# Fingerboards Project IAC

Tony McAlister – Surface Water Quantity and Quality

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# Tony McAlister – Professional Background

- BE (Civil) First Class Honours (1981)
- Master of Engineering Science (1989)
- Graduate Certificate in Executive Leadership (2013)
- FIEAust, CPEng, RPEQ, GAICD
- Director and Regional General Manager (QLD) Water Technology

# Tony McAlister – Experience

- 2017 – Current Director, Water Technology, Brisbane, QLD
- 2015 – 2017 Senior Principal Engineer, Water Technology, Brisbane, QLD
- 2008 – 2015 Managing Director, BMT WBM, Brisbane, QLD
- 2000 – 2008 Director, WBM and then BMT WBM, Brisbane, QLD
- 1993 – 2000 Associate, WBM, Brisbane QLD
- 1992 – 1993 Senior Water Quality Modeller, HR Wallingford, United Kingdom
- 1987 – 1991 Senior Engineer, WBM
- 1982 – 1987 Engineer, Department of Local Government/Water Quality Council of Queensland

# Tony McAlister – Experience

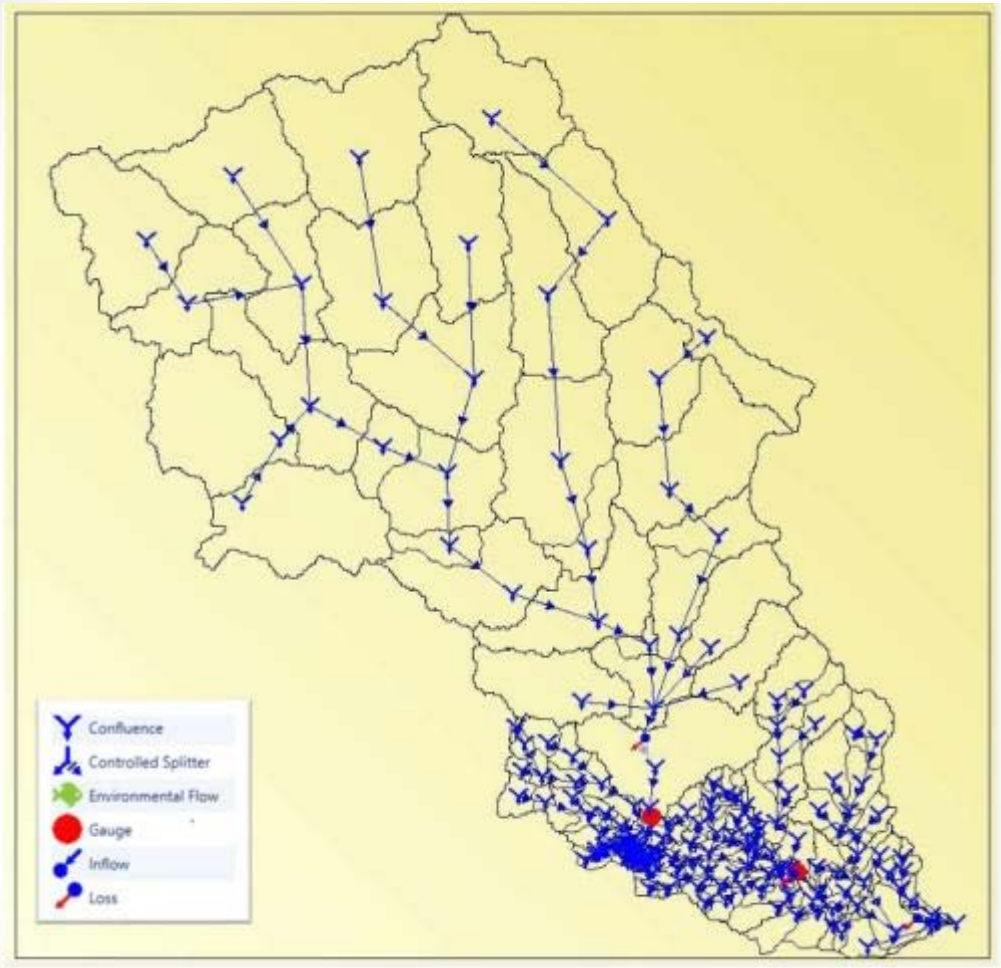
- More than 30 years Australian and International (United Kingdom, the Middle East and South East Asia (Singapore, Thailand, Malaysia and Indonesia)) water engineering expertise in the areas of numerical flood and water quality modelling, field data collection and assessment, non-point source pollution assessment and mitigation, WSUD and IWCM, water quality and catchment management and sewerage and water supply investigations.
- Instrumental in the 'Healthy Waterways' movement in South East Queensland for more than 20 years and has played a pivotal role in this area, ranging from being involved in preparation of one of the scoping studies which fundamentally started the whole process (as the 'Brisbane River and Moreton Bay Wastewater Management Study' in its early days), through the undertaking and oversight of the development of progressively more comprehensive 1, 2 and 3D water quality and catchment and modelling tools and ongoing roles on the Scientific Expert Panels which have guided and informed the movement.
- Also had important roles in three significant national Cooperative Research Centres, or CRC's, these being the CRC for Catchment Hydrology, the eWater CRC and now the CRC for Water Sensitive Cities.

# Work done on Fingerboards Project

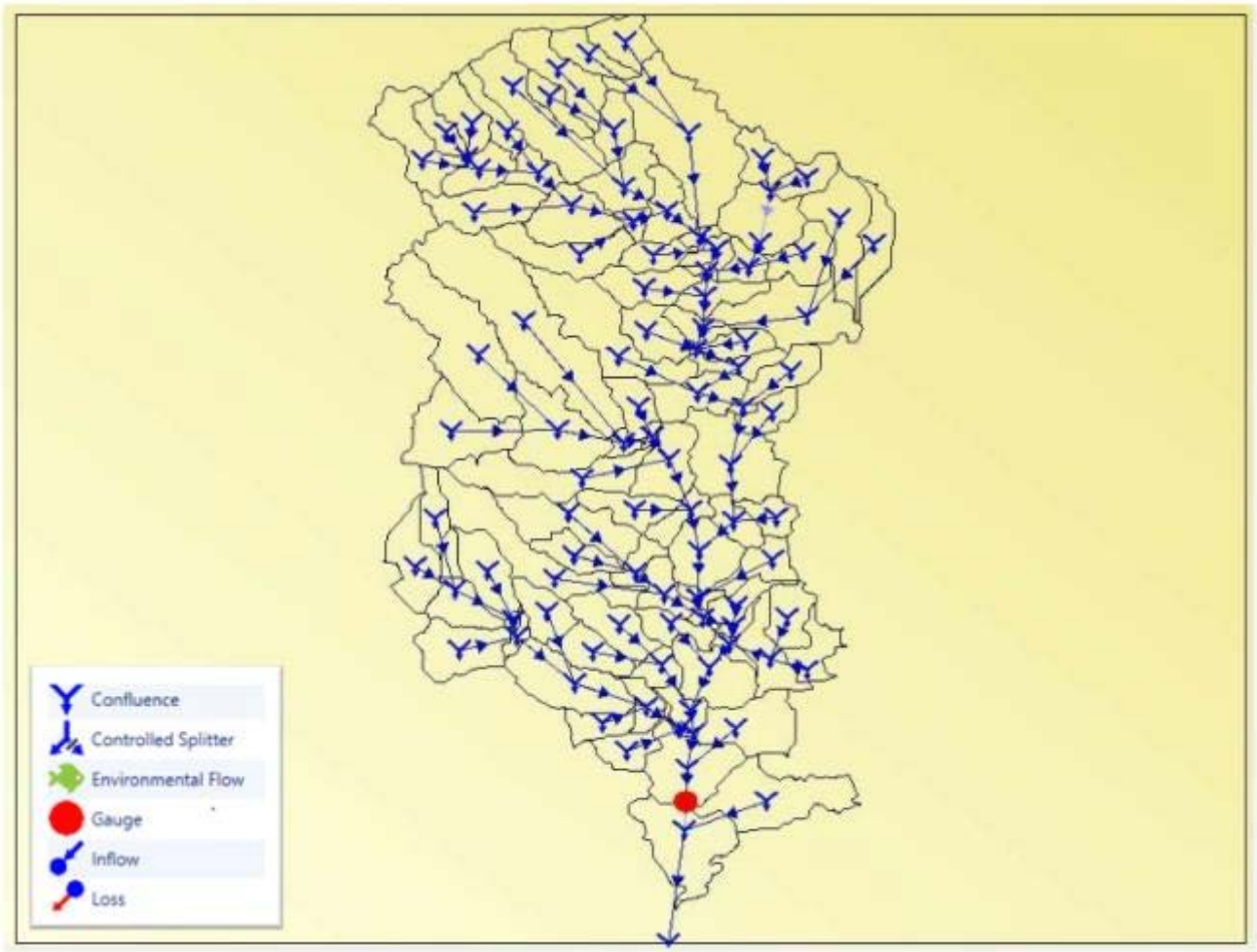
- Oversaw surface water quantity and quality assessments, with a focus on the Mitchell and Perry River systems
- Interfaced with EMM regarding mine water balance assessments and how these fit in a regional context
- Recently undertook broad assessments of centrifuge and flocculant matters

# Surface Water Quantity

- Developed, calibrated and validated SOURCE models of the catchments of the Mitchell and Perry River systems
- Used these (calibrated) models to provide relevant model coefficients to EMM for their modelling of the Fingerboards site
- Then ‘replaced’ the parts of the model that represent the Fingerboards site with the various predictions made by EMM




Mitchell River




Perry River

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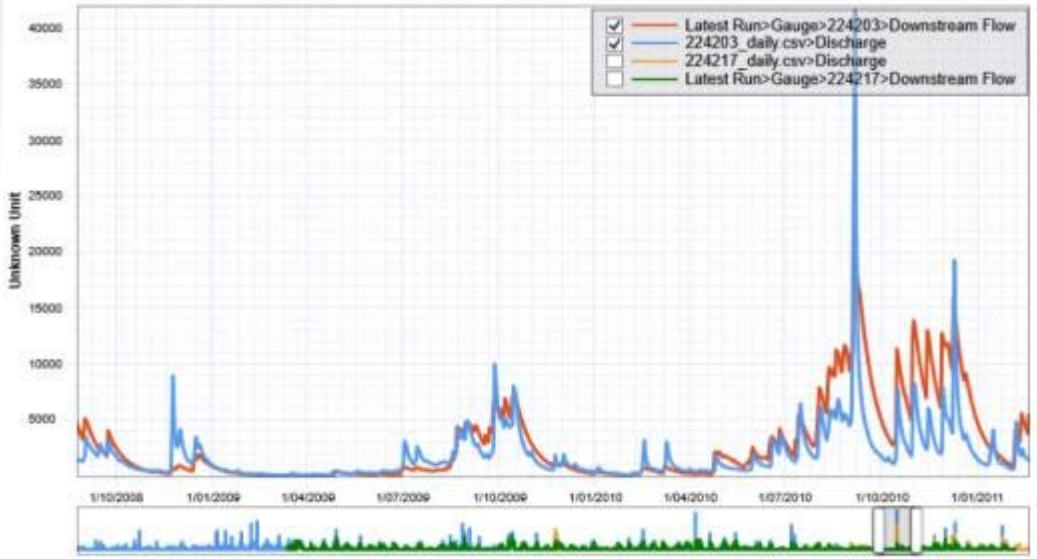
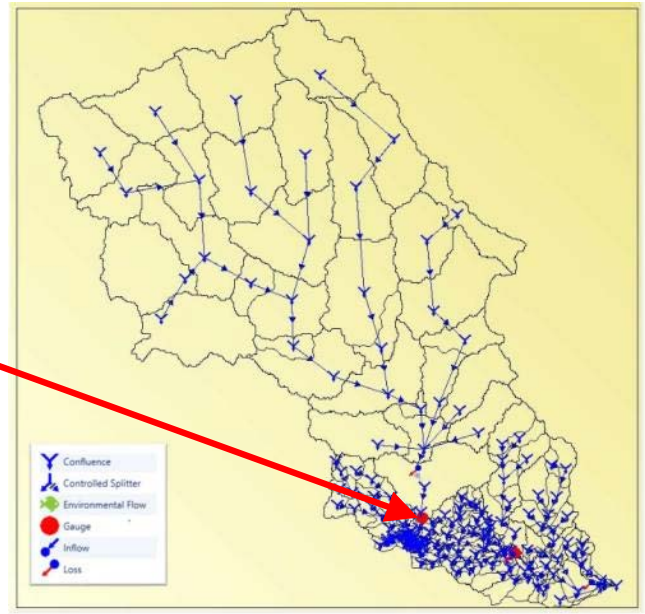
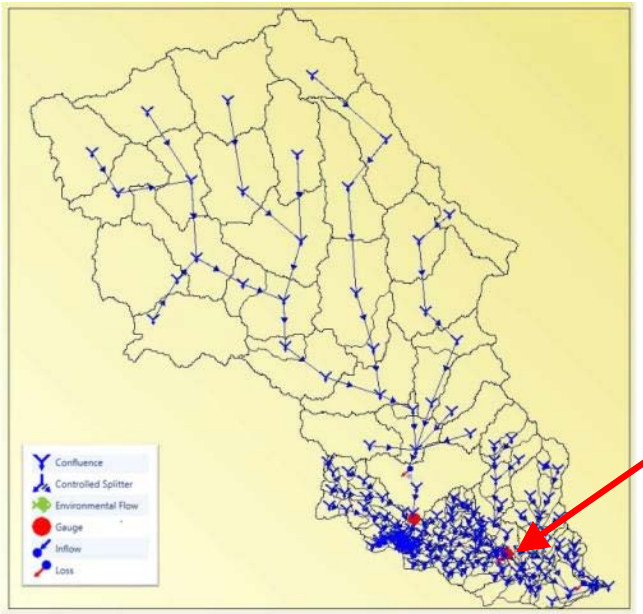



FIGURE 4-11 CLOSER LOOK AT GAUGE 224203 OBSERVED VS MODELLED (MITCHELL RIVER)



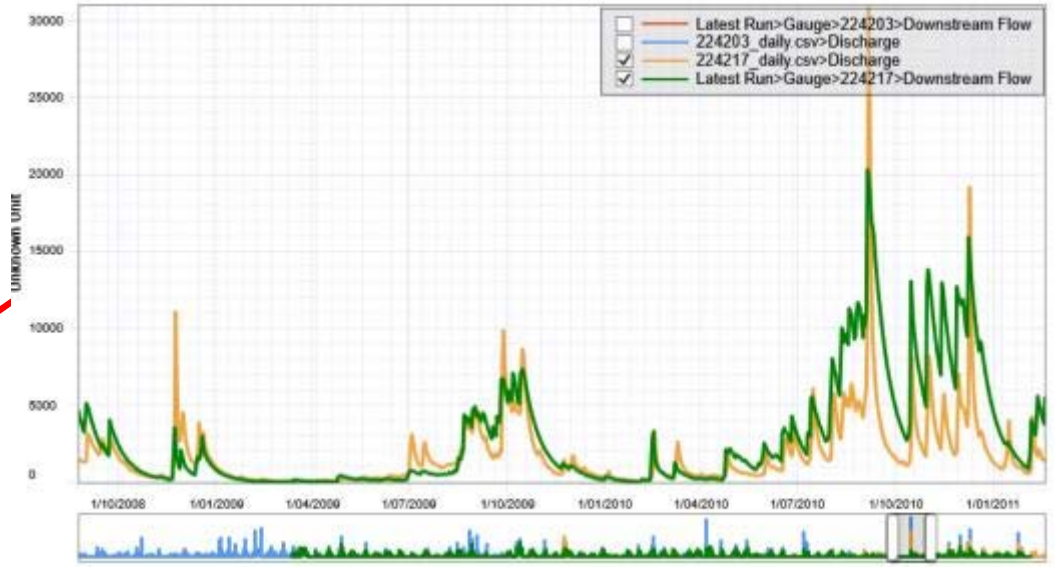




FIGURE 4-12 CLOSER LOOK AT GAUGE 224217 OBSERVED VS MODELLED (MITCHELL RIVER)

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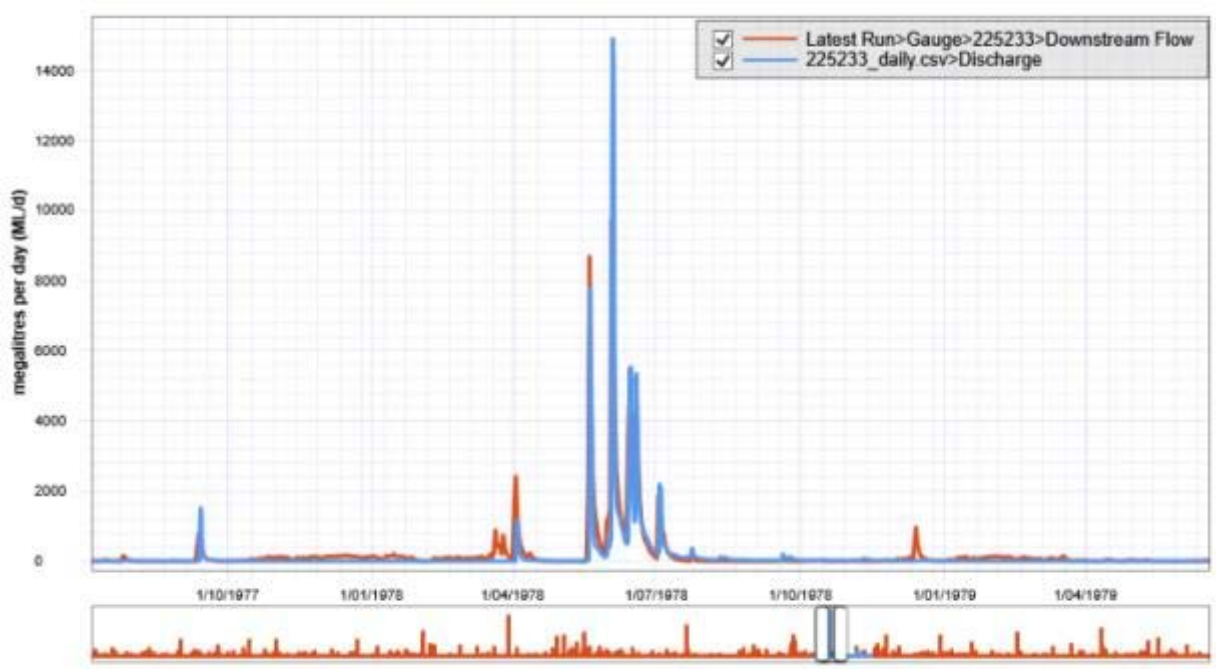


FIGURE 4-13 COMPARISON OF MEASURED (GAUGE 225233) AND MODELLED FLOW IN RED (PERRY RIVER)

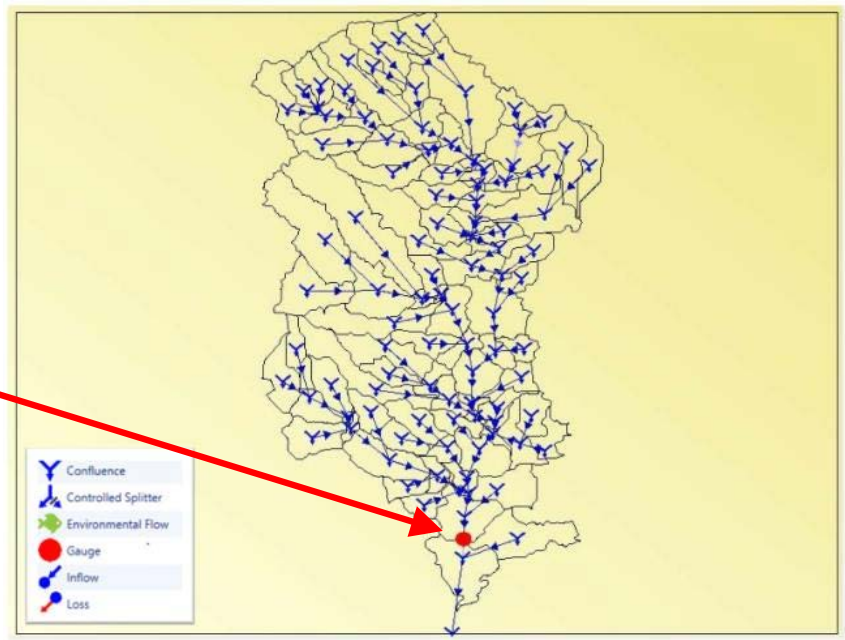


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TABLE 4-6 CATCHMENT CONTRIBUTION TO MITCHELL RIVER ANNUAL VOLUMES

| | Pre-Mining (ML) | 5 Year (ML) | Change (ML) | Change (%) | 8 Year (ML) | Change (ML) | Change (%) | 15 Year (ML) | Change (ML) | Change (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Average annual volume DS site (ML) | 1,145,316 | 1,145,101 | -215 | -0.02% | 1,144,957 | -359 | -0.03% | 1,145,154 | -162 | -0.01% |
| Average annual volume at Gauge 224217 | 1,158,759 | 1,158,544 | -215 | -0.02% | 1,158,401 | -358 | -0.03% | 1,158,597 | -162 | -0.01% |
| Average annual volume at Mitchell River outlet | 1,170,833 | 1,170,619 | -215 | -0.02% | 1,170,475 | -358 | -0.03% | 1,170,672 | -161 | -0.01% |

TABLE 4-7 CATCHMENT CONTRIBUTION TO PERRY RIVER ANNUAL VOLUMES

| | Pre-Mining | 5 Year (ML) | Change (ML) | Change (%) | 8 Year (ML) | Change (ML) | Change (%) | 15 Year (ML) | Change (ML) | Change (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Average annual volume DS site (ML) | 5,546 | 5,604 | 58 | 1.05% | 5604 | 58 | 1.05% | 5543 | -3 | -0.05% |

Note this does not include any abstractions from the Mitchell River for site water use or water returning to the river from day to day site operations

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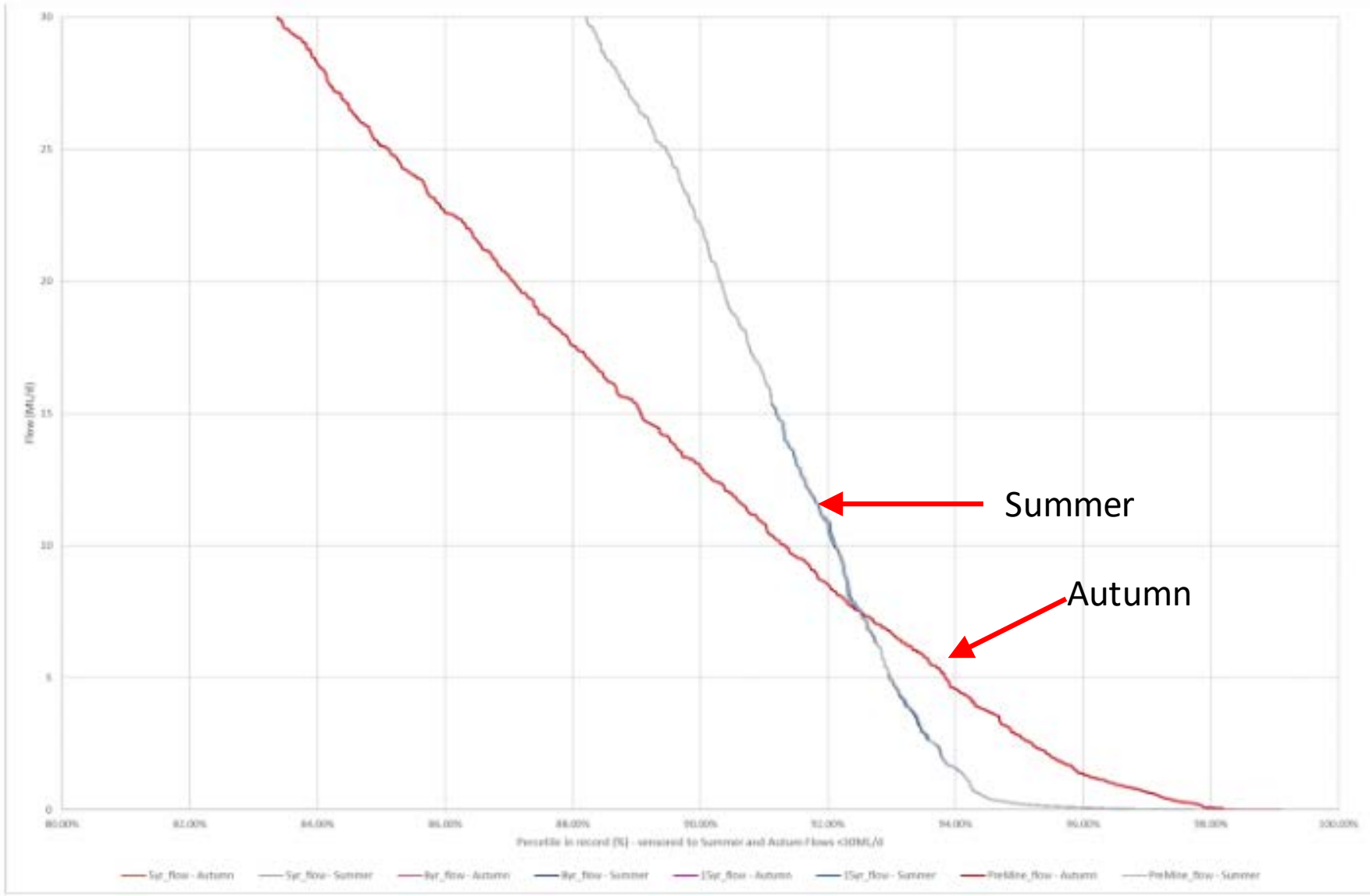


FIGURE 4-17 FLOW DURATION CURVE COMPARISONS - MITCHELL RIVER

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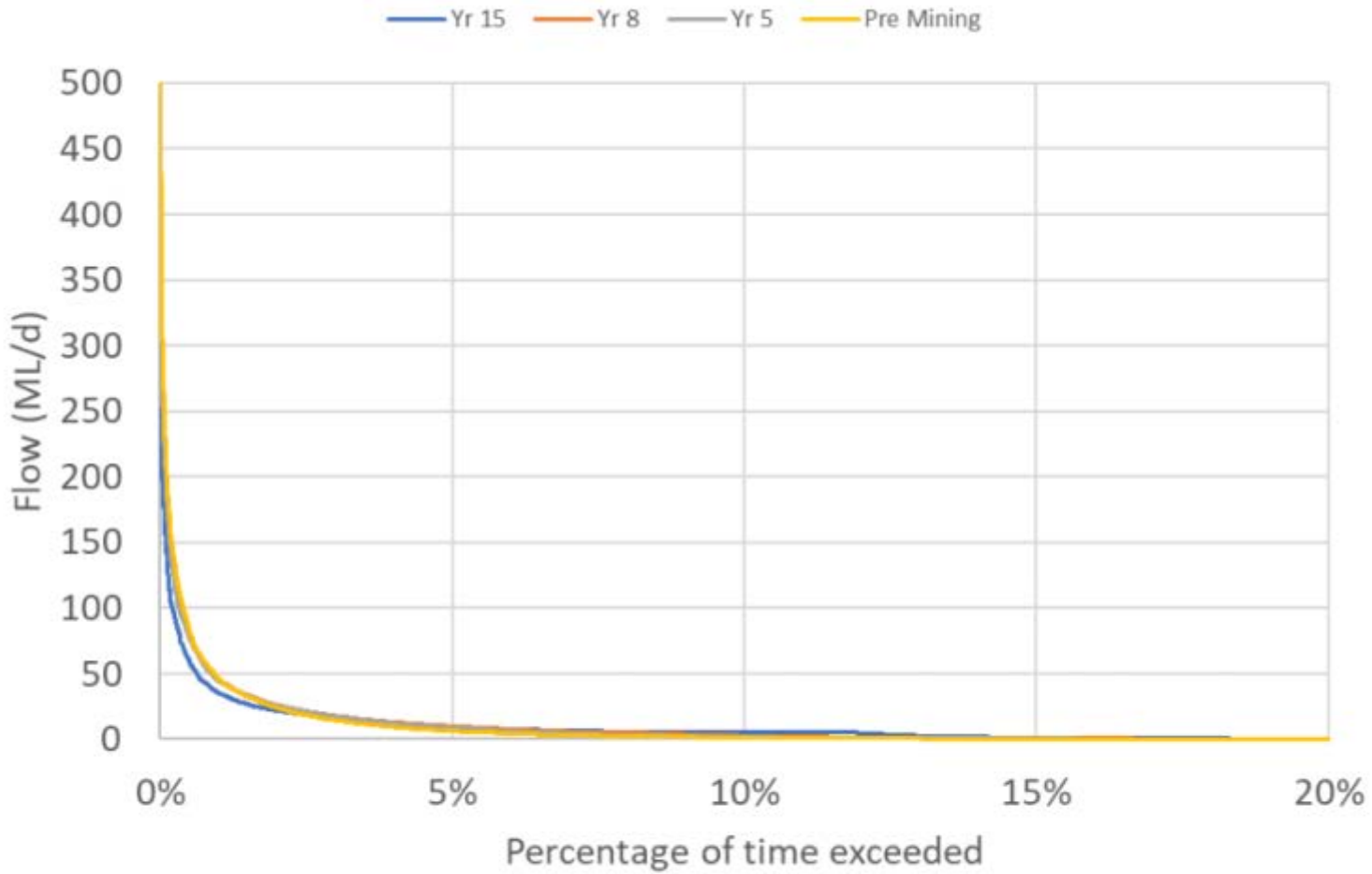


FIGURE 4-19 CONFLUENCE WITH HONEYSUCKLE CREEK - FLOW DISTRIBUTIONS CURVES FOR PRE-MINING AND REFERENCE MINING YEARS

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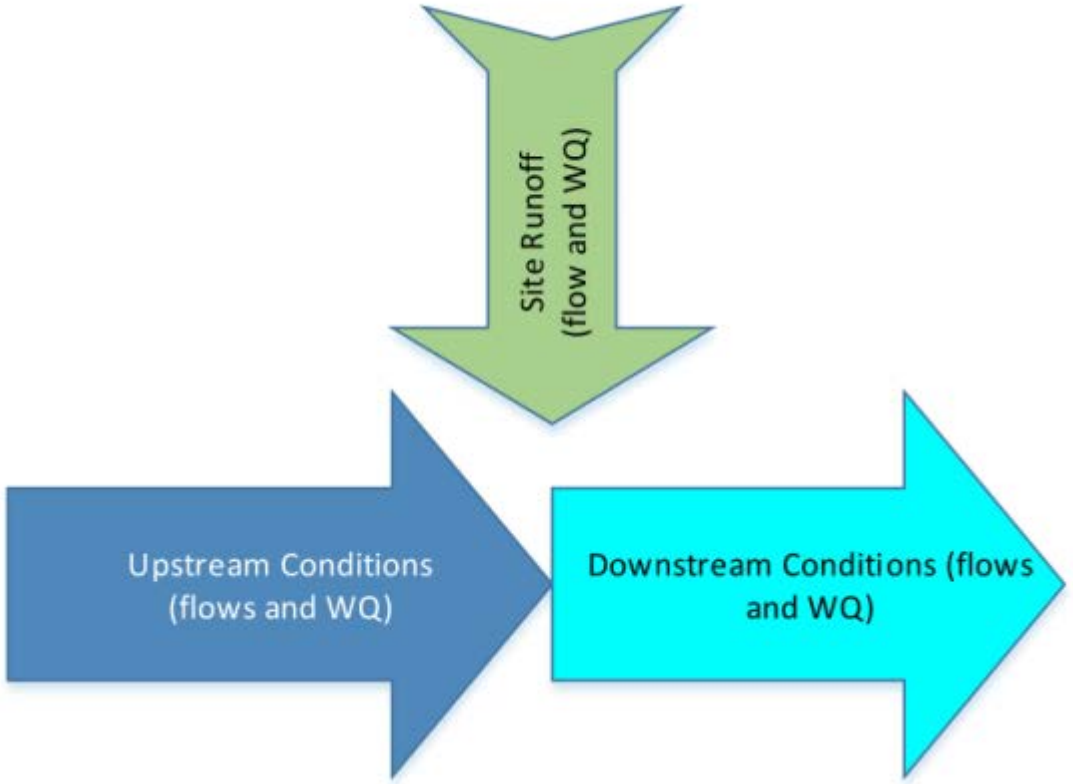
# Water Quality

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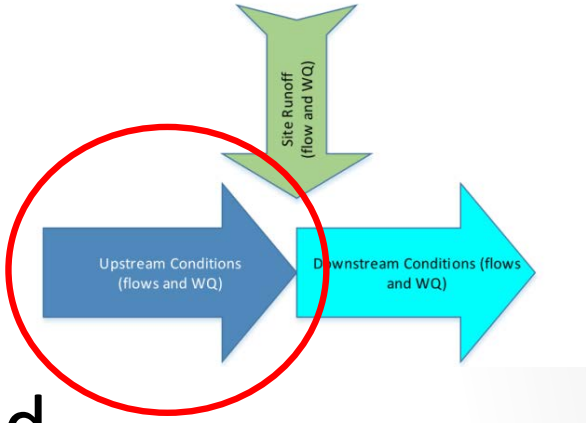
# Water quality




- Extensive background data set available
- All relevant data were collated and reviewed

TABLE 5-5 BACKGROUND RECEIVING WATER NUTRIENT AND METAL CONCENTRATIONS USED IN MITCHELL RIVER WATER QUALITY MODEL

| Parameter | Units | Low Flow | Ambient Flow | High Flow | Data Source |
|---|---|---|---|---|---|
| Flow | ML/D | <167 | 167 - 4,399 | > 4,399 | Station 224203 |
| TN | mg/L | 0.26 | 0.15 | 0.21 | Station 224203 |
| TP | mg/L | 0.018 | 0.01 | 0.020 | Station 224203 |
| Arsenic | mg/L | 0.001 | 0.001 | 0.001 | Station 224203 |
| Aluminium | mg/L | 0.01 | 0.01 | 0.01 | Monitoring |
| Barium | mg/L | 0.004 | 0.004 | 0.004 | Monitoring |
| Copper | mg/L | 0.001 | 0.001 | 0.001 | Station 224203 |
| Chromium | mg/L | 0.001 | 0.001 | 0.001 | Station 224203 |
| Iron | mg/L | 0.12 | 0.12 | 0.12 | Monitoring |
| Molybdenum | mg/L | 0.001 | 0.001 | 0.001 | Monitoring |
| Lead | mg/L | 0.001 | 0.001 | 0.001 | Monitoring |
| Nickel | mg/L | 0.001 | 0.001 | 0.001 | Station 224203 |
| Strontium | mg/L | 0.037 | 0.037 | 0.037 | Monitoring |
| Zinc | mg/L | 0.004 | 0.004 | 0.004 | Station 224203 |

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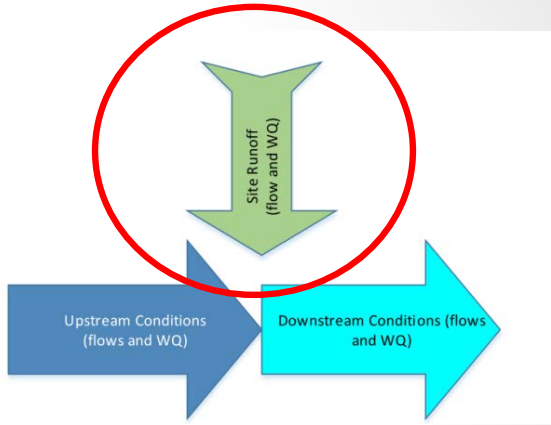
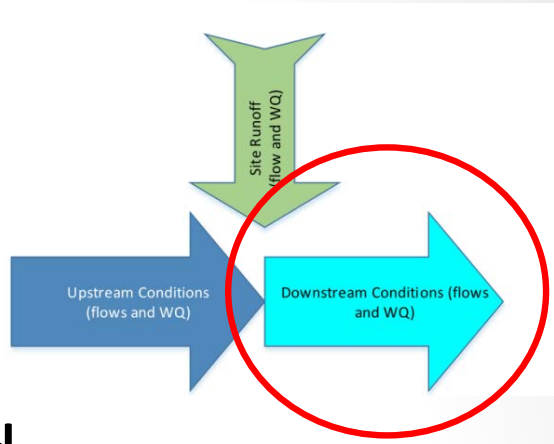



- Event monitoring data collected (some)
- Literature values used
- Laboratory testing conducted
  - Floc testing (sediments)
  - ASLP testing (metals)
  - Elutriate testing (nutrients)
- Regarding groundwater, our work assumed that any changes to the recharge or quality in the underlying aquifer(s) would be minimal and would not affect surface water quality. Given the size of the catchment and expected site management practices, I am comfortable with this assumption.

# Water quality




- Previous two data sets used in modelling
- Long and short term assessments conducted

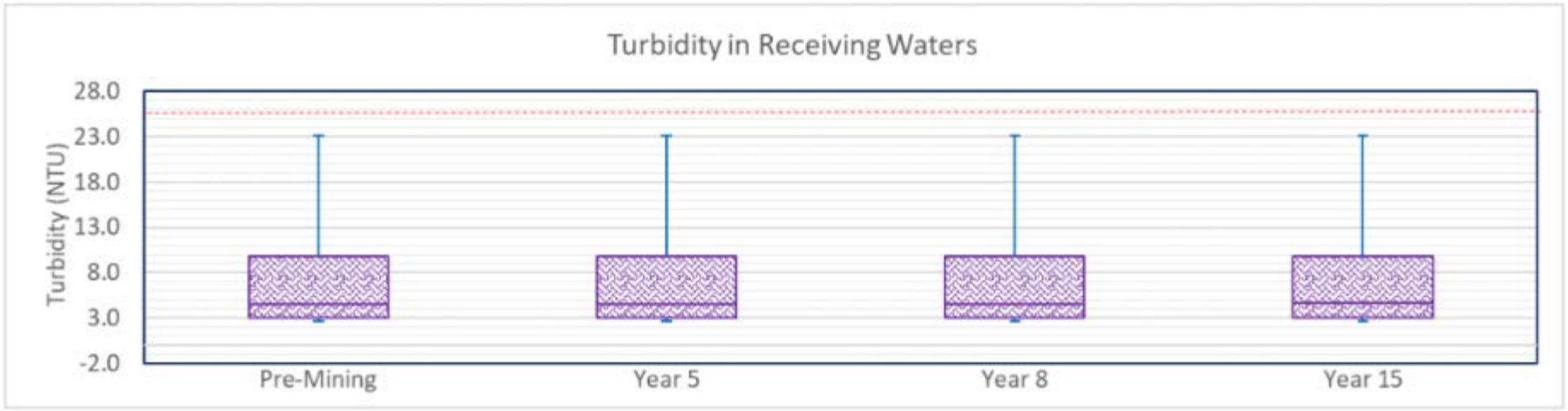



FIGURE 5-34 BOX AND WHISKER PLOT OF TURBIDITY IN THE MITCHELL RIVER FOR EACH SCENARIO (NOTE: RED DASHED LINE IS THE WQO)

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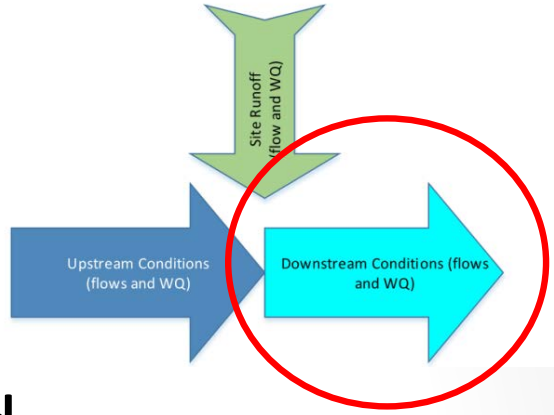


- Previous two data sets used in modelling
- Long and short term assessments conducted

| Parameter | Units | WQO | Pre-mining | 5 year | 8 year | 15 year |
|---|---|---|---|---|---|---|
| TSS | mg/L | - | 8 | 8 | 8 | 8 |
| Turbidity | NTU | 25 | 7 | 7 | 7 | 7 |
| TN | mg/L | 1.1 | 0.700 | 0.700 | 0.700 | 0.700 |
| TP | mg/L | 0.055 | **0.120** | **0.120** | **0.120** | **0.120** |
| Arsenic | mg/L | 0.013 | 0.001 | 0.001 | 0.001 | 0.001 |
| Aluminium | mg/L | 0.055 | **0.790** | **0.790** | **0.790** | **0.790** |
| Barium | mg/L | - | 0.005 | 0.005 | 0.005 | 0.005 |
| Copper | mg/L | 0.0014 | 0.001 | 0.001 | 0.001 | 0.001 |
| Chromium | mg/L | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Iron | mg/L | - | 1.360 | 1.360 | 1.360 | 1.360 |
| Strontium | mg/L | - | 0.033 | 0.034 | 0.036 | 0.036 |
| Zinc | mg/L | 0.008 | 0.005 | 0.005 | 0.005 | 0.005 |

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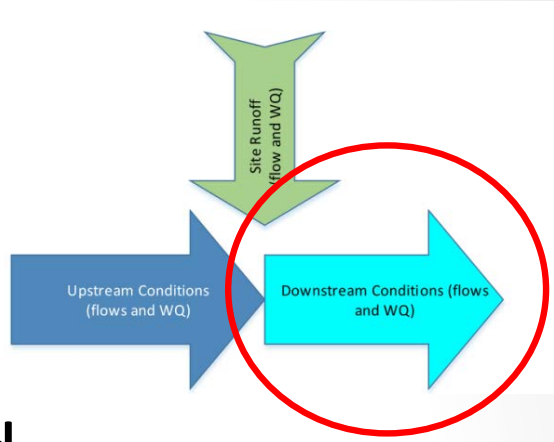


- Previous two data sets used in modelling
- Long and short term assessments conducted

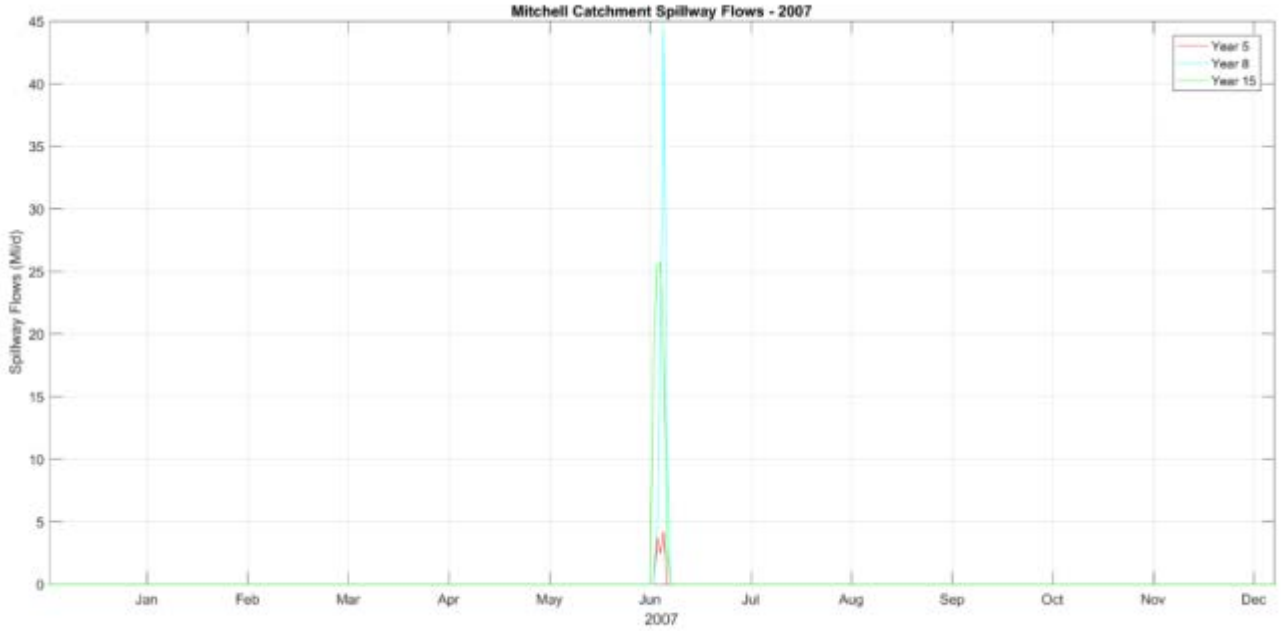


FIGURE 5-41 MITCHELL RIVER SPILLWAY FLOWS FOR 2007

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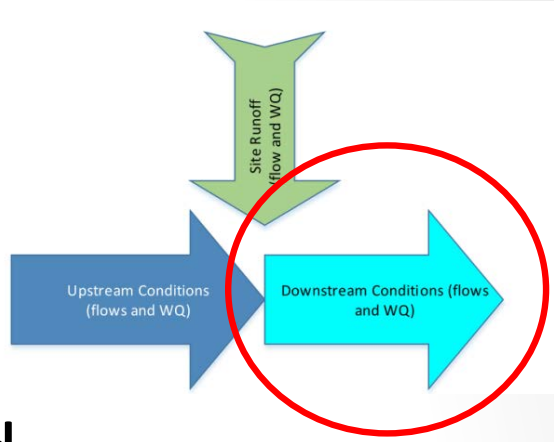
# Water quality




- Previous two data sets used in modelling
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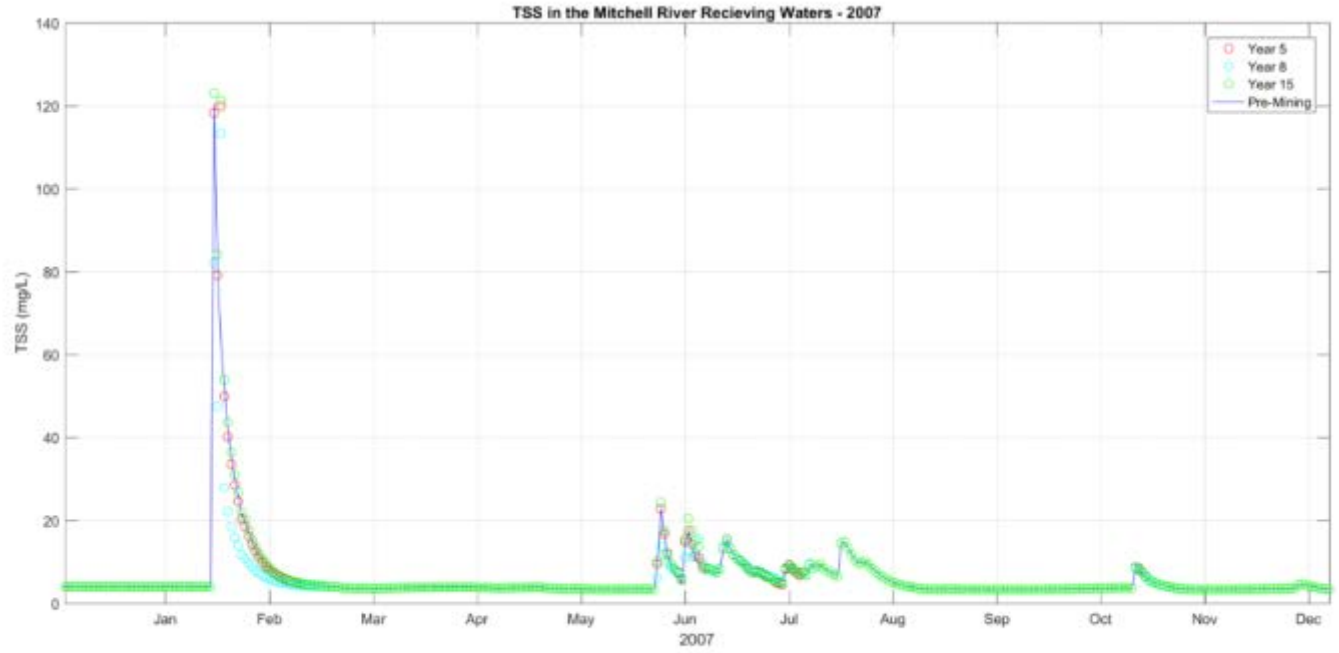


FIGURE 5-40 EVENT BASED TSS IN MITCHELL RIVER RECEIVING WATERS FOR 2007

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# Conclusions (of modelling conducted to date)

- Surface Water Quantity
  - Mitchell – negligible impact (0.01% annual volume change)
  - Gippsland Lakes – no change
  - Perry – potentially greater impact (0.98% increase), but still effectively negligible
- Surface Water Quality
  - Mitchell – no long or short term impacts
  - Gippsland Lakes – no change
  - Perry – no long term impacts, short term increases in TSS may occur (due to flows from the project when the system is normally dry)

# Where to from here?

- The (likely beneficial) impact of the inclusion of centrifuges has not been modelled – they should be in my opinion
- Further site based evaluations are recommended to confirm some of the assumptions made to date before the project proceeds to full scale operations
  - Update regional water balance/quality assessments as new data comes to hand (e.g. the recently recast EMM site water balance modelling with the inclusion of centrifuges and no tailings dams)
  - Pilot scale field testing of centrifuges and refinement of flow and water quality elements (as above)
  - Local data collection to inform adaptive management and BACI program for full scale site operations