



MOUNT BARKER
DISTRICT COUNCIL

Hydraulic Model

Final Progress Report



Introduction

Mount Barker District Council (MBDC) owns and operates the largest council-run wastewater and the second largest recycled water scheme in South Australia comprising wastewater collection, wastewater treatment, bore water supply, and recycled water treatment and distribution.

The council currently services a community of just under 40,000 in Mount Barker, Littlehampton, Nairne and other townships in the district. The service is provided via four wastewater systems. The Mount Barker and Meadows systems include both Sewer and community wastewater management system (CWMS), while the other two systems are CWMS only.

With the population in the district forecast to reach 65,000 over the next 25 years the district is one of Australia's fastest growing areas. Council is facing the significant challenge of delivering large-scale investment required to meet this rapid population growth and transitioning to a contemporary wastewater/recycled water system.

Project Summary

In collaboration with Stantec, the council has developed a hydraulic model for the Mount Barker scheme wastewater system. A hydraulic model is a tool by which the performance of the network under current and future scenarios can be assessed. The model utilises asset data, such as pipe attributes, pump station configurations and historical data to model the network performance.

Once developed, the model will assist the council with future planning for the network by assessing its performance under different scenarios, such as high rainfalls and greenfield and infill developments. This analysis will inform the council of the current and future risks in the network, allowing for better planning and implementation of risk mitigation strategies.

Project Benefits

The hydraulic model has been used to assess the performance of the network under current demands, highlighting the areas of constraint and risk in the network. This has informed future planning for the wastewater network, assisting the council will delivering its levels of service, improving customer experience and reducing environmental impact.

Further, the hydraulic model will be used for the master planning of the network, considering future scenarios. A benefit of the hydraulic model is its ability to produce financially, environmentally and socially optimised solutions, allowing the council to contribute to the economic development of the region while simultaneously acting in the best interest of the current customers.

Further, the hydraulic model will also be used to assess infill growth in the district, which is on the rise. This allows for an accurate assessment of the impact of the additional load on the network and proper management of the development inquiries.

Additionally, the hydraulic model can also help with assessing the impact of climate change on the network. Due to climate change, high-intensity rainfalls are expected, which can introduce a significant additional load to the network. The impact of this rainfall can be assessed through the model, allowing the council to prepare for these scenarios.

Project Stages

The wastewater hydraulic model was developed in five key stages, each contributing to the successful delivery of a comprehensive and reliable model. These stages are shown in Figure 1.

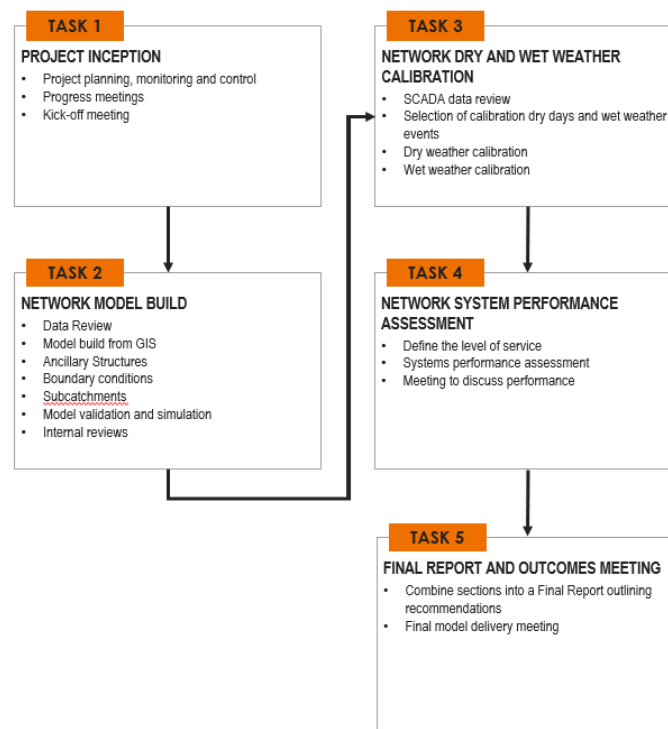


Figure 1: Project Stages

Task 1: Project Inception

This stage involved project planning, monitoring, and control to set a solid foundation for the development process. It included the kick-off meeting and progress meetings, establishing clear objectives, timelines, and expectations for all stakeholders.

Task 2: Network Model Build

The network model is constructed using data from GIS and includes ancillary structures, sub-catchments, and boundary conditions. This stage also involved validating the model through rigorous internal reviews, ensuring accuracy and reliability.

Task 3: Network Dry and Wet Weather Calibration

The calibration of the hydraulic model is crucial for its accuracy in predicting real-world conditions. This stage included reviewing SCADA data and selecting appropriate calibration events for both dry and wet weather. The calibrated model allows the council to assess the network's capacity under varied weather conditions.

Task 4: Network System Performance Assessment

In this stage, the network performance was assessed under current conditions. Through this, the council has identified areas of concern in the network, which are targeted for further investigations.

Task 5: Final Report and Outcomes Meeting

The final stage of the model has not been completed. It consolidates all findings into a comprehensive report, outlining recommendations for future actions. The final model delivery meeting marks the completion of the project and ensures that all stakeholders are aligned with the outcomes and next steps.

The structured approach of these stages ensured that the hydraulic model is robust and capable of addressing the challenges posed by infill growth, development inquiries, and climate change impacts on the network. Through this, the council is equipped to make informed decisions to ensure sustainable management of its wastewater assets.

Project Progress

The wastewater hydraulic model project is currently in the **Task 5 Final Report, Meeting and Model Files** stage.

Table 1 **Error! Reference source not found.** below highlights the project milestones and progress.

Table 1: Project Milestones and Progress

Deliverables/Milestones		Deliverable to be achieved by (date)	Progress
1.	Project Kickoff	22/10/2024	Complete
2.	Network Model Build Review Meeting	6/12/2024	Complete
3	Model Build and Network Dry and Wet Weather Validation	14/01/2024	Complete
4	Network System Performance Assessment Review	29/01/2024	Complete
5	Final Report, Meeting and Model Files	10/02/2025	Complete

Project Details, Methodology and Findings

A calibrated hydraulic model of the Mount Barker wastewater network was built to support day-to-day operations, growth planning, and climate-resilience decisions. The model was built in InfoWorks ICM to the Melbourne Metro (MRWA) specification and validated against SCADA and rainfall records.

Catchment overview

Service area: ~2,000 ha covering Mount Barker plus Nairne, Littlehampton and Brukunga.

Customers: ~13,300 residential and non-residential connections across ~11,400 parcels.

Assets in scope: ~275 km gravity sewers, ~22 km rising mains, 14 sewer pump stations (SPS), with flows to the Mount Barker WWTP. The study excludes other wastewater networks.

What was built

An ICM model (v2023.2) was constructed from the latest GIS and AutoCAD datasets, contours, SPS configuration data (start/stop levels, wet-well dimensions, overflows), and customer/trade-waste information. Where data were missing (typical in older areas), elevations and attributes were inferred using ICM tools, contours, and engineering judgment; all assumptions and data flags were recorded for traceability.

Model Elements

Network elements: 6,159 nodes (manholes, wet wells, junctions), 6,414 pipes (~298 km), ancillary structures (cross-connections, siphons, ERS), and the WWTP inlet system.

Pump stations (14): Duty configurations, pump curves or SCADA-derived rates, and on/off set points were incorporated (and adjusted during validation where SCADA showed different duty levels). Emergency storages and piped overflows were represented where present.

Ancillary structures: 13 cross-connections (with assumed inverts where unknown), eight overflow/Emergency Relief Structures (ERS) mostly near SPS sites, two principal emergency storage facilities (plus one additional storage at Nth Railway Tce), and five siphon crossings.

Inlet works boundary: The (new) WWTP inlet pump station and its diversion/overflow arrangements were modelled to reflect operational influence on upstream trunk sewers.

Subcatchments: 11,372 parcels (~1,150 ha) connected via property branches to the nearest gravity node; trade-waste customers were assigned appropriate diurnal patterns and average discharges.

Model parameters and assumptions (high level)

Pipe IDs/roughness: Pressure main diameters by material/pressure rating; gravity sewer IDs against typical catalogues. Colebrook-White ks values set to 'normal' conditions for materials (e.g., UPVC/PE ks≈0.6 mm), with roughness not tuned to condition due to SCADA-only validation constraints. Headloss coefficients inferred by junction angle.

Overland/wet-weather response: Fixed runoff surfaces were used for fast/slow responses; Groundwater Infiltration Module (GIM) captured delayed, very slow responses. Evaporation from SILO, rainfall from local gauge A4261786.

Validation approach

Four SPS locations were used for validation (Brukunga, Hogan Rd, Dean St, and WWTP Inlet) based on data quality, catchment size, and representativeness.

Dry weather: Typical weekday (2 Jun 2025) and weekend (1 Jun 2025) were selected from SCADA. Residential diurnal curves were derived by aggregating pumped flows to 30–60-min intervals; non-residential profiles applied to trade waste and major non-residential customers. Residential loading rates (weekday) ranged ~240–300 L/conn/day with weekend uplift factors ~1.08–1.18; dry-weather peaking factors ~1.7–2.2. Tolerances: $\pm 20\%$ for volume/peak, $\pm 20\%$ runtime, representative shapes/levels.

Wet weather: Three events (6 Jun, 9 Jul, 25 Jul 2025) were selected with intensities ~40–60% of the 18.1% AEP benchmark. Tolerances: $\pm 30\%$ for volume/peak/runtime; representative shapes/levels (with surcharge allowance). Fast response areas were small (0.2–0.4%); slow response 0.4–2.0%; very slow (GIM) percolation parameters varied by sub-system to match observed delayed responses.

Dry weather: Across the four validation sites, most weekday/weekend volumes and runtimes were within tolerance; peaks at the Inlet PS reflect pump-controlled hydrographs (hourly aggregation dampens instantaneous peaks). Dean St on/off levels were realigned to drawings where coarse pit-level intervals misrepresented duty set points.

Wet weather: Modelled inflow volumes, peaks, and runtimes for the three storms generally met $\pm 30\%$ tolerances. The system shows noticeable delayed groundwater-type response consistent with local soils and rising-main/gravitation transitions.

Overall confidence is appropriate for master-planning and scenario testing, noting SCADA-only calibration limits fine-tuning (e.g., pipe roughness by condition) without temporary flow monitors on gravity trunks.

How the model will be used

Current-state performance: Pinpoints capacity constraints, surcharge/overflow risks, pump duty stress, and storage performance to prioritise investigations and operational fixes.

Growth planning (greenfield and infill): Tests connection strategies and staged upgrades under forecast development to maintain levels of service and avoid unintended downstream impacts.

Climate resilience: Assesses system behaviour under higher-intensity storms to inform ERS risk mitigation, storage needs, and infiltration management.

Investment optimisation: Compares options for cost, service, environment, and risk to support financially sustainable programs and clear business cases.

Key findings & insights

Model is robust and operationally relevant: Built to a recognised spec with comprehensive QA, transparent data flags, and pragmatic assumptions where legacy data were incomplete.

System shows mixed responses: Predominantly CWMS contributions keep dry-weather peaks modest; wet-weather behaviour includes distinct delayed components captured via GIM.

Critical interfaces matter: WWTP inlet pump station operation materially influences upstream trunk behaviour and apparent peaks at hourly resolution.

Trade-waste representation improves realism: Key dischargers and flows (aggregated ~56 ML/yr) were explicitly modelled with suitable diurnals.

Limitations to note

SCADA-only calibration: Without temporary depth/velocity monitors in gravity trunks, condition-dependent roughness could not be tuned; some ERS and cross-connection levels are assumed.

Coarse/variable data intervals: Certain sites (e.g., Inlet, Dean St) required careful interpretation and inferred pump rates/runtimes.

Contribution to the Innovation Fund Grant

The wastewater hydraulic model directly supports the objectives of the Community Wastewater Innovation Fund, contributing to priority areas 2 to 5:

- **Staff Development – Skills and Training:** The team members will undergo targeted training to understand the hydraulic models' use cases, capabilities, and application in decision-making. This process will enhance the technical skills and knowledge of the team, equipping them with modern tools and methodologies to manage complex network challenges. It also fosters a culture of continuous learning and skill enhancement.
- **Financial Sustainability and Cost Pressures:** By incorporating the hydraulic model into planning processes, the council can optimise resource allocation and identify cost-effective solutions for network expansion, maintenance, and upgrades. This ensures that investments deliver the maximum economic, environmental, and social benefits, ultimately alleviating cost pressures and contributing to financial sustainability.
- **Benchmarking and Sector Data Analysis:** The model enables data-driven planning and analysis, offering a new level of insight into network performance and capacity. This creates opportunities for benchmarking against other councils and identifying best practices in wastewater management, further enhancing operational efficiency and service delivery.
- **Innovation and Technology Advancements:** Hydraulic models are an established technology, but their application within councils remains uncommon. By developing and utilising a hydraulic model, the council is adopting innovative approaches that position it as a leader in using advanced tools to address complex challenges. This initiative demonstrates how technology can be harnessed to enhance service delivery and meet growing community needs.

In addition to addressing these priorities, the hydraulic model will play a crucial role in master planning by helping the council develop risk mitigation strategies optimised for

economic, environmental, and social outcomes. It also ensures preparedness for growth and climate change impacts, enabling the council to serve customers more effectively.

Benefit to the Local Government Sector

The development and implementation of the wastewater hydraulic model deliver several benefits to the broader local government sector:

- **Demonstration of the Use of Technologies for Enhanced Decision-Making:** The model showcases the benefits of investing and implementing existing proven technologies to enhance decision-making, risk preparedness and implementation of optimised solutions.
- **Innovation Leadership and Support:** By creating the hydraulic model and its utilisation, the Mount Barker District Council is leading in innovation within the local government sector and can provide support to other local government authorities in developing and utilising similar systems.

Conclusion

The Mount Barker District Council was granted the Community Wastewater Innovation Fund for the development of a hydraulic model for the Mount Barker scheme wastewater system. The hydraulic model, which was built with the use of asset attributes, has allowed the council to assess the network performance under current conditions, allowing the council to develop economically, socially and environmentally optimised risk mitigation strategies.