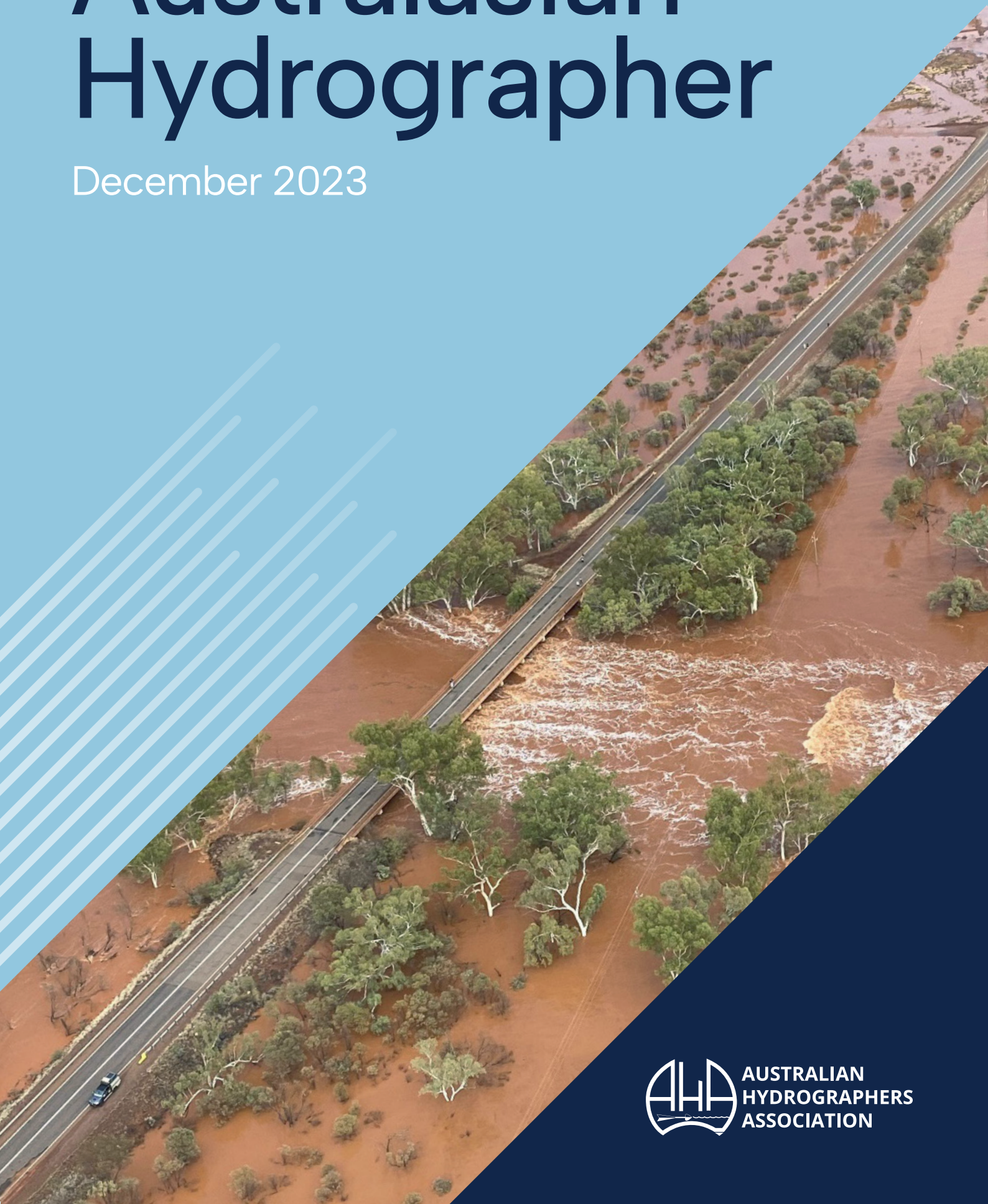
Australasian Hydrographer

December 2023



AUSTRALIAN HYDROGRAPHERS ASSOCIATION

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Material Submitted

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Photo Credit: (Cover and Below)
Jayden Weaver – Heliwest.
Photo Information: (Cover and Below)
Chopper Photo – Fortescue River 25/01/2024
Newman, Western Australia (WA).

Acknowledgement of Country

The AHA acknowledges the Australian Aboriginal and Torres Strait Islander peoples of this nation. We acknowledge the traditional custodians of the lands on which our association is located and where we conduct our business. We pay our respects to ancestors and Elders past, present and emerging. The AHA is committed to honouring Australian Aboriginal and Torres Strait Islander peoples' unique cultural and spiritual relationships to the land, waters and seas and their rich contribution to society.

Contents

From the Editor-In-Chief

Zac Ward

Greetings from the other side of 2023!

What a start to the new year and as usual Mother Nature has not disappointed with substantial rainfalls across all of Australia, along with some more than uncomfortable summer heatwaves felt in multiple states & territories. No doubt the back to back Tropical Cyclones of Jasper and Kirrily are continuing to be felt in Queensland with the extent of flooding/weather damage being felt all over the multiple regions. As always please stay safe out there and lookout for your fellow Hydrographers Water Industry workers who are no doubt having a busy time of it all.

From my side of the fence in WA I got to experience some first-hand flooding in the Pilbara last week with the town of Newman copping up to 250mm in one single downpour around parts. This resulted in the previously dry Fortescue River commencing its flow for the year and reaching a massive peak of +5m, +1600m3/s shown in the below hydrograph!

Two men jump into flooded river in Newman, Western...

4.7K views • 2 days ago

I've chosen to share a few images of the event along with a locally filmed event which I would not recommend for anyone in these flow events. Don't worry, the individuals featured are alive and well. Please, as always reach out if you have any photo's, articles or interesting hydrographic items you'd like to share. Queensland hydrographers I look forward to hearing more from y'all shortly.

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I'm looking forward to seeing more & more content over the new year in 2024 and also am eagerly awaiting the 2025 AHA Conference given the success of last years event in Penrith. Arran will no doubt mention more below with further info and hype coming in the following months.

Cheers,

Zac Ward CPH

Newman Townsite (WA) & Great Northern Highway (ref Jayden Weaver – Heliwest)

Fortescue River Gstn - Peak Flow (ref https://wir.water.wa.gov.au/Pages/Water-Information-Reporting.aspx)

From the President

Arran Corbett

Happy New Year and Slainte Mhath!

As we bid farewell to 2023, a year marked by an early onset of the wet season, we reflect on its significant weather events. Cyclone Jasper made landfall near Cairns in mid-December, lingering to drench North Queensland with considerable rainfall. However, Jasper's impact was just the beginning. Subsequent low-pressure systems brought extensive flooding to Victoria, New South Wales, and Queensland. As we step into 2024, many of our members face a wet start, diligently collecting high-flow gaugings and ensuring the continued operation of critical networks. Your safety remains our top priority, so please take all necessary precautions in the field.

Looking ahead, 2024 is set to be an eventful year for the AHA. We're excited to announce the inaugural Regional AHA Training Week, slated for June in Darwin. This week-long event, coinciding with our AGM, promises to be a highlight, offering valuable training opportunities. We encourage you to allocate time and resources to participate in what promises to be an exceptional gathering. We'll also be reaching out to our corporate partners to discuss limited support opportunities for this event.

In parallel, we're gearing up for the 2025 conference in Tasmania. A working group has been formed and will commence planning in mid-January 2024. We're eager to involve our Tasmanian members in this process, so if you're based there and interested in contributing, your involvement would be greatly appreciated.

On an organizational note, we extend our heartfelt thanks to Thermo Fisher Scientific for their continued support as 4-star partners for the next two years. Similarly, we welcome Ninox* as new 4-star partners, and we're grateful for their commitment to supporting our industry.

As we embark on this new year, filled with challenges and opportunities, we remain committed to our mission and look forward to your active participation and support. Stay safe, stay engaged, and let's make 2024 a year of growth and learning for the AHA community.

Sincerely,

Arran

*(*AHA President, Arran Corbett, is an employee of Ninox)*

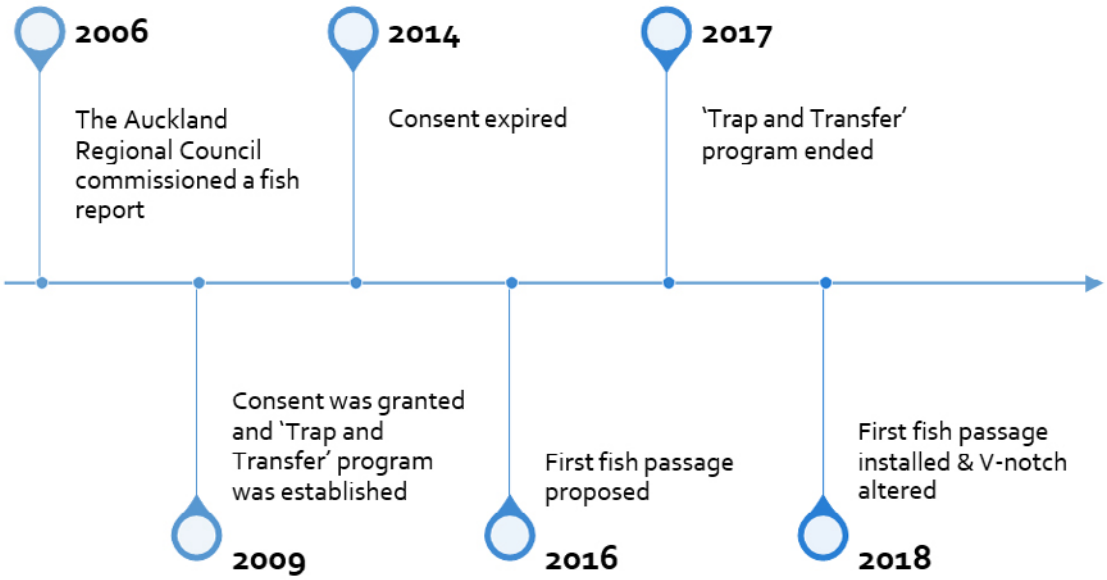
Oteha: Weir Have All the Fish Gone

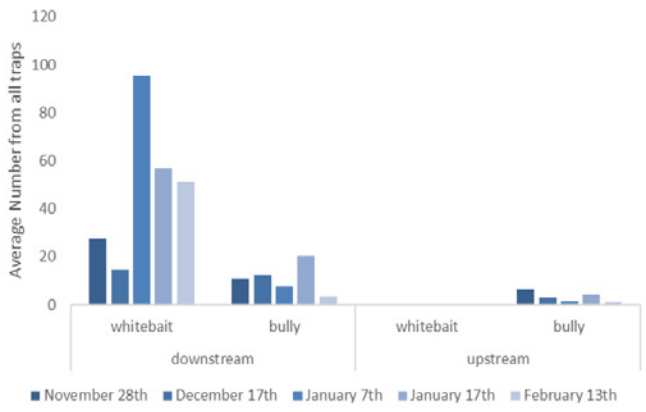
Presentation from the AHA Conference 2023. Amber Taylor – Environmental Consultant (Terra Pura Consulting Limited)

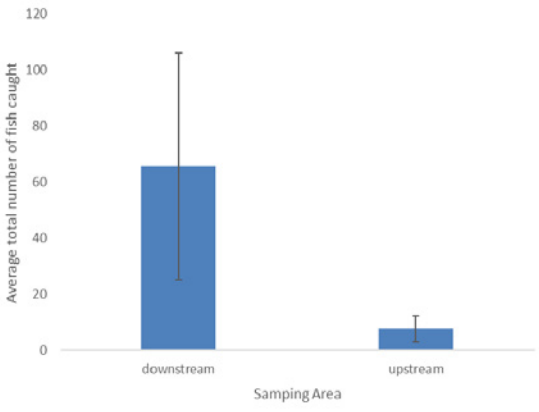
Site Introduction

- Located on the North Shore, Auckland
- Installed in 1979 by Ministry of Works
- Installed a 120o V-Notch weir
- Granted consent as a damming structure

Timeline of Events

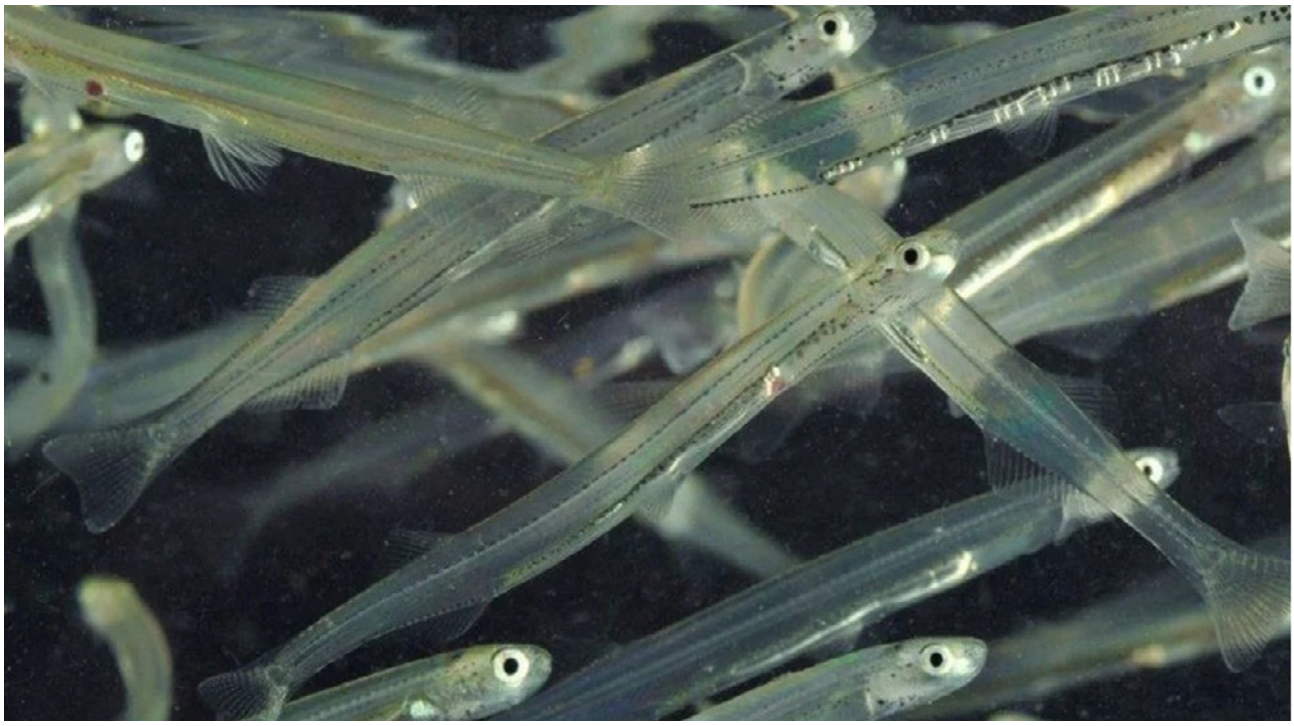



120
100
80
60
40
20
0
Average Number from all traps
whitebait
bully
whitebait
bully
downstream
upstream
November 28th
December 17th
January 7th
January 17th
February 13th


120
100
80
60
40
20
0
Average total number of fish caught
downstream
upstream
Samping Area

Velocity Disturbance

- Inanga is a velocity sensitive species
- Prevented from moving upstream when encountering vertical drops of 100-200mm at a velocity of 0.6m/s (Hicks 2008)
- Using conventional designs can be ineffective



Ramp Angle

- Angle sitting roughly at 30°
- Issue for both fish ramps

Considerations to the Water Level Record

SITING OF WATER LEVEL RECORDING DEVICE

ABILITY TO COMPARE NEW AND HISTORIC DATA

FLOOD FREQUENCY AND CLIMATE CHANGE

SENSITIVITY TO LOW FLOWS

ABILITY TO TRACK IMPACTS OF LAND USE CHANGE

Sensitivity to Low Flows

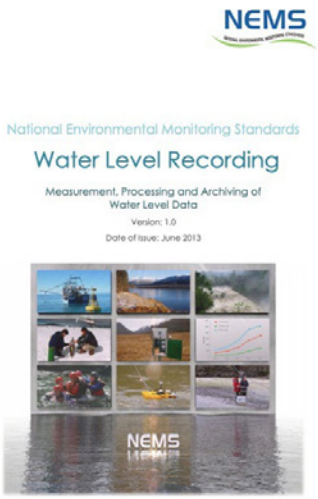
- Will lose some sensitivity around low-flow monitoring
- Challenge of trying to maintain long-term record
- Have options to try overcome this

Downstream View from Weir

Ability to compare new and historic data

MAINTAINING HIGH QUALITY DATA

FUNCTIONAL REQUIREMENT WHEN DEALING WITH WATER LEVEL



1966

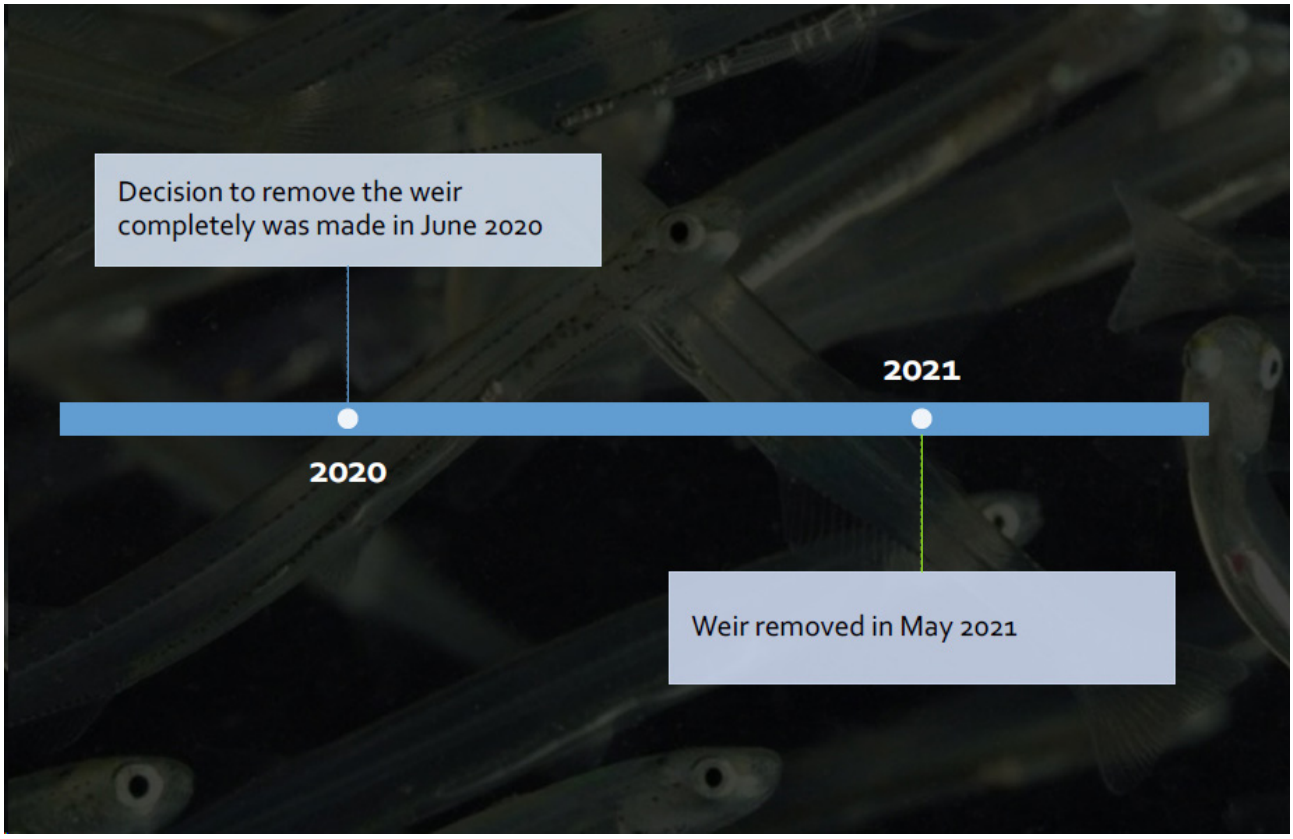
2017

Gauging for a New Rating Curve

Upstream Gauging Section

Downstream Gauging Section

Final Decision



Current State of the Control

Outcome?

SITING OF WATER LEVEL RECORDING DEVICE

ABILITY TO COMPARE NEW AND HISTORIC DATA

FLOOD FREQUENCY AND CLIMATE CHANGE

SENSITIVITY TO LOW FLOWS

ABILITY TO TRACK IMPACTS OF LAND USE CHANGE

Auckland Council
Te Kaunihera o Tāmaki Makaurau

TERRA PURA

Non-Urban Metering – Insitu measurement guidelines and uncertainty tools to build better Hydrographers

Presentation from the AHA Conference 2023. Andrew Judge – Hydrometrics and Metering Specialist (Manly Hydraulics Laboratory)

Overview

This presentation aims to:

- Show the challenges of in-situ meter testing
- Basic understanding of the term 'uncertainty'
- Different methods MHL has tested
- A summary of current tools available for hydrographers

Requirements

In the Metrological Assurance Framework 2 (MAF2) calls for meter verification and notes there is a Measurement act 1960 there is an exemption from verification, but that Regulators may still require verification, undertaken by an approved person.

An approved/competent (AS 4747) person for Verification is a Utility Meter Verifier, in NSW also called a Duly qualified person.

Verification

Insitu (±5%) – the uncertainty of the reference volume measurement shall be not greater than one-third of the maximum permissible error of the meter under test, which is ±1.67% [AS4747 Part 2].

Understanding that all measurements we make has an element of uncertainty, tools have been developed to aid hydrographers in assessing and reporting the uncertainty of their measurements, based on ISO and Australian Standards.

Challenges

- Ability to meet or understand the uncertainty of measurements
- Cost effectiveness
- Practicality
- WHS
- Environmental

These become part of our assessment criteria when looking at different methods.

Summary of Methods

Method	Install type	Advantages	Disadvantages	AS4747 practicality*
Laser doppler velocimetry	Closed conduit	• Traceable • Accurate	• Expensive	Not yet practical for non-urban metering
Space time image velocimetry (STIV)	Open channel	• Likely to be cost effective • May suit difficult to measure sites	• Relies on secondary measurements • Still in development and uncertain if can achieve accuracy	Not yet practical for non-urban metering
In-series reference meter	Closed conduit	• Traceable • Accurate • Proven technology	• Increases capital cost • Needs to be adapted to suit characteristics of each site	Acceptable, particularly if combined with standardised installation design/s
Thin plate v-notch weir	Open channel or closed conduit	• Accurate • Cost Effective	• Limited to low flow rates • May be limited by available head	Acceptable
Tracer dilution	Open channel or closed conduit	• Can be used in channels with high turbulence	• Not suitable for wide or low velocity channels • Environmental/ health considerations	May not meet the required uncertainty and required development for Australian conditions
Tracer travel time	Open channel or closed conduit	• May be practical in applications where other methods are not possible	• Requires an accurate estimate of water volume between sensors – difficult in flexipipes and open channels	Has the potential to provide the required accuracy, but requires further development
Ultrasonic transit time clamp-on device	Closed conduit	• Short set-up time, easily portable, can be used on different pipe sizes	• Needs access to a hydraulically suitable pipe section • Actual internal pipe diameter and condition may impact accuracy	May not consistently meet the ±1.67% accuracy specification
Electromagnetic insertion probe	Closed conduit	• Relatively low test cost, easy to install once tapping is in place, easily portable to different pipe sizes	• Accuracy and reliability is yet to be confirmed • Needs access to a straight section of pipe with little turbulence	May not consistently meet the ±1.67% accuracy specification

Method	Install type	Advantages	Disadvantages	AS4747 practicality*
Component uncertainty analysis	Open channel or closed conduit	• Can provide supporting information on likely meter performance, especially when used in conjunction with in-situ measurement methods	• Is not a volumetric measurement • Standardised approaches not well adopted	Not a volumetric measurement, hence cannot verify a meter's compliance with AS4747 Is required to be provided with metering systems
Sharp crested weirs (for emplacement meters)	Open channel or closed conduit	• Low cost • Accurate, traceable • Robust and simple operation	• Suitable for fixed pipe sizes and low flow rates only	Acceptable
Electronic fingerprint	Closed conduit	• Can assess drift in the electrical properties of electromagnetic flow meters • Can allow remote troubleshooting	• Not available for all meters • Is not a volumetric measurement • May not detect issues caused by incorrect installation • Unable to detect meter bias, calibration errors, velocity profile distortion or degradation of internal pipe conditions	Not a volumetric measurement, hence cannot verify a meter's compliance with AS4747
Pump around	Open channel	• Open channel solution • Good uncertainty	• Time consuming set-up • Expensive	In limited use in Australia

Methods Tested

Included:

- Inline reference meter (tested in the laboratory)
- Weir box (field tested and laboratory)
- Transit time (clamp-on) meter (field tested and laboratory)
- End of pipe multi-beam Doppler (field tested and laboratory)

Practice Procedures

Insitu flow measurement practice procedures covering:

- Common requirements
- Ultrasonic clamp-on measurement devices
- End of pipe HVQ multi-beam sensors
- Thin plate V-notch weir box

Weir Box

Transit Time (clamp-on)

Multi-Beam Doppler (end of pipe)

Calculation Tools Developed

- V-Notch Weir Calculator
- Transit time uncertainty calculator
- In-line meter uncertainty calculator
- Open channel manual gauging uncertainty calculator
- Multibeam Doppler (closed circuit) uncertainty calculator

Example (transit time)

In-situ flow performance test

Site details			**Meter-under-test details**		
Owner			Make		
Address			Model		
			Type		
			Serial number		
			Size		mm
Offtake type	Bore				

In-situ test details

Reference device			**Date**		
Reference device make/model			Start time	10:00:00	
Reference device serial number			Finish time	10:15:00	
Calibration date (if applicable)			Test operator		
Calibration uncertainty		%	Reviewer		
Measurement point			**Secondary measurements**		**Error**
Pipe nominal diameter			Pipe external diameter	750 mm	1 mm
Pipe class			Pipe wall thickness	5 mm	1 mm
Pipe material	Hard plastic		Out of roundness deformation	0 mm	
Pipe lining	Nil		Pipe internal diameter	740 mm	
No. of transect paths	2		Water temperature	20 (°C)	5 (°C)
			Distance from flow disturbance	20000 mm	
			Approximate leakage	L/min	Good Quality of this estimate

	Meter-under-test reading (ML/d)	Reference meter reading (ML/d)
1	14	14
2	14	14
3	14.01	14.002
4	13.91	14.006
5		
6		
7		
8		
9		
10		
11		
12		

Meter performance assessment uncertainty estimate

Meter-under-test flowrate	13.98	ML/d
Reference flowrate	14.002	ML/d
Difference	-0.16%	
Reference uncertainty	2.29%	
k	1.98	
Test Uncertainty	4.43%	
	2.36	

Conclusion

- Tools and procedures are freely available to help build better Hydrographers and practices
- There is no 'one solution' for in-field testing at a site, all have positive and negative aspects
- It's up to the regulators to set the rules of what they will accept

Link to these tools and practice guidelines via Irrigation Australia https://water.nsw.gov.au/__data/assets/pdf_file/0004/528385/in-situ-meter-accuracy-procedures-guide.pdf

NSW GOVERNMENT Manly Hydraulics Laboratory

Semi-Automating an Unsteady State Hydraulic Model to Manage Variable Tailwater

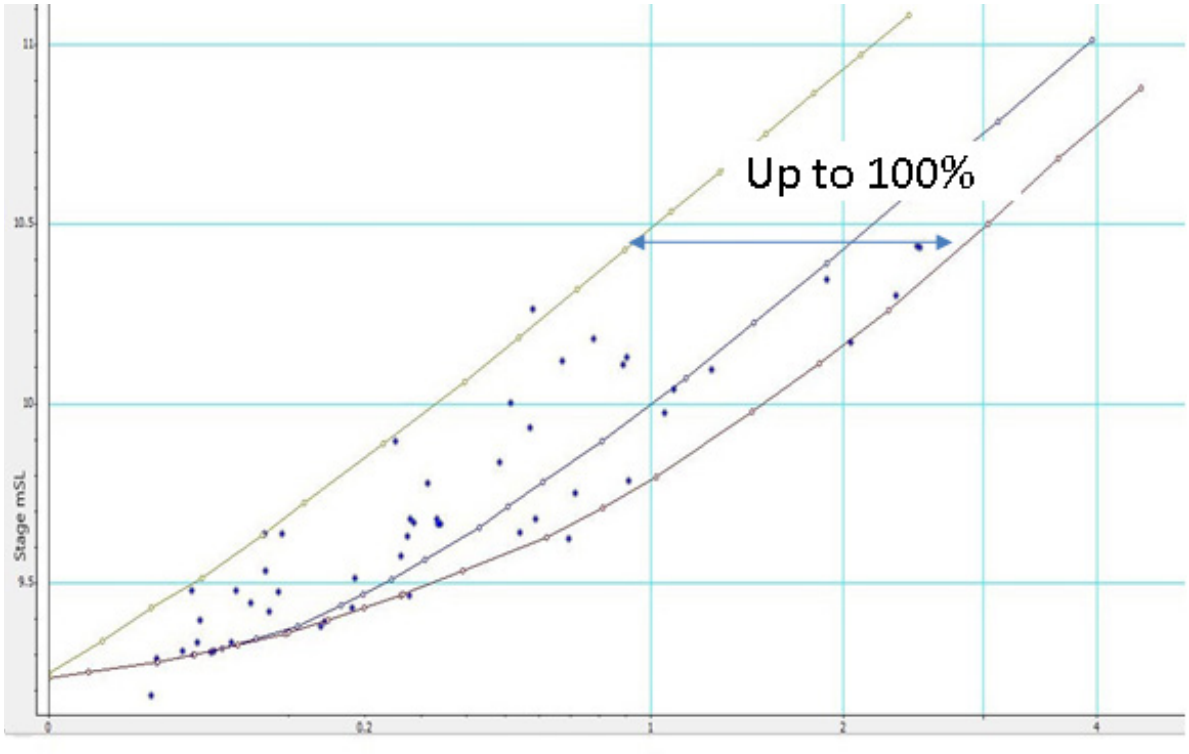
Presentation from the AHA Conference 2023. Andrew Weatherburn – Supervising Hydrographer (Department of Water and Environmental Regulation)

Peel Main Drain

Tributary of the Serpentine River ultimately flowing into the RAMSAR listed Peel Harvey Estuary. Important site in understanding nutrient contributions from an urbanising catchment. Five streamflow gauges have been operated over the past fifty years.

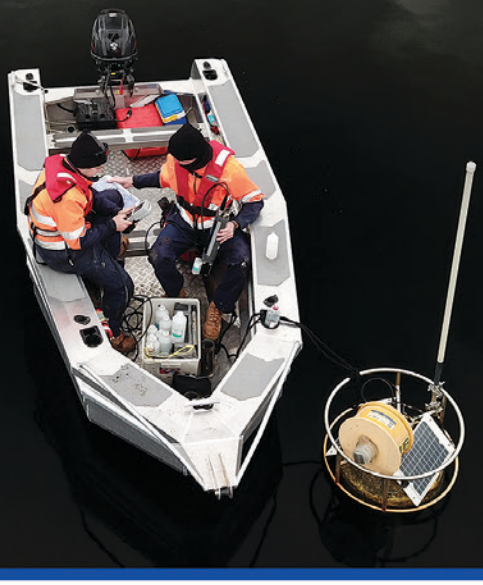
Problems with Traditional Methods

- Lack of slope in channel
- Variable Tailwater Conditions
- Unable to create a stable flow rating curve



Gauging's from Karnup Road

Historical Gauge Hope Valley



right solutions.
right partner.

Hydrographic Careers at ALS

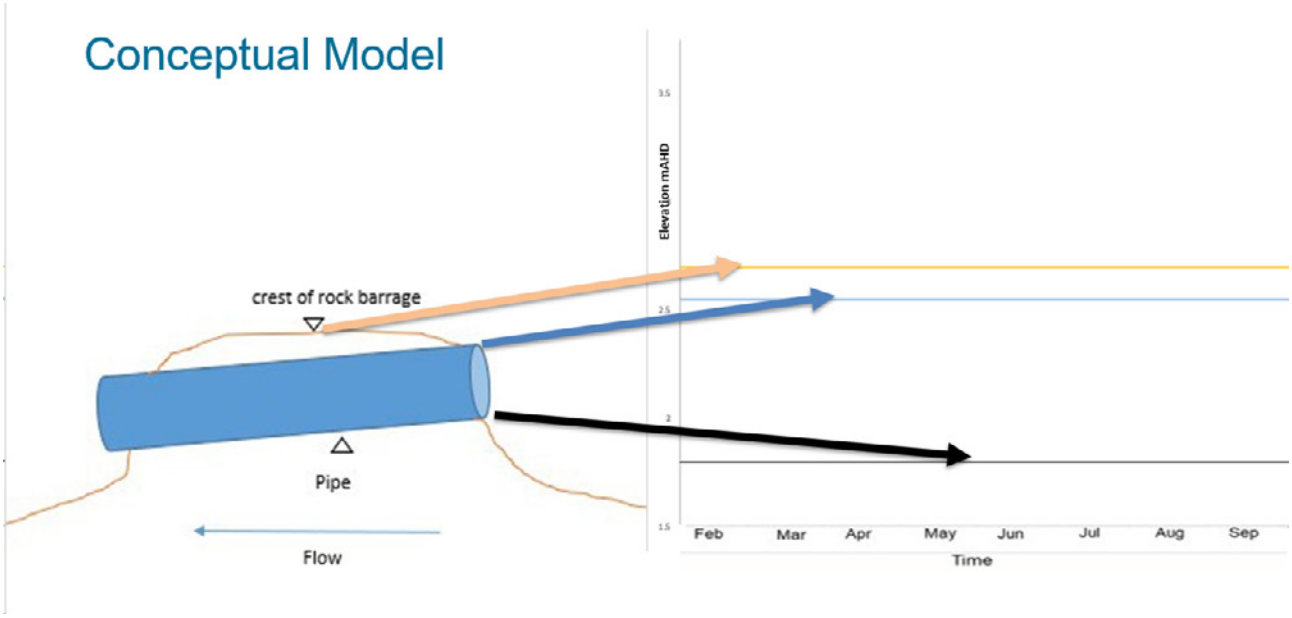
ALS has the biggest contingent of Hydrographers in Australia. We operate many long-term contracts for major Water Authorities as well as a diverse list of Government and private sector clients. If you're after a career in Hydrography while working with a dynamic team, ALS is your destination.

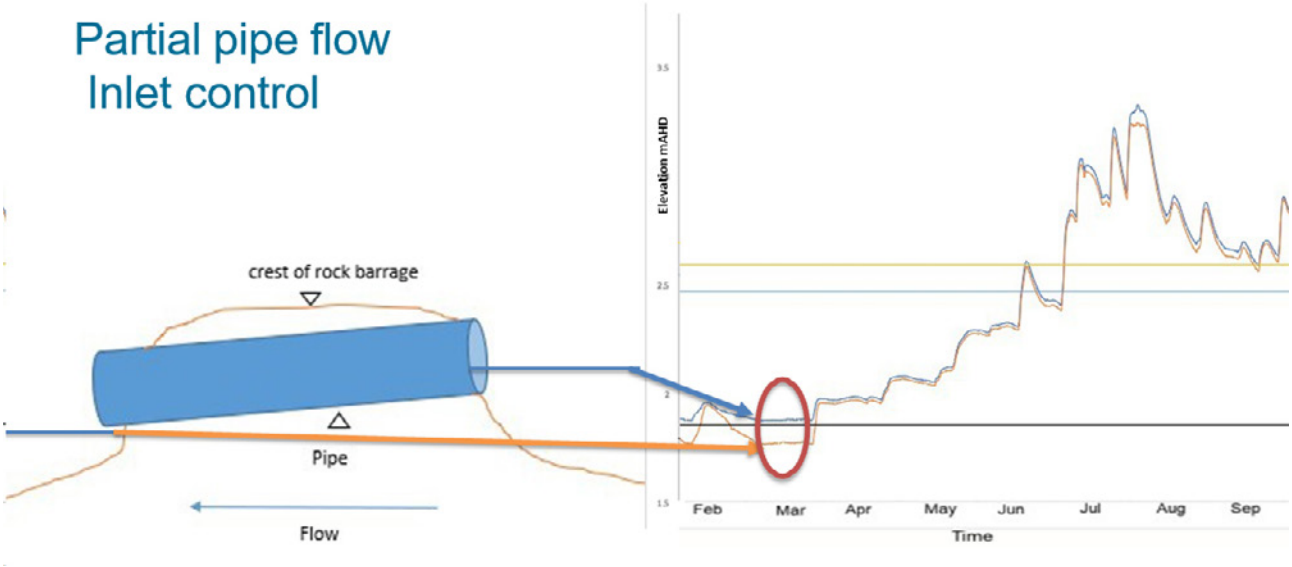
What ALS offers

- A safety-first approach
- The largest employer of Hydrographers in Australia offering room for advancement in varied career paths across the following groups: field hydrology, international projects, data management, instrumentation, and systems in 16 office locations across Australia allowing for voluntary relocation and Management opportunities
- Industry approved Enterprise Agreement with guaranteed annual salary increments and above market pay rates
- Sponsored certification and membership of the Australian Hydrographic Association and free enrolment for the AHA Diploma Water Industry Operations (Hydrometric Monitoring)
- Strong R&D Focus allowing for exposure to technological advancements including Photogrammetry/STIV, remote control boats, acoustic dopplers, iPhone app and sonar
- Field work encompassing working above the snow line, 4WD'ing in isolated areas, kayaking on rivers, hiking, working from boats, and operating drones
- Providing awareness in the education system through work experience placements and internships

If you are keen for a challenge while working alongside the best staff in the industry in a very dynamic company, contact us via email **hydrographics@alsglobal.com**

Maramanup Outflow


Conceptual Model
crest of rock barrage
Pipe
Flow
Elevation mAHD
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Time


Partial pipe flow
Inlet control
crest of rock barrage
Pipe
Flow
Elevation mAHD
Feb
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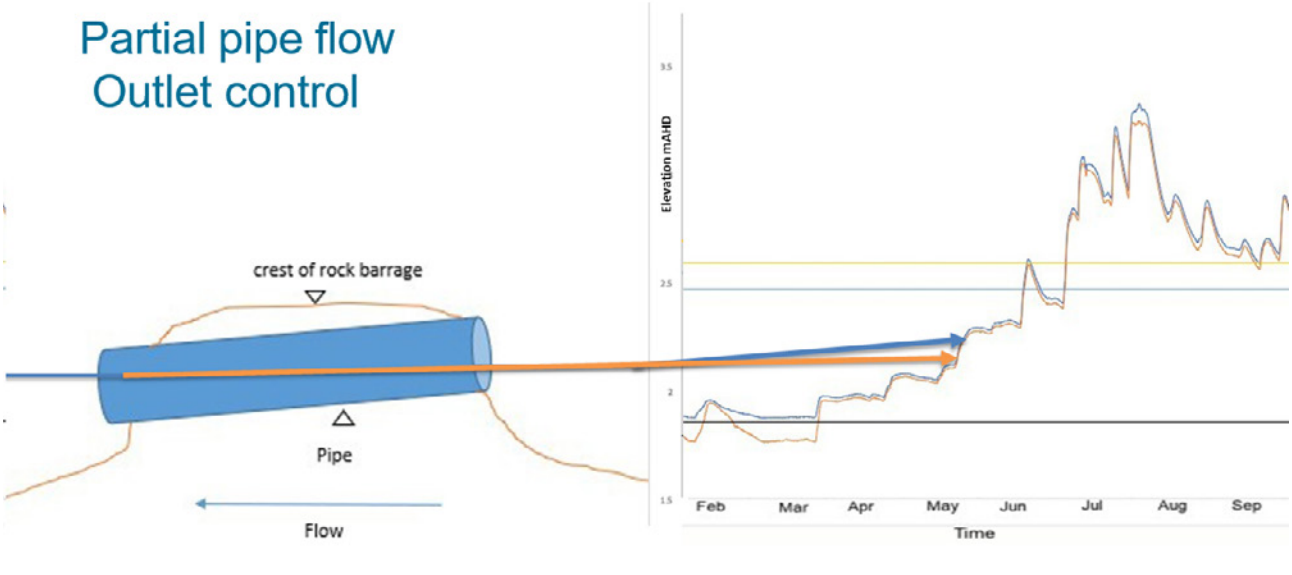
Time


Partial pipe flow
Outlet control
crest of rock barrage
Pipe
Flow
Elevation mAHD
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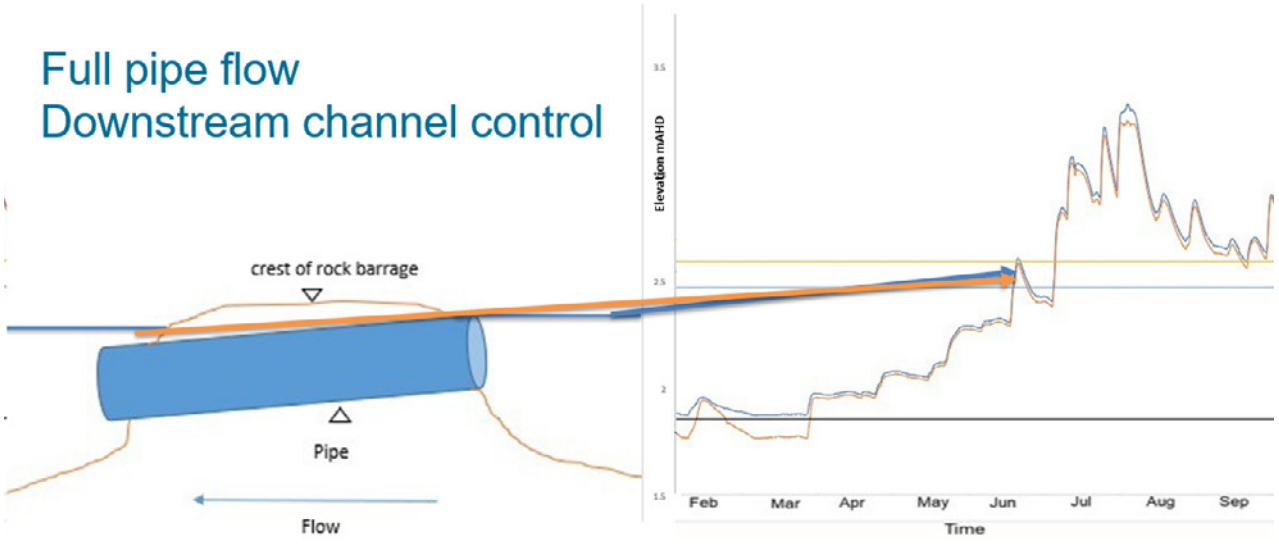
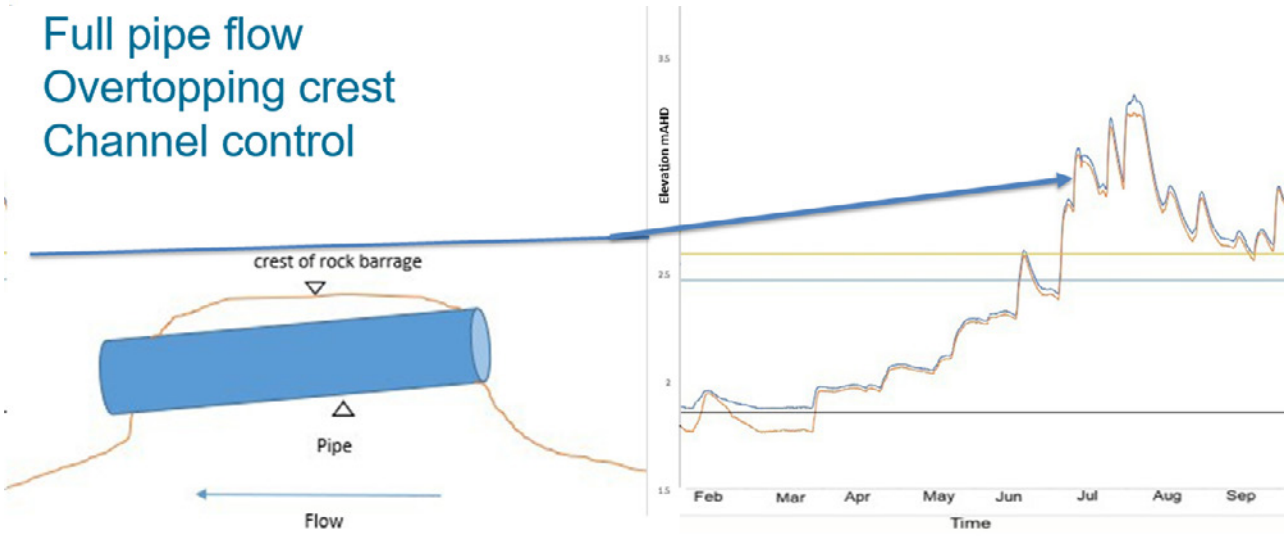
Sep
Time

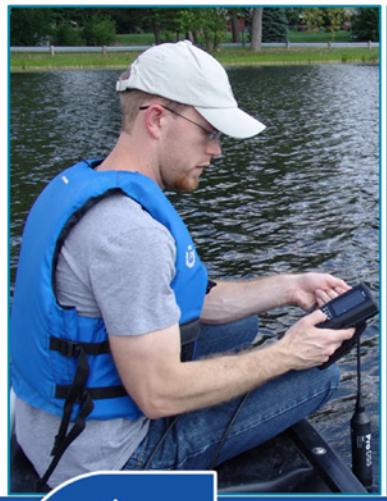
Full pipe flow
Downstream channel control



Full pipe flow
Overtopping crest
Channel control



Our Capabilities: Leaders in Water Quality, Flow & Discharge Instruments



Water Quality Monitoring

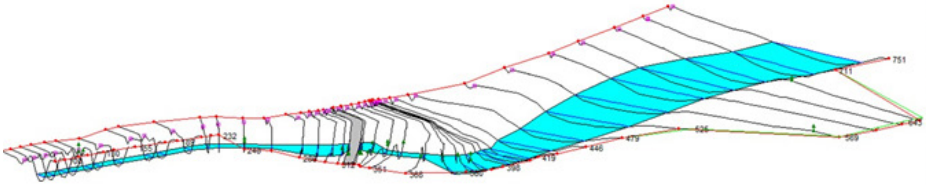
YSI handheld instruments and Sondes are used to collect water quality data across the globe.

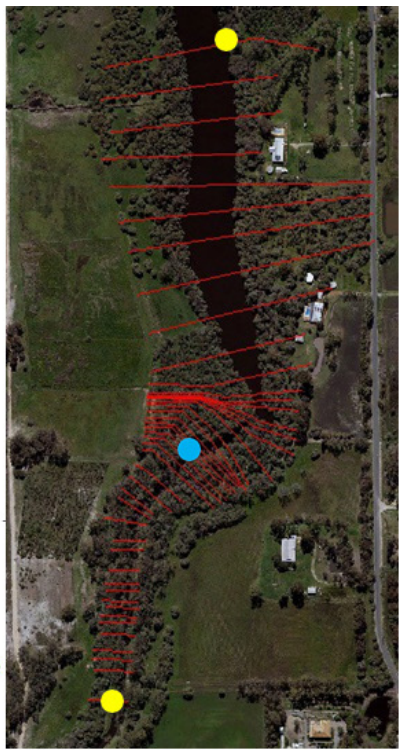
Water Movement – Currents, Waves & Flow

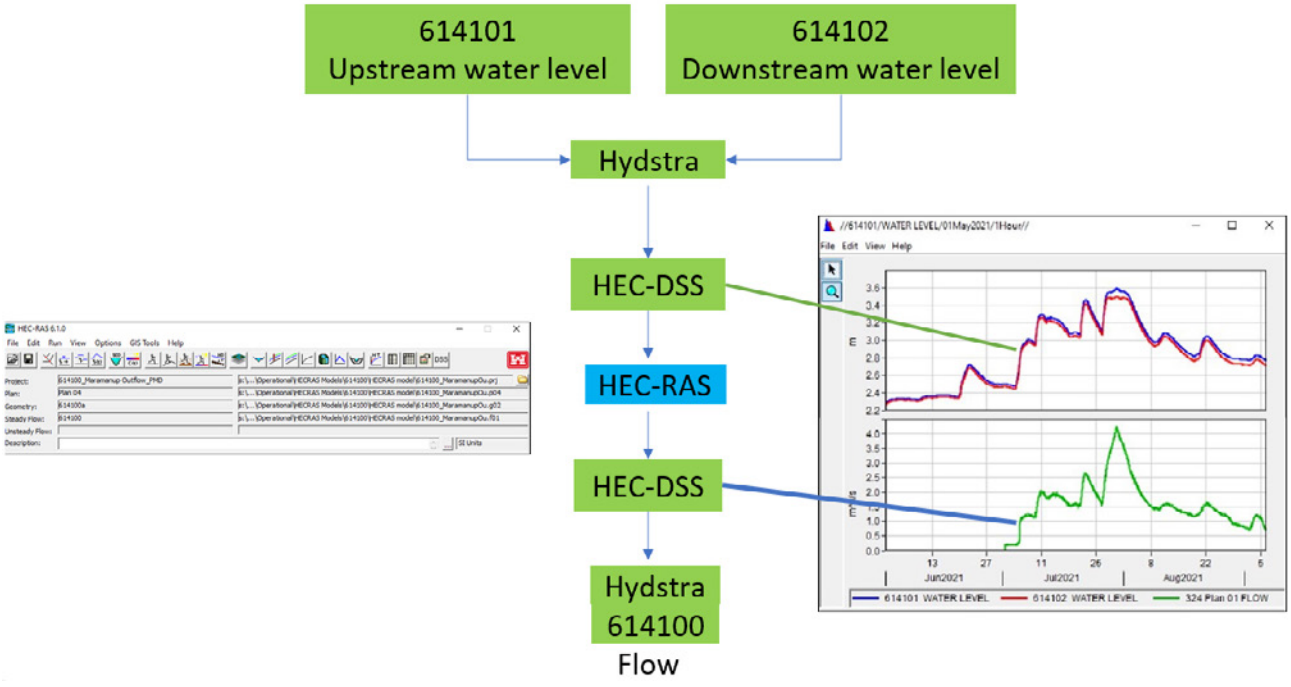
Xylem's portfolio includes instruments that can measure the movement of water in streams, rivers, lakes and even the depths of the ocean.

Modelling Flow

- Fifty cross sections surveyed
- 1D unsteady state HEC-RAS model
- Two water level recorders upstream and downstream used as boundary conditions in the model
- Flow data output at the rock barrage and pipe







Government of Western Australia
Department of Water and Environmental Regulation

The Role of Hydrographer's in Non-Urban Water Metering Reform

Presentation from the AHA Conference 2023. John Hayes – Senior Project Officer Telemetry & Metering (NSW DPIE)

National Commitment to Water Reform

The Roots of the Need for Metering Reforms

- The post-war focus on promoting economic and population growth and creating jobs saw a large expansion in both water storage and irrigation especially in the Murray Darling Basin
- This period of expansion also coincided with a period of increased rainfall and flow from the 1950's through to the mid-1990's
- The confidence engendered by these favourable conditions lead to an overallocation of the available resources and to an increasing awareness of a range of related environmental consequences.

The Roots of the Need for Metering Reforms

The Benefits of All This Include

- Improved protection of water entitlements and environmental water,
- Improved compliance with entitlements, allocations and access conditions
- Better flow event sharing
- Enablement of two-part tariffs, including a consumption-based fee component, with greater equity in cost-sharing
- Increased support for on-farm investment and operational enhancements
- Improved capacity to identify and obtain river system water savings
- Increased support for water plan development and review
- Enabling the protection of environmental flows passing down rivers
- Improving public and investor confidence in the management of water and the integrity of water entitlement systems

Non-Urban Metering and Floodplain Harvesting Measurement

Murray Darling Basin

- The Murray Darling Basin (MDB) makes up 14% of mainland Australia and covers 75% of New South Wales, more than 50% of Victoria, sections of Queensland and South Australia, and all of the Australian Capital Territory
- NSW contains the largest portion of irrigated area in the Murray Darling Basin
- NSW has the largest amount of water use, the largest number of licensed water users, and three of the basin's largest irrigation areas in the state
- NSW and the basin's health are closely linked

NSW Metering Reforms

- In December 2018, the NSW Government introduced a new non-urban water metering (NUM) framework
- In 2022 the NSW began implementation of the Floodplain Harvesting (FPH) policy

Non-Urban Metering Framework

- Non-urban metering (NUM) refers to water taken from regulated or unregulated rivers, and groundwater systems under a water access licence, where the take can be measured by a meter
- It became law in NSW in December 2018 and is being rolled out in stages until December 2024
- This was part of the NSW Government's commitment to improve water management and build community confidence in how the state's water is managed

Metering Staged Rollout Dates

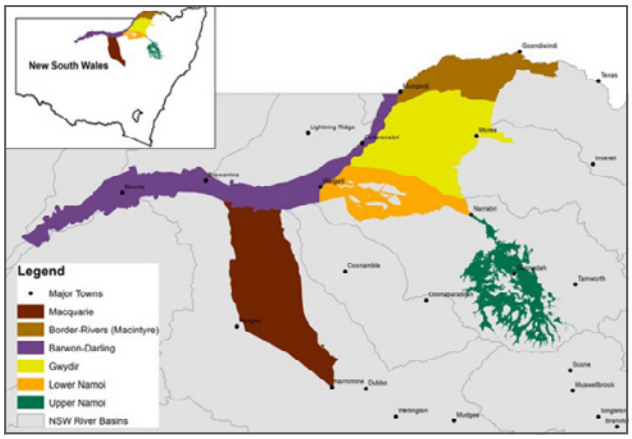
1 December 2020	Surface water pumps 500mm and above in NSW
1 December 2021	Northen inland NSW*
1 June 2023	Southen inland NSW
1 December 2024	Coastal NSW

Existing licence and approval conditions apply until new compliance date comes into effect.

Floodplain Harvesting

- Floodplain harvesting (FPH) is the capture of any water flowing across a designated floodplain, including overbank flow and rainfall runoff
- In July 2008 a new policy was announced regarding the construction of works that facilitate the harvesting of water on a floodplain
- Floodplain harvesting measurement initially rolled out in the **Macquarie and Barwon–Darling** with conditions imposed when floodplain harvesting licences are issued

Floodplain Harvesting Policy Application



Valley	Storage
Macquarie	178
Barwon Darling	86
Gwydir Valley	324
Border Rivers	110
Namoi	447
Total	**1,145**

Landholders have 12 months to install 'primary metering equipment' from when licences are first credited.

Landholders can use 'secondary metering equipment' such as a guage board, if they wish to floodplain harvest during that time.

Key Elements to the Metering Rollouts

1 Use of approved meters/sensors

2 Direct connection of meters to approved loggers with telemetry

3 Data delivery at agreed time intervals in agreed format to the data acquisition service (DAS)

4 Certification of the installation by a Duly Qualified Person (DQP)

5 Use of tamper-evident seals and reporting to deter/detect any modifications

6 Regular maintenance and validation

Duly Qualified Persons

What Does this Mean for Hydrographers

- It is estimated that over 20,000 irrigation meters and 1,200 floodplain harvesting storage meters need to be installed and maintained as these reforms progress
- Duly Qualified Persons (DQP) are needed to install, validate and maintain them
- This includes:
  - Certified meter installers (CMI)
  - Certified Storage Meter Installer and Validator (CSV)
  - Registered Surveyors
  - **Certified Practicing Hydrographers**
- Only Certified Practicing Hydrographers are able to validate and install open channel meters
- All meter systems use technologies very familiar to hydrographers

Training

Australian Hydrographers Association offers one course that:

- will enable a CPH to validate open channel meters in accordance with NSW legislation
- is not an accredited course because of the specialised content.

More information: https://aha.net.au/training/meter-validation/

Irrigation Australia Limited offers two courses:

- Certified Meter Installer and Validator (CMI): 6 units of competency
- Certified Storage Validator (CSV): 4 units of competency

More information: https://ial.associationonline.com.au/certification/certification

Useful Resources

Online Tools for Water Users and Installers

- **Metering and Measurement Virtual Marketplace:** is a web-based tool that will help you find customers in need of installation, validation or maintenance of meters and floodplain harvesting measurement equipment.
  - Hydrographers can register as installers and show registered water users what services they can provide.
- **Telemetry coverage report:** allows water users or DQPs to identify whether a site is within network coverage. If the report shows it is not, the report and a form need to be emailed to the department to be eligible for an exemption.
- **Metering guidance tool:** is an interactive online tool that helps water users understand their responsibilities under the non-urban metering framework.

Information and Resources

- **The non-urban metering document library** contains helpful resources including:
- Policies
- Reports
- Fact sheets

Visit: www.dpie.nsw.gov.au/water/nsw-non-urban-water-metering/document-library

***WaterNSW** has information that can help in the **DQP Portal** (for registered DQPs).*
Visit: https://dqp.waternsw.com.au/Help

Hydrographers are DPQ's

- Certified Practising Hydrographers (CPHs) have an important part to play in both the NUM and FPH reforms.
- Only CPHs are able to validate and install open channel meters
- CPHs can install and validate FPH storage measurement equipment and telemetry
- CPHs can assess the eligibility for FPH point-of-intake measurement

The Department would like to encourage Hydrographers to use their existing skills and knowledge with a technology that is very familiar to them, to assist with the metering rollouts in NSW and to assist water users meet their metering obligations.

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