Final report

Adoption of Wildeye ag-technology at Romani Pastoral Co.'s Redbank Station (as part of the MLA Digital Livestock 4.0 Pilot)

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Abstract

This final report provides details of a deployment of the Wildeye agricultural technology products at Romani Pastoral Company property, Redbank Station (NSW) as part of Meat and Livestock Australia's Digital Livestock 4.0 Pilot. The project was undertaken to demonstrate the range and application of "ag tech" products available to MLA's membership, with the ultimate goal of increasing adoption of such technologies to improve the industry's productivity. A range of products were deployed at assets within the Redbank pastoral operation. Data was collected in-field by Wildeye hardware, transmitted to a central server via pre-existing cellular wireless technologies, and viewed via Wildeye's apps and web applications.

Executive summary

Background

MLA's Digital Livestock 4.0 pilot is a continuation of MLA's commitment to fostering the adoption of fit-for-purpose agricultural technology products by Australian livestock producers. It continues from the 2018 project at Carwoola Pastoral Company, where solutions from around 20 technology providers (not including Wildeye) were deployed and showcased at a "Digital Forum" attended by 200+ producers.

Wildeye is a developer of "ag-tech" solutions with 40+ staff spanning 4 international operations, and products deployed throughout the world. We have a 17-year history involving the manufacture and deployment of some 50,000 unique IoT solutions, and believe we are among the leading ag-tech solution providers in Australia based on number of deployments, business history, revenue and market acceptance. Wildeye was invited to submit a proposal for provision of a range of ag-tech solutions as part of the 2020 pilot, and subsequently engaged to supply, install and commission a range of our products at Romani Pastoral Company's Redbank Station.

Objectives

The objectives were to deploy ag technology products at Redbank and have these products used and assessed by the operators. The project was successful in demonstrating the ease of which the hardware can be deployed, the lack of need for dedicated IoT networks, a suitability and coverage of existing cellular technologies, the importance of correct sensor type selection and allowances for routine maintenance when planning and deploying ag etch projects involving remote monitoring of assets using such sensor technologies.

Methodology

A suite of desired "ag-tech" products were nominated by MLA in conjunction with Romani management. Wildeye attended the property and installed and commissioned the products. Products have bene operational since, with access to data made available to MLA and Redbank management via Wildeye's software suite.

Results/key findings

The results indicate that connectivity is generally not a constraint to deployment of "internet of things: type ag technologies. They also highlight the importance of sensor selection and quality, with some of the sensors installed proving to be unsuited to the applications despite the sensor manufacturer's claims (e.g. ultrasonic sensor types measuring grain levels in silo's).

Benefits to industry

Industry has benefited through demonstration of the extent to which exiting radio networks, built on proven and open standards, delivered by "household-name" businesses under demonstrably sustainable business models, and accessible to the agricultural industry at commercially viable and deterministic prices, are suited to servicing the connectivity requirements of meters and sensors.

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1. Background

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2. Objectives

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3. Methodology

Wildeye were engaged by MLA to provide the following IoT installations at Redbank Station:

1 x Water tank sensor

1 x Diesel fuel tank sensors

4 x Grain silo level sensors

1 x Weather station

1 x Rain gauge

2 x Water flow sensors

3.1 Connectivity requirements and supporting infrastructure

Wildeye have some specific requirements regarding what we deem "fit-for-purpose" connectivity solutions. These requirements are intended to ensure secure and reliable connectivity for our products, for the full lifecycle of the IoT products themselves (typically 5+ years), at deterministic prices. We believe that, as a developer and vendor of IoT solutions, our requirements in terms of connectivity are perfectly aligned with those of adopters of agricultural ag-tech products (i.e. our

customers), and that the issue of connectivity as it relates to IoT devices in agriculture is a topic of considerable misunderstanding and misinformation within our industry.

Our specific requirements for connectivity are:

- That the end-to-end connectivity be provided by a third party (i.e. not by Wildeye or our customers) using a business model that is proven to be sustainable in the long term. The building, operating and supporting of radio networks is a well-established industry serviced by dedicated businesses. We believe the connectivity needs of Wildeye and our customers, as they relate to IoT devices, are best outsourced to such businesses/industries, where we leverage very high service levels and ubiquitous connectivity, using existing infrastructure that is also servicing a myriad of other users and industries.
- The connectivity technology must be based on open standards. This ensures that we (Wildeye, and by extension our customers) are not affected by "vendor lock-in" in the future. Most, if not all, network technologies that are pitched as being dedicated to IoT do not currently meet this requirement, either being proprietary at a network level (e.g. Sigfox), or at a hardware level (e.g. Lora/LoraWAN).
- The connectivity technology must have global adoption/coverage. Wildeye are an international company (with offices in Australia, New Zealand, USA and Canada and customers throughout the world) and we need to know that we can leverage the same development investment to service customers in any part of the world. There are no dedicated LP-WAN's (i.e. those that operate within networks solely dedicated to the servicing of IoT) that currently (or that we believe will in the foreseeable future) meet this requirement.
- The connectivity technology needs to be secure and needs to provide the capacity to cater for firmware updates of our products to ensure long term reliability. There are no dedicated LP-WAN's (i.e. those that operate within networks solely dedicated to the servicing of IoT) that currently (or that we believe will in the foreseeable future) meet this requirement.

We believe that at present, the only technologies that meet the above requirement are those based on cellular standards (e.g. GSM, 2G, 3G, 4G and 5G – open standards developed by the 3GPP standards body).

The connectivity used at Redbank is 3G and Cat-M1 accessed via the existing Telstra network. This allows us to leverage very reliable coverage, delivered on existing infrastructure, by an established and sustainable business, using open standards, with service levels determined by and essentially subsidised by countless other users such as smart phone subscribers, at a deterministic price (that we are yet to see be matched by a dedicated LP-WAN provider).

Note that Wildeye also offer products that operate on 4G networks using the Cat-M communication protocol (a subset of the 4G standard developed specifically for IoT applications). Despite this, 3G was selected for the Redbank demonstration project because:

- The network will operate for at least another 4 years
- Our 3G products have been being produced for 10+ years and have been produced in 10's of thousands. The Cat-M network in Australia itself is relatively new, and therefore by definition the modems used in our products and our products themselves, are also relatively new. Given the demonstration nature of the project, and the fact the functionality of our 3G products is largely indistinguishable from our 4G/Cat-M products from an end-user perspective, a strategic decision was made to deploy products on the 3G network.

- We were confident that the significant extra coverage offered by the 4G/Cat-M network was not necessary, and that the 3G network provided enough coverage for the successful delivery of IoT across the Redbank Station operation.

We note that no signal testing was undertaken at the installation locations assigned to Wildeye prior to our arrival, and that all installations have been completed successfully without any concerns or issues relating to connectivity/signal.

3.2 Hardware

It is Wildeye's experience that the nature of rural IoT applications requires an adaptable, practical and pragmatic approach to installation methodology. There is frequently the need to adapt to site specific requirements that often vary between assets of the same type (e.g. "no 2 tanks are the same"). Details and photographs of the specific installations are provided below.

3.2.1 Diesel Tank (Wildeye serial number op48983)

The "Diesel Tank" installation (Wildeye serial number op48983) is shown in the annotated image below. It comprises a solar powered Wildeye device connected to a pressure transducer that detects the pressure of diesel fluid at the tank outlet (which is proportional to the depth of diesel stored, and therefore diesel volume).

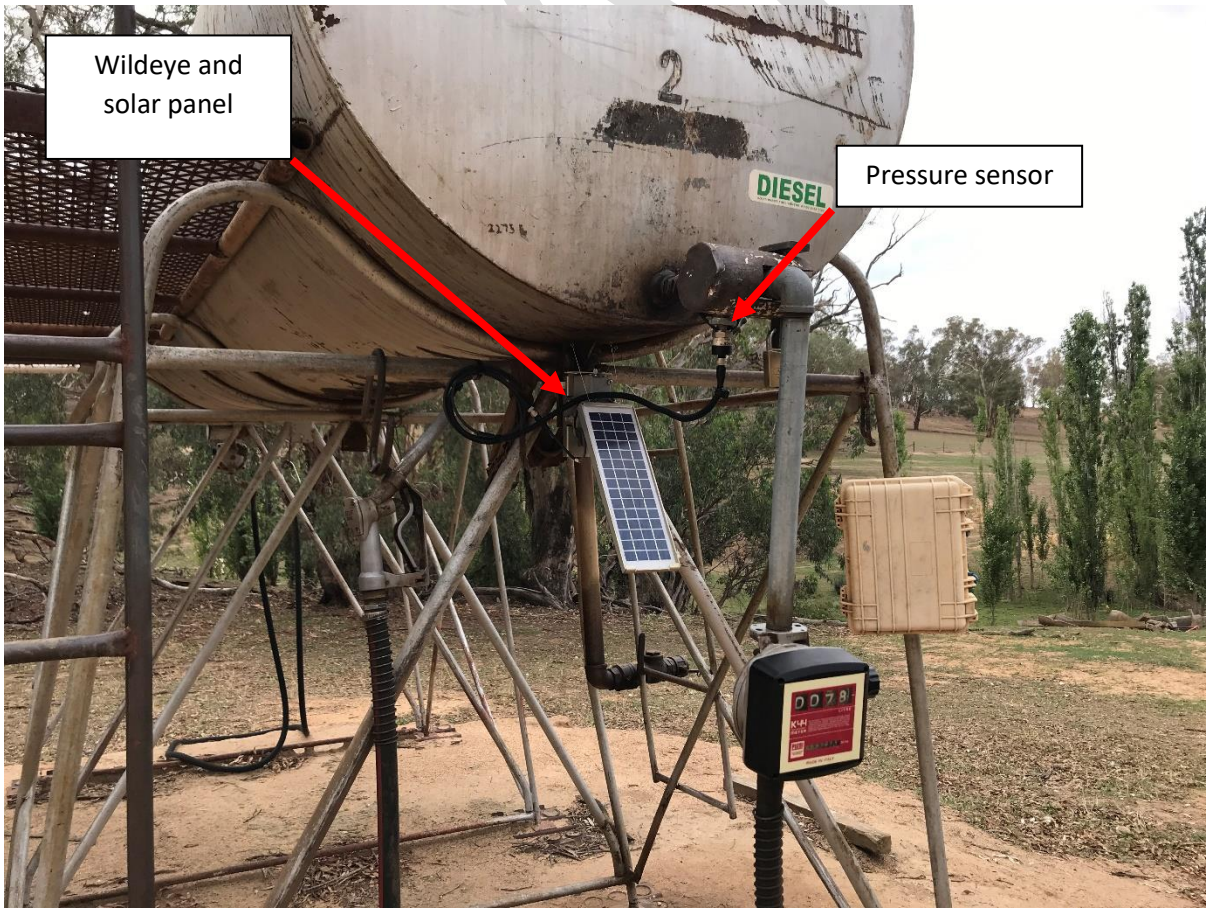


Figure 1. Fuel monitoring system

3.2.2 Hut Rain Gauge (Wildeye serial number op48309)

The ”Hut Rain Gauge” installation (Wildeye serial number op48309) was initially installed by Wildeye as shown below. The gauge (with integrated telemetry not visible in the photos) was fixed to a concrete Besser block with masonry fixings and the Besser block was subsequently set on a concrete pad on top of a rocky outcrop. This approach was chosen because the position was inherently cattle-proof (as demonstrated on our return visit where there had been considerable deposition of cattle manure around the installation and no sign of cattle having touched the rain gauge), and in a sufficiently open area as to be reasonably expected to be representative of broader rainfall in the area.

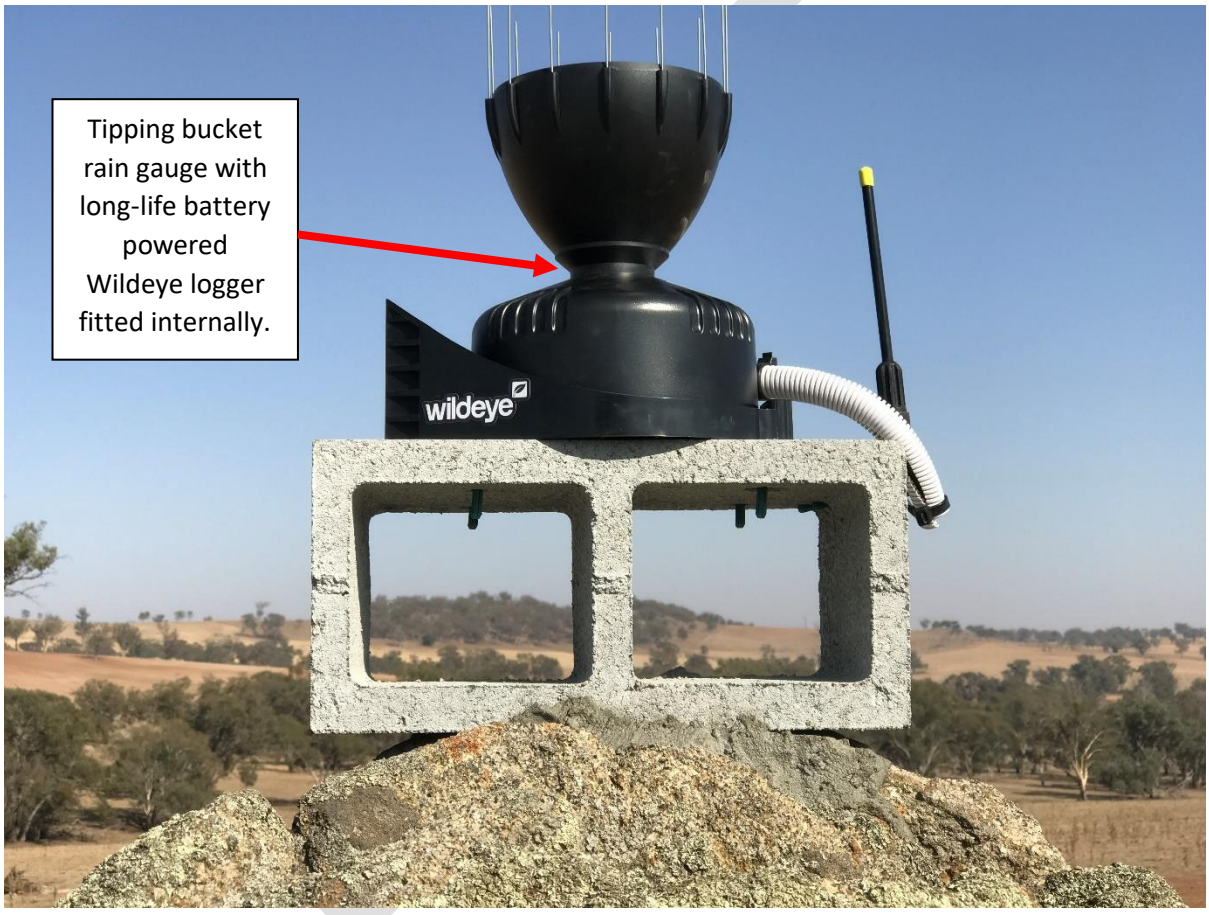


Figure 2: Rain gauge

Subsequent to the installation shown above, Wildeye was asked by the project team to reinstall the gauge at an alternative location (within a cattle-proof enclosure around a nearby soil moisture probe). As this soil moisture sensor installation and cattle proof enclosure had not been installed at the point of Wildeye completing our other work at the site, MLA’s project manager agreed to reinstall it. This was completed during the week ending Friday 20 March 2020.

3.2.3 Polo Tank (Wildeye serial number op48991)

The ”Polo Tank” installation (Wildeye serial number op48991) is shown in the annotated image below. It comprises a solar powered Wildeye device connected to a submersible pressure transducer, suspended within the tank so that the sensor element is held just above the tank floor and accumulated sediment and which detects the pressure of water within the tank (which is proportional to the depth of water stored, and therefore water volume).

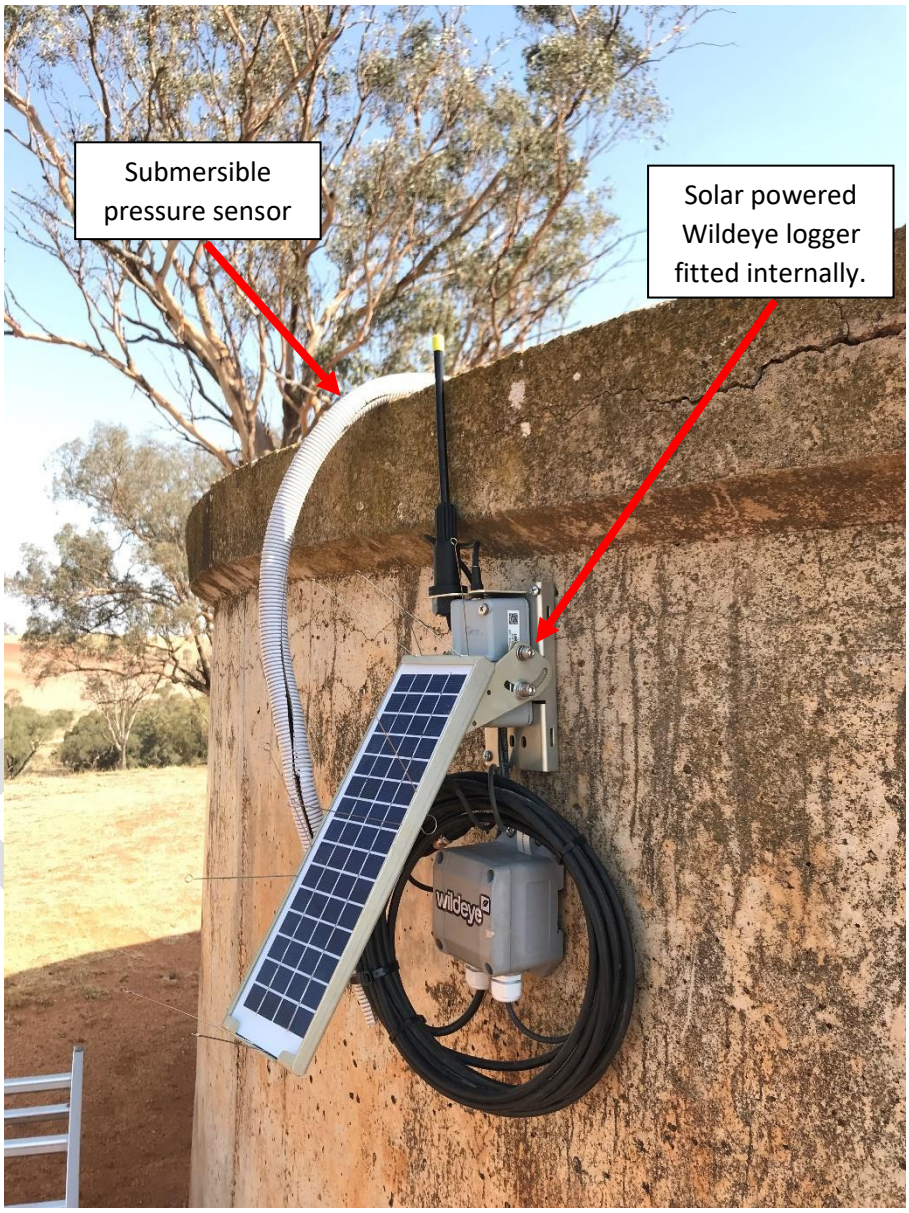


Figure 3: Tank sensor

3.2.4 Silo 1 Bill's (Wildeye serial number op48986), Silo 2 Bill's (Wildeye serial number op48987) & Silo 3 Bill's (Wildeye serial number op48988)

Silo’s 1, 2 and 3 at “Bill’s” are similar installations comprising rechargeable Wildeye logger, external battery pack using user-replaceable Alkaline D cells and ultrasonic level sensor to detect the distance

from the sensor to the surface of the stored bulk goods. An example installation is shown in the annotated images below. Care was taken to ensure any penetrations into the silo were waterproofed to protect the quality of the stored goods and that no adverse impact on fumigation requirements would be caused.

Figure 4: Silo sensor

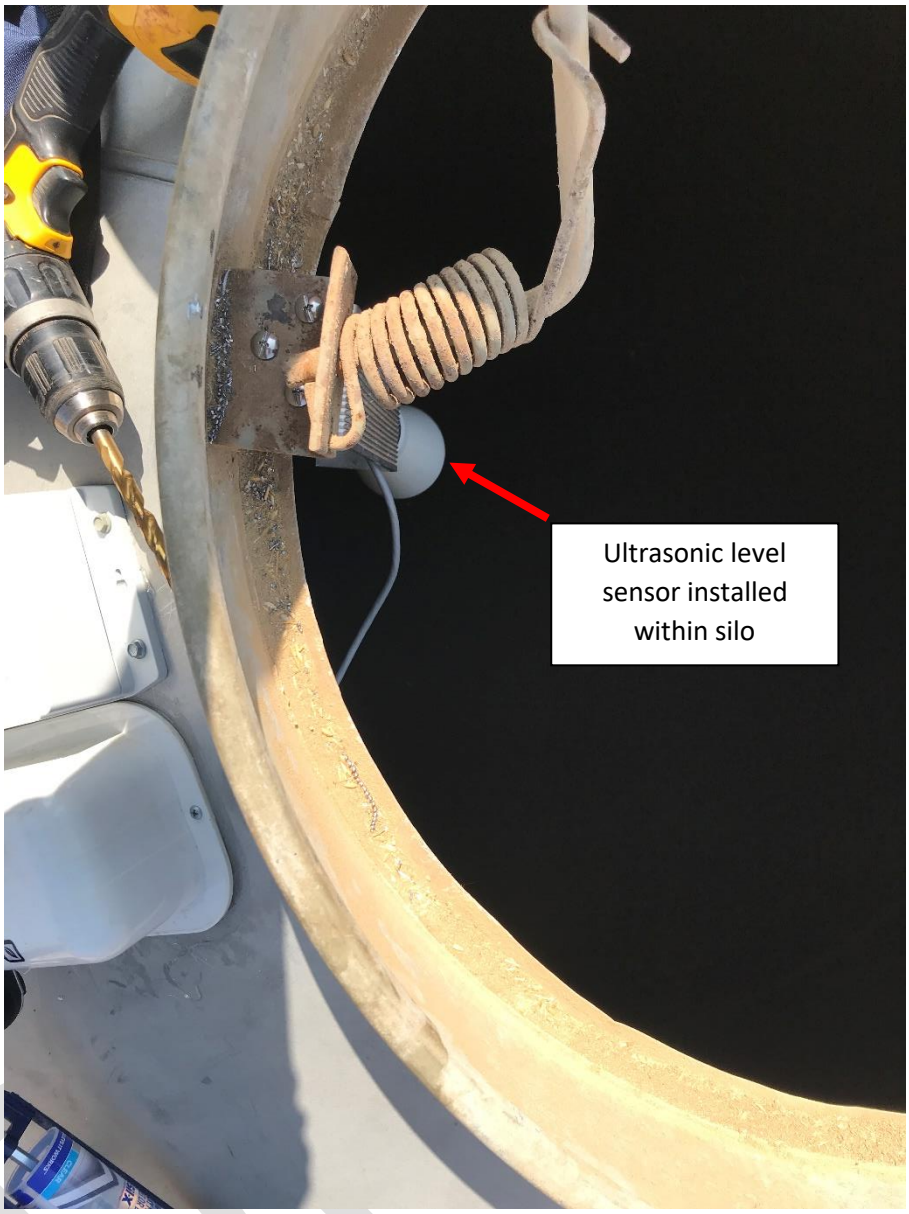


Figure 5: Silo sensor

3.2.5 Silo 4 Garangula (Wildeye serial number op50097)

Silo 4 at "Garangula" is similar to the installations at Bill's silos, however a sensor using radar measurement principles (as opposed to ultrasonic) was used. The installation comprises rechargeable Wildeye logger, external battery pack using user-replaceable Alkaline D cells and radar level sensor to detect the distance from the sensor to the surface of the stored bulk goods. Care was taken to ensure any penetrations into the silo were waterproofed to protect the quality of the stored goods and that no adverse impact on fumigation requirements would be caused.

3.2.6 Top Doorknock Weather Station (Wildeye serial number op48990)

The "Top Doorknock" weather station comprises a Wildeye "standard" weather station for agriculture. We note that weather stations can come in a wide range of configurations, each with very different

costs and specifications in terms of sensor accuracy, prevision, serviceability and reliability. Depending on the exact configuration, Wildeye weather stations can range from around $3000 to well over $10,000. The “Top Doorknock” weather station specifically comprises:

- Rechargeable Wildeye telemetry unit and solar panel
- Davis™ tipping bucket rain gauge
- Davis™ anemometer
- Davis™ solar radiation sensor
- Wildeye Temperature and humidity sensor

Figure 6: Weather station

3.2.7 Warranoy Tank (Wildeye serial number op50134)

Unlike the “Polo Tank” installation (which measures the level of water stored within the tank), the ”Warranoy” Tank installation measures the volume of water going into the tank. This installation utilises a long-life battery powered Wildeye logger that collects 15-minute records of water consumption on 5 litre resolutions. The installation is shown below.

Figure 7: Tank sensor

3.2.8 Woodford Tank (Wildeye serial number op50133)

Unlike the “Polo Tank” installation (which measures the level of water stored within the tank), the “Woodford” Tank installation measures the volume of water going into the tank. This installation utilises a long-life battery powered Wildeye logger that collects 15-minute records of water consumption on 5 litre resolutions. The installation is shown below.

Figure 8: Tank flow sensor

3.3 Software and data access

3.3.1 Cross-platform Data Sharing

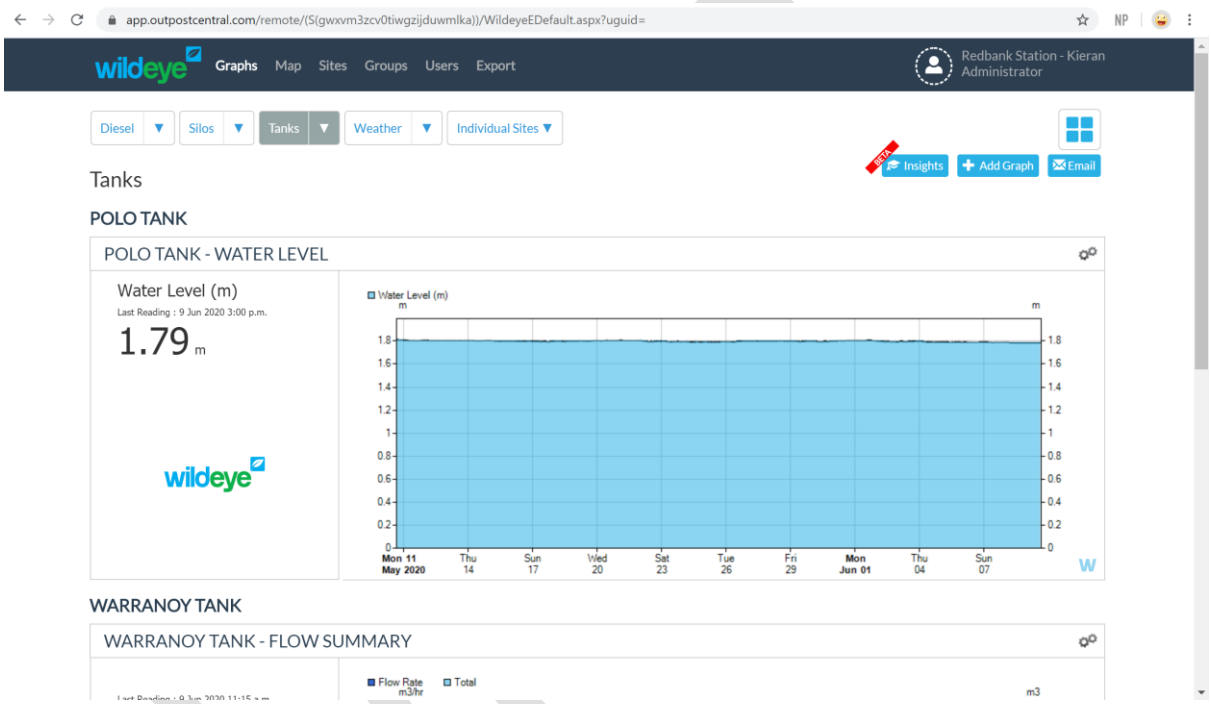
Wildeye have been developing cloud hosted IoT solutions for more than17 years. As pioneers of cloud computing in IoT, we have an acute awareness of the need to build cloud platforms that encourage cross-platform data sharing. We believe that "agriculture" is too broad to ever have all requirements of all applications fully serviced by a single software solution, and we are avid subscribers to the philosophy that, as custodians of a customer's data, it is incumbent on us to facilitate integration of that data with 3rd parties where our customers desire it. To this end we have a number of very flexible, user-accessed and user-managed tools to allow users to share data collected by Wildeye devices with third-party platforms. These tools include:

- An open API (based on RESTful standards) that allows Wildeye users to issue secure API access credentials to their trusted third parties to provide access to their data.
- A range of automated export functions with flexible file structures (including those required by common hydrographical, irrigation management, and SCADA software packages), flexible data formats (including JSON, XML and CSV) and transport mechanisms (including sFTP, FTP, email, HTTP and Dropbox™).

3.3.2 Wildeye Portal

Wildeye data is available to Romani Pastoral Company and other users via dedicated smartphone apps for iOS and Android or through our web-based software. An example of the web-based software option is shown below. Monitored assets at Romani have been grouped into Silos, Diesel Storage, Tanks and Weather. An example of the user interface for each is shown below. The web portal also provides access to tools for:

- Creating and managing individual user accounts, what they can access and what user-privileges they have access to
- Configuring site settings (upload frequency, alerts, adding new sensors etc)
- Configuring and managing automated push-exports of data to third parties
- Visualising sites in a map-view layout via Google Maps integration.



4. Results

The Wildeye installations at Romani Pastoral Company properties have proven successful and useful in a range of applications, including:

- Identifying leaks in pressurised water supplies to stock tanks
- Managing stock water supplies
- Understanding weather patterns and rainfall records

A number of technical issues have been encountered, including:

- Venting issues with the diesel tank sensor, resulting in extended periods where diesel storage data is believed to be incorrect.
- Reliability issues with ultrasonic sensors at 3 of 4 grain storage silos (noting that the silo where radar technology was used had reliable data)
- Transient connectivity issues at one installation.

Wildeye have taken some valuable learnings from our involvement in the project to date (for which we are very appreciative), including:

- The extent to which protection from cattle is required. While we operate within all facets of agriculture, we predominantly service cropping and horticultural operations, as opposed to livestock operations. Furthermore, most of our involvement in livestock operations to date has been with sheep producers. It is fair to say that the "heavy duty" nature of protection requirements for our installations within a cattle operation was under-appreciated by us prior to our involvement in this project.
- The varied nature of water supply infrastructure in a station operation, in particular the extensive use of threaded galvanised pipes (which are considerably more challenging to work with regards to retrofitting of sensors relative to LDPE/HDPE/PVC pipe).
- The lack of suitability of ultrasonic sensor types for bulk goods monitoring.

5. Conclusion and recommendations

Agriculture technology that falls into the "IoT" category – being meters and sensors connected to the internet - have been demonstrated to be accessible, simple and fast to install and to be able to be applied without complex analysis and consideration of the issue of connectivity.

Correct selection of the part of the system that does the measurement (the meter or sensor) is critical, as the reliability of the IoT hardware, connectivity and software accounts for little if the data being handled and presented is not accurate or representative.