Use of Historical Weather Data in Planning a Diverse Water Supply System in an Uncertain Climate Future

Presenter:
Ding Chan (City West Water)

Stormwater Vic Conference May 2017

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Problem Statement

- How will Climate Change impact City West Water's water supply services?
- Specifically, can we estimate what the peak, seasonal and annual demands under a reasonable climate change scenario might be?
- How can a diversity of water supplies help in addressing these impacts?

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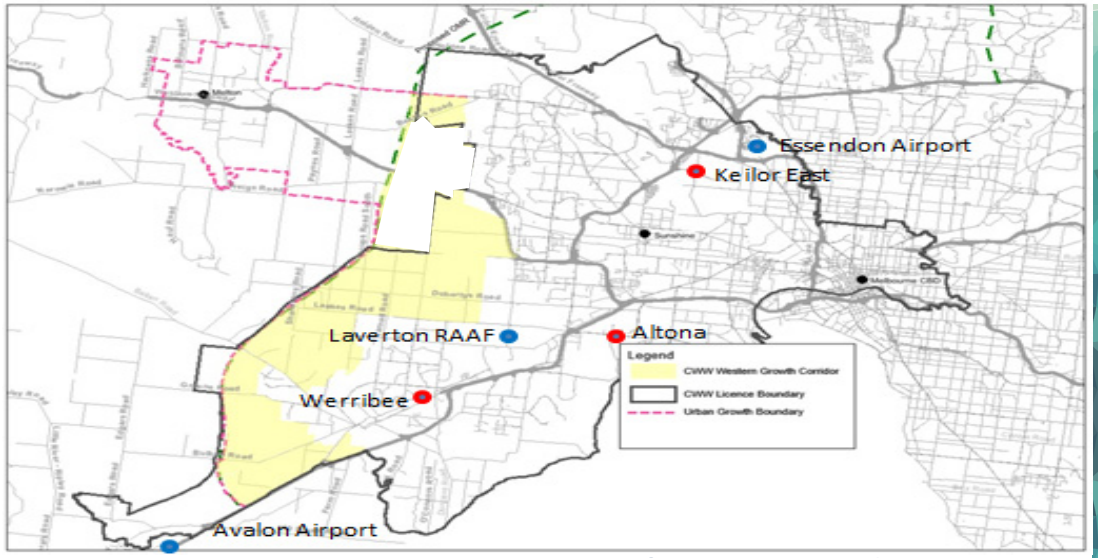
Input Data Sources

- Bureau of Meteorology
- Population Forecasts
- REUMS Study 2011
- DELWP Forecast (climate scenarios)
- PI Data (Scada)
- CWW Demand Assumptions Manual



Western Growth Corridor

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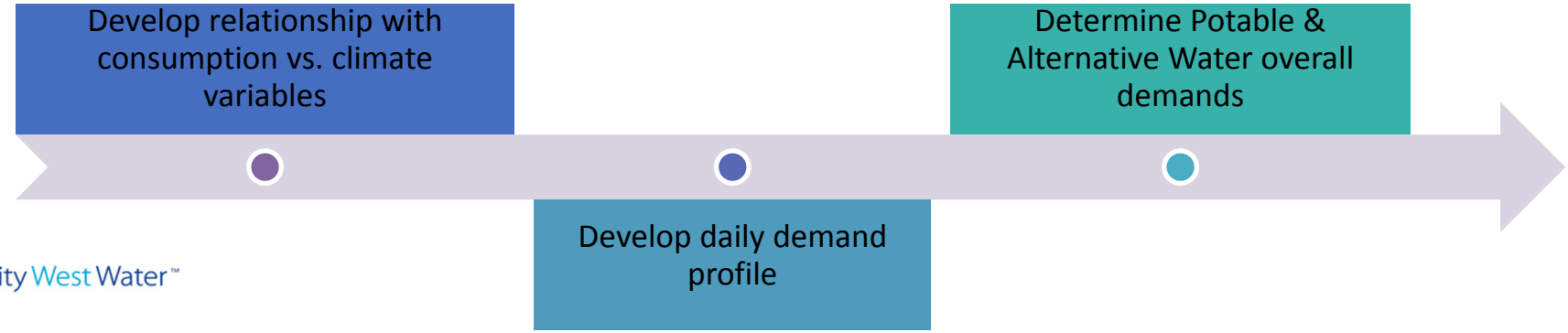
Modelling

- Excel Demand Model Development
  - Develop a climate vs. water use model using historical data
  - Develop a daily demand model correlating to climate variables (precipitation, temperature)
  - Forecast water demand under a range of climate change scenarios



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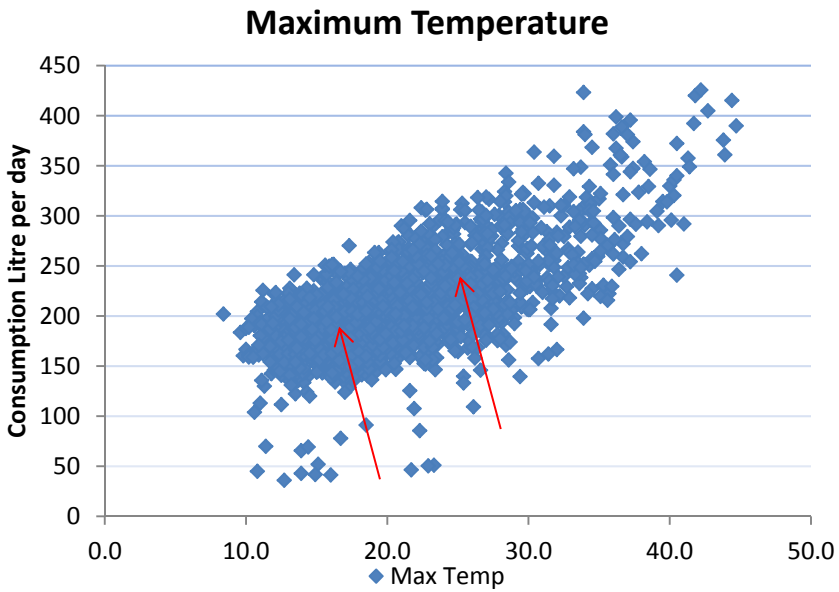
Modelled Variables

- Temperature, Rainfall, Consumption

River basin	Average Daily Temperature Change relative to current climate baseline (°C)					
	Year 2040			Year 2065		
	10th percentile	50th percentile	90th percentile	10th percentile	50th percentile	90th percentile
	Low	Medium	High	Low	Medium	High
Werribee	1.0	1.3	1.5	1.8	2.3	2.8

River basin	Average annual Rainfall Change relative to current climate baseline (%)					
	Year 2040			Year 2065		
	10th percentile	50th percentile	90th percentile	10th percentile	50th percentile	90th percentile
	Low	Medium	High	Low	Medium	High
Werribee	2.2%	-2.7%	-11.7%	2.4%	-6.2%	-21.4%



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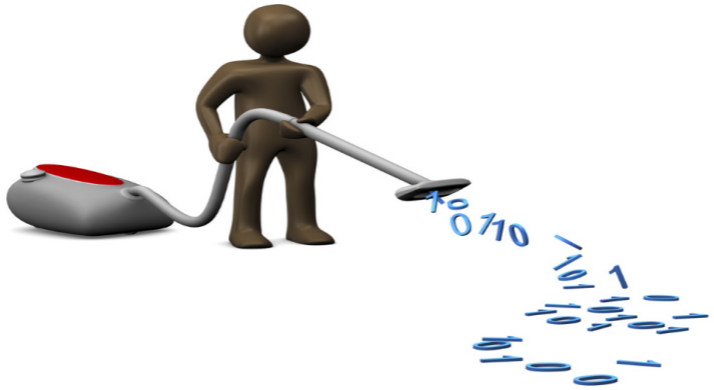
Data Preparation

- Gaps in BoM data
- Separate non-residential water usage
- Water Supply Zones & Billing Data



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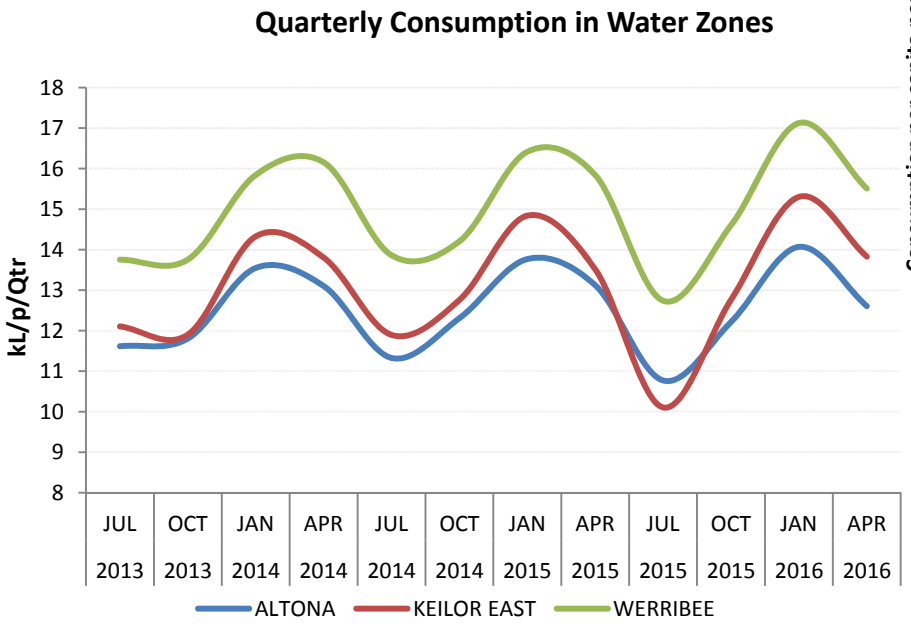
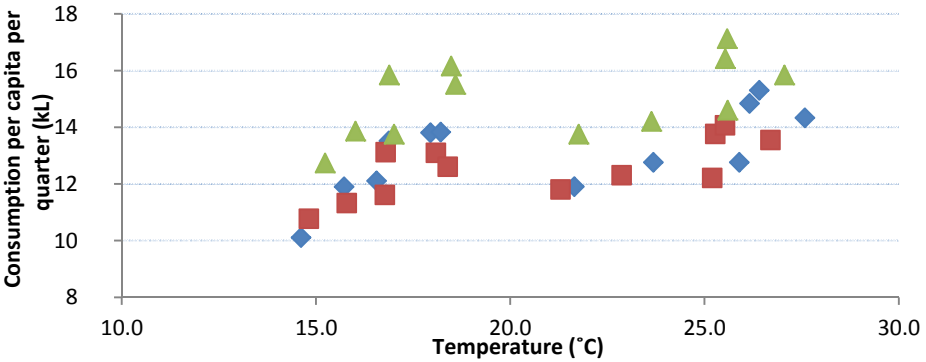
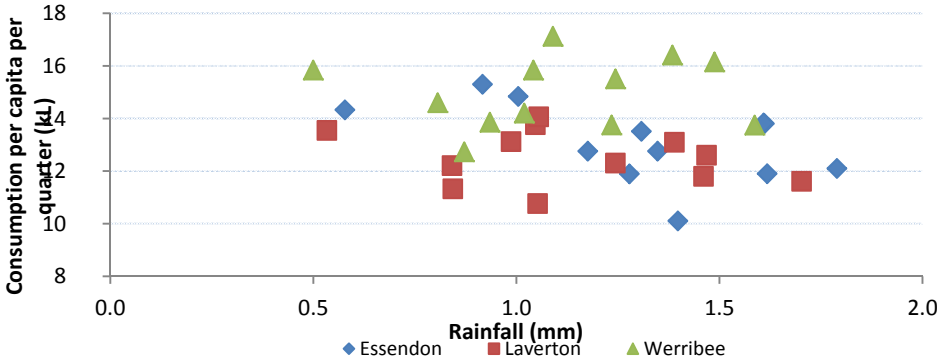
Climate Variance

Variance of consumption based on seasonality







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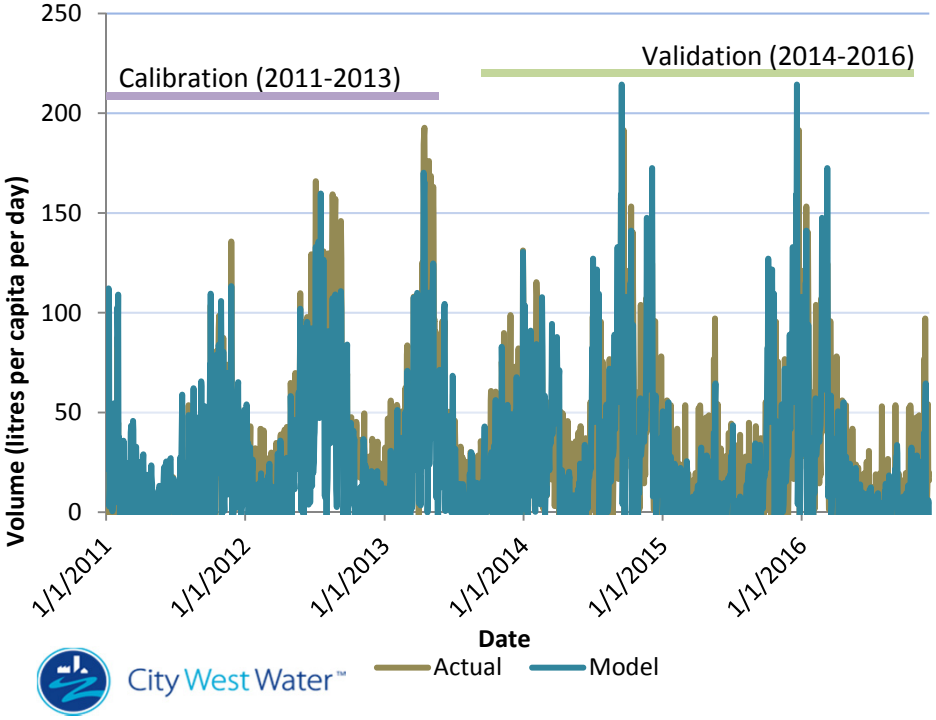
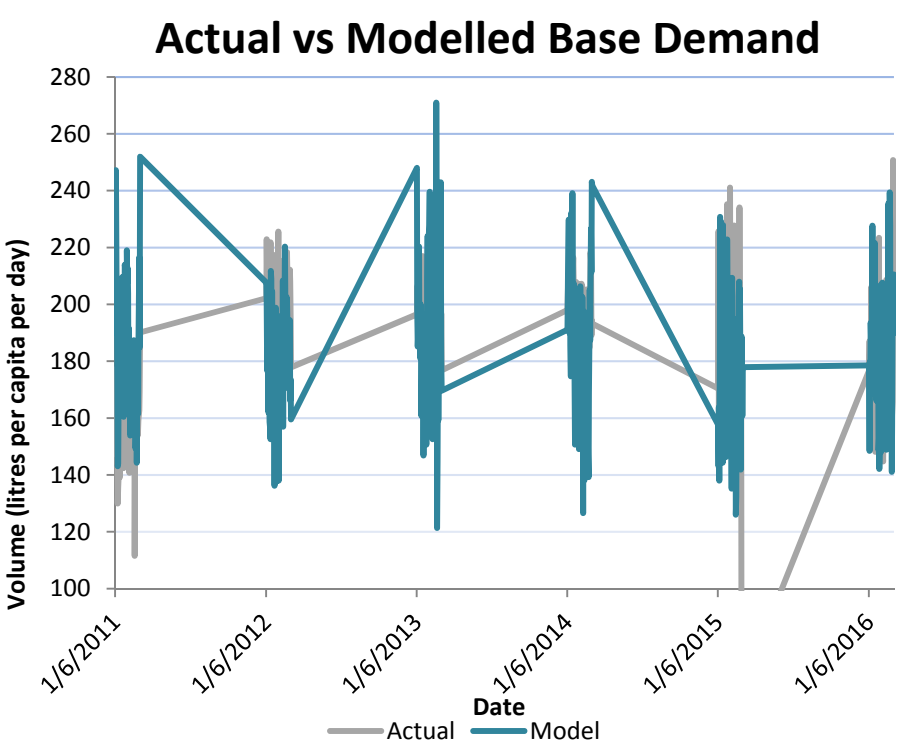
Demand Profile

- Two Step Process





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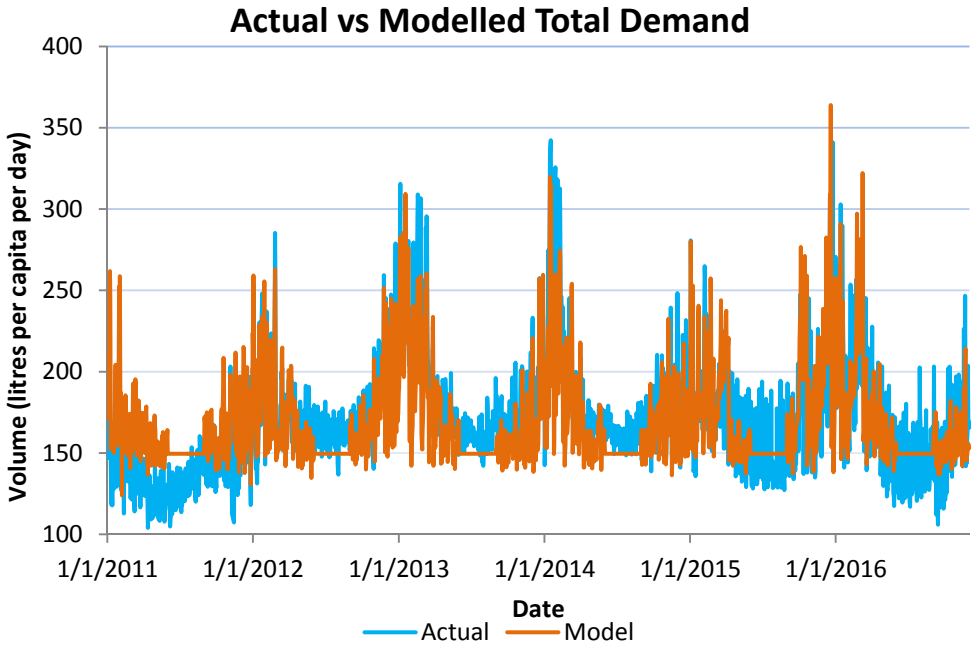
Modelled Results



Key Modelling Variables	Value	Optimal Value
Multiple R	0.80	1.0
R Square	0.64	1.0
NSE Coefficient (Calibration period) – Seasonal Demand	0.52	1.0
NSE Coefficient (Validation period) – Seasonal Demand	0.53	1.0
NSE Coefficient (Total Period) – Seasonal Demand	0.52	1.0
NSE Coefficient (Calibration period) – Base Demand	-8.51	1.0
NSE Coefficient (Validation period) – Base Demand	-4.14	1.0

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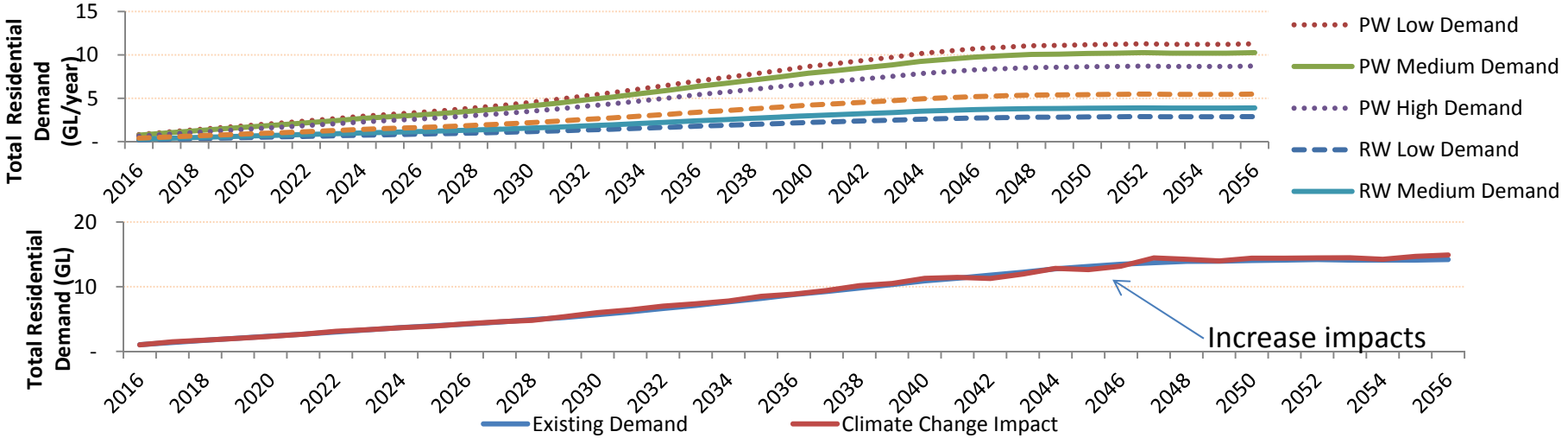
Climate Change Impacts



Category (lpcd)*	Baseline	Climate Change (10th Percentile)	Climate Change (50th Percentile)	Climate Change (90th Percentile)	% Max Difference (Average)
Average daily demands	189	191	191	192	1.6%
Average monthly demands (litres)	5,756	5,801	5,818	5,848	1.6%
Average winter (base) demands – daily	149.6	149.6	149.6	149.6	-
Average summer demands – daily	223	226	227	228	2.2%
Average autumn demands - daily	196	198	199	200	2.0%
Average spring demands	188	190	190	192	1.7%

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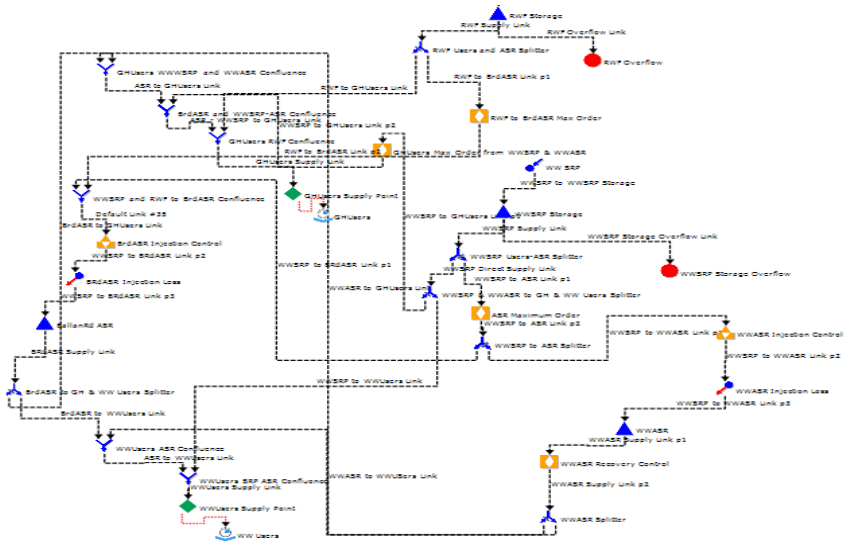
Alternative Water Demands

- Small change in Total Water Demand

Climate Change Variation	Value
Daily variation	-88% to 87%
Monthly variation	-2% to 0%
Annual variation	2%

	Method	10th Percentile		50th Percentile		90th Percentile	
Demand Scenario	Modelled (GL)	Climate Change (GL)	% Diff	Climate Change (GL)	% Diff	Climate Change (GL)	% Diff
Low	40.23	40.98	0.7%	41.23	0.9%	41.72	+1.3%
Medium	51.07	51.82	0.7%	52.07	0.9%	52.56	+1.3%
High	60.69	61.63	0.7%	61.95	0.9%	62.55	+1.3%



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Conclusion & Next Steps

- Based on this methodology, the impact of climate change on overall demand is small
- Continue to refine model using latest data and climate change predictions
- Peer review the model
- Build dynamic Stormwater Catchment Model
- Optimise eWater Source Model with climate data

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