final) | 0.50 - 1.16 |
| Adsorbed phosphorus (kg/ha) (Initial - Final) | 3201.01 - 3474.12 |
| Average phosphate-P concentration in rootzone (mg/L) | 0.18 |
| Average phosphate-P concentration of deep drainage (mg/L) | 0.04 |
| Max. annual phosphate-P concentration of deep drainage (mg/L) | 0.08 |
| Design soil profile storage life based on average infiltrated water phosphorus concn. of 4.84 mg/L (years) | 59.62 |

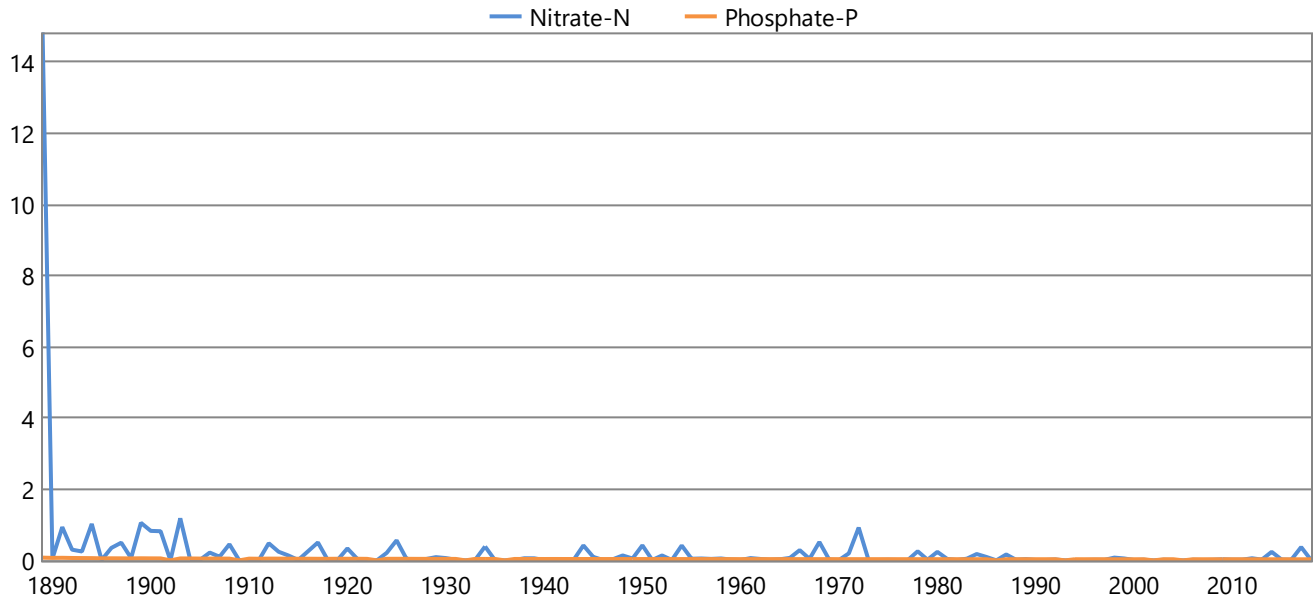
DIAGNOSTICS

## Sustainability Diagnostics: Kalbar

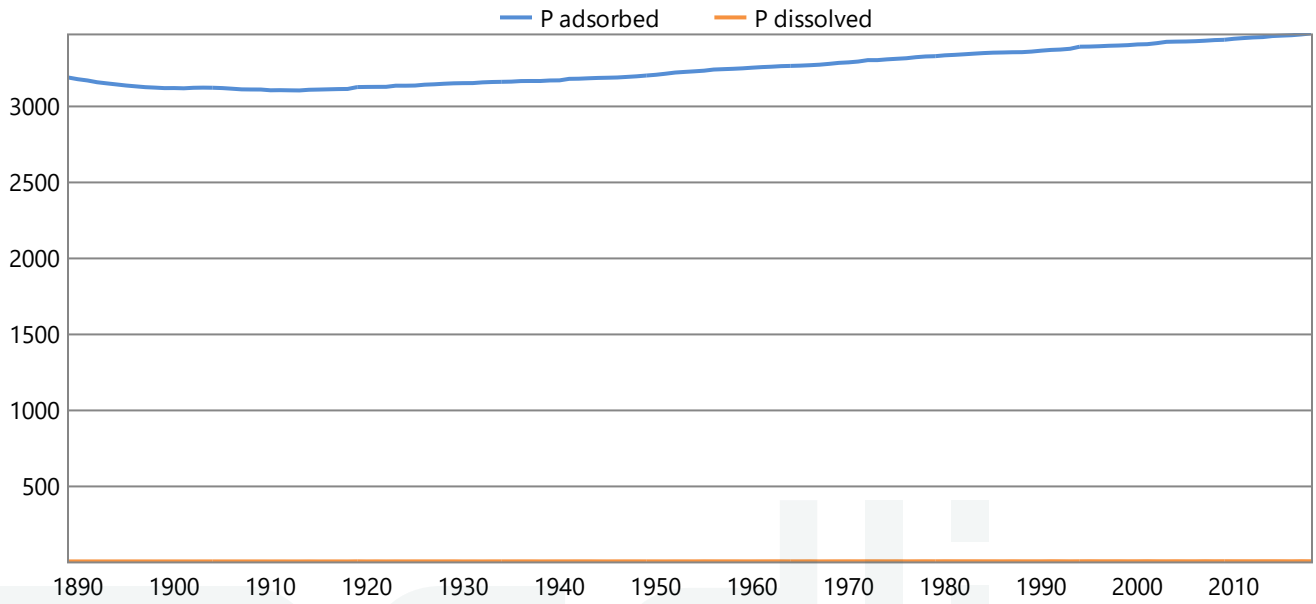
**Paddock Land:** New Paddock: 2 ha

**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: 2 ha

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

| | |
|---|---|
| Average annual shoot dry matter yield (kg/ha/year) | 23697.39 (19783.96 - 31776.25) |
| Average monthly plant (green) cover (fraction) | 0.71 (0.70 - 0.71) |
| Average monthly crop factor (fraction) | 0.64 (0.63 - 0.64) |
| Total plant cover (both green and dead) left after harvest (fraction) | 0.75 |
| Average monthly root depth (mm) | 1492.41 (1479.69 - 1500.00) |
| Average number of normal harvests per year (no./year) | 12.83 (10.00 - 16.00) |
| Average number of normal harvests for last five years only (no./year) | 12.20 |
| Average number of crop deaths per year (no./year) | 0.04 (0.00 - 1.00) |
| Average number of crop deaths for last five years only (no./year) | 0.20 |
| Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient) | 0.29 (0.06 - 0.37) |
| 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) | 0.08 (0.02 - 0.16) |
| Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient) | 0.01 (0.00 - 0.03) |
| No. days without crop/year (days) | 0.19 |

### 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) | 794.11 |
| Salt added by rainfall (kg/ha/year) | 149.57 |
| Average annual effluent salt added & leached at steady state (kg/ha/year) | 7629.66 |
| Average leaching fraction based on 10 year running averages (fraction) | 0.30 |
| Average water-uptake-weighted rootzone salinity sat. ext. (uS/cm) | 1213.62 |
| Salinity of the soil solution (at drained upper limit) at base of rootzone (uS/cm) | 8150.45 |
| 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

MEDLI REPORT - FULL RUN

**Enterprise**: **Kalbar**

**Description**:
Rural Enterprise Precinct

**Client**: **Kalfresh**

**MEDLI User**: PRECISE-LAP02\Main

**Scenario Details**:

DESCRIPTION

## Climate Data: Kalbar, -27.95°, 152.62°

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

**Climate Statistics**:

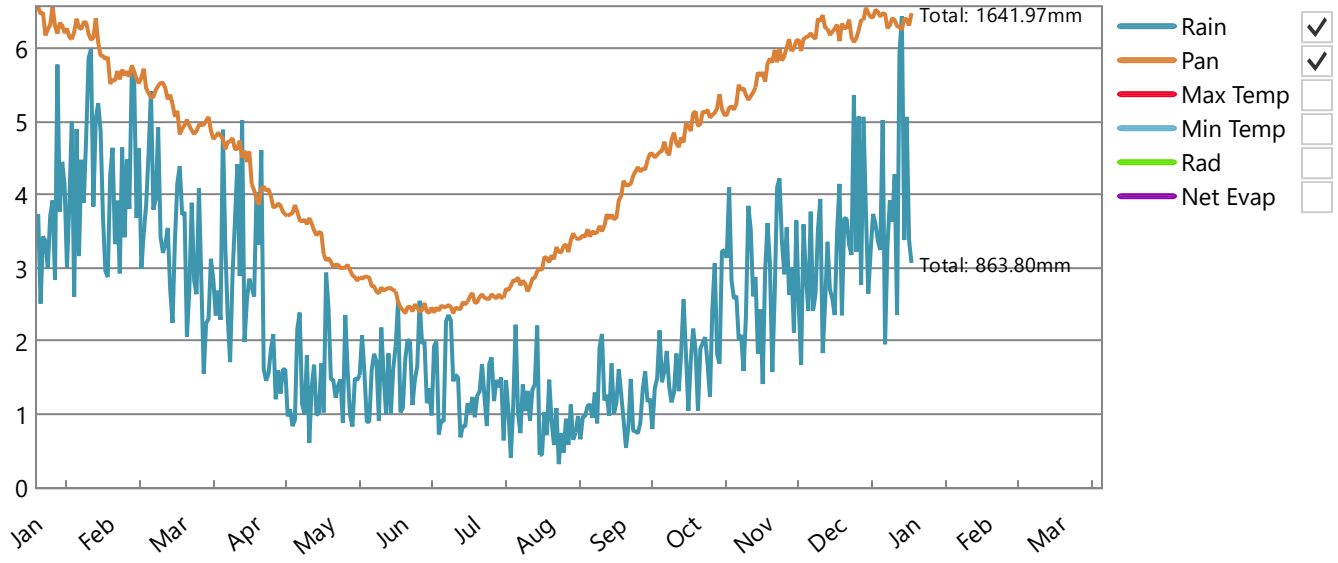
| | 5th Percentile | 50th Percentile | 95th Percentile |
|---|---|---|---|
| Rainfall (mm/year) | 503 | 867 | 1219 |
| Pan Evaporation (mm/year) | 1483 | 1633 | 1804 |

**Climate Data:**

Chart Table

Monthly Daily

**Daily Average Across Run Period**

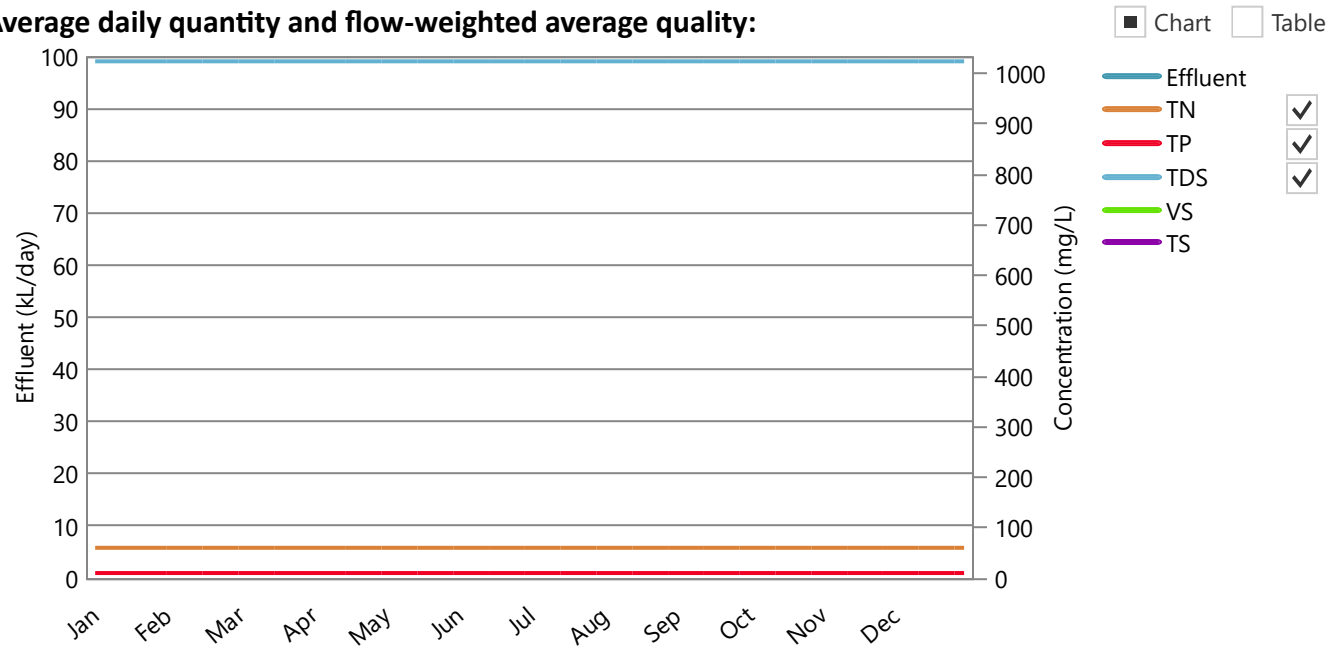


DESCRIPTION

## 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:** **0.00 kL/year** or 0.00 kL/day (Min-Max: 0.00 - 0.00)

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

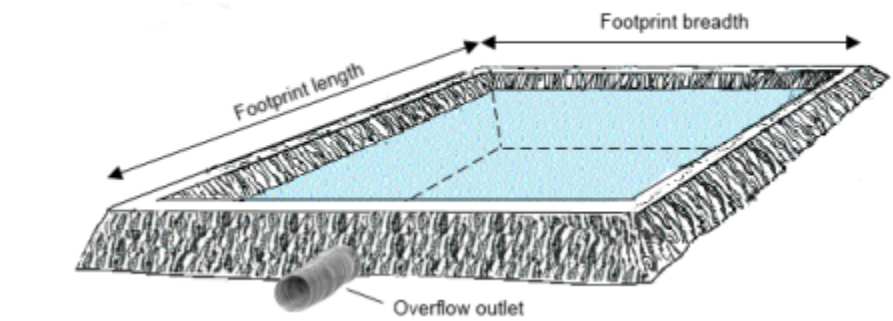
| | Concentration (mg/L) | Load (kg/year) |
|---|---|---|
| Total Nitrogen | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.00) |
| Total Phosphorus | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.00) |
| Total Dissolved Salts | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.00) |
| Volatile Solids | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.00) |
| Total Solids | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.00) |

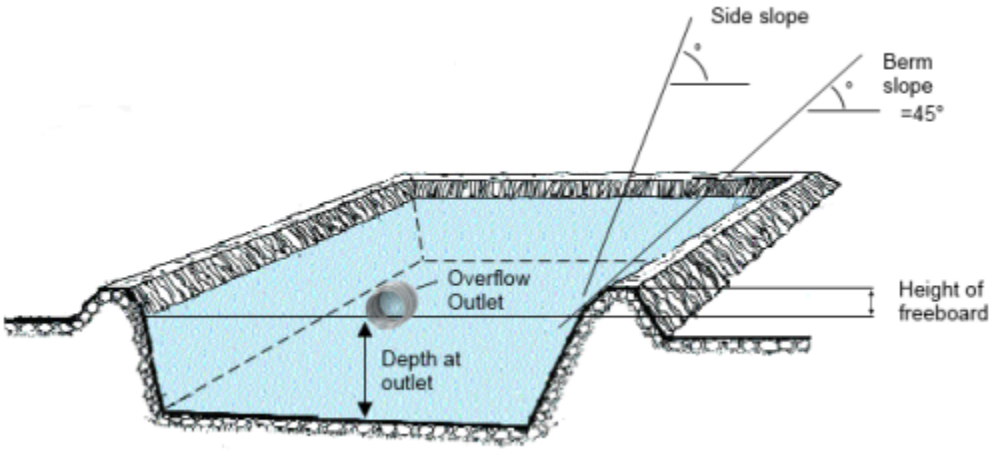
DESCRIPTION

## Pond system: 1 closed storage tank

### Pond system details:

| | Pond 1 |
|---|---|
| Maximum pond volume (kL) | 200.00 |
| Minimum allowable pond volume (kL) | 0.00 |
| Pond depth at overflow outlet (m) | 6.00 |
| Maximum water surface area (m2) | 33.33 |
| Pond footprint length (m) | 5.77 |
| Pond footprint width (m) | 5.77 |
| Pond catchment area (m2) | 33.33 |
| Average active volume (kL) | 0.00 |




### Irrigation pump limits:

| | |
|---|---|
| Minimum pump rate limit (ML/day) | 0.00 |
| Maximum pump rate limit (ML/day) | 1.00 |

### 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 |

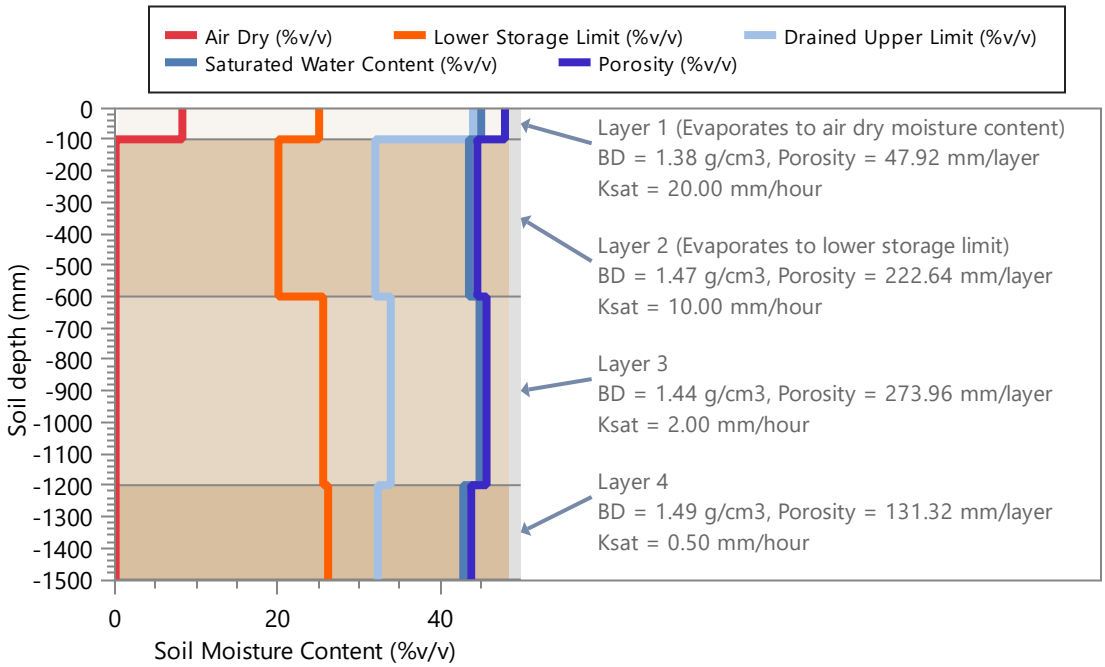
DESCRIPTION

## Land: New Paddock

**Area (ha)**: 2.00

**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) | 0.36 (0.25 - 0.46) |
| 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: **200 kL**

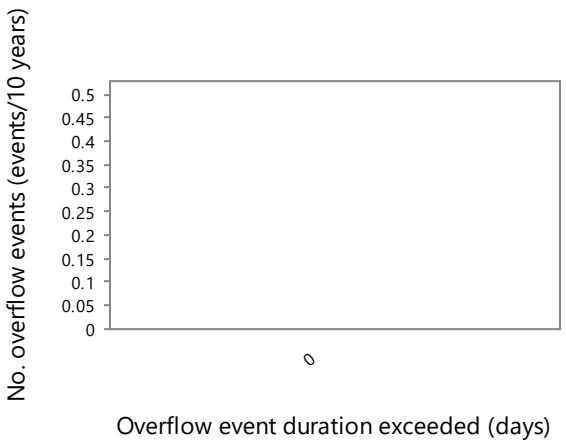
### Pond System Water Balance (kL/year)

(no data available)

| Name | Value |
|---|---|
| **Rain** | 0.00 |
| **Inflow** | 0.00 |
| **Recycling** | 0.00 |
| **Evaporation** | 0.00 |
| **Overflow** | 0.00 |
| **Irrigation** | 0.00 |
| **Seepage** | 0.00 |
| **Delta Storage** | 0.00 |

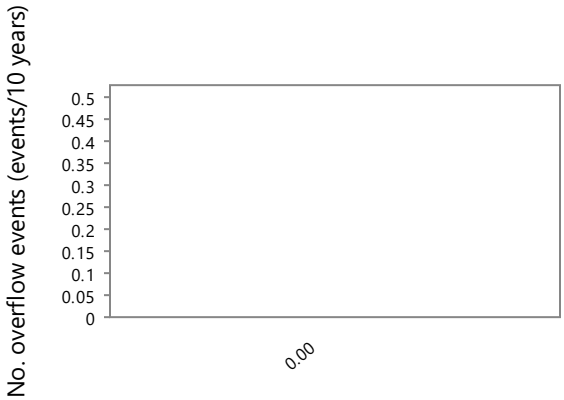
### Overflow Diagnostics

| | |
|---|---|
| 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) | 0.00 |
| Probability of at least 90% reuse (fraction) | 0.00 |



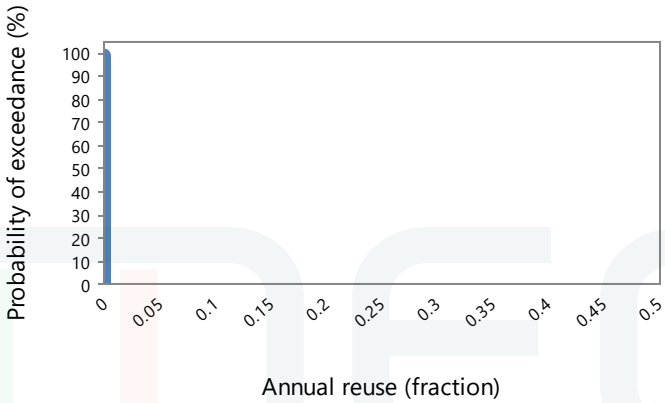

Overflow event duration exceeded (days)

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)

(no data available)

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

#### Phosphorus Balance (kg/year)

(no data available)

| Name | Value |
|---|---|
| Inflow | 0.00 |
| Recycling | 0.00 |
| Sludge | 0.00 |
| Overflow | 0.00 |
| Irrigation | 0.00 |
| Seepage | 0.00 |
| Delta Storage | 0.00 |

#### Salt Balance (kg/year)

(no data available)

| Name | Value |
|---|---|
| Inflow | 0.00 |
| Recycling | 0.00 |
| Sludge* | 0.00 |
| Overflow | 0.00 |
| Irrigation | 0.00 |
| 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) | 0.00 |
| Average phosphorus concentration of pond liquid (mg/L) | 0.00 |
| Average salinity of pond liquid (uS/cm) | 0.00 |

| 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) | 0.00 |
| Average Shandy water irrigation (kL/year) (minimum - maximum) | 0.00 (0.00 - 0.00) |
| Total water irrigated (kL/year) | 0.00 |
| 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) | 0.00 |
| Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L) | 0.00 |
| Average phosphorus concentration of irrigation water (mg/L) | 0.00 |
| Average salinity of irrigation water (uS/cm) | 0.00 |

## Irrigation Diagnostics (No effluent irrigation occurred!):

| | |
|---|---|
| Proportion of Days pond volume below min. vol. for irrigation (fraction) | 1.00 (Hence no irrigation!) |
| Proportion of Days irrigation occurs (fraction) | 0.00 |

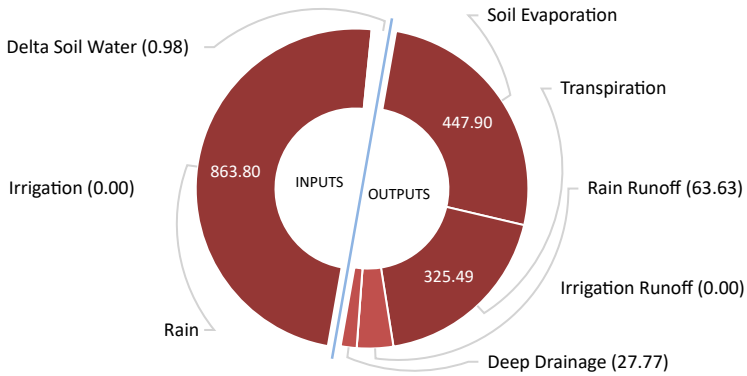
PERFORMANCE

# Land Performance - Soil Water

**Paddock:** New Paddock, 2 ha
**Soil Type**: Kalbar Low Permeability Red Brow, 146.50 mm PAWC at maximum root depth

## Land Water Balance (mm/year):

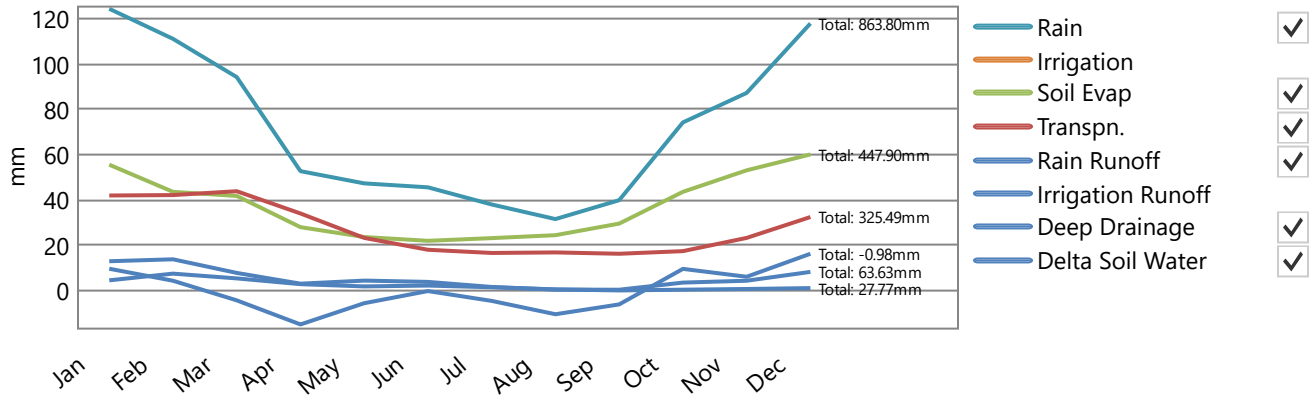
mm/year  % Total inputs




| Name | Value |
|---|---|
| **Rain** | 863.80 |
| **Irrigation** | 0.00 |
| **Soil Evaporation** | 447.90 |
| **Transpiration** | 325.49 |
| **Rain Runoff** | 63.63 |
| **Irrigation Runoff** | 0.00 |
| **Deep Drainage** | 27.77 |
| **Delta Soil Water** | -0.98 |

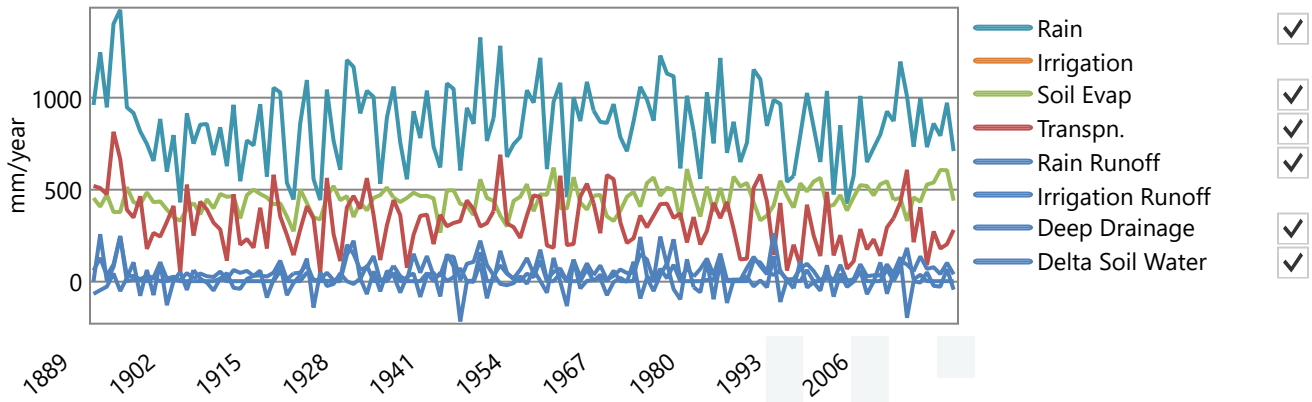
## Average Monthly Totals (mm):

Chart  Table




## Average Annual Totals (mm/year):

Chart  Table



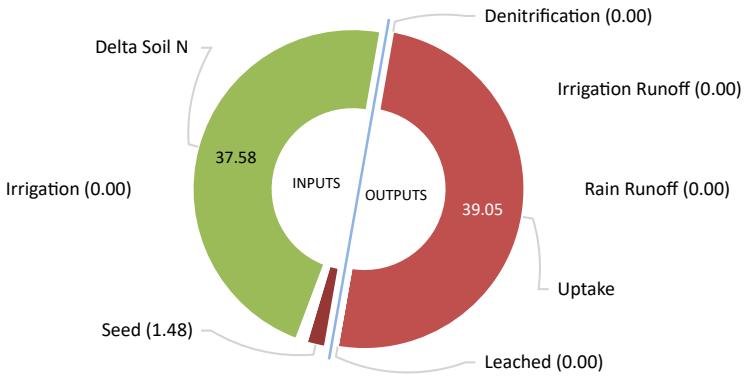
PERFORMANCE

## Land Performance - Soil Nutrient

**Paddock:** New Paddock, 2 ha **Soil Type**: Kalbar Low Permeability Red Brow

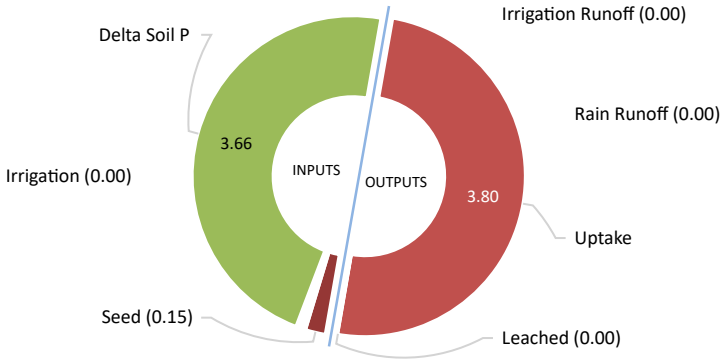
**Irrigation ammonium volatilisation losses (kg/ha/year)**: 0.00
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.00

### Land Nitrogen Balance (kg/ha/year)




| Name | Value |
|---|---|
| **Seed** | 1.48 |
| **Irrigation** | 0.00 |
| **Denitrification** | 1.30E-04 |
| **Irrigation Runoff** | 0.00 |
| **Rain Runoff** | 0.00 |
| **Uptake** | 39.05 |
| **Leached** | 3.08E-03 |
| **Delta Soil N** | -37.58 |

### Land Phosphorus Balance (kg/ha/year)




| Name | Value |
|---|---|
| **Seed** | 0.15 |
| **Irrigation** | 0.00 |
| **Irrigation Runoff** | 0.00 |
| **Rain Runoff** | 0.00 |
| **Uptake** | 3.80 |
| **Leached** | 4.70E-03 |
| **Delta Soil P** | -3.66 |

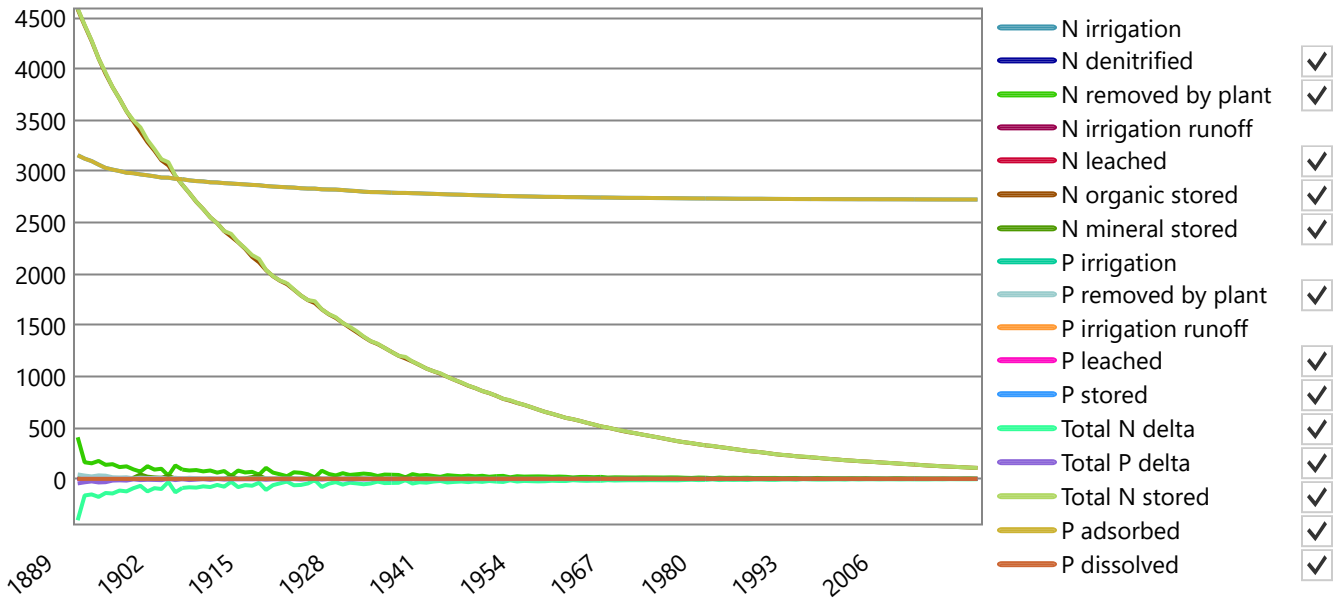
PERFORMANCE

## Land Performance - Soil Nutrient

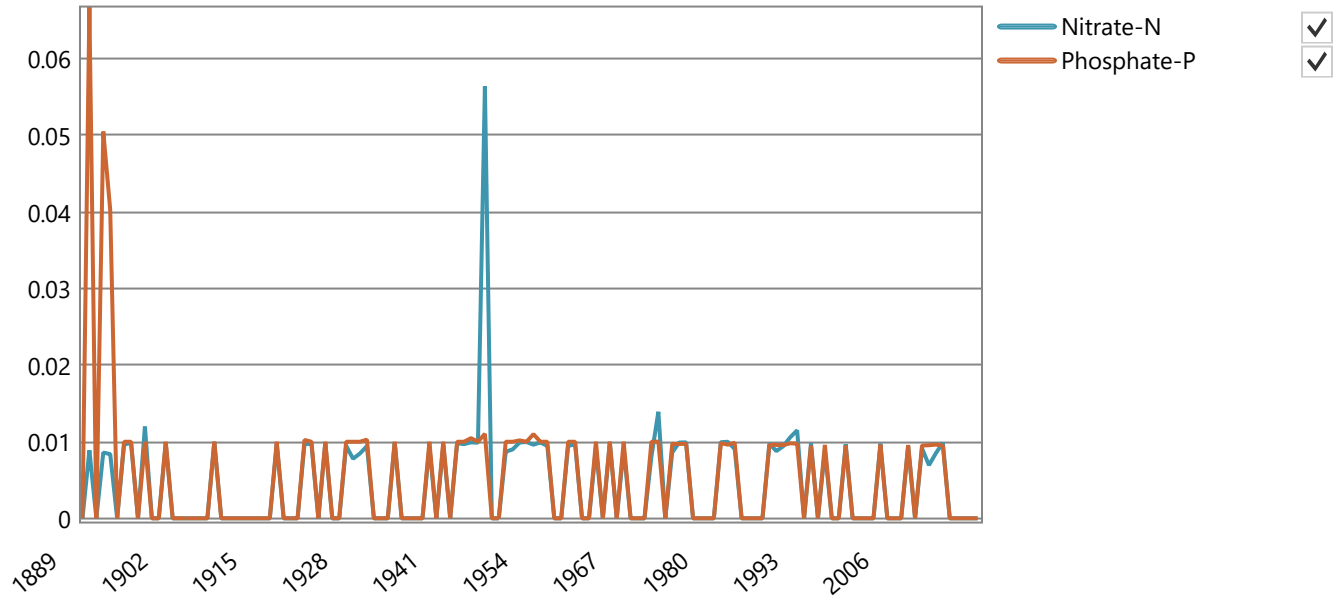
**Paddock:** New Paddock, 2 ha

**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, 2 ha

**Soil Type**: Kalbar Low Permeability Red Brow

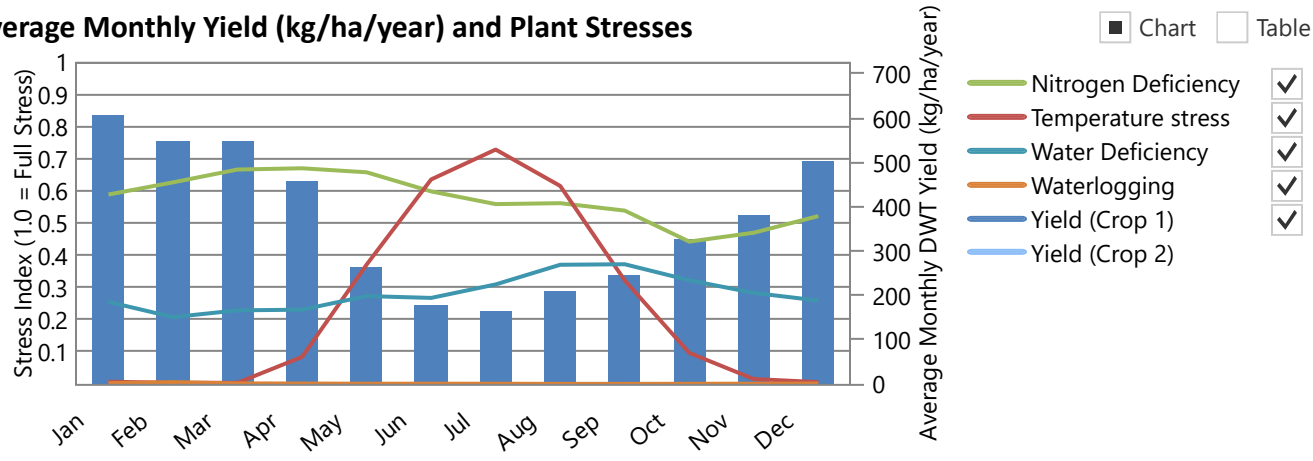
**Plant:** Continuous Lucerne (Winter Active) Pasture

| | |
|---|---|
| Average annual shoot dry matter yield (kg/ha/year) | 4478.37 (902.34 - 16833.03) |
| Average monthly plant (green) cover (fraction) (minimum - maximum) | 0.36 (0.25 - 0.46) |
| Average monthly root depth (mm) (minimum - maximum) | 956.26 (694.22 - 1182.84) |

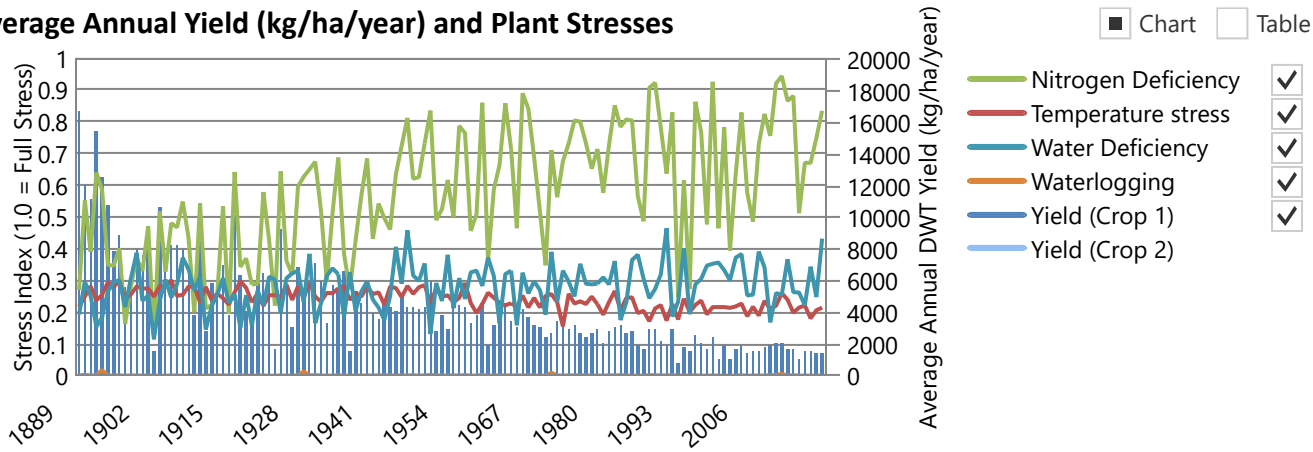
**Nutrient Uptake (minimum - maximum):**

| | |
|---|---|
| Average annual net nitrogen removed by plant uptake (kg/ha/year) | 39.05 (3.62 - 406.02) |
| Average annual net phosphorus removed by plant uptake (kg/ha/year) | 3.80 (0.17 - 44.13) |
| Average annual shoot nitrogen concentration (fraction dwt) | 0.01 (0.00 - 0.02) |
| Average annual shoot phosphorus concentration (fraction dwt) | 0.001 (0.000 - 0.003) |

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




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




**No. of harvests/year**: 1.75 (normal), 1.64 (forced by crop death due to water stress (1.64))

**No. days without crop/year (days/year)**: 58.31 due to frosting (1.38), temperature stress - not frost (0.39), water stress (56.54)

PERFORMANCE

## Land Performance

**Paddock:** New Paddock, 2 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:**

| | |
|---|---|
| Average Infiltrate Salinity (uS/cm) | 30.00 |

Insufficient deep drainage to run steady state salinity calculations.

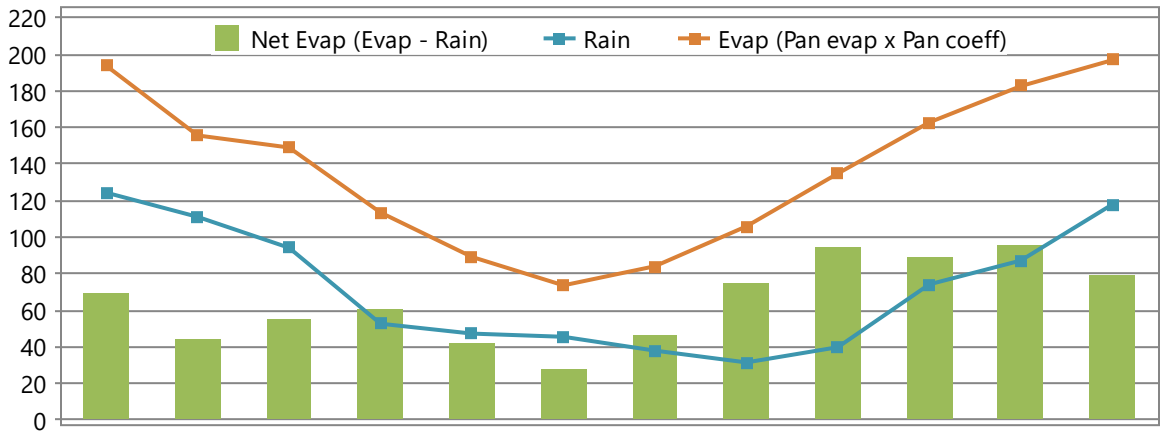
DIAGNOSTICS

## 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 - 0.00 kL/year or 0.00 kL/day generated on average

### Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 0.00 non-zero flow days, after any pretreatment and recycling.

| Constituent | Concentration (mg/L) | Load (kg/year) |
|---|---|---|
| Total Nitrogen | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.00) |
| Total Phosphorus | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.00) |
| Total Dissolved Salts | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.00) |
| 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) |

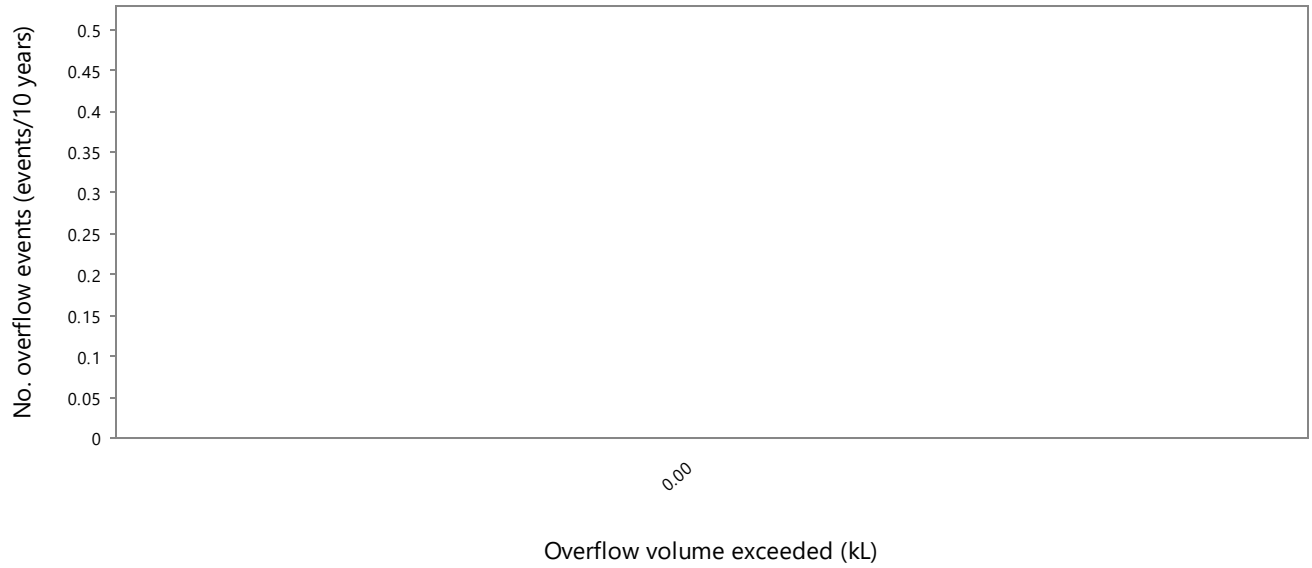
### Last pond (Wet weather store): 200.00 kL

| | |
|---|---|
| Theoretical hydraulic retention time (days) | 0.00 |
| Average volume of overflow (kL/year) | 0.00 |
| No. overflow events per year exceeding threshold* of 0.03 kL (no./year) | 0.00 |
| Average duration of overflow (days) | 0.00 |
| Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction) | 0.00 |
| Probability of at least 90% effluent reuse (fraction) | 0.00 |
| Average salinity of last pond (uS/cm) | 0.00 |
| Salinity of last pond on final day of simulation (uS/cm) | 0.00 |
| 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: 2 ha total area (assumed 100% irrigation efficiency)

| | Quantity/year | Quantity/ha/year |
|---|---|---|
| Total irrigation applied (kL) | 0.00 | 0.00 |
| Total nitrogen applied (kg) | 0.00 | 0.00 |
| Total phosphorus applied (kg) | 0.00 | 0.00 |
| Total salts applied (kg) | 0.00 | 0.00 |

### 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 is prevented when triggered (fraction) | 1.00 |

DIAGNOSTICS

## Sustainability Diagnostics: Kalbar

### Paddock Land: New Paddock: 2 ha

### Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

| |
|---|
| Irrigation triggered every 1 days |
| Irrigate a fixed amount of 5.00 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 | 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 |
| Soil Evap | 55.5 | 43.5 | 41.7 | 27.9 | 23.6 | 21.9 | 23.1 | 24.4 | 29.5 | 43.5 | 53.0 | 60.1 | 447.9 |
| Transpn. | 41.9 | 42.1 | 43.8 | 34.0 | 23.2 | 18.0 | 16.5 | 16.8 | 16.2 | 17.4 | 23.2 | 32.4 | 325.5 |
| Runoff | 12.9 | 13.7 | 7.7 | 3.0 | 4.3 | 3.8 | 1.5 | 0.4 | 0.3 | 3.5 | 4.3 | 8.2 | 63.6 |
| Drainage | 4.5 | 7.4 | 5.3 | 2.8 | 1.8 | 2.2 | 1.4 | 0.5 | 0.0 | 0.3 | 0.6 | 1.0 | 27.8 |
| Delta | 9.6 | 4.3 | -4.4 | -15.0 | -5.6 | -0.3 | -4.6 | -10.5 | -6.2 | 9.5 | 6.0 | 16.2 | -1.0 |

### Soil Nitrogen Balance

| | |
|---|---|
| Average annual effluent nitrogen added (kg/ha/year) | 0.00 |
| Average annual soil nitrogen removed by plant uptake (kg/ha/year) | 39.05 |
| Average annual soil nitrogen removed by denitrification (kg/ha/year) | 1.30E-04 |
| Average annual soil nitrogen leached (kg/ha/year) | 3.08E-03 |
| Average annual nitrate-N loading to groundwater (kg/ha/year) | 3.08E-03 |
| Soil organic-N kg/ha (Initial - Final) | 4752.00 - 107.31 |
| | 240.24 - 0.10 |
| Average nitrate-N concentration of deep drainage (mg/L) | 0.01 |
| Max. annual nitrate-N concentration of deep drainage (mg/L) | 0.06 |

### Soil Phosphorus Balance

| | |
|---|---|
| Average annual effluent phosphorus added (kg/ha/year) | 0.00 |
| Average annual soil phosphorus removed by plant uptake (kg/ha/year) | 3.80 |
| Average annual soil phosphorus leached (kg/ha/year) | 4.70E-03 |
| Dissolved phosphorus (kg/ha) (Initial - Final) | 0.50 - 0.04 |
| Adsorbed phosphorus (kg/ha) (Initial - Final) | 3201.01 - 2725.51 |
| Average phosphate-P concentration in rootzone (mg/L) | 0.01 |
| 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 0.00 mg/L (years) | 0.00 |

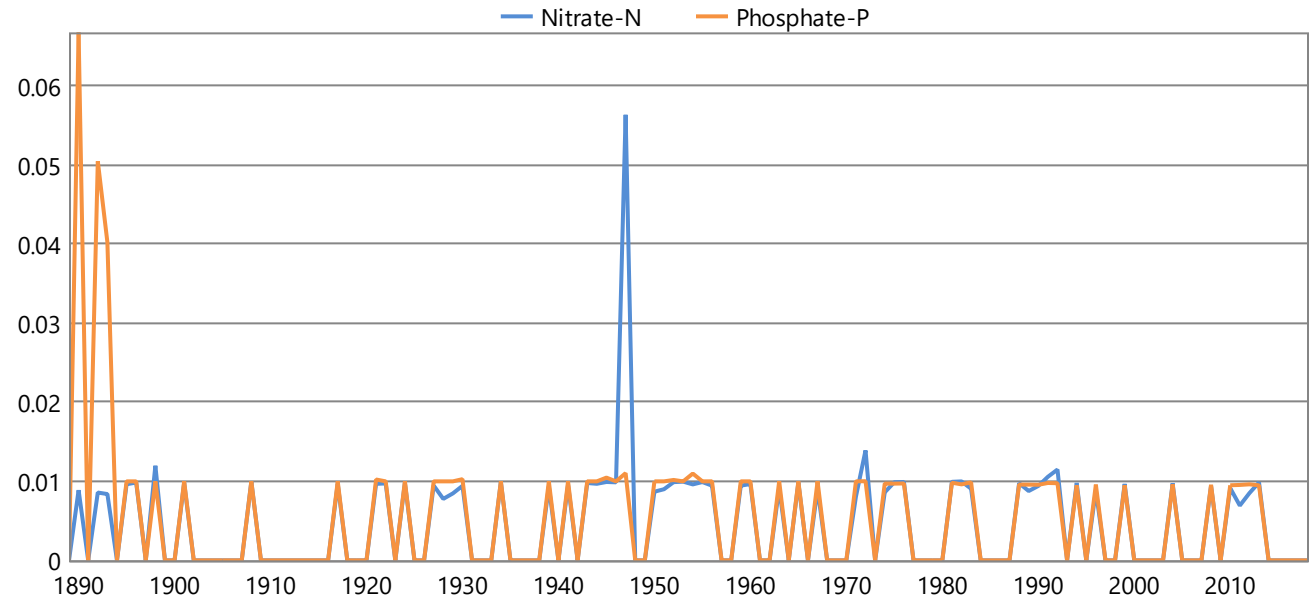
DIAGNOSTICS

## Sustainability Diagnostics: Kalbar

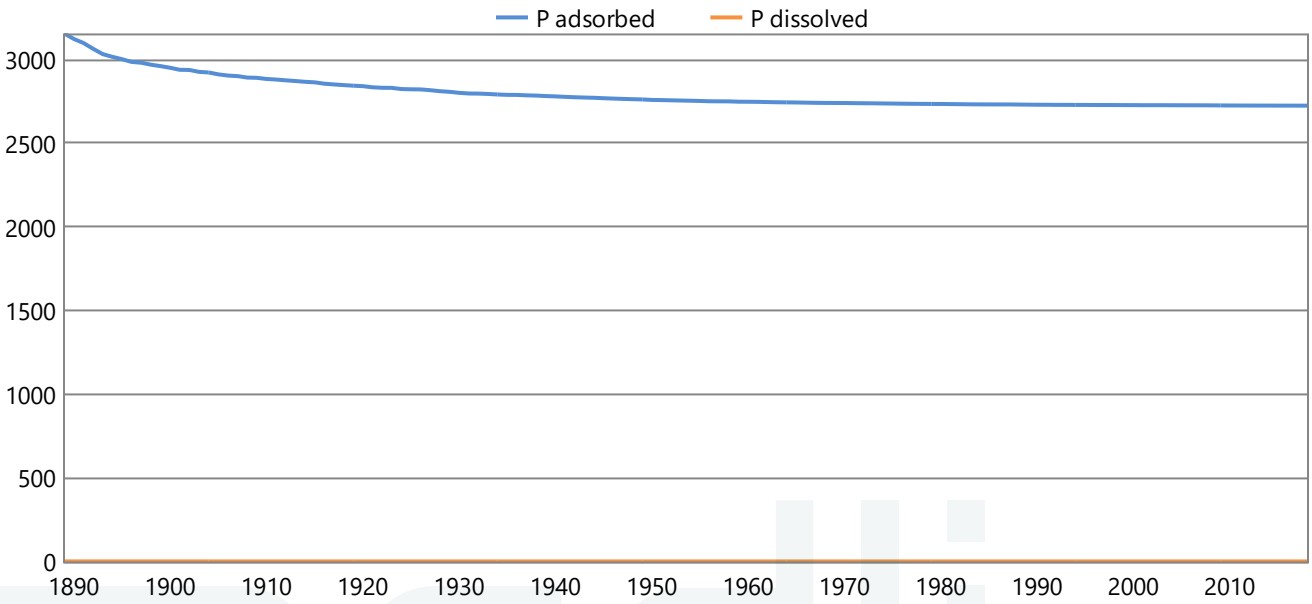
**Paddock Land:** New Paddock: 2 ha

**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: 2 ha

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

| | |
|---|---|
| Average annual shoot dry matter yield (kg/ha/year) | 4478.37 (902.34 - 16833.03) |
| Average monthly plant (green) cover (fraction) | 0.36 (0.25 - 0.46) |
| Average monthly crop factor (fraction) | 0.33 (0.23 - 0.42) |
| Total plant cover (both green and dead) left after harvest (fraction) | 0.75 |
| Average monthly root depth (mm) | 956.26 (694.22 - 1182.84) |
| Average number of normal harvests per year (no./year) | 1.75 (0.00 - 8.00) |
| Average number of normal harvests for last five years only (no./year) | 0.00 |
| Average number of crop deaths per year (no./year) | 1.64 (0.00 - 5.00) |
| Average number of crop deaths for last five years only (no./year) | 1.60 |
| Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient) | 0.57 (0.11 - 0.94) |
| 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) | 0.28 (0.21 - 0.37) |
| Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient) | 0.00 (0.00 - 0.01) |
| No. days without crop/year (days) | 58.31 |

### 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*

Insufficient deep drainage to run steady state salinity calculations.

DIAGNOSTICS

## Run Messages

### Messages generated when the scenario was run:

| |
|---|
| This is a Dryland scenario |
| No effluent irrigation has occurred! |
| Full run chosen |