Final Report

SWIRO

Services and Waste Insights, Reduction and Optimisation

Project Code
2021-1025

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1.0 Executive Summary

The 2021-1025 Services and Waste Insights, Reduction and Optimisation project aimed to enhance the environmental performance of the red meat processing sector by installing digital meters, developing insights to identify leakage/waste, and informing future investments.

Significant achievements include reducing water usage from 5.45 L/kg HSCW to less than 3.0 L/kg HSCW for the combined primary and secondary processing at the site, saving over 25 ML of water annually, and reducing natural gas and electricity consumption in the process.

The project has successfully implemented data analytics to monitor and optimise utility usage, demonstrating significant improvements in resource efficiency. Recommendations for future actions include focusing on factoring in labour requirements to further predict utility usage based on processing throughput. A new SCADA system will also be rolled out to accommodate the growing amount of data captured, data integrity requirements and provide visibility for the data being collected.

This report can aid other processors in developing an educated decision to the benefits of sustainability across their businesses and driving positive change for the industry.

2.0 Introduction

Dardanup Butchering Company(DBC) is an SME in the Australian processing industry. At the commencement of this project DBC was processing 380 head beef & venison, 3,200 sheep/lamb and 1,650 pigs per week on two processing chains. In early 2020 DBC was approached by AMPC to undertake the 2021-1025 Services and Waste Insights, Reduction and Optimisation project to aid in the improvement of the environmental performance of the red meat processing sector.

The goal was to install digital meters and data analytics, aiming to identify and reduce waste in water and energy usage. This initiative built on previous research in environmental performance and sustainability frameworks, targeting specific improvements in utility management within the sector.
Prior to the commencement of the project DBC relied on manually recorded water meter readings, performed monthly, which were used in the annual reporting for Department of water and environmental regulation licensing requirements.

The DBC team saw this as an opportunity to improve its own processes and hoped that some of the lessons learned within our own organisation could possibly be used by the wider processing industry.

3.0 Project Objectives

The project objectives were to:

- (input objective) Install digital meters on all service incoming and discharge points with reporting back to a single location
- (output objective) Insights developed that identify leakage/waste, schedule changes and future distribution investments required, by both DBC (private benefits) and AMPC core R&D activities (public benefits)
- Obtain data to inform environmental performance reporting for the red meat processing sector as part of AMPC environmental performance review and industry sustainability frameworks.

4.0 Methodology

After completing the 2020 AMPC environmental performance review and pinch analysis, it was determined that water metering, in particular the hot and steriliser lines should be metered first. Any reduction in these two areas would also have a flow on effect for power and natural gas usage.

4.1 Initial methodology

- Identify points of process where flow data would be deemed beneficial.
- Select, purchase and install meters.
- Configure data collection and reporting system
- Intense review for a 3-month period
- Quarterly high-level review for a total project monitoring period of 3 years.
- Quarterly meetings with AMPC to review use points and opportunities for improvement R&D to be undertaken either (or by both) by DBC and AMPC.

Being a relatively small plant DBC did not have any supervisory control and data acquisition on site, with only a few human machine interfaces (both physical and virtual) for individual systems, primarily controlling refrigeration and wastewater monitoring.

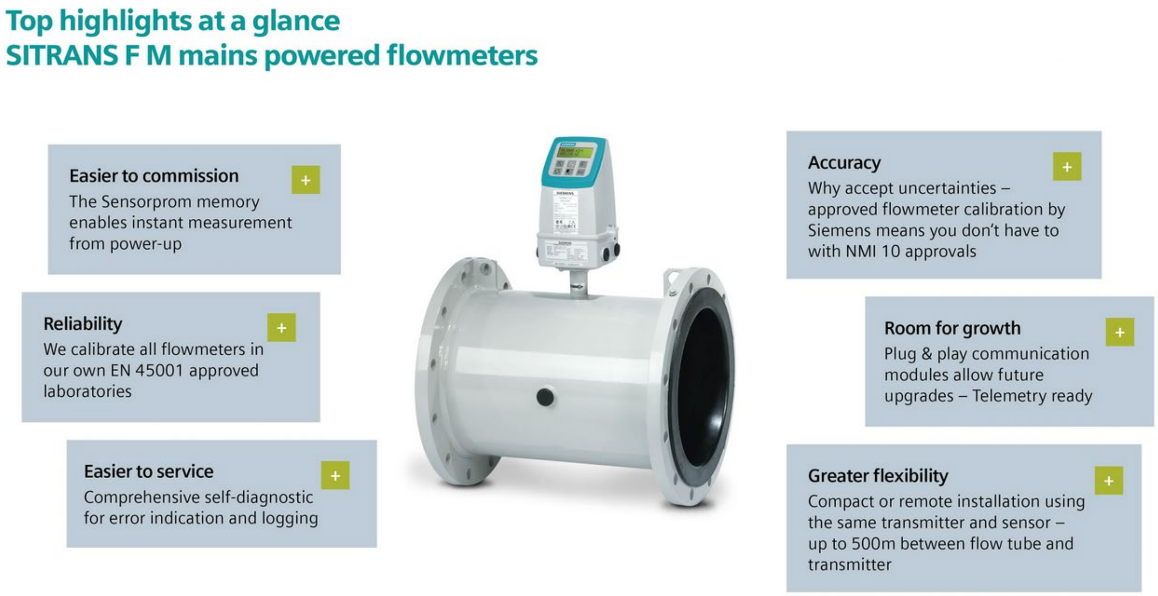
After internal discussions took place, it was established that the project should have the following deliverables.

- 3 meters installed initially to differentiate each stream and formulate a plan on the next areas to target (figure 9.1).
- Meter data to go to a centralised onsite SQL server for further analysis.

- IOT edge controllers to perform the math calculations to remove unnecessary data manipulation.
- Leverage existing business intelligence software for all dashboards and business insights, refreshed as necessary.
- Compare daily kill numbers (in units) against daily services/utility usage to benchmark and identify excessive usage.
- Power metering equipment to be installed after water metering complete.
- Gas usage to be extracted directly from the supplier through online portal. Investigate if API (Application programming interface) is available for direct input into the database.
- Bridge the gap between industrial automation and production data, through unified IT and OT architecture.

4.1.1 Architecture and Equipment Selection

Water Meters: Siemens magnetic flow meters were chosen for their reliability and ease of installation, connected to data capturing via Modbus modules.



Power metering: DBC opted for the latest release of Schneider power tag rope components which significantly reduced installation time and cost, as well as integrate into the existing network via MODBUS.

Supervisory control and data acquisition: At the commencement of the project a full-fledged SCADA system was out of reach as the time, instead we opted for a bespoke system utilising the Redlion flex edge controllers. These devices perform all the protocol conversion, visualisation and send data to SQL databases for further analysis for far less capital costs. The device also contains protocols such as MQTT for the forwarding of data to a cloud based IOT provider (AWS MQTT) for further visualisation, analysis and front-end development.

Business Intelligence Software: DBC opted to use Microsoft PowerBI for all reporting as it was currently utilised throughout our processing operations and could easily extract existing processing data to compare against utility usage. PowerBI has a low cost to entry and contains power data manipulation capabilities and great visualisations for reporting.

4.2 Project expansion

4.2.1 Water metering

Like many other processing plants around the country, DBCs processing plant has evolved and grown over the years which has seen its utility layout morph and change beyond what was previously documented. Initial meetings were held with plumbing contractors to trace all services throughout the factory so a plan could be formulated on the implementation process for the meters. (Figure 9.2)

After this process was completed, it was decided that 9 additional meters would be installed throughout the factory, to differentiate between hot, cold and steriliser across different sections of the factory.

- *Cooling Tower*: to measure the water usage to ammonia refrigeration cooling towers. In hindsight we would not have installed this meter as 95% of the water for the towers comes from the “South cold” meter line when the factory cold pumps are active.
- *Stock Pump*: All animal drinking troughs in pens and paddocks.
- *Boiler Feed*: 2MW main boiler water usage for steam production.
- *DAF cold:* Contains Tripe/Runner room, Wastewater area for floc make-up and washdown, and rotating screen wash.
- *DAF Hot*: Wastewater area washdown and rotating screen cleaning
- *South Cold:* Washdown for boot wash, beef boning, food service division, ice machine, as well as the cooling tower when cold pumps are on.

- *South Hot:* Washdown for boot wash, beef boning, and food service division.
- *VAR Cold*: Washdown (pork and sausage room), hook shed tanks for hook cleaning and truck wash.
- *VAR Hot*: Washdown (pork and sausage room), hook shed tanks, truck wash.

4.2.2 Electrical

Individual circuit monitoring was not feasible, instead we focused on metering distribution boards to gather information on further breakdowns if required. 8 sets of CT meters were installed breaking down into the following zones.

- *Boiler Room:* contains equipment used for cold, hot and steriliser distribution and makeup. 2 other smaller processing rooms are also attached to this sub.
- *DAF sub board:* responsible for all wastewater treatment and discharge for the site
- *Kill floor:* Primary processing for both lines, hook shed, pork room secondary processing and lighting for 3 chiller rooms.
- *DB PR P1:* 3 phase equipment distribution on southern side of factory for freon refrigeration and secondary processing.
- *DB PR P2:* 3 phase equipment distribution on southern side of factory for freon refrigeration and secondary processing.
- *DB PR P3:* single phase equipment distribution on southern side of factory for secondary processing.
- *DB WS:* maintenance workshop, dry goods stores, carton freezer and hide and skin processing.
- *DB NH3:* Ammonia refrigeration distribution.

4.2.3 Final Project Architecture

The final design pictured in Figure 1. shows the final system architecture overview.

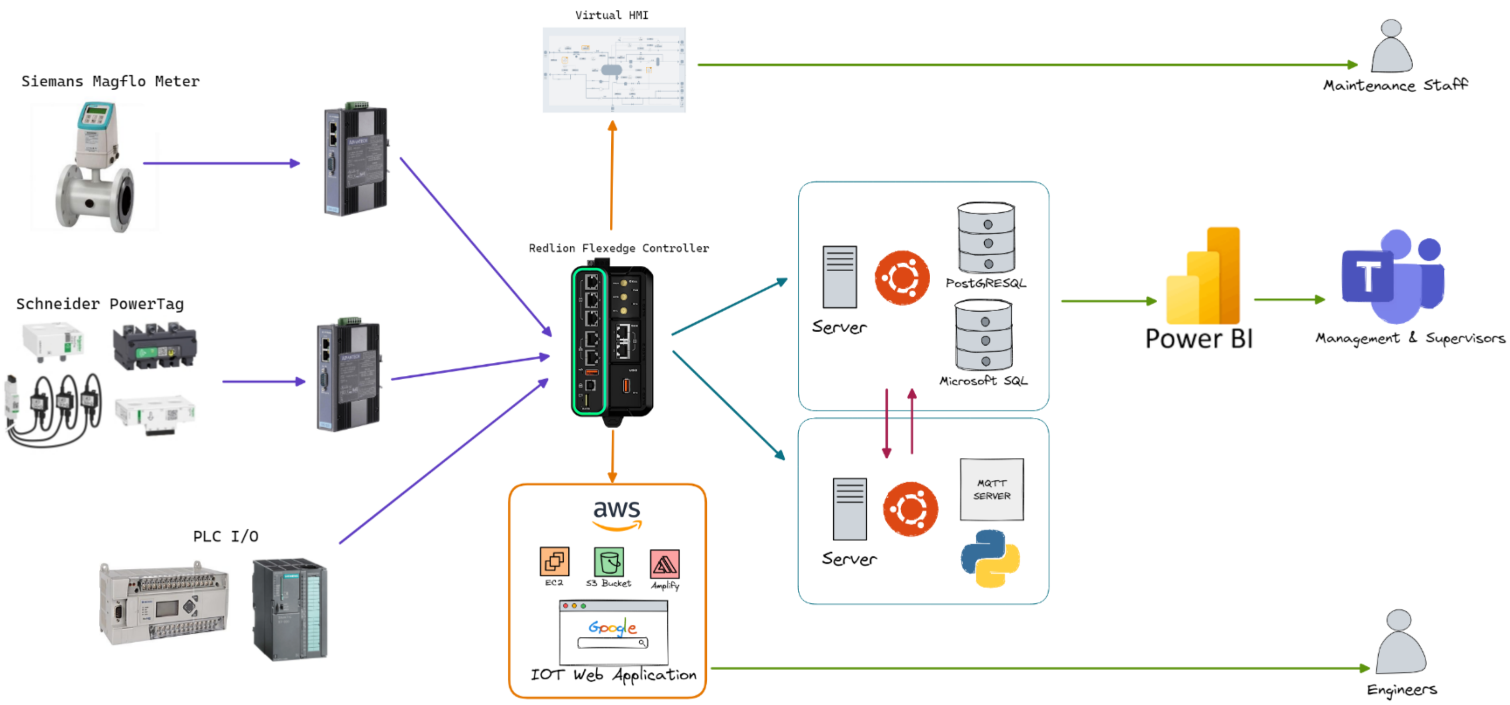


Figure 1: System Architecture

4.3 KPIs

Initially usage was compared against units processed. The units calculated used static values to convert other species back to a small stock unit. As this is subjective measurement to our specific process, AMPC requested our reports to come into line with industry HSCW as the primary performance indicator. As a result, our final metrics were as follows and visualised in PowerBI across relevant time frames:

- **Water** - Litres per kilogram of hot standard carcass weight (L/HSCW)
- **Electricity** – kilowatt hours per kilogram of hot standard carcass weight (kWh/HSCW)
- **Gas** – MJ per kilogram of hot standard carcass weight (MJ/HSCW)

5.0 Project Outcomes

The DBC - Services and Waster Insights, Reduction and Optimisation Innovation project has provided outcomes far exceeding the initial objectives set out at the project inception. These include but are not limited to.

5.1 Improved Operational Efficiency

- **Real-Time Monitoring:** Real-time data on resource usage allows for immediate adjustments and optimisations. This dynamic approach ensures that resource usage is always aligned with operational needs, reducing waste and improving efficiency. For instance, the introduction of a max 5-minute timer on the wastewater rotating screen solenoid reduced water usage by approximately 30kL of hot water per day.

- **Predictive Maintenance:** The integration of hardware into predictive maintenance strategies based on usage patterns helps prevent downtime and equipment failure. For example, identifying and rectifying faults in the condensate tank and stock water line leaks has prevented significant resource wastage and ensured the smooth operation of the facility.

5. Enhanced Resource Management

- **Accurate Consumption Tracking:** Implementing precise measurement tools for water, electricity, and natural gas usage has significantly enhanced our ability to track and manage these resources. By utilising PowerBI for all dashboarding, we were able to visualise and analyse data in close to real-time, revealing areas that could be immediately targeted for reductions. For example, PowerBI reporting helped identify that the sheep yard sump pump was cavitating, causing the wash solenoid to be constantly on and leading to higher cold-water usage. Additionally, accurate tracking facilitated the identification of a major underground leak in the DAF wastewater area and multiple leaks/back feeds in the roof due to faulty valves, which were rectified to prevent resource wastage.
- **Optimised Resource Allocation:** The improved allocation of resources based on accurate usage data has ensured the efficient use of water, electricity, and natural gas. For instance, changing the boiler and steriliser start times to 4:50 am and turning off hot pumps after production have optimised resource use. QA staff now check that sterilisers are switched off when changing species, saving approximately 6kL per day. This strategic allocation of resources has led to a notable decrease in overnight water usage and a more efficient overall operation.

5.3 Cost Reduction

- Identification and elimination of inefficiencies have led to reduced water, electricity, and natural gas consumption, thereby lowering utility costs.

5.4 Waste Reduction

- **Leak Detection:** The ability to identify potential leaks that deviate from expected norms has significantly reduced unnecessary consumption and associated costs. For example, leaks located in the steriliser and hot water lines were promptly addressed, minimising resource waste and optimising efficiency.
- **Minimised Resource Waste:** Improved processes and practices have been implemented to minimise waste of water, electricity, and natural gas. These enhancements include turning off hot pumps after production and using a separate hot water system for the after-production clean-up crew, leading to reduced resource wastage and cost savings.

5.5 Data-Driven Decision Making

- **Informed Decisions:** Enhanced decision-making capabilities are based on accurate and timely data regarding resource usage. This data-driven approach ensures that all decisions are well-informed and targeted towards optimising resource use.
- **Benchmarking and Performance Tracking:** The ability to benchmark performance against industry standards and track improvements over time through other AMPC-related initiatives, such as environmental performance reporting, is invaluable. Although each plant is different in scope and operations, this data is still useful to gauge if the company is making positive headway at an acceptable rate and what outcomes the industry is achieving as a collective.

5.6 Sustainability and Environmental Impact

- **Reduced Carbon Footprint:** Although the project has only delivered small savings in natural gas and electricity to date, the data collected has justified capital outlay for future environmental projects. This investment in sustainability demonstrates our commitment to reducing our carbon footprint.
- **Water Conservation:** Improved water management practices have led to reduced water wastage and conservation of this vital resource. For instance, the change to DAF rotating screens with 1.5mm perforations reduced the cleaning cycle via PLC, saving approximately 20kL per day.

5.7 Compliance and Reporting

- **Regulatory Compliance:** Enhanced ability to meet regulatory requirements through accurate and detailed reporting of resource usage. As is the case with many processors, meeting environmental departments licensing obligations is of critical importance in the current climate. The water savings from this project have made achieving these license obligations far easier and provided room for the business to explore expansion if needed.
- **Transparent Reporting:** Improved transparency in reporting resource consumption and waste management practices to stakeholders. This capability has enabled us to develop in-house reports in PowerBI to send to senior management on short and long-term trends.

5.8 Community and Stakeholder Engagement

- **Enhanced Reputation:** The project has laid the foundation for environmental reporting data capturing and aiding with ESG reporting. Our improved reputation within the community and among stakeholders due to responsible resource management and sustainability practices is a testament to our commitment to environmental stewardship.
- **Stakeholder Trust:** Increased trust from stakeholders through transparent and responsible reporting and management practices. This trust is crucial for ongoing support and collaboration with our stakeholders, ensuring the long-term success and sustainability of our operations.

6.0 Discussion

This project aimed to optimise resource usage and operational efficiency in the plant, focusing primarily on water, gas, and electricity consumption. By implementing a range of operational changes and fault rectifications, we have achieved significant reductions in resource consumption. This section will analyse the outcomes and their broader implications for the facility's efficiency and sustainability goals.

6.1 Key Findings

The project has delivered substantial water savings, reducing consumption from 5.44 L/kg HSCW to 3.81 L/kg HSCW, with projected reductions to 2.70 L/kg HSCW. Similarly, an 18% reduction in gas usage was achieved, contributing to lower operational costs. Electricity usage improvements were minimal but indicate potential for future optimisation, particularly in peak load management. Improvements and information gathering were categorised into three categories, Operational, Faults and Findings.

Operational	Faults	Findings
Boiler and steriliser start time changed to 4:50am from 3/4am. Boiler is also not started on Sunday anymore as the boiler attendant lights early Monday morning before production	Sheep yard sump pump was cavitating causing the wash solenoid to remain on, led to higher cold-water usage.	The steriliser line makes up for ~50% of our total hot water used.
Changing of DAF rotating screen to 1.5mm perforations which meant the cleaning cycle could be reduced via PLC. ~20kL per day saving (25-11-20)	Rotating screen solenoid was always left on by staff. This was using approximately 30kL of hot per day. A max 5min timer was put in place to combat	average overnight usage is 7.56kL =1890KL per annum.
Hot pumps are turned off after production and a separate hot water system is now being used for the after-production clean-up team.	Found a major underground leak in DAF wastewater area.	Calculated the amount of water used per unit to be 5.6L/HSCW at project commencement (01-2020)
Sterilisers are being turned off during break times by production staff.	Found multiple leaks/back feeds in the roof due to faulty valves.	Achieved the lowest usage of water per unit: 4.89 L/HSCW (10-2020)
QA staff to check sterilisers are switched off when changing species (~6kL per day saved)	Leaks located in steriliser and hot water lines.	Notable decrease in overnight water usage since hot pumps shut down.
Boiler blowdown reduced a third while still maintaining correct TSS readings.	Fault in condensate tank found due a noticed increase in overnight usage of cold town water.	Since installation of the Magflow on the cold-water inlet, water use per unit has decreased by an average of 20L per unit

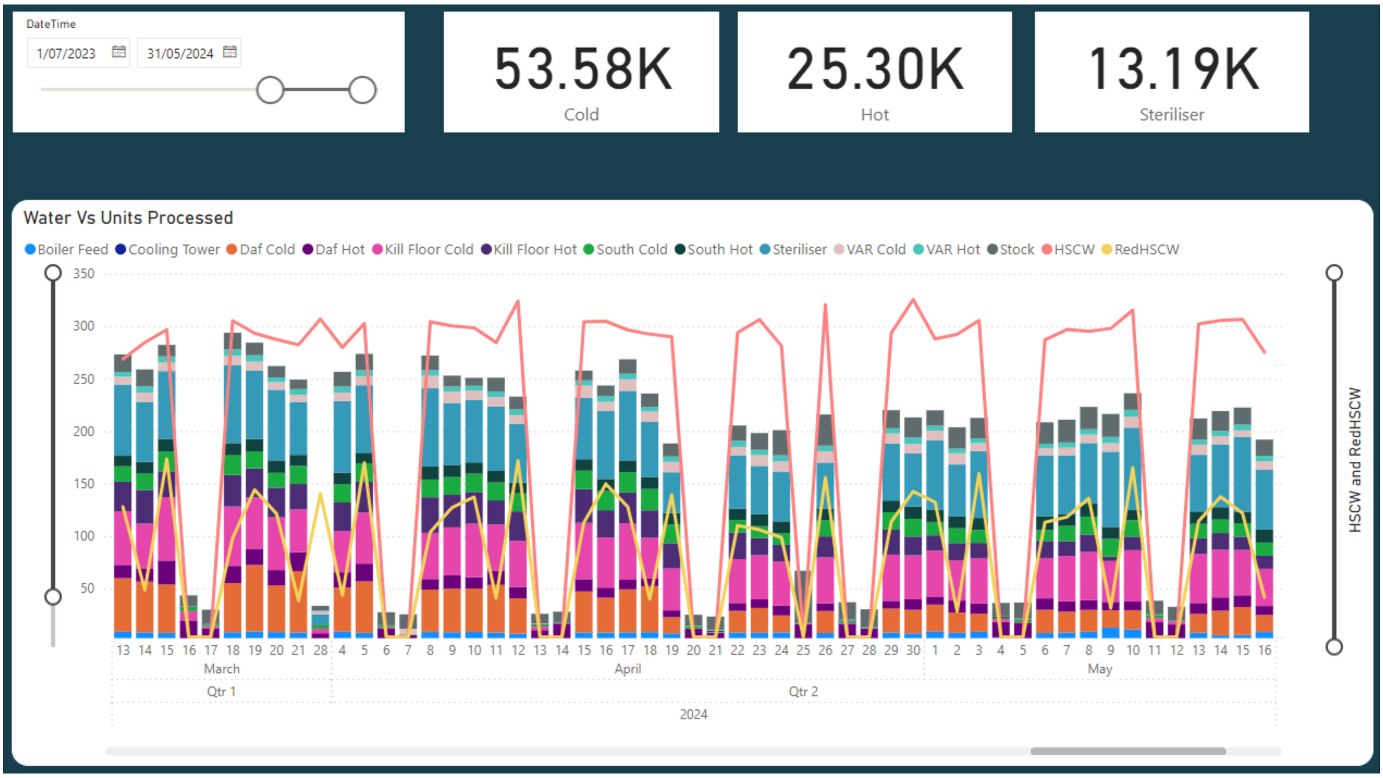
Hot water production PID tuning (08-2024)	Stock water line fault from multiple leaking troughs. Could be as high as 1000kL for the month, previously missed until monthly readings taken.	Lowest consumption day 3.36L/HSCW for the day since recording started. (06-2021)
	All steam traps inspected and serviced. Approximately 2-3% savings on gas	2.71L/HSCW recorded for whole factory (08-2024)

6.1.1 Reporting

Throughout the project, our reporting templates evolved significantly, both at the request of AMPC and internally, depending on the selected timeframes. Microsoft Power BI has consistently served as the foundation for reporting on timeframes greater than hourly, as data is only refreshed periodically. For live analysis, we rely on our internal SCADA/data capturing software for alarming.

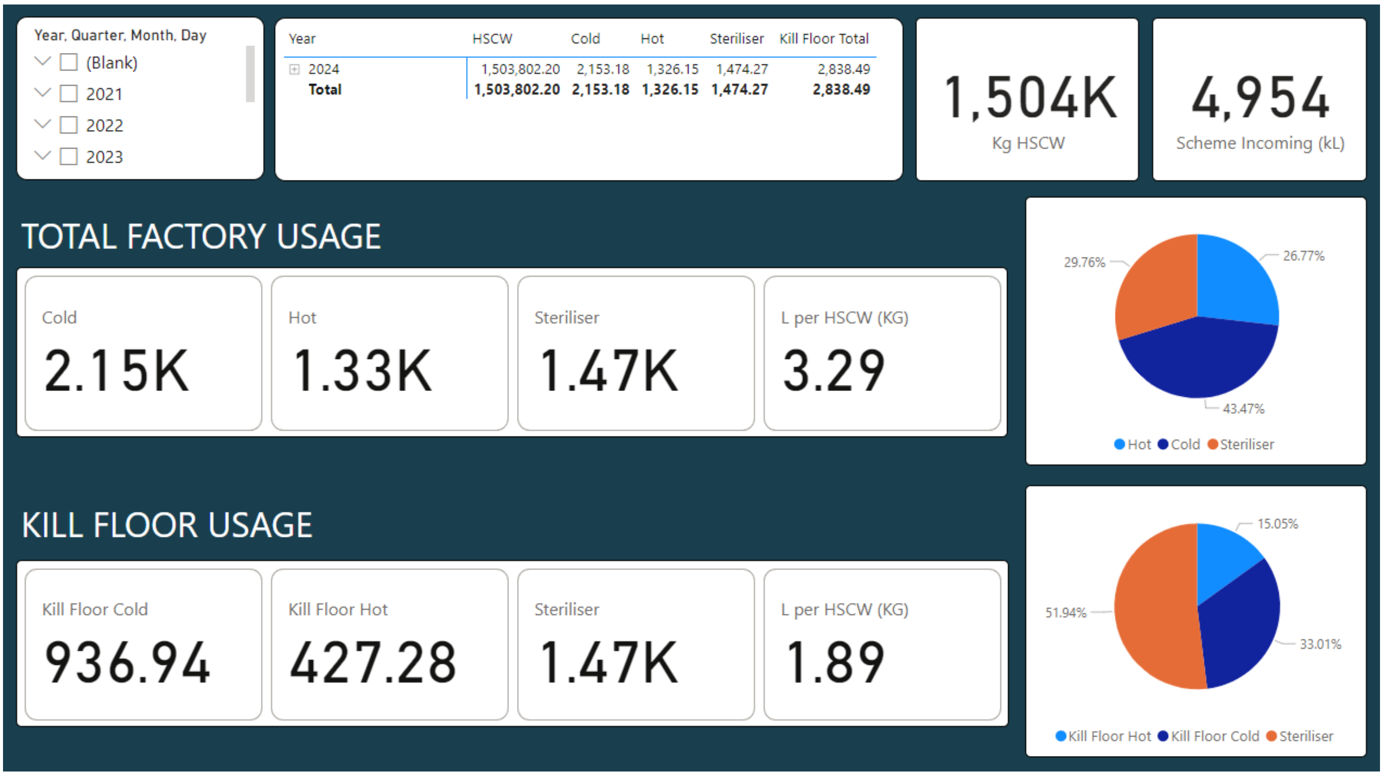
One of the key benefits of Power BI is its ease of use when drilling down into specific time periods, providing a clearer view of the analysis being conducted. The key reports initially used included:

Total water usage by area vs HSCW



Breakdown of water usage vs. HSCW is one of the most frequently used reports from a maintenance perspective. It allows for drill-downs to an hourly level if required and provides a good historical range to analyse long-term trends. Different sections can also be isolated to focus on specific areas when necessary.

Total factory vs kill floor usage



Isolation of kill floor usage versus total factory usage allows for a quick assessment of consumption during a specific period.

Monthly L/HSCW for both kill floor and factory

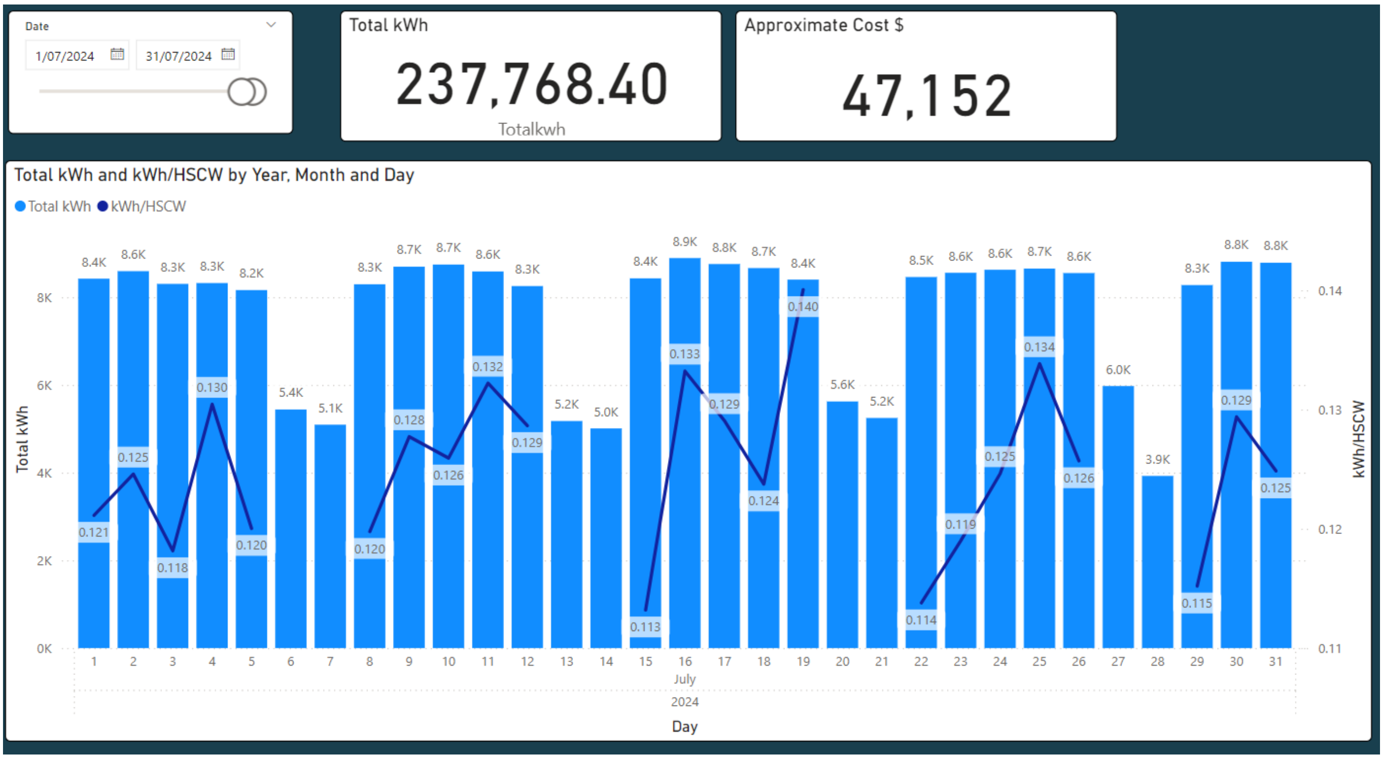
Long-term usage trends, both for the factory and the kill floor, show significant variations. As shown, operational and technical changes in August 2023 caused a spike to 4.7 L/HSCW, primarily due to adjustments in evisceration table flow rates, the installation of constant flow wash stations for lamb processing, and the implementation of a new pork wash system. Following technical improvements, including the addition of timers and solenoids, along with procedural changes, we observed a steady decrease in water usage over the next 12 months. The commissioning of STAD valves on steriliser lines led to our best results to date

- 2.7 L/HSCW for factory usage
- 1.52 L/HSCW for kill floor usage
- 0.73 L/HSCW for sterilisers

Gas Usage MJ/HSCW

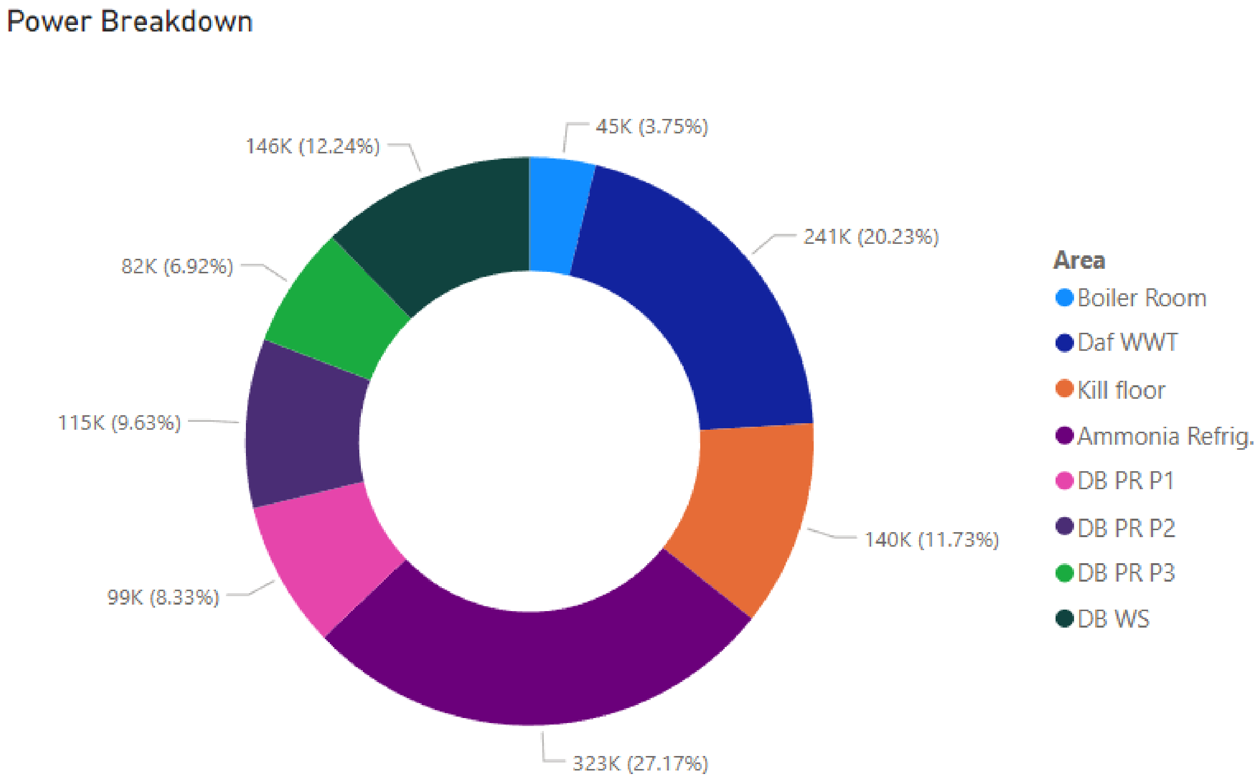
Gas usage remained steady at around 0.76 MJ/HSCW following the initial water savings in late 2021. Only recently have we seen a significant drop to below 0.63 MJ/HSCW, which can be attributed to steam trap inspections and servicing, reductions in steriliser usage, and optimisations in our hot water production systems.

Power usage total kWh/HSCW



Drill-down of power consumption: Over the course of the project, power usage has remained relatively constant, with long-term trends averaging around 0.15-0.16 kWh/HSCW when weekend usage is included. On production days alone, this figure drops to approximately 0.12 kWh/HSCW. As noted, refrigeration accounts for a significant portion of the site's power consumption, meaning that processing numbers versus available fridge space have a greater impact on perceived performance than operational factors. While comparing power usage against HSCW offers some insights, it is more beneficial to analyse operational changes against long-term trends to account for seasonal variations in temperature and humidity.

Power usage breakdown %



Key findings indicate that refrigeration accounts for approximately 50% of the total power consumption on site, with wastewater treatment contributing 20%. More granular power metering is not required at this stage. Instead, the priority is regular inspections and servicing, along with chiller calibrations, to ensure accurate product temperature is maintained.

6.2 Analysis of Success Factors

The quote "You can’t manage what you can’t measure” (Drucker, n.d.) remains true to the SWIRO project and was critical to the success of the project. Establishing the correct metering locations that would have the most impact on potential savings required careful planning. The approach taken to meter the 3 main lines and increase metering to suitable locations after the initial data was analysed was the right strategy.

The most successful or these interventions included the installation of the Mag flow on the cold-water inlet itself, which decreased water use per unit by 20L, through operational adjustments such as turning off hot pumps after production. These changes reduced overnight water usage, eliminated inefficiencies and help pinpoint issues such as undetected cavitation in the sheep yard sump pump, which caused excessive cold-water usage. The decision to switch steriliser start times and implement QA oversight during species changes further optimised water use, saving approximately 6kL per day.

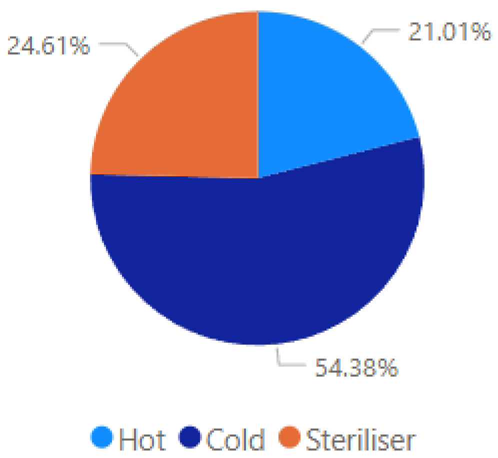
6.2.1 Water

Prior to project commencement, the plant's water usage from the scheme was 5.44 Litres per kilogram of Hot Standard Carcass Weight (HSCW). After implementing the project, the average water usage has been reduced to 3.81 Litres per kilogram of HSCW. This reduction (Δ) of 1.63 Litres per kilogram of HSCW translates to significant water savings:

WATER SAVINGS	L/KG HSCW	Δ	LITRES SAVED	Savings (per annum)
PRE SWIRO-MEAN	5.44			
POST SWIRO-MEAN	3.82	1.62	25751.68	$ 82,405.39
PROJECTED POST SCADA	2.70	2.74	43506.03	$ 139,219.30
*Assumes $3.2 per kL & 15,000 tonne HSCW				

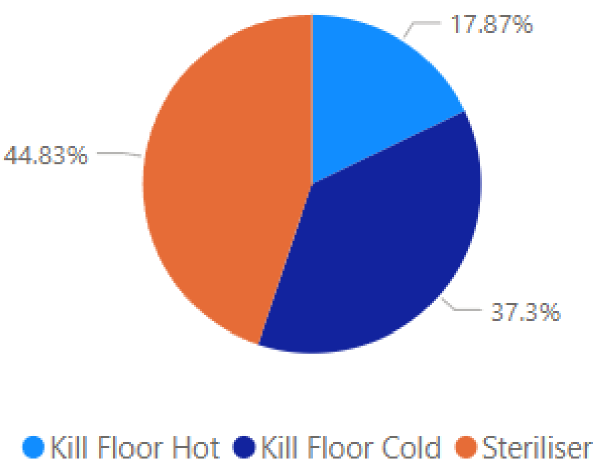
FACTORY HIGH LEVEL BREAKDOWN

Breaking down water for the site we can see that both Hot water and Steriliser make up ~45% of the sites scheme water usage (21% and 24.6% respectively, 01-2024



KILL FLOOR BREAKDOWN

After removing secondary processing and wastewater data we can see almost 50% of kill floor usage is attributed to steriliser usage



Sterilisers

From the onset sterilisers have proved difficult to reduce on a consistent basis. Issues constantly arise, either from maintenance, operator or compliance perspectives. This requires intensive monitoring on a daily basis as well as weekly tuning of individual sterilisers to maintain temperature whilst optimising flowrates. The most significant drop to steriliser usage was the replacement of evisceration table jets and reduced flow during pork processing.

During the SWIRO project the team tried numerous methods to mitigate usage. An Econoliser knife steriliser was purchased as a trial. This unit required extensive modification to the existing steriliser line to maintain temperature and was subsequently abandoned on a larger implementation. These units would ideally be suited to a new floor or if full replacement of existing lines was feasible.

Next a small-scale pilot trialled the use of temperature probes, solenoids and a programmable logic controller. This logged individual steriliser temperatures and maintained a 1°C differential. This looked to be a promising solution reducing usage by 50% on previous recordings. Long term issues arose from excessive water ingress from daily cleaning and chemicals and as a result this method was also abandoned. If a suitable IP (ingress protection) rated enclosure/controller could be installed, we would have achieved better results.

The final solution was to install stad manual balancing valves on each steriliser. Each steriliser is then optimised for the minimum flow to reach the desired setpoint. Again, long term issues started to arise from internal brass components failing requiring replacement to upgraded stronger components.

These valves have saved a considerable amount of water but require finetuning at predetermined intervals to maintain correct flow.

A more efficient and effective long term solution will continue to be explored but this is beyond the scope of the SWIRO project.

6.2.2 Gas

Any reduction in hot water or steriliser usage also benefits by lowering natural gas consumption. Since the commencement of the project, there has been an approximate 18% reduction in natural gas usage relative to processing throughput.:

Year	MJ/Kg	Mean
2018	0.940	
2019	0.897	**0.906**
2020	0.881	
2021	0.726	
2022	0.750	**0.746**
2023	0.761	
2024	0.745	
***Assumes $12/GJ**	**Δ**	**0.161**
	Savings	**18%**
		$ 28,908.00

6.2.3 Electricity

While the primary focus of this project was on water savings, minimal flow-on effects on electricity usage have been observed. Calculating the exact savings is challenging, but it is estimated to be less than $4,000 per annum, or less than 1% of our total electricity costs. As the project matures, we will focus on peak load management with better scheduling and resource use during off-peak hours to further reduce costs. Currently this is not needed as our electricity supply agreement is bundled and as such, we do not receive any return from load shedding. Looking forward to the future prospect of unbundled supply agreements the SWIRO project lays the foundation for items such as:

- **Prioritising critical loads**: Essential systems (like refrigeration, safety equipment, or core production lines) are kept running, while non-essential systems (such as HVAC, lighting, or non-critical machinery) are temporarily powered down.
- **Automated controls**: Advanced energy management systems may be used to automatically reduce or distribute the plant's load based on pre-set conditions, such as peak energy pricing or grid demand signals.
- **Demand response programs**: Plants may participate in programs where they agree to reduce power usage during peak periods in exchange for financial incentives or lower energy costs.

6.3 Challenges and Solutions

The project faced several technical challenges, most notably the identification and repair of multiple underground leaks in the DAF wastewater area. These leaks went undetected for extended periods, leading to increased water usage. This solve this more granular reporting was implemented with frequent data reviews. Behavioural challenges, such as staff leaving the rotating screen solenoid on, were addressed by introducing a max 5-minute timer, which reduced daily water wastage by 30kL.

Another significant challenge lay with the site being multi species. Accurately setting benchmarking for each specie at each time of the day remains a challenge with the current architecture, not because of the software capabilities but the hardware used was reaching its limitations with the extent of the data being logged and manipulated. Moving forward DBC in the process on implementing a new software package for the supervisory control and data acquisition. This will allow us to utilise hardware far exceeding the current infrastructure for more computationally heavy workloads.

6.4 Impact on Long-Term Efficiency and Sustainability

The reductions in water and gas usage have not only lowered utility costs but also improved the plant's overall sustainability. The data-driven approach to monitoring and fault detection, using tools like PowerBI, has provided a foundation for ongoing improvements. While the immediate electricity savings were minor, the groundwork has been laid for more effective resource allocation and peak load management in the future.

Another significant positive from the project lay with regulatory environmental compliance. Prior to the project commencement nutrient loadings were reaching the upper bounds of the licensing conditions. With the decreased load on the wastewater treatment facility total nitrogen levels specifically have been able to remain lower on average when comparing periods. This is attributed to less load on the anaerobic digestor, and subsequent aeration and filtration processes that take place.

6.5 Lessons Learned and Future Opportunities

One key lesson learned is the importance of real-time monitoring and predictive maintenance in preventing resource wastage. The introduction of smart metering and further automation of critical systems, such as the steriliser and boiler processes, could yield even greater savings in the future. Additionally, the modest electricity savings suggest that further efforts in load balancing and scheduling during off-peak hours could reduce overall energy consumption if unbundled supply agreements are sought.

6.6 Comparison of Red meat vs Pork utility usage

Water: During Milestone 9 of 16 the implementation of Litres per Kg HSCW took place changing reporting away from Litres per unit. Initial data comparisons on production days with red meat processed verses pork indicate minimal water savings on increased pork production, of no more than 100mL per Kg of HSCW. Being multi species and processing on 2 chains, splitting red meat against pork is not clear cut without increased metering far beyond the scope of the project.

The average total red meat HSCW processed for 2021 was 53% and the best comparisons possible at the time was to take the top 10% of red meat HSCW production days and compare it to the top 10% HSCW of pork processing. The last years' worth of data was used, with comparisons below.

6.6.1 Total Factory Usage (Production Days):

Looking at water usage from a total plant point of view.

- 3.233 L per Kg/HSCW on the top 10% of pork processing days.
  34%/66%, Red meat/Pork HSCW respectively.
- 3.214 L per Kg/HSCW on the top 10% of red meat processing days.
  70%/30% Red meat/Pork HSCW.

6.6.2 Kill Floor Usage (Production Days):

Separating Kill floor hot, cold and steriliser usage only.

- 1.987L per Kg/HSCW average for 2021, 53% Red meat
- 1.946L per Kg/HSCW on the top 10% of pork processing days.
  34%/66% Red meat/Pork HSCW
- 2.042L per Kg/HSCW on the top 10% of red meat processing days.
  70%/30% Red meat/Pork HSCW.

7.0 Conclusions / Recommendations

7.1 SCADA and DATA Analysis

Although Hub and spoke design has its benefits namely a more simplified network design, cost efficient and easier scalability, this is not without its draw backs. On several occasions the Redlion control system failed and required reprogramming or replacement. Whilst we do have backups on site the loss of data also requires data cleaning for reporting and can affect monthly reporting for management.

With the amount of data points being captured we started to run into hardware restrictions on the device, which required a second and third device to handle the workload. Real time alarming thresholding also proved difficult to scale with the existing solution when tag numbers and devices increased.

The decision was made to upgrade to a more robust full-fledged solution. Ignition automation has always been our go to preference and the minimal viable product completion is anticipated for completion late 2024. This will expand on the existing Redlion controllers using them as edge devices handling smaller loads. From there we will integrate the Scada into other ERP and MES solutions for more granular usage reporting and better accessibility for maintenance staff to correct issues real time, rather than receiving directive from daily reporting.

7.2 Stakeholder Buy-In

Regardless of the technology and reporting methods employed, having buy-in from all stakeholders is crucial, without it serious savings opportunities will be missed. DBC has achieved exceptional results from the project thus far and it has paved the way for a future where we are always conscious of our ongoing sustainability and utility usage.

7.3 Conclusion

The project successfully met its objectives within the allocated scope and budget, demonstrating significant improvements in utility management. Any plant serious about optimising and reducing utility usage would greatly benefit from the strategic implementation of metering and data analysis, as continuous process improvements are always possible when data is effectively captured.

8.0 Bibliography

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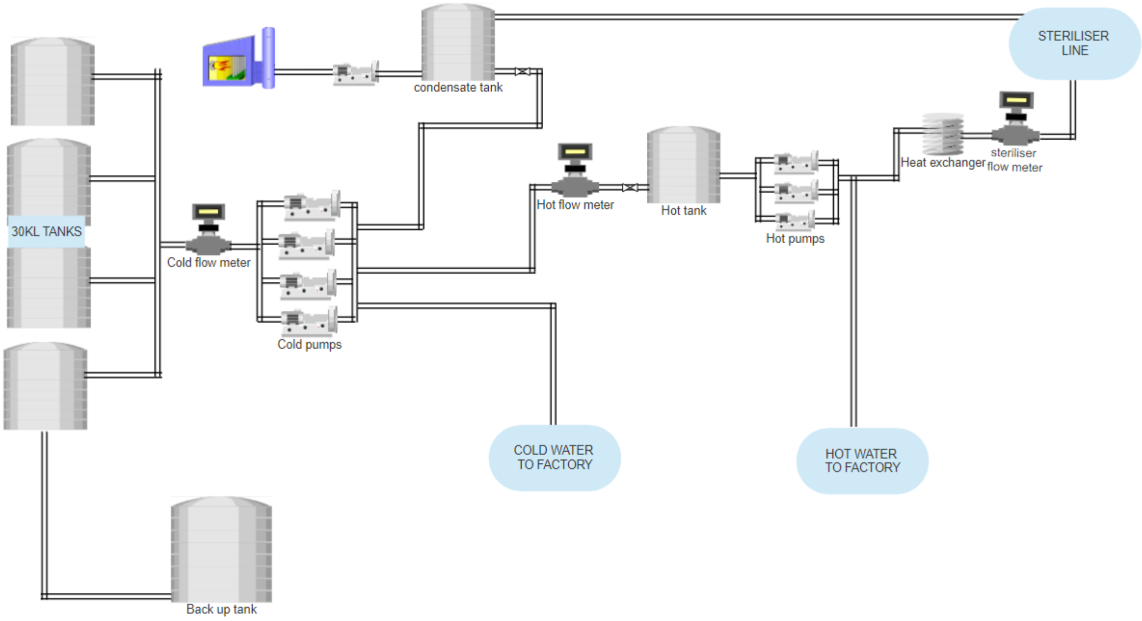
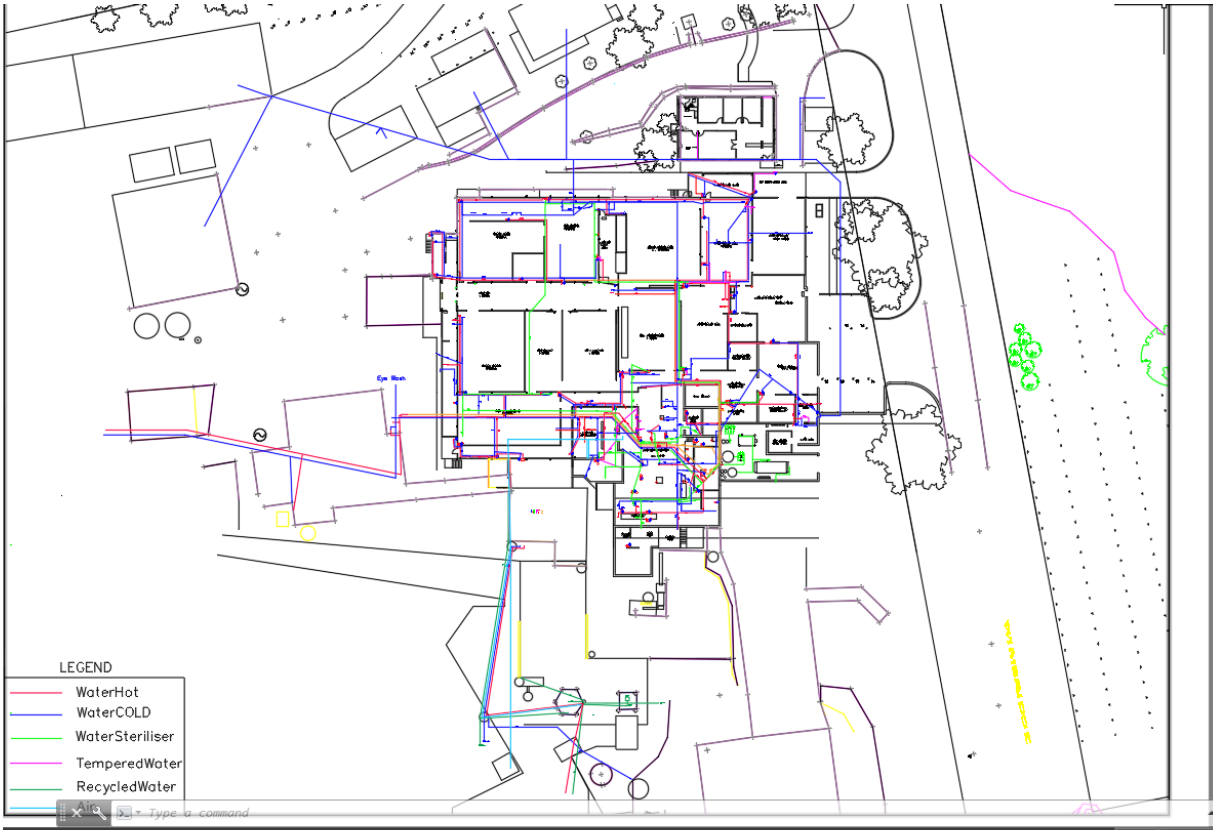
9.0 Appendices

Appendix 1: Initial water metering layout



Appendix 2: Site water services mapped



Appendix 3: Final water metering layout

DBC - Water Meter Locations