Irrigation demand forecasting and its role in multi-scale system storage control *(One Basin CRC Quick Start project [QS2])*

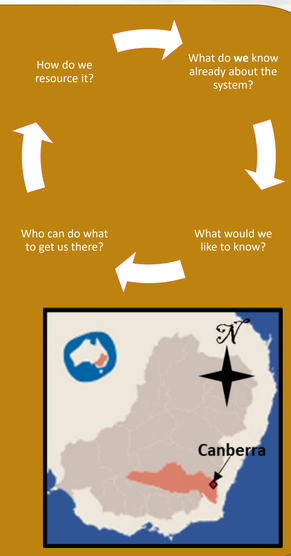
MOTIVATION AND PROJECT OVERVIEW

This project is one of a suite of One Basin CRC and Institute for Water Futures (IWF) Flagship project collaborations on data science and knowledge systems for water delivery in the Murrumbidgee.

The long-term vision for the QS2 collaboration is that improved integration of multi-stakeholder operational management of water storage in the landscape will enable the emergence of new water delivery solutions to achieve environmental, social and economic outcomes in the region. As an entry point towards this vision this project aims:

- To understand how new demand forecasting tools can improve water delivery across the landscape.
- To develop and test how demand forecasting tools can better support river ordering in water operations.

Along with the 'Anomaly Detection' project team (QS5), we have established partnerships, procedures, and infrastructure within a 'tech accelerator' to support rapid testing of new data science capabilities within the region.

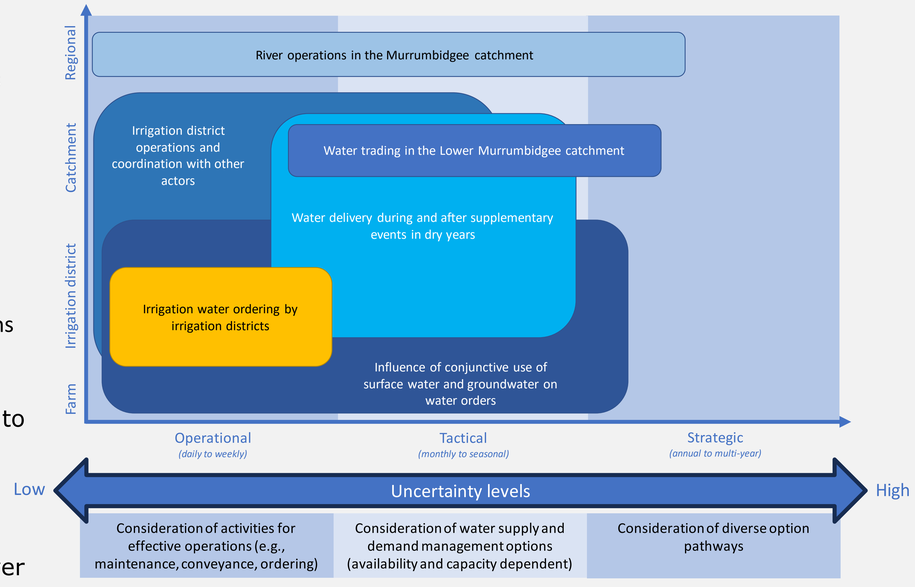


A LANDSCAPE VIEW OF OPPORTUNITIES FOR DEMAND FORECASTING TOOLS

This project component scoped a suite of potential use cases that identify ways in which demand forecasting approaches might complement existing technologies and processes used by key actors involved in their operational through to strategic decisions related to water ordering, delivery and use by environment, irrigation and consumptive users in the Murrumbidgee. The main decision types considered in the use cases include:

- Operations / water orders
- Environmental water
- Regulation / compliance
- Crop / agronomic decisions

The use cases are being used to foster discussions beyond the life of this Quick Start project on how demand forecasting technologies might be developed and applied to support water delivery and river operation decisions.



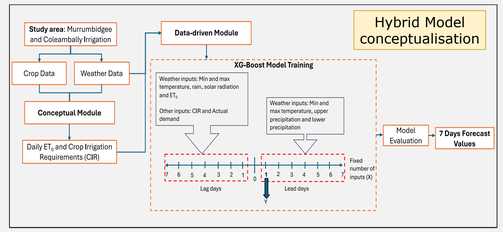
Credit: Sammy Hawker

DEVELOPMENT OF DEMAND FORECAST ALGORITHMS TO SUPPORT RIVER ORDERING

This project component developed short-term (0-7 day) demand forecasting algorithms for the MI and CICL districts.

Evaluation focused on performance at critical times for MI and CICL such as when there is an elevated risk of underordering.

Project team members and operations staff met regularly to evaluate the demand forecasting algorithms and evaluation framework and to work through the opportunities and challenges to operationalisation and continuously improve the algorithms beyond the project.

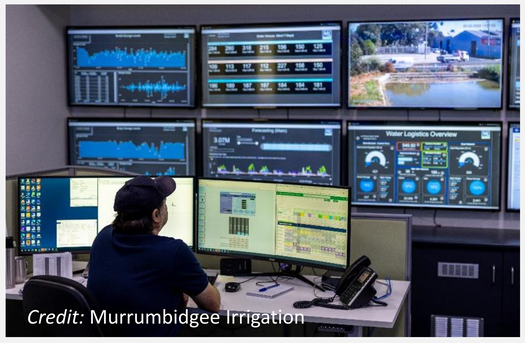


Application to CICL

Lead	Perfect weather forecast	No weather forecast		
	RMSE (ML)	RMSE (ML)	NSE	MSSS
1	313.1	**340.6**	**0.780**	**0.242**
2	359.8	**412.9**	**0.668**	**0.359**
3	396.7	**455.6**	**0.601**	**0.416**
4	424.8	**485.6**	**0.504**	**0.489**
5	434.3	**508.1**	**0.480**	**0.513**
6	453.0	**531.8**	**0.456**	**0.552**
7	442.1	**532.7**	**0.461**	**0.556**

Application to MI

Lead	Perfect temp and rain forecast	Perfect forecast for all feature inputs	Actual temp and rain forecasts		
	RMSE (ML)	RMSE (ML)	RMSE (ML)	NSE	MSSS
1	409.8	380.6	**417.6**	**0.902**	**0.334**
2	472.3	431.3	**483.1**	**0.874**	**0.0570**
3	524.3	504.5	**559.0**	**0.840**	**0.0553**
4	559.4	502.5	**596.5**	**0.798**	**0.0596**
5	589.6	515.4	**649.5**	**0.776**	**0.098**
6	585.8	531.3	**682.2**	**0.757**	**0.0996**
7	677.6	637.4	**728.6**	**0.727**	**0.1419**



Credit: Murrumbidgee Irrigation

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