Final Report

Services Insights, Reduction and Optimisation

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Project code
2021-1012

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Date submitted
05/06/2025

Published by
AMPC

Date published
05/06/2025

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1.0 Abstract

This project was initiated to address a key operational challenge in the meat processing industry: live utility monitoring and usage reduction to minimise inefficiencies and high costs associated with utility wastage. Traditional practices relied on retrospective data, limiting the facility's ability to influence outcomes in real time. The project aimed to develop and implement a data-driven approach to monitor utility use more effectively and support the adoption of reduction technologies and practices across key processing areas.

A structured methodology was employed, beginning with the identification of the utility areas offering the greatest reduction potential. This included detailed data collection, process mapping, and the application of analytical and optimisation tools. Implementation of targeted reduction strategies followed, along with validation of outcomes. Although the facility uses multiple utilities, water and wastewater were prioritised due to their significant potential for both cost savings and environmental impact. The project specifically targeted reductions in the use of 42°C and 82°C water and minimisation of on-site water treatment chemical use.

Key outcomes included a 40% reduction in 42°C water usage, a 15% reduction in 82°C water usage, and weekly savings of $2,000 in water treatment chemicals. A live water usage tool was also developed to share performance data with stakeholders, helping to detect leaks and support continuous improvement.

The project delivers a replicable model for other facilities, offering a pathway to improved efficiency, cost reduction, and sustainability. It also enables better-informed decision-making through real-time data insights, strengthening industry resilience and competitiveness.

2.0 Executive summary

This project, *Services and Waste Insights Reduction and Optimisation*, was developed to address a major operational challenge in the Australian red meat processing industry—inefficient utility usage, particularly water, and the associated high costs and environmental impact. Traditionally, facilities have relied on retrospective data to assess utility use, limiting their ability to act in real-time to prevent waste, detect leaks, or optimise processes. The core research question was: How can live monitoring systems be implemented in meat processing to reduce utility usage ? The outcomes of this project are intended to be applied directly within processing facilities and used to inform wider industry programs and policies for environmental performance improvement.

Project objectives were to:

- Install digital meters at key incoming, discharge, and internal flow points with centralised monitoring.
- Develop insights through data analysis to identify leaks, usage patterns, and inefficiencies.
- Inform industry environmental reporting and sustainability frameworks.

Methodology:

- Flow meters were installed across hot and cold water services, effluent.
- Data was integrated into SCADA and Power BI dashboards for live monitoring and reporting.
- Weekly reports and dashboard insights were used to guide decision-making, behavioural change, and technology trials.

Key results included:

- A reduction in 42°C water usage, saving up to 18 million litres annually**.**
- A 15% decrease in 82°C hot water usage and weekly chemical savings of $1,868 through automated dosing utilising the flowmeter technology.
- A 12–15% reduction in wastewater volumes, reducing treatment costs and environmental risks.
- Development of a user-friendly dashboard and cultural shift toward water-saving practices across the site.

Benefits to industry:

- The project provides a replicable model for live utility monitoring and utility optimisation in meat processing.
- It delivers clear cost savings, improved resource efficiency, and supports long-term sustainability and compliance goals.

Future research and recommendations:

- Further development of robust, fit-for-purpose flow meters is recommended to ensure consistent data quality.
- Additional research should quantify the indirect benefits of water savings on energy and emissions.
- Adoption activities should focus on training, benchmarking, and industry-wide extension of monitoring tools and frameworks.

This project proves that integrating real-time monitoring with operational and cultural changes can deliver measurable and lasting benefits to meat processors and the broader industry.

3.0 Introduction

The Australian red meat processing industry is one of the country's largest water users, with estimates from Meat & Livestock Australia (MLA) indicating that water usage can range between 2–10 kilolitres per head of cattle processed, depending on facility efficiency and operational practices (MLA, 2021). Compounding this challenge is the significant rise in energy costs over the past 15 years. According to the Australian Energy Regulator, average wholesale electricity prices have increased by over 120% since 2008, and natural gas prices have seen similar upward trends due to export market pressures and domestic supply constraints. These costs are forecast to continue rising, driven by decarbonisation policies, market volatility, and infrastructure upgrades (AEMC, 2023). For processing facilities already operating on tight margins, inefficiencies in utility usage pose both financial and operational risks.

This project was developed to address a key knowledge and operational gap: the lack of live, actionable utility usage data to inform real-time decisions that can reduce water, energy, and chemical consumption. Historically, facilities have relied on retrospective utility data, which does not support immediate operational change or leak detection. The research question underpinning this project was: How can live utility monitoring systems be implemented and optimised in red meat processing to enable measurable utility reduction outcomes and cost savings?

Targeting a red meat processing plant water usage the project's results aim to demonstrate a replicable model that enables real-time monitoring, leak detection, strategic utility reduction and external benefits from these changes. Unlike previous studies focused solely on technology or broad efficiency guidelines, this project integrates live monitoring tools with actionable insights to drive behavioural and process change for specific facilities. The outcomes are intended to inform future industry investment, support MLA sustainability goals, and enable facilities to remain competitive in an increasingly resource- and cost-constrained market.

4.0 Project objectives

- (input objective) install digital meters on all service incoming and discharge points with reporting back to a single location.

- (output objective) Insights developed (from BI tool) that identify leakage/waste, schedule changes and future distribution investments required, by both the meat processor (private good) and AMPC core R&D activities (public good)

- Obtain data to inform environmental performance reporting for the red meat processing sector as part of AMPC Environmental Performance Review and Industry Sustainability Frameworks.

5.0 Methodology

Project Methodology Overview

The methodology for the *Services and Waste Insights Reduction and Optimisation* project was designed to enable precise, real-time monitoring and optimisation of utility usage—specifically water, energy, and chemical inputs—within a red meat processing facility. The methodology was executed in multiple stages across several milestones and included the following core components:

1. Selection of Utilities and Monitoring Points

- The project focused on critical water services**:** 82°C hot water, 42°C warm water, 20°C potable cold water, recycled water, and effluent streams.
- Priority was given to processing areas with historically high usage or leak risk, such as beef and lamb slaughter floors, boning rooms, and irrigation systems.
- Monitoring locations were selected collaboratively with site plumbing and operations teams to ensure data captured key usage points and potential leak zones.

2. Meter Installation and Integration

- Digital flow meters were installed on selected incoming, discharge, and sub-metering points. Over time, more than 30% of the meters were found faulty and required replacement or manufacturer warranty claims.
- Flow meters were connected to the plant's SCADA (Supervisory Control and Data Acquisition) system to enable daily monitoring.
- Additional inline mag flow meters and IFM sensors were trialled as replacements for underperforming or failed Dwyer meters.

3. Data Capture and Power BI Dashboards

- Data from the SCADA system was fed into Microsoft Power BI, enabling development of dynamic dashboards to visualise:
    - Daily, hourly, and weekly flow rates
    - Comparative water usage between processing areas
    - Litres per carcass processed (beef/lamb)
- Dashboards were designed to be interactive, allowing filtering by date/time and tracking performance over time.
- A Power BI training course was completed by staff, with later transitions to external dashboard support as needed.

4. Monitoring, Analysis, and Feedback Loop

- Continuous analysis of flow data allowed for identification of:
    - Leaks (e.g., Continues water trough flow)
    - Process inefficiencies (e.g., excessive chemical use)
    - Equipment failure (e.g., underperforming or misconfigured meters)
- Regular reports were shared with site foremen to drive behavioural change and support a culture of water awareness and conservation.

5. Process Modifications and Technology Trials

- Based on insights from monitoring, process improvements were implemented, such as:
    - Installing water-saving valves on processing lines
    - Automating chemical dosing pumps to only activate during verified flow
    - Upgrading hand basins and implementing production-based flow scheduling
- Trials of new flow sensor technology (e.g., IFM sensors) and infrastructure upgrades were carried out as part of a continuous improvement loop.

6. Iterative Development and Future Planning

- Faulty meters and SCADA limitations were addressed iteratively, with ongoing replacements and system tuning.
- Future milestones focus on:
    - Completing integration of remaining meters
    - Refining Power BI reporting
    - Allocating utility usage to specific species and production activities

6.0 Results

The “Services and Waste Insights Reduction and Optimisation” project delivered substantial operational and sustainability outcomes through the implementation of a site-wide digital utility monitoring system at the meat processing facility. Over a multi-year period, the project deployed flow meters across key water services (82°C, 42°C, and cold potable water), integrated data into the plant’s SCADA system, and developed interactive Power BI dashboards for real-time analysis.

Key Results:

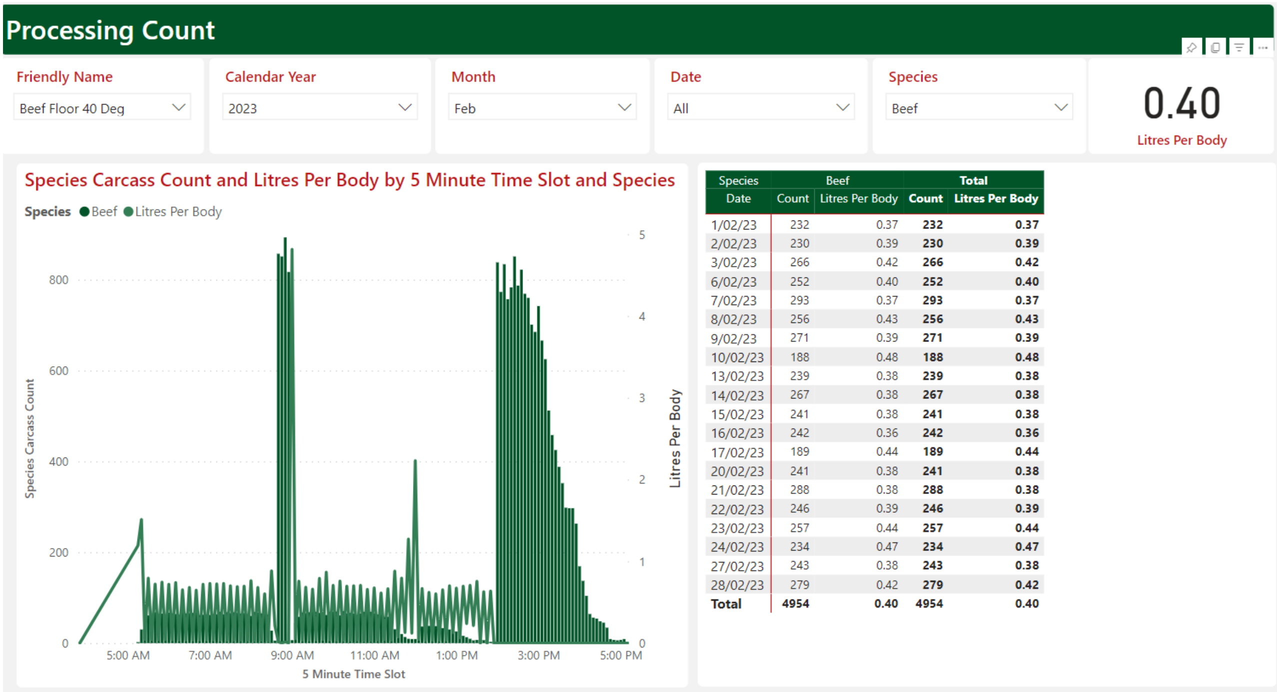
Water Usage Reductions:

A major highlight was the reduction in 42°C water usage on the beef processing floor from in excess of 400L per carcass to 230L—a 43% improvement—saving nearly 1 million litres of water monthly and projecting up to 11 million litres saved annually. This figure was further improved to 90L per body with instillation of pneumatic valves to engage hand basins. (Image 1 and 2)

Similar reductions were initiated for 82°C water through improved monitoring and process changes. Across a 12 month period, from an average of 330kL/day to 280kL/day. A 15% reduction. (Image 3)

Reductions across the plan lead to a substantial reduction in wastewater processed by the facility. Over the course of 2024 to 2025, the facility saw a 12-15% reduction in wastewater. This not only reduces cost of water treatment associated with wastewater management, but also the cost and challenges of wastewater disposal faced by the red meat industry.(Image 4)

Image 1 – February 2023 42 degree water usage – Beef Floor



Species	Beef		Total	
Date	Count	Litres Per Body	Count	Litres Per Body
1/02/23	232	0.37	232	0.37
2/02/23	230	0.39	230	0.39
3/02/23	266	0.42	266	0.42
6/02/23	252	0.40	252	0.40
7/02/23	293	0.37	293	0.37
8/02/23	256	0.43	256	0.43
9/02/23	271	0.39	271	0.39
10/02/23	188	0.48	188	0.48
13/02/23	239	0.38	239	0.38
14/02/23	267	0.38	267	0.38
15/02/23	241	0.38	241	0.38
16/02/23	242	0.36	242	0.36
17/02/23	189	0.44	189	0.44
20/02/23	241	0.38	241	0.38
21/02/23	288	0.38	288	0.38
22/02/23	246	0.39	246	0.39
23/02/23	257	0.44	257	0.44
24/02/23	234	0.47	234	0.47
27/02/23	243	0.38	243	0.38
28/02/23	279	0.42	279	0.42
Total	**4954**	**0.40**	**4954**	**0.40**

Image 2 – September 2023 42 degree water usage – Beef Floor

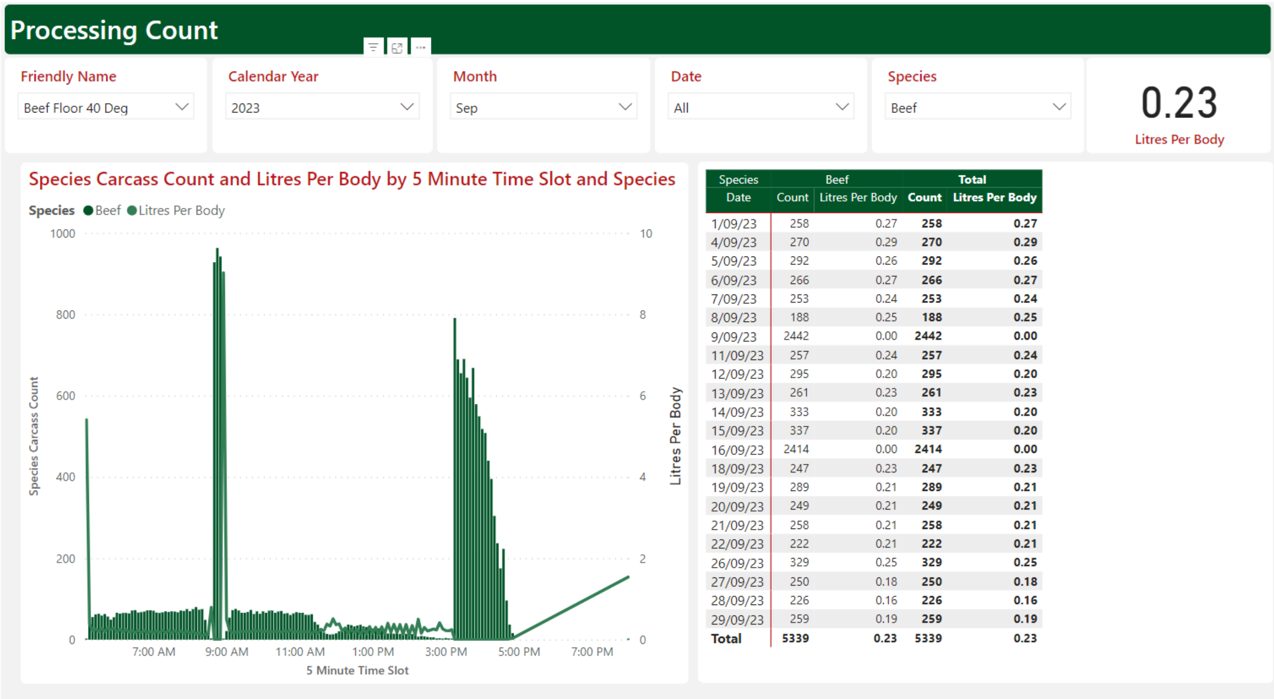


Image 3: Hot water usage reduction over 18 month (Jan 2024 – June 2025)

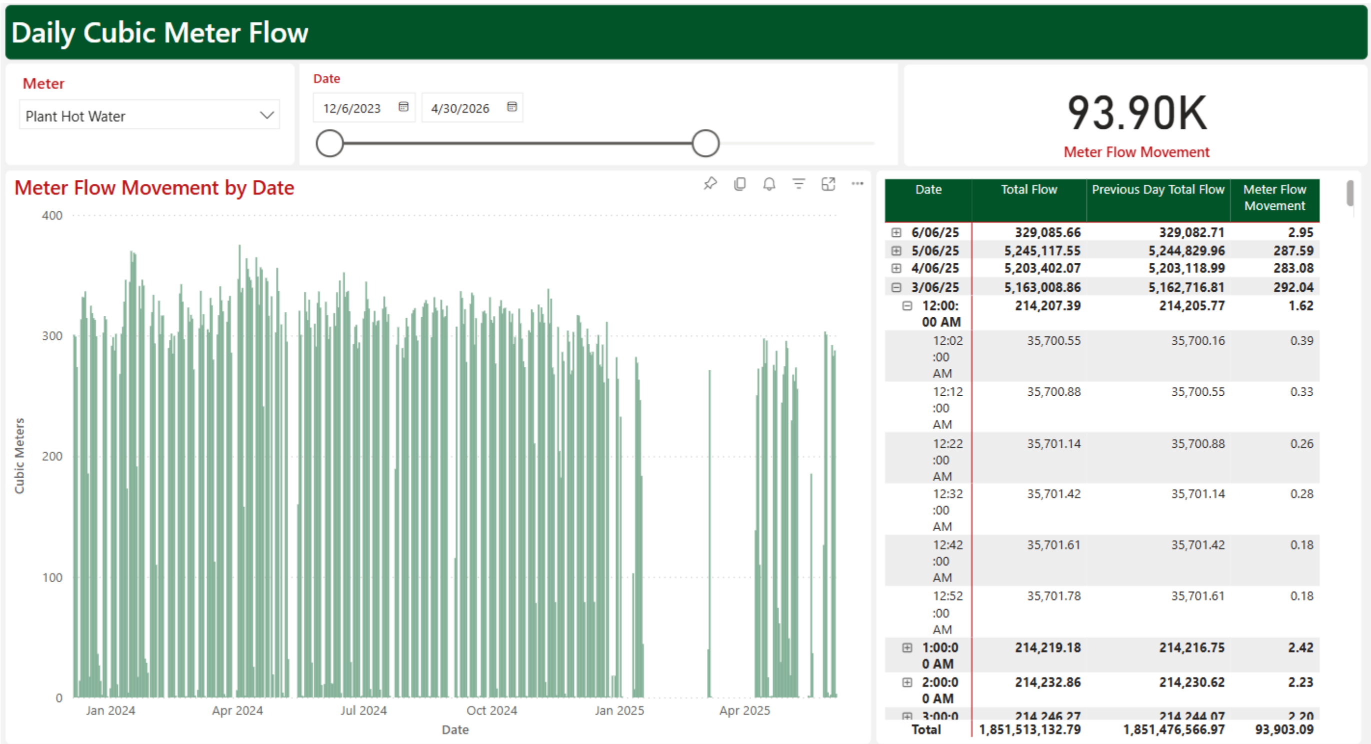
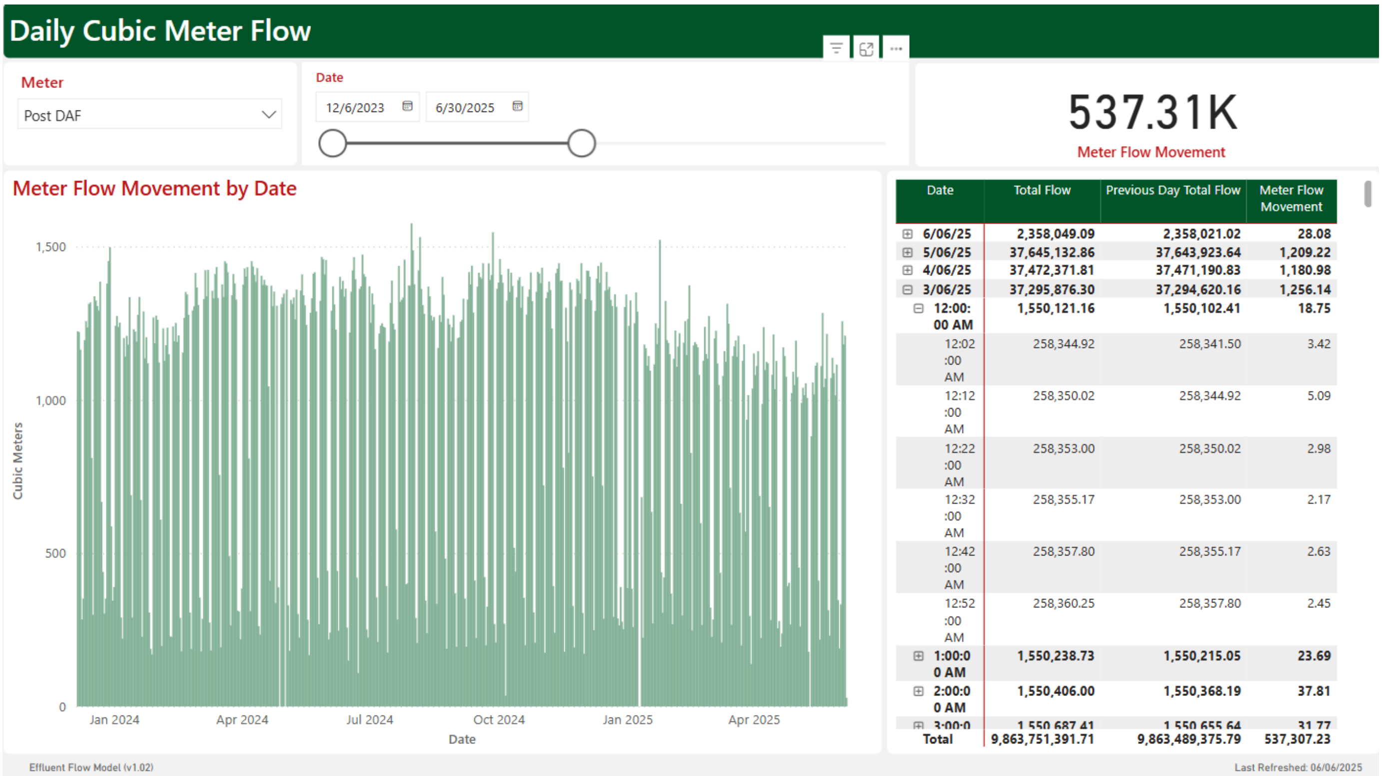


Image 4: Wastewater usage Jan 2024 to June 2025



Dashboard Development and Improvement

The development of a practical dashboard to track and monitor water usage took time to develop a user friendly and useful tool that can be used by key staff onsite. The outcome of the project found that a single dashboard was best suited for overall use, but a more detailed dashboard that allows for detailed assessment was also required for fault finding, trend identification and water usage improvement tracking.

These were separated int Facility water usage summary (Daily Water Usage Snapshot), Wate Flow Model (Daily Cubic Meter Flow) dashboard that allowed for interactive assessment of individual flow meters which brock down usage up to 6 minute increments across various time periods (days, weeks or months)

Image 5 – Daily Water Meter Usage Snapshot

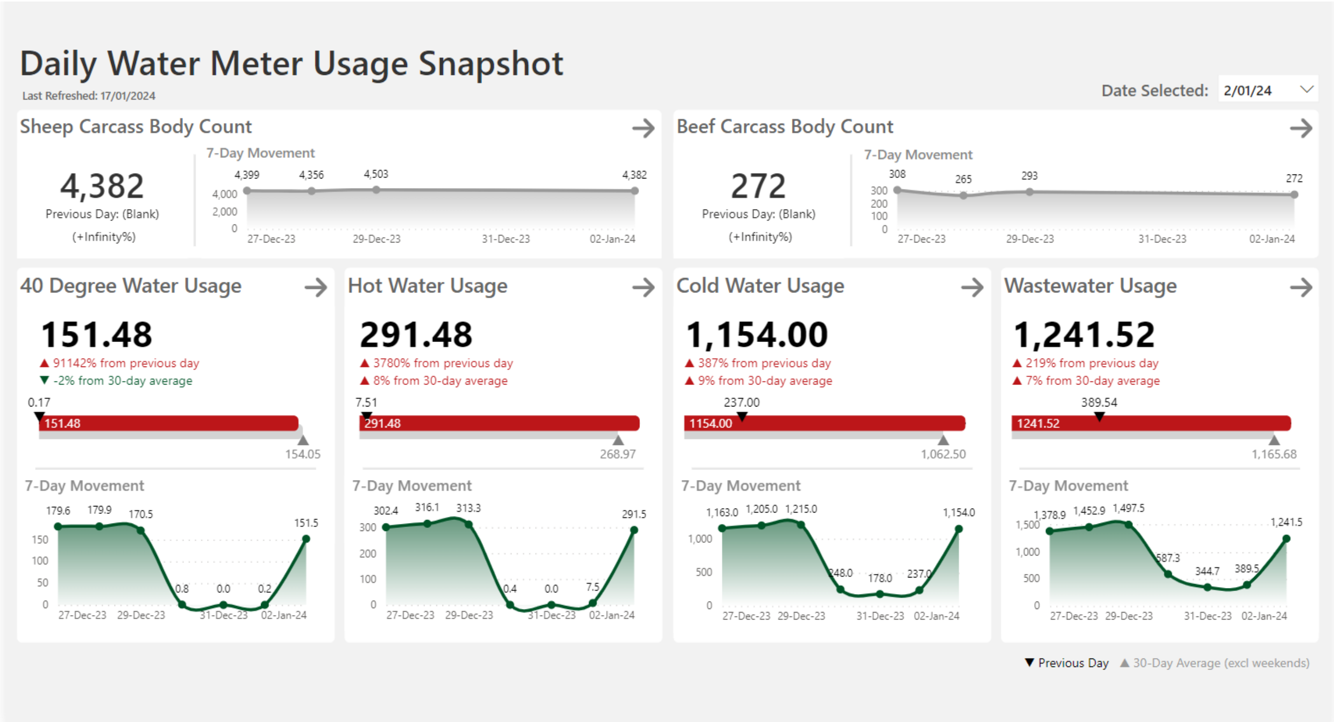
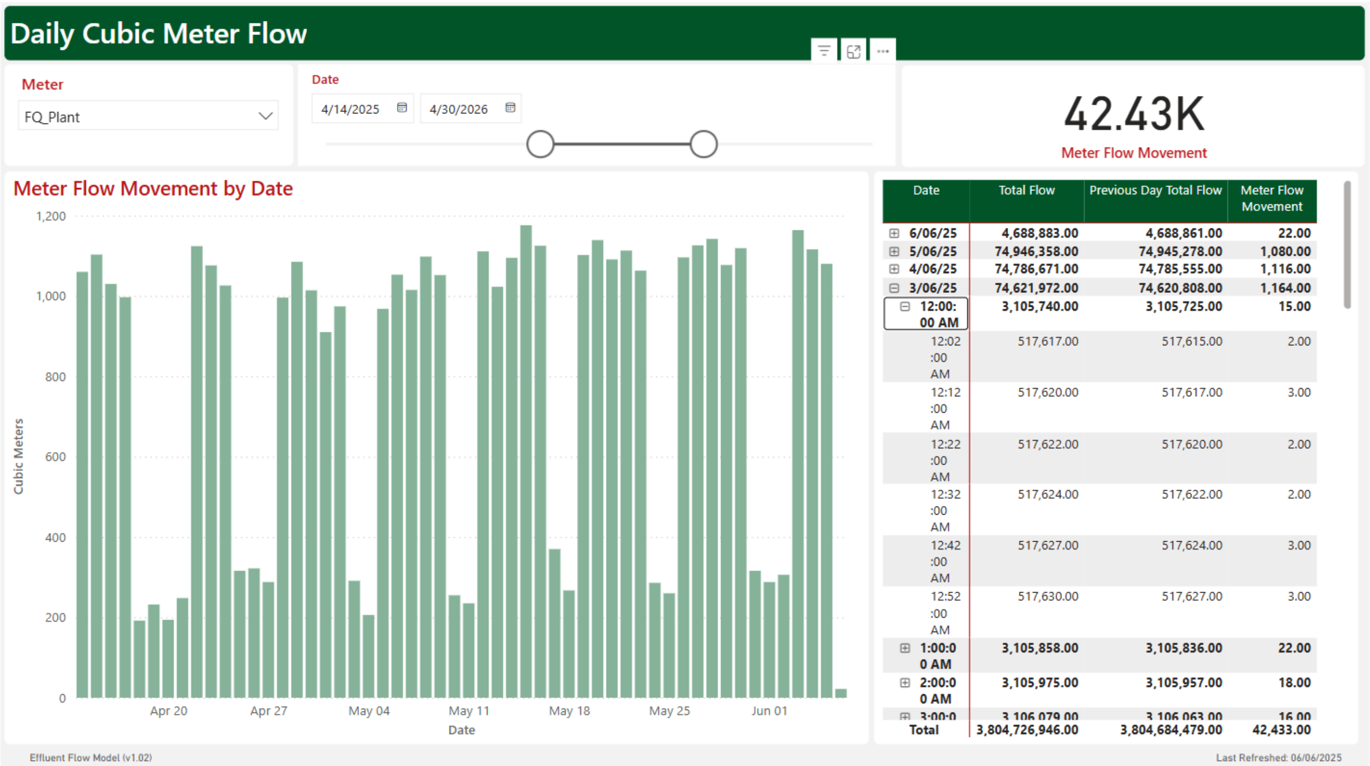


Image 6 – Daily Cubic Meter Flow



Chemical Cost Savings:

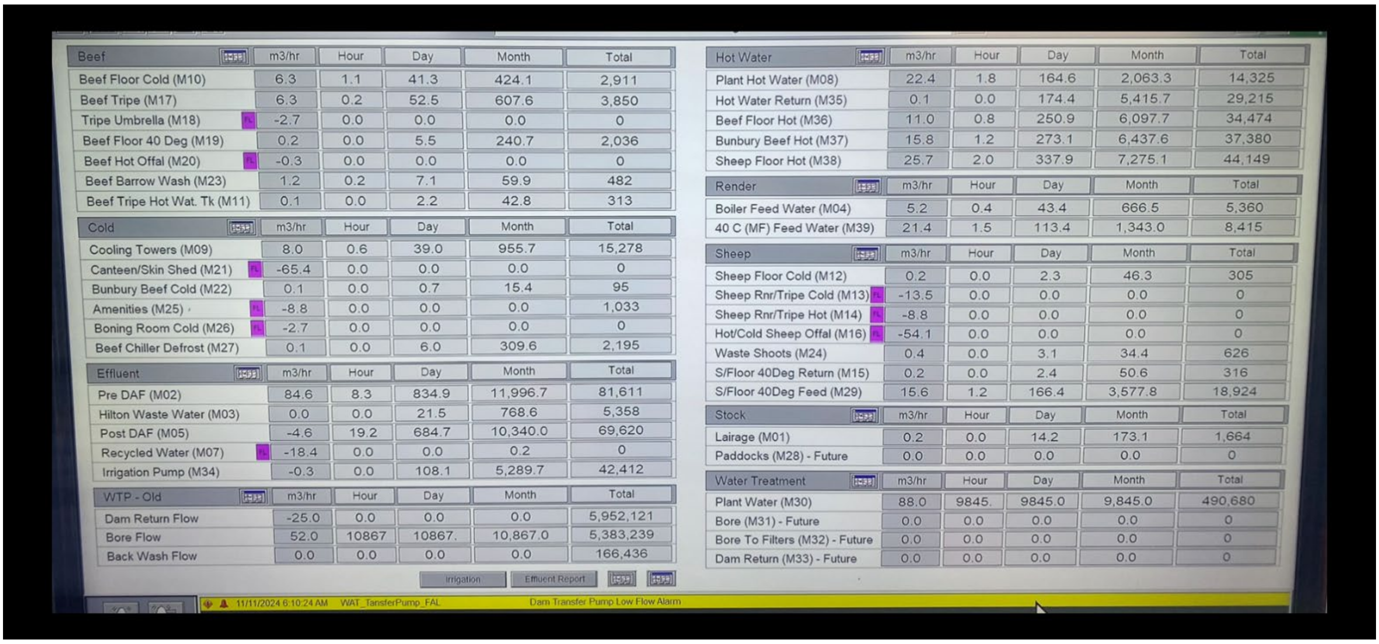
Integration of chemical dosing pumps operation to operate based off a flow meter detecting flow led to weekly savings of up to $1,868, by ensuring dosing only occurred during active water flow, reducing unnecessary chemical consumption on the plants DAF plant. This was a significant saving for the facility and has paid for the project itself.

Leak and Waste Detection:

Continuous monitoring enabled early detection of leaks (e.g., lairage lines running for 40+ hours) and identification of faulty flow meters, preventing environmental risks and resource loss. Specific example of this leak detection was through the SCADA system on the morning of a long weekend avoided 72 hours of continuous irrigation, preserving water resources and preventing nutrient overload in irrigated areas.

The SCADA dashboard (Image 7) provided a separate tool to that of the Power BI dashboard, allowing live facility operation to be monitored and identify current water usage and any indication of leaks or over usage, specifically at times outside of production. This also provided a key monitoring tool for meters that were in fault, which was invaluable due to the large number of Dwyer flow meters that failed in their application across the facility.

Image 7 – Water usage post Boxing day



Cultural water usage trends and Operational Change:

The project fostered a shift toward a “water-saving culture” among operations staff. Dashboards and weekly reports empowered foremen with actionable data, directly linking usage trends to production performance. Specifically, noting the increased in plant water usage post public holidays, enforcing the need to remind staff on returning to work the importance of water saving. The tools also allowed for staff to identify trends where water usage was becoming excessively high and needed to revise at key management meetings to return the practice to the front of mind of staff.

Image 8: Daily Water Meter Usage Snapshot

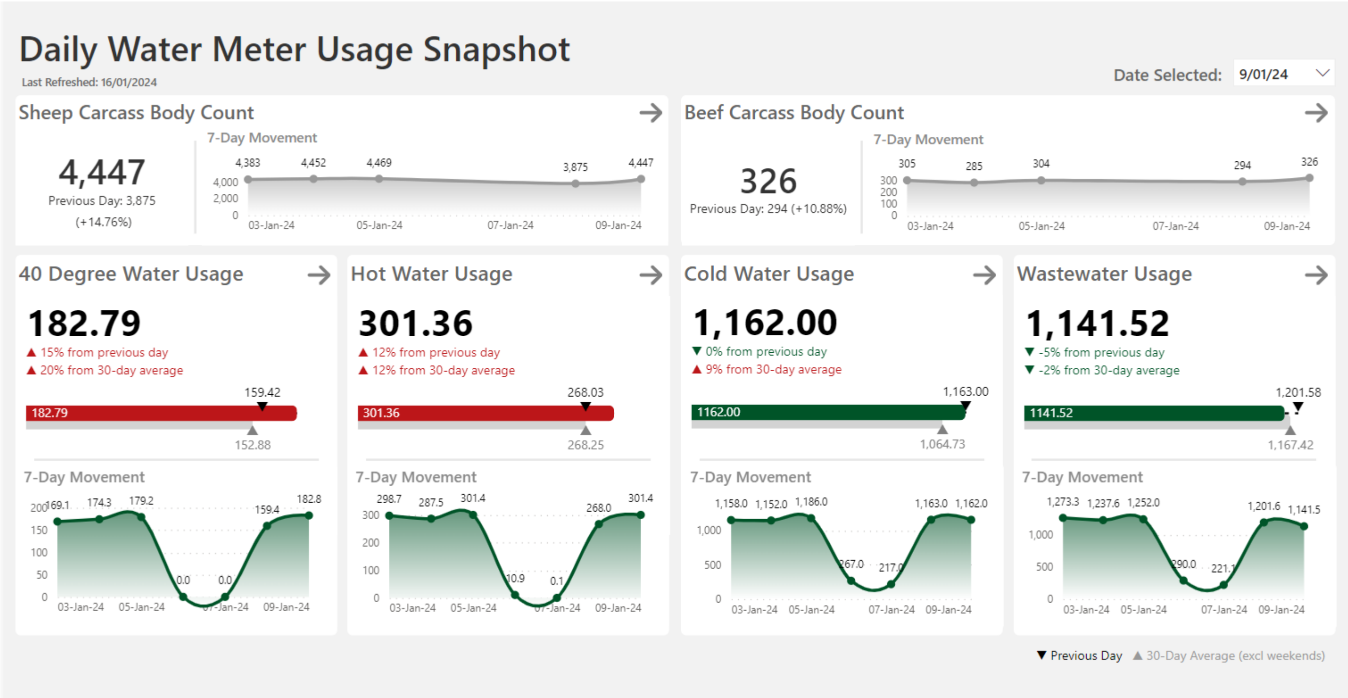


Image 9 – Water usage post Boxing day

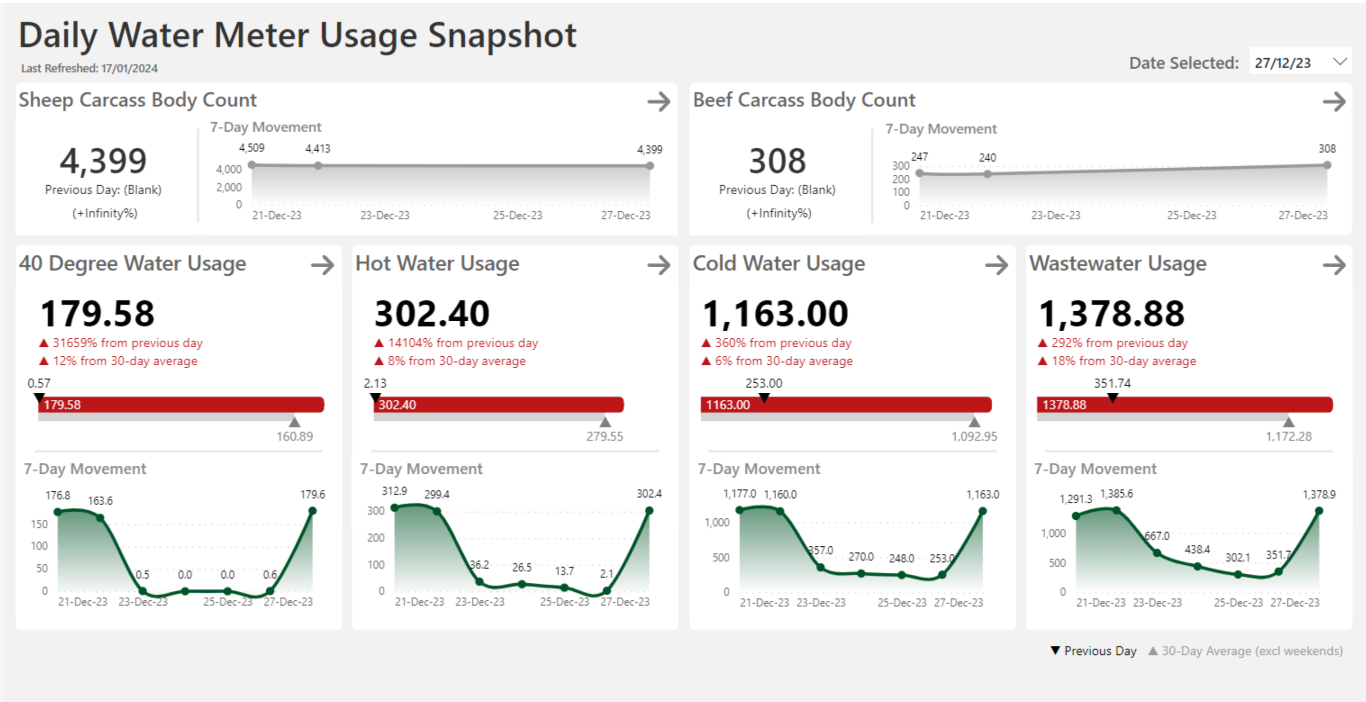


Image 10 – Water usage post New Years Day

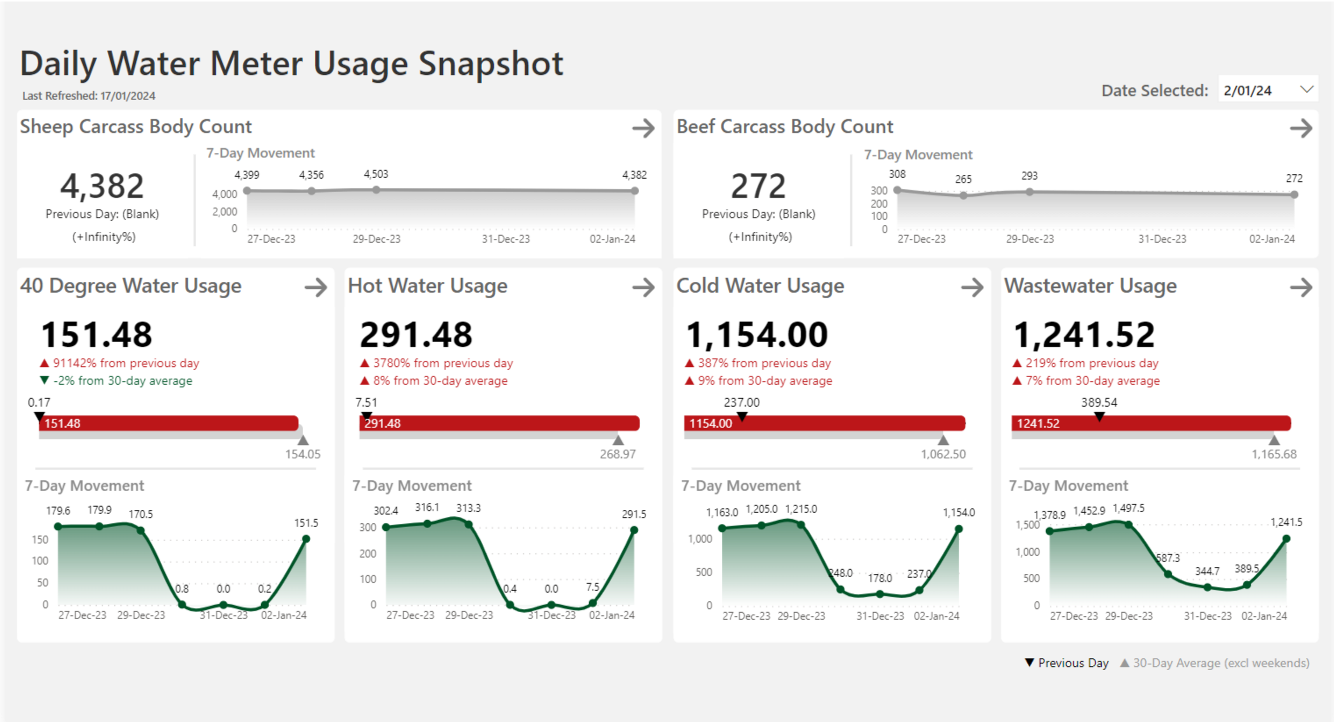
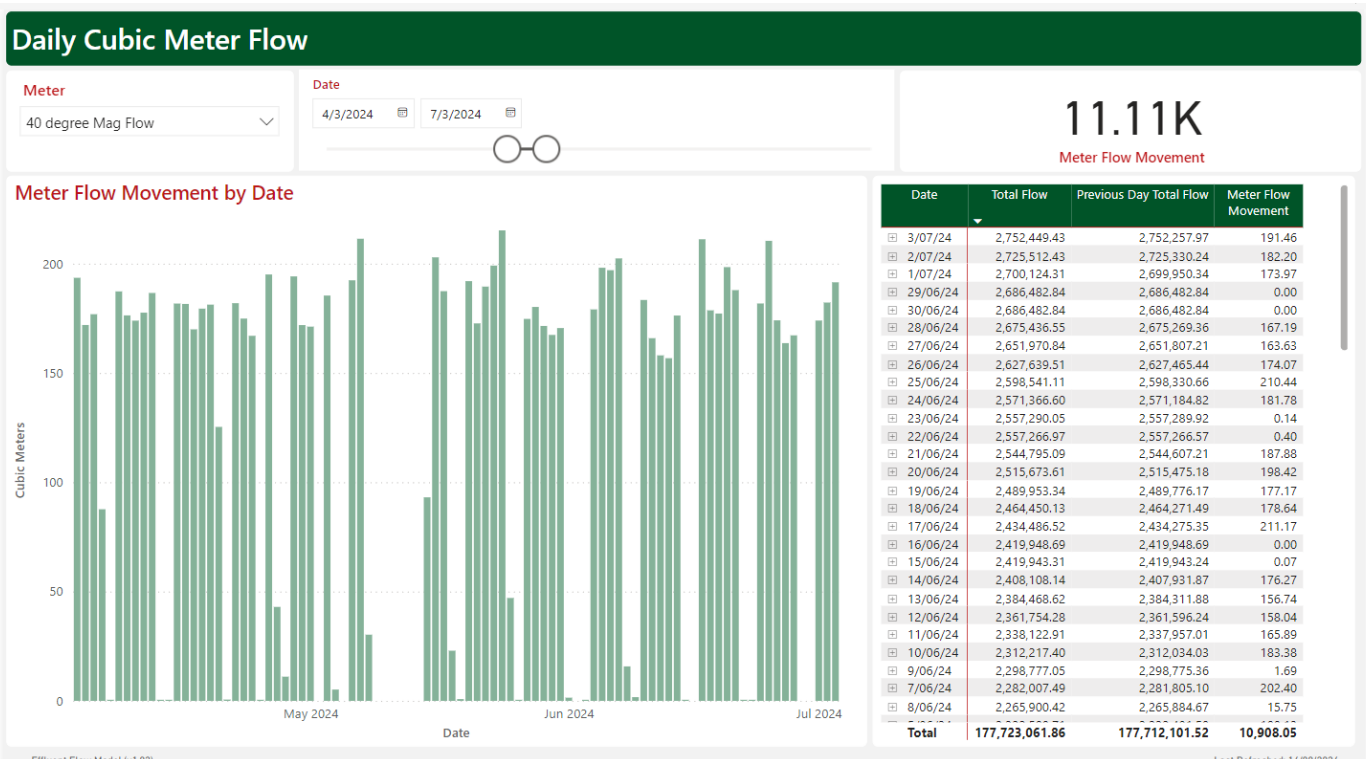


Image 11 - Varying 42 degree water usage trends



Data Infrastructure Enhancement:

The Power BI platform now enables live tracking of utility use by processing area (e.g., beef vs. lamb), supporting future benchmarking and sustainability reporting.

The project proved to be a replicable model for utility efficiency and offers valuable insights and tools for adoption across the red meat processing industry.

7.0 Discussion

The *Services and Waste Insights Reduction and Optimisation* project has yielded important findings for the red meat processing sector, offering valuable insights into how digital monitoring and targeted interventions can reduce utility use, operational costs, and environmental impacts. Beyond the quantitative results, this project has provided a roadmap for integrating live utility data into facility operations and has identified key enablers and challenges that influence success.

Interpretation of Results and Industry Implications

The most compelling result from the project was the dramatic reduction in 42°C water usage, which dropped from 400L to 90L per beef carcass processed**,** equivalent to in excess of 18 million litres saved annually. This result demonstrates the substantial impact that targeted technology (e.g. water-saving valves) and behaviour change can have when informed by real-time data. Processing businesses can interpret this outcome as clear evidence that live water usage monitoring systems directly enable cost savings, reduce environmental burden, and improve operational resilience when looked at from the overall impacts of using water has (energy for pumping and heating, cost of disposal etc)

Similarly, the 15% reduction in 82°C hot water usage and other associated reductions in chemical dosing and treatment costs show that improvements in one utility stream can generate cascading benefits across energy and chemical systems. For industry stakeholders, this presents an opportunity to align water efficiency efforts with energy and emissions reduction targets, particularly relevant for processors pursuing sustainability certifications or grants.

Monitoring Infrastructure – A Foundation for Efficiency

The effectiveness of water reduction strategies in this project hinged on the implementation of a comprehensive, real-time monitoring system. Integration of digital flow meters into SCADA and Power BI dashboards allowed for transparent, accessible performance tracking. For businesses, the key takeaway is that data must be visible, actionable, and trusted**.** The value of investing in utility monitoring is not just in measurement, but in the ability to link data with operational decisions—such as identifying leaks, detecting equipment faults, and modifying workflows.

For future research and industry projects, the success of these dashboards suggests a strong case for continued investment in data integration platforms, supported by training and change management to empower staff in their use. An important progression is to implement alarm limits for the excessive flow to facilitate data and or equipment assessment, reducing time required by staff to assess data.

Challenges with Meter Reliability and Data Gaps

Despite strong outcomes, a major limitation was the failure rate of over 30% of installed flow meters, particularly those from the Dwyer brand. Faulty meters created data gaps and delayed progress, with some areas still lacking reliable readings or dependent on basic flow indicators. This highlights a clear requirement for rigorous product testing before procurement and a taking a staged approach to implementation in instrumentation and monitoring across facilities. Specifically, starting with the largest utility stream (e.g. overall facility water) and breaking these down into smaller assessment areas (e.g. 82 degree plant water > sub metering for 82 deg water). For other processors this is a cautionary message to implement change in staged approach and understand that certain monitoring can be simplified to merely provide indications of process (e.g. water flow detected in an area of no production) whilst others require specific detail (daily volume of 82 deg water used to the specific Liter for the overall facility). Fro some processes, indication is enough to allow change to occur, where as other require the detail to allow tangible change and assessment to occur.

Staged Implementation – A Practical Pathway

A strength of the project was its staged implementation model, which allowed the team to adapt to challenges, reallocate funds, and refine strategies over time. For processing businesses considering similar projects, this staged approach reduces risk by enabling learning at each phase and avoiding large-scale implementation failures. Future R&D projects could benefit from using the staged milestones as a framework for first trialling interventions, validating outcomes, and expanding investment based on performance.

The Role of Culture and Behaviour Change

Technical solutions alone are insufficient to achieve sustained efficiency. A key insight from this project is the importance of building a water-saving culture within the workforce. The use of live dashboards, regular reporting, and management engagement played a vital role in shifting behaviours—particularly by drawing attention to poor usage patterns following weekends, holidays or growing trends. This cultural change directly contributed to reductions in water waste and leak reporting.

Processors adopting similar systems should prioritise communication, training, and visual tools that make data relevant and actionable to operational staff. For industry groups, this presents an opportunity to invest in behavioural change programs alongside technology rollouts.

Energy and Gas Impacts – Often Overlooked but Significant

Although the project focused primarily on water, the indirect benefits to energy and gas use were notable. Every reduction in 82 and 42 degree water usage reduced natural gas consumption and lessened the strain on boilers, pumps, and heat exchangers. These downstream savings, though not explicitly quantified in the results, are critical when justifying water-saving projects to business owners and staff. They also align with the industry's broader goals to reduce carbon emissions and improve energy efficiency.

For future research, quantifying the combined utility impact of water-saving measures (including thermal energy, chemical use, and treatment load) would provide even stronger justification for investment and adoption of water saving measures and technologies

Recommendations for Future Projects and Adoption

For widespread industry adoption, this project provides a validated model that includes:

- Early identification of critical metering points
- Phased meter installation with post-installation evaluation
- SCADA and Power BI integration for accessible data visualisation
- Regular reporting to drive engagement and accountability
- Strategic selection of durable meters and suppliers
- Ongoing reinforcement of a culture of conservation

Future R&D should focus on improving the reliability of metering technologies, exploring automated leak detection**,** and investigating species-specific benchmarking (e.g. L/carcass for lamb vs. beef). In parallel, industry bodies should support processors through knowledge-sharing platforms**,** template systems for monitoring dashboards**, and** subsidised trials of validated technologies.

8.0 Conclusions

The Services and Waste Insights Reduction and Optimisation project has demonstrated that the integration of live utility monitoring, supported by targeted interventions and data-driven decision-making, can lead to substantial improvements in operational efficiency and environmental sustainability in the red meat processing sector. The results of this project are both quantifiable and replicable, offering a clear path forward for other processing facilities seeking to reduce water, energy, and chemical use.

The standout result was the reduction in 42°C water usage from over 400L to 90L per beef carcass, saving up to 18 million litres annually. Alongside a 15% reduction in 82°C water, a 12–15% decrease in wastewater volumes, and weekly chemical cost savings of up to $1,868, these figures confirm the technical and financial viability of implementing real-time monitoring and responsive control systems. Importantly, these savings extend beyond water, indirectly reducing energy and gas consumption, critical considerations in an industry facing increasing utility costs and decarbonisation pressures.

For processing businesses, these findings present a strong case for investment in staged, scalable monitoring systems. The project's methodology shows that full-scale implementation is not required from the outset; instead, a phased approach can de-risk capital investment while allowing for performance validation. Integrating monitoring with SCADA and Power BI not only creates transparency but also empowers staff to take ownership of resource use, fostering a water-saving culture that reinforces the value of the investment over time.

For other industry stakeholders, the outcomes provide a proven framework to support sustainability initiatives. The project also highlights where future research can further enhance industry outcomes—particularly in developing more robust metering technologies, quantifying cross-utility benefits (e.g., energy and emissions), and refining benchmarking tools by species or product line.

Ultimately, this project proves that combining the right technology with cultural change, process redesign, and data transparency delivers measurable, ongoing utility savings. It offers a clear and actionable model for the red meat industry to adopt, adapt, and build upon as it strives for greater sustainability, efficiency, and competitiveness in a resource-constrained future.

9.0 Recommendations

Based on the results and lessons learned throughout the *Services and Waste Insights Reduction and Optimisation* project, the following recommendations are provided for industry stakeholders, researchers, and processors to guide future research, development, and adoption activities:

A. Practical Application of Project Findings

1. **Adopt real-time utility monitoring systems**:
   Red meat processors should implement staged, real-time water and utility monitoring across their facilities. Starting with major water flows (e.g. hot water ring mains, site inflows), then expanding into specific processing areas, allows gradual optimisation with measurable savings.
2. **Incorporate dashboards into daily operations**:
   Use simplified Power BI dashboards at a site management level to drive day-to-day decision-making and empower staff to identify leaks, abnormal usage, or process inefficiencies in real time.
3. **Leverage data to inform operational planning**:
   Utility consumption data should be directly integrated into production reporting (e.g., litres per carcass), enabling smarter scheduling and better resource allocation aligned with sustainability and cost goals.
4. **Invest in utility-linked control systems**:
   Facilities should integrate water flow sensors with chemical dosing and heat systems where practical, ensuring utility use only occurs during active processing, thus reducing unnecessary consumption.

B. Future Research, Development, and Extension (RD&E)

5. **Develop fit-for-purpose flow meter technologies**:
   Further R&D is needed to develop and test durable, accurate metering systems tailored for meat processing environments, addressing the high failure rates seen with off-the-shelf products.
6. **Quantify energy and emissions savings** from water reduction:
   Additional research should focus on modelling and verifying the full utility chain impact—specifically how water savings translate into gas, electricity, and emissions reductions. This will provide a more complete business case for utility optimisation projects.
7. **Explore automated leak detection and alert systems**:
   Future development should aim to automate alert systems within SCADA or Power BI, notifying staff of abnormal flow rates or leaks without requiring constant manual monitoring.
8. **Benchmark utility usage across species and plant sizes**:
   Develop national benchmarking standards for litres per carcass (e.g. beef vs. lamb) to support continuous improvement, standardised reporting, and performance comparison across sites.

C. Adoption and Extension Activities

9. **Deliver targeted training on monitoring tools**:
   Host workshops and training for operations and engineering staff to upskill on SCADA and Power BI use, ensuring site-level expertise in interpreting and acting on data insights.
10. **Develop an industry toolkit for utility monitoring**:
    Create a best-practice guide that outlines how to implement staged metering systems, select appropriate equipment, and integrate with visualisation tools. This could be shared via MLA/AMPC extension channels.
11. **Promote cultural change campaigns at site level**:
    Encourage the adoption of water- and energy-conscious workplace cultures through internal communications, leadership commitment, and periodic performance reviews linked to utility KPIs.
12. **Facilitate peer-to-peer case study sharing**:
    Enable knowledge transfer by supporting processors who have implemented these systems to share their experiences, savings, and challenges with others through forums, webinars, or site visits.

These recommendations aim to not only sustain the impacts of this project but also to guide the red meat processing sector toward broader, data-enabled utility efficiency, improved environmental performance, and long-term cost reduction.

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