

Australasian Hydrographer

April 2011



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BILL STEEN

Chairman's Address



It has been a while since the last newsletter as the Association is struggling to find anyone willing to take on the role of Publicity Officer. This is a key position and link between the Associations committee, changes within the industry and you the members. So if you have an interest in journalism we would welcome you to the committee.

In this edition we look at the 2010 Conference that was held in Perth plus the publications of several technical articles along with a little light relief with a USGS article on the Hydrographers Webster Dictionary.

2010 again saw a lot of changes within the Hydrographic industry. These changes in general stemmed from the Australian Government's Modernisation and Extension of Hydrologic Monitoring Systems Program is administered by the Bureau of Meteorology. All the key Australian agencies involved in this funding program took the opportunity to undertake a variety of funded projects in 2010 such as;

- *IP Telemetry Systems Upgrade*
- *Standardisation of Height Datums*
- *Training in Hydrographic Procedures*
- *Continuous Stream Flow and Velocity monitoring*
- *Develop a standard for the collection of discharge measurements using Acoustic Doppler Current Profilers.*
- *Improving the quality of the Linear Hydrography dataset*

It was evident at the Perth Conference the number of projects and improvements as a result of the Modernisation funding project through the various presentations and discussions.

The conference by far was a major achievement and there is a report on the conference in this edition of the journal. Equally to the significant of the conference was the training that the AHA undertook all over Australia. The actual training numbers have exceeded 100 students and this is an enormous accomplishment showing the need and also the support from the industry. Full credit goes to Paul Langshaw, the Hydrography Technical Reference Group (HTRG) and the actual trainers who worked tirelessly presenting course material and marking papers.

The AHA committee is endeavouring to get the journals back on track so hopefully this is the first of several for 2011.

BILL STEEN
Chairman
AHA

AHA Training Update

Hello members,

I last wrote to members via the AHA Bulletin of August last year. Since then the AHA has made a lot of progress in its quest to provide services to its members by way of a standard of basic training courses nationally, as well as the development and pending delivery of the NWP50107, Diploma (Hydrography).

Firstly, with regard to the Diploma course, I asked Scott Walker for an update from OTEN's perspective (see Scott's accompanying article). This is mainly due to the fact I believe the message is better related from the organisation dealing with the issue as opposed to someone like me attempting to translate OTEN's operations.

Scott Walker is the relatively recently appointed hydrography teacher at OTEN. From a personal perspective, I have worked closely with Scott since his appointment, he has realised numerous challenges and I believe has handled these challenges admirably. As Scott is a qualified hydrographer with around 30 years experience working at all levels of this discipline within several water agencies both

in the public and private sector I believe our industry will benefit from his involvement. This is highlighted by the fact that if Scott had not accepted this position, our industry was looking at an electrician or plumber as the hydrography teacher. This is not to downgrade these trades or its teachers but due to hydrography being quite unique in that it requires such a varied range of skills, that to have a teacher with such experience in hydrography is surely an asset.

Now for the Hydrography-Basics course. Over the last 14 months the AHA delivered the Hydrography-Basics course at 13 locations around Australia, resulting in providing a minimum standard of qualification to around 150 people working in the hydrography industry. This course has also trained overseas based members from Thailand and Singapore.

The AHA sees this course as a best practice model of what Professional Associations should be striving to deliver to its members, stakeholders and the industry as a whole by providing an opportunity for hydrographers to gain a standard of training that delivers underpinning knowledge on a national basis.

At this stage there are no more Hydrography-Basics courses scheduled. The main reason for this is that the initial demand seems to have been satisfied. Although, if there are 12 or more participants interested, another course may be staged.

If industry wishes to support further delivery of face to face courses relevant to other sections of the Diploma the AHA is prepared to deliver more courses later this year. The areas which I believe may be of most benefit to students/members would be "develop and maintain ratings" and/or "apply principles of hydraulics to pipe & channel flow" although, the AHA will consult members on this matter to ensure delivery of appropriate material.

The Hydrography-Basics provides four days of theory delivery which culminates in a one day field practical session which provides tutoring and assessment by the industry specialist trainers.

The following is a random selection of photographs taken of some of the students participating in these tasks.

PAUL LANGSHAW
AHA National Training Coordinator





sydney

15/12/2010



sydney

25/11/2010



perth

25/10/2010



10/03/2010



gisborne



gisborne



08/09/2010
adelaide



perth

25/10/2010

NSW TAFE OTEN Update

Scott Walker: Teacher - Hydrography

As you may be aware, OTEN course 3573, the Cert. IV in Hydrography is being phased out later this year. OTEN intends to offer NWP50107 Diploma of Water Operations (Hydrography) progressively from around July 2011.

The following information provides the potential student with information in regards to the progress of the rollout of the new diploma.

The existing course 3573 Cert IV Hydrography

OTEN is taking enrolments up to 30th June 2011. Students enrolled in the Certificate IV will have a further three to four years in which to complete it, or they may swap over to the diploma when it commences. At time of writing the certificate IV 3573 this is the only accredited course in Australia that provides the student with an industry recognised qualification in Hydrography.

However students may wish to swap to the new diploma when it becomes available and obviously they should carry across as many credits as possible for recognition of prior learning (or RPL).

Mapping the RPL across from the certificate IV to the diploma is a major undertaking, and an initial assessment has been carried out. The subjects in the certificate IV that would most likely gain exemptions or RPL in the diploma have been identified in the table below. While some diploma elements of competency may be fully satisfied by existing certificate IV subjects, others are only partly satisfied. In these cases, we are looking at ways in which the missing requirements may be provided or assessed.

The following table shows the subjects that have been initially assessed and is still in the development stage.

NWP50107 Diploma of Water Operations (Hydrography)

It is hoped this course will be available second semester 2011. OTEN could not act upon the diploma until the national water industry training package was endorsed just before Christmas 2010.

We had to wait and see what the packaging rules were for the diploma and what units of competency were available to be incorporated into the diploma. This comes under the auspices of the Australian Quality Training Framework (or ATQF).

A unit of competency can be considered a stream of subjects within a course. Within a unit of competency are elements of competency. These can be considered the individual subject within a course.

A national training package qualification has its focus on students gaining most of their competencies from their workplace. OTEN's primary role is to assess the level of competency of the student. OTEN's secondary role is to provide learning resources to students where there is a gap in their knowledge and skills.

Learning materials from OTEN is to augment and test workplace skills and they are developed buy an independent industry skills council. In the water industries case, that is Government Skills Australia (or GSA). GSA in accord with the AHA

developed learning materials for the new diploma and they have only recently become available. OTEN is now in possession of these materials and we need to develop them to ensure they meet the Australian Qualifications Framework (AQF). As the diploma is at a higher level than the certificate IV, OTEN needs to ensure the learning materials meet the frameworks diploma standard.

The diploma's content and scope has now been agreed upon by OTEN and the AHA. It will be now put up for a TAFE "authority to run" or ATR. Once OTEN is granted the diploma's ATR we can then deliver the course. The content is to follow this model

Two units of competency are core. This means that all students need to undertake these units:

CORE UNITS

PSPSOHS501A Participate in the coordination and maintenance of a systematic approach to managing OH&S

NWP505B Implement & monitor environmental management policies, plans, procedures & programs

To gain AHA Certification at the Associate/Cadet level, the students need to undertake these three units of competency. Note these units don't make up the formal qualifications of the diploma as they are at cert III and cert IV level. They make up what is called a 'skills set'. They can be considered a requisite to undertake the diploma.

SKILLS SET

RTD3507 Undertake sampling & testing of water

NWP420A Install, operate & maintain hydrologic instruments & equipment

NWP421A Collect, measure & process hydrologic stream discharge gauging

These units of competency will be available from OTEN or via the Hydrography Basics Course RPL.

The AHA has indicated to OTEN the following electives from the national training package should be available. The students need to undertake 5 elective units of competency from the list below and the 2 core subject to be granted a Diploma in Water Operations (Hydrography).

ELECTIVES WILL INCLUDE BUT ARE NOT LIMITED TO:

NWP504A Collect & manage hydrological station survey data

NWP508A Apply principles of hydraulics to pipe & channel flow

NWP509A Collect, verify and report hydrological time series data

NWP510A Develop & maintain ratings

NWP520A Contribute to hydrometric planning and water resource management

NWP525B Implement & manage asset construction & maintenance

Not all electives will be available at the start of the diploma. They will be progressively introduced as the mapping is finalised and as materials become available.

So in summary: to attain the AHA endorsed Diploma, students must complete the Core units, the Skills Set and 5 Electives.

Conversely there is no mapping backwards from the Hydrography Basics Course to the Certificate IV course but students can apply for RPL based on any evidence of skills and knowledge obtained. The RPL application should cover all areas of the subject's learning criteria.

See the OTEN Course 3573 webpage for the criteria and tips on how to apply for RPL.

The stronger the case for RPL the easier it is to grant.

NOTE: the following table (next page) is only what has been identified as possible sources of RPL for the new course and is yet to be officially mapped.

If the table is implemented as the path to transfer from the cert IV to the diploma then please be aware that OTEN (like all registered training organisations) will review their operations and delivery of training and services. So it is likely that after any review process the aforementioned model will be subject to change.

If you have completed these Cert IV subjects or the Hydrography Basics Course	You should be eligible for	Recognition of prior learning in the diploma's unit of competency
CORE UNITS		
2991P OH&S	RPL	PSPSOHS501A Participate in the coordination & maintenance of a systematic approach to managing OH&S
To Be Advised (T.B.A.)		NWP505B Implement and manage environmental management policies, plans, procedures & programs
SKILL SET UNITS		
2991P OH&S plus 8004K Water Quality Chemical Techniques plus 8004L Water Quality Lab & Field Techniques OR Hydrography Basics Course plus Work based evidence	RPL	RTD3507A Undertake sampling & testing of water
2991P OH&S plus 8004F Water Industry Basic Instrumentation A plus 8004G Water Industry Basic Instrumentation B plus 8004H Water Industry Specialist Instrumentation OR Hydrography Basics Course plus Work based evidence	RPL	NWP420A Install, operate and maintain hydrologic instruments and equipment.
2991P OH&S plus 8004X Hydrography A plus 8004Y Hydrography B plus Work based evidence OR Hydrography Basics Course plus Work based evidence	RPL	NWP421A Collect, measure & process hydrologic stream discharge data
ELECTIVE UNITS		
8004J Applications of Land Surveying plus Practical evidence (work based evidence or Hydrography Basics survey practical)	RPL	NWP504A Collect and manage station survey data
2991B Engineering Maths B plus 2991AE Pipe and Channel Flow plus 2991AU Hydraulic Mechanics plus Work based evidence	RPL yet to be officially mapped	NWP508A Apply principles of hydraulics to pipe & channel flow
8004A Computing for hydrographers (work based evidence)	RPL But it must match the NWP509A criteria	NWP509A Collect, verify and report hydrometric time series data
8004X Hydrography A plus 8004Y Hydrography B plus 8004R Atmospheric physics & Hydrology plus others T.B.A.	RPL yet to be officially mapped	NWP510A Develop & maintain ratings
8004AA Project –	RPL But it must match the NWP520A criteria	NWP520A Contribute to hydrometric planning and water resources management
2991P OH&S plus 8004H Water industry specialist instrumentation plus 8979P Presenting reports plus others T.B.A.	RPL yet to be officially mapped	NWP525B Implement & manage asset construction & maintenance.

15th AHA Biennial Conference Perth 2010

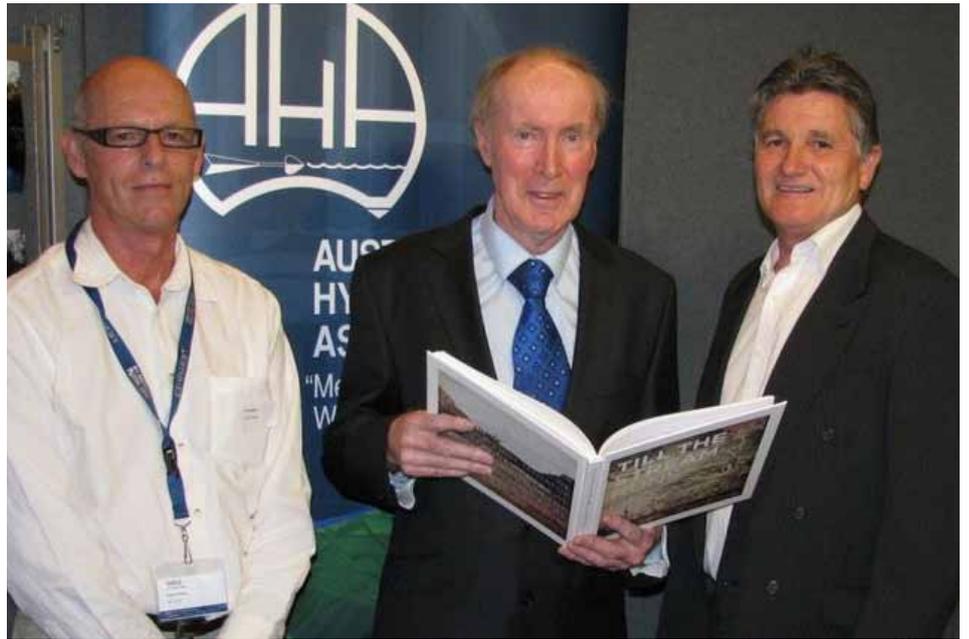
The AHA committee and membership wishes to formally thank the convenors of the 2010 AHA conference held in Perth in October last year.

The Convening Committee consists of representatives from various Hydrographic organisations and companies from Western Australia - Allan Deane (Water Corporation), Greg May (Department of Water), Kelvin Baldock (Hydro-smart) and Russell Marks (Greenbase Pty Ltd), and Michael Whiting (Department of Water).

Those that attended will testify that this was one of the best and by far the biggest AHA conference to date. With every major Australian and New Zealand water authority represented as well as international guests from Singapore, USA, Germany, Philippines and Canada.

The Theme for the Conference is Hydrography - Reflection, Refinement, Resurgence. And this provided the foundations for some very interesting and well thought out papers. The AHA intends to publish these papers in future journals however those that attended should have by now received a DVD containing all the Papers, Presentations with synchronised audio, plus a variety of additional information including photographs from across the three days.

The Alex Miller Award for the best paper presented at the conference went to Mike Harris from the Department of Water WA.



Mike's paper is the feature article in this newsletter – "River Hydraulic Rating Analysis – Using LiDAR and HEC-RAS in the Kimberley Region Western Australia".

The conference dinner was again a highlight with entertainment provided by comedian Rod Quantock of such hits as "Australia You're Standing in It" [ABC TV] and "Fast Forward" [Channel 7]. So if you ever wondered about climate change visit Rod's website <http://www.quantock.com.au>

However Rod was upstaged a little by a well known West Australian who performed a skit on how to have a suit tailor made. No more needs to be said but a picture tells a thousand words (*right*).

Besides the main activities in the conference room the trade exhibition area was well patronised with all the key suppliers to the Hydrographic industry. From both the exhibitors and Hydrographers the trade exhibition was of benefit to all and the AHA thanks all exhibitors for getting involved.

It is also worth noting that all participants received a copy of the "Till the Stream Runs Dry - History of Hydrography in Western Australia" written by Bill Bunbury.

Bill is a former radio broadcaster and producer for the Australian Broadcasting Corporation [ABC], and an accomplished historian and writer.

Bill Bunbury's book was launched by Dr Geoffrey Bolton [Emeritus Professor, Murdoch University Western Australia] at the conference after Bill had undertaken substantial research including interviews with former employees such as Phil Hulbert and Keith Barrett along with a constant supply of information from Greg May.



Perth Conference Field Day

The third day of the Conference was the Field Day travelling to the unique and popular water-centric Peel region south of Perth. The Field Day was well attended with over one hundred delegates travelling in three buses travelling nearly 300km on a well planned day throughout the region.

The first part of the day saw people visit the Western Australian Data Logger and Transducer manufacturer Unidata Pty Ltd in O'Connor, viewing the supply, manufacturing technologies, assembly, quality assurance, and repair processes. This was organised precisely by the Matt Saunders and the people at Unidata to funnel the one hundred plus people through each of the areas of interest.

After Unidata, at each stop an along the route a talk was given by expert presenters on a diverse range of topics and discussions about the various water related projects being undertaken in the Peel area.

The first talk was from Bruce Hamilton (Environmental Consultant) providing an insight into the challenges faced managing the river health of the Peel Inlet, and the major civil engineering



project of building a channel to the sea to help flush the nutrient rich waters from the inlet.

Further along the route, the group stopped at the Harvey River at Clifton Park to hear Ian Tite (Water Data S talk about a BoM funded project to evaluate the ADCP technology in the challenging river conditions at the site, using an innovative mounting system to attempt to maintain velocity measurements at 0.6 of the depth throughout the flow range.

A sumptuous Lunch was had by all, near Pinjarra on the banks of the Murray River at 'Redcliffe on the Murray' followed by a short bus trip to a Forrest Thinning trial in the Wungong River catchment.

Donning their AHA Hard Hats the group moved through the Thinning Trial for a presentation from

Keith Barrett (Hydrologic Engineer), Frank Battini (Forrest Management Consultant) and Michael Lowe (Engineer - Water Corporation), on the efforts to better manage a catchment to yield more water for public drinking supply and balancing that with the environmental sustainability requirements of the forest.

The final talk of the day was by Leanne Pearce (Hydrologist) about the Serpentine River Dam water supply system, and the extreme hydrology modeling undertaken for dam safety.

Leanne's talk rounded out the day well, and was closely followed by a Cocktail Reception at the Café on the Dam overlooking the Serpentine River Dam, with finger food aplenty and a few drinks for all. The Cocktail function provided the delegates with the opportunity to end the Conference on a high note before their long journey home.



NOMINATIONS OPEN

2011 AGM



Nominations for the position of Chairman, Secretary, Treasurer and Publicity Officer are now open.

Michael Whiting who has been extensively involved with the AHA for 10 years has expressed his desire to stand aside this year for re-election. See following notice from Michael.

From the association we wish to whole heartedly thank Michael for his truly professional input to the Association. Michael basically revolutionised the AHA membership database and management of members. In my personal opinion the secretary job is the hardest of the office bearers and Michael has undertaken this role with a passion to ensure members and there wishes are addressed.

Michael was also instrumental in the success of the 2010 AHA Conference in Perth and his efforts were greatly appreciated by all.

We wish Michael all the best and look forward to catching up with Michael at future gatherings.

“All,

I would like to flag with the Committee (six months in advance) that I will not be filling the role of Secretary beyond the next AGM, nor standing for a position on the Committee. This should provide sufficient time for resolving outstanding tasks, finalising paperwork, hopefully finding a successor to fill this role, and handover. I will manage the renewals process for the next Financial Year, which should allow the changeover to occur smoothly.

I have been with the Committee for ten years, and taken on the role of Secretary for over five years, and feel that the time is approaching for me to step aside.

It is has been a very exciting period, and I have seen a lot of changes in the Association which culminated in the convening of perhaps one of the most successful Conferences ever held by the Association, and the membership now soaring from 75 to 400+ Members.

Beyond the AGM, I wish to devote my valuable time my family, and my career”

- Michael Whiting

HUMOUR

The Hydrographer Webster

Unknown Author [USGS Source – some Australiana corrections made]

HIP BOOTS: A device used to keep Hydrographer feet wet.

BOOTS, WADERS: same as HIP BOOTS, but keeps more than feet wet.

BRIDGE: A structure used for blocking traffic, entertaining the natives, and air drying Hydrographers.

BRIDGE BOOM: Intricacy of structural steel, brass, cast iron, rubber, and stuff, which Hydrographers hang meters on and predict floods with, also used to hold down the rear end of field vehicles.

CABLE CAR: An object usually found at the centre of a stream. An amusement ride for locals and other people equipped with a hacksaw and/or bolt cutters. **WARNING:** Device has been known to devour fingers.

CRANK: Part of a reel. Used as a sledgehammer, crow-bar, snake-killer, and bottle opener.

EXCELLENT RECORD: Period of no flow

FLOOD PEAK: An event occurring six hours before the arrival of a stream gauging party

GAUGE: Stuff on river banks that the public call USGS offices about during floods. (see recorder).

JUSTIFIABLE HOMICIDE: The permanent silencing of anyone kittenishly asking: (a) “are you talking to the fish?” (b) “getting any bites” (c) “what’re yuh doin’ that fur?”

GAUGE READER: An abnormal subhuman species usually found along rivers and characterized by inability to read or write, large appetite and small capacity for alcohol, and a habit of hiding from observation during floods.



HOME: See terra incognito.

MEALS: Consist of breakfast (5-am), lunch (3pm) and dinner (a cold collection about 9pm)

METER: (1) An instrument requiring the care usually given an invalid infant, the finesse of a jeweller, and the ingenuity of a sound effects man. Usually given the care accord an abandon barge, the finesse given a gondola car in the freight yards, and about enough ingenuity as would be required to stand under a downspout to keep dry. (see “care and feeding of current meters, “ TWRI, Book 3, Chapter A8).

OFFICE: A place used for computing measurements, making out travel vouchers, making out accident reports and telephoning (a) the wife, requesting a suitcase packed, (b) the girlfriend that the dance is off, or both a and b.

RAINDROP: A small globule of water, formally streamlined, now usually battered out of recognition by encountering rain gages, current meters, water stage recorders, or Hydrographer hats.

RATING CURVE: A diagram used in technical arguments. Based on (a) thousands of dollars worth of field observations, or (b) twenty-five cents worth of log paper. Either one can cause arguments.

REEL: Stuff used for raising and lowering current meters, physical exercise, and intelligence tests for prospective electricians and mechanics.

GRAPHIC RECORDER: A machine for keeping records of gauge height on paper, which automatically stops during floods.

DIGITAL RECORDER: A machine designed to shred paper, destroy batteries, and manufacture confetti. Normal operational life is about 1 week.

ROAD LOG [AUSSIE MAD MAP]: Directions to gauging stations never used by anyone except the novice Hydrographer. If followed precisely, you will (a) become lost, (b) get stuck or (c) arrive at a local bar.

SOUNDING WEIGHTS: Equipment designed by the Spanish inquisition fabricated by Mephisto, christened by Lady Macbeth, and used for ballasting trucks, exercising Hydrographers and keeping meter cables in the path of floating drift.

SPARE PARTS: Any hardware not wanted by any other section.

STREAM GAUGER [HYDROGRAPHER]:

A morose individual seeing, measuring, soaked in, governed by, marooned by, bedevilled by, but unaccustomed to drinking, water. Reference : Any standard test on abnormal psychology.

STREAM GAUGING: An outdoor sport played by a team of three people or less. A combination of auto racing, water polo, basketball, weight lifting, lumbering, mining, and farming. Scoring is as follows:

- Getting cut off on phone25 point penalty
- Getting wet to knees normal, no score
- Getting wet all over.....25 point bonus
- Starving normal, no score
- Missing flood crest disqualification
- Losing current meter death penalty

TELEMARK: Combination gauge, telephone exchange, broadcasting studio, and means of rendering telephone operators insane wondering what is answering the phone.

INDIRECT MEASUREMENT OF DISCHARGE: Determination of discharge of a stream for which field data is gathered at the local motel bar.



River Hydraulic Rating Analysis

Using LiDAR and HEC-RAS in the Kimberley Region, Western Australia

Michael Harris and Leith Bowyer,

Department of Water, Government of Western Australia

1. Introduction

The use of river hydraulic analysis is well established in engineering hydrology for use in flood studies, and more recently in determining environmental flows. Analysis of river hydraulics is also important in understanding how to reliably estimate and measure river flows at gauging stations. Historically, river flows have been measured in a number of ways, most commonly with current meters and more recently quantified using hydraulic models. These models fundamentally depend on defining river channel geometry, river slope and channel roughness.

Flow analysis at gauging stations using hydraulic models has not been widely used. Recently, a number of river reaches in the Kimberley were surveyed and the flow modelled to substantiate existing and to develop river flow rating curves. Reliable rating analysis for gauges in the Kimberley

has historically been limited by technical, operational and funding / resourcing issues.

The river hydraulic rating analysis focused on defining or verifying the rating curve for mid to higher flows measured by the gauge. The gauges used in the hydraulic rating analysis ranged from river reaches with a simple channel geometry and channel roughness including a main channel with a uniform bed material and regular banks and overbank flow, to very complex channel geometry and channel roughness including a main channel with extra channels or distributaries on the floodplain.

The focus of this paper is to discuss the applicability of Aerial Laser Survey (LiDAR) and RTK surveying technology, in the development of stage/discharge rating curves at gauging stations. The following approach was trialled at 9 gauges across three general geomorphic

features commonly found in the Kimberley. These were:

- simple channel and overbank situation,
- gorge complex and
- main channel with distributary floodplain system

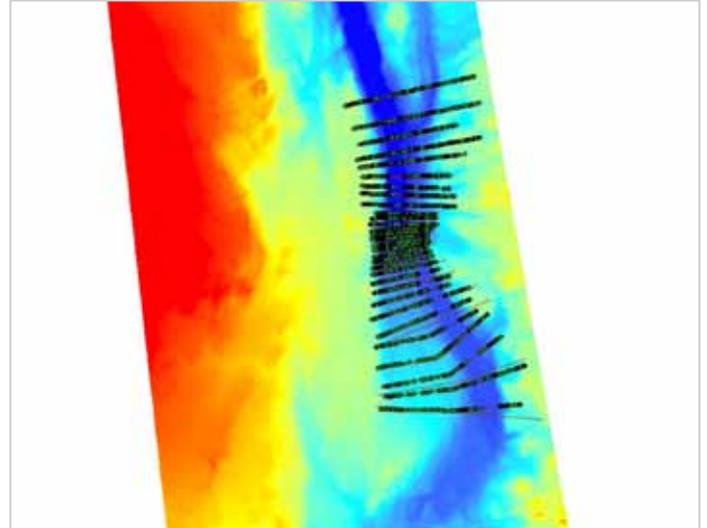
2. Methodology

The same approach and methods were used for the nine Kimberley gauging station reaches, where LiDAR and RTK survey data was used to develop a 1-D hydraulic model using HEC-RAS.

The XYZ Aerial Laser Survey (ALS) data captured was separated into ground and non ground data and processed into a 1 m x 1 m grid, A Digital Terrain Model (DTM) / Digital Elevation Model (DEM) was created to define the geomorphic features of the river such as channels, banks, rock bars, gorges, floodplains and cultural



Figure 1: DTM for the King Edward River gauging reach with cross sections and cross section points located



attributes such as bridges. A number of control points located in the footprint area were used to calibrate the XYZ data.

Cross sectional data was extracted from the DTM's, compared to others obtained from the RTK surveys and then used in the HEC-RAS hydraulic model to produce a stage/discharge rating curve for the gauge.

2.1 GEOMETRIC DATA

The gauging reaches to be surveyed were defined after analysis of the available aerial and satellite images and water level data recorded at the gauge. Local records and knowledge were also used to assess the extent of the area to be covered. River reaches of up to 10 km were identified for the ALS surveys. This work and knowledge of the ALS capability provided the basic specifications for the project to produce DTM's. This LiDAR data capture project was funded under the Bureau of Meteorology's Modernisation and Extension of Hydrological Monitoring Program.

A contractor was utilised to collect, process and produce the XYZ ground data by airborne laser scanning involving the ALS50-II-M technology, also known as Light Detection And Ranging (LiDAR). The ground data was processed to within a relative elevation accuracy of 0.15 m for clear flat ground.

The XYZ ground data grid was used to create a DTM of the river channel and floodplain from which surface contours were produced using 3D and spatial analysis tools in ArcGIS.

Contour intervals between 0.2 and 0.5 metres were produced depending on the channel and floodplain definition required.

The DTM, surface contours, aerial photographs and/or satellite images were analysed with local knowledge and experience of the river to select the appropriate cross sections for the model river reach. The number of cross sections identified and used exceeded 30 for some gauges (*Figure 1*).

Simple computations were made for data required in the geometric and structure files of HECRAS. Where available, cross sections extracted were compared with cross sections derived from traditional stadia techniques and more recently surveys using Real Time Kinematics (RTK). (*Table 1, Figures 8-11*). In addition, the roughness condition of the channel was assessed by characterising the river reach into typical features to estimate the Manning's number using the Cowan method. Based on these typical river reach features- such as deep pools, open sandy bed, open grassy/spinifex ground, cobble over bank ground, vegetation, etc, roughness numbers were evaluated and distributed across the cross sections.

2.2 MODEL DEVELOPMENT AND SET UP

Hydraulic models were developed for simple channel and overbank; channels with gorges; and channels with floodplains. Some models were developed with levees and ineffective flow areas in the geometry to

represent the expected flows through distributaries across a floodplain and natural features such as gorges. At one gauge, several models were set up to assess the effect of flows from downstream tributaries on the gauge rating curve. These model runs provided an understanding of the possible rating uncertainty for combined peak flow events.

The models were run for a subcritical flow in steady flow analysis with a normal depth flow boundary condition. The model calibration varied and depended on the extent of discharge measurements collected for each gauge. Most gauging stations had some discharge measurements to support the calibration of the model rating, although most of those discharge measurements were in the low to medium flow range and not recent.

Those gauges without this evidence-based rating curve data (no discharge or slope measurements) had models developed using Manning's numbers established from models for gauges with similar channel condition features that had good calibration data. It is expected models without this evidence based rating curve data will be calibrated when reach slopes are measured for various peak flow events, and/or discharge measurements are undertaken. Vertical variations in roughness were input into the models where it was assessed this to be the most likely scenario.

3. Results and Discussion

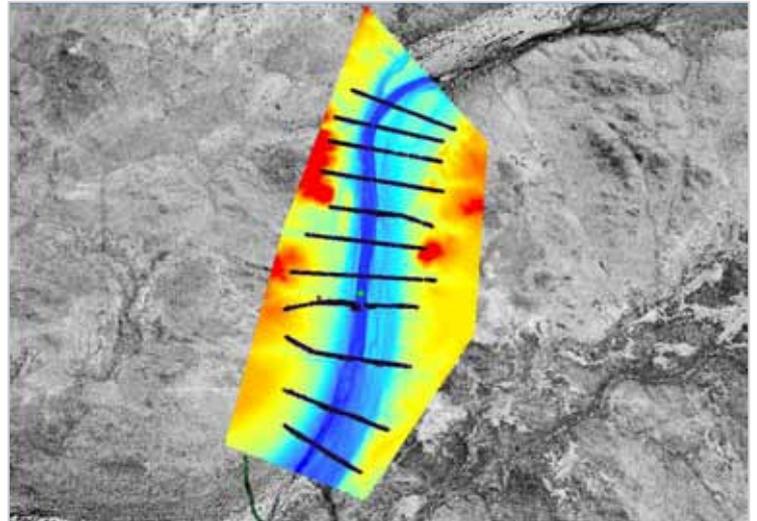
The focus of this section of the paper is to examine the results of 3 individual gauges that represent the 3 common geomorphic features as listed in the Introduction.

3.1 GEOMORPHIC ATTRIBUTE 1 - Simple channel and overbank (Leopold River at Mt Winifred Gauge)

This gauging station selected had a rating curve based on well-measured flows using current meters. A comparison was made between the measured flow and modelled flow rating and is briefly explained below. The Leopold River, a major tributary to the Fitzroy River, has a gauge (802202) operated for the purpose of flood and water assessment. The gauging reach is typically contained in a straight main channel of sand and cobbles with banks of sand stabilised by fringing riparian vegetation, and an over bank of consolidated rocky material overgrown with grass (spinifex) and sparsely distributed, poorly structured tree cover.

Although the gauging station has operated for 23 years, flow measurements have been few and were predominantly collected during a significant flow event in the wet season of 1986/7. These flow measurements are the basis for the gauging station's current flow rating. Eighteen good discharge measurements from low to high flows had been collected. The highest flow measured was 2,500 m³/s (16m SL). In February 1991, the gauging station recorded the highest water level of

Figure 2: DTM for the Leopold River gauging reach with satellite image, cross sections and cross section points located.



21.955m SL, almost six metres above the highest discharge measurement.

Eleven cross sections extracted from the DTM (Figure 2) were used in the HecRas model. The channel geometry included a rock bar configuration that controls the very low flows. The Manning's numbers for each channel cross sections were derived using the Cowans Method. Elements of channel roughness in terms of 'n' were assessed and based on material, irregularity, cross sectional variation, effect of obstructions, vegetation and meander. Horizontal and vertical variations in 'n' were compiled for each cross section and iterations made to fine tune the calibration of the flow relationship with river height.

Cross section points extracted from the DTM were compared with the points collected by the RTK for the 'same' cross sections. The cross section identified on the DTM was aligned with the RTK surveyed cross section as best as possible.

The results of the comparison are shown in Table 1 and individual cross sections and area curves for the 'same' section of channel are shown in the following figures (Figures 6 to 9).

This indicates some discrepancies in area between the RTK and LiDAR cross sections. at some stages of river level. The effect of this discrepancy has not been further researched at this point, however it is believed to be relatively minor and results from the differences in collection method and processing of data. Briefly, the LiDAR data was collected and processed indiscriminately, ie (numerous) straight cross sections and numerous points. The RTK data was collected manually picking up key features both on and slightly offset from the cross section. Most likely as a result of the lower number of points collected and calculations made for chainage offset, some discrepancy was observed.



Figure 3: Main Channel – Typical view of cross sections upstream of the low flow control on the Leopold River in the gauging reach $n=0.0485$



Figure 4: Main Channel – Typical view of cross sections downstream of the low flow control on the Leopold River in the gauging reach $n=0.0485$



Figure 5: Over Bank Channel – Typical view of cross sections on the Leopold River in the gauging reach $n=0.1$

TABLE 1

Cross Section	% difference in total area for the area curve extremity	Greatest % difference in total area for a stage in the area curve
LiDARc1	0.0	0.0
LiDARc2	2.3	2.3
LiDARc3	2.4	28.1
LiDARc4	18.1	18.1
LiDARc7	17.9	17.9

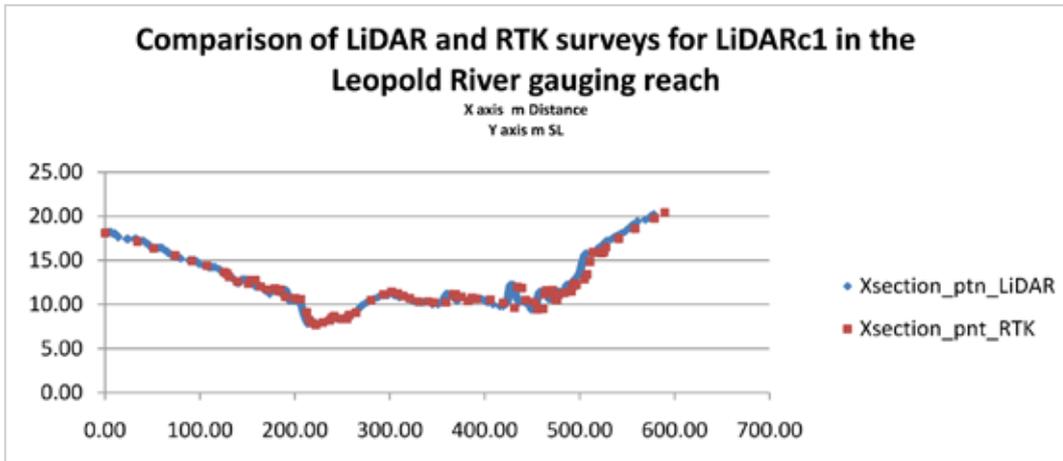


Figure 6: Comparison of LiDAR and RTK surveys for cross section LiDARc1

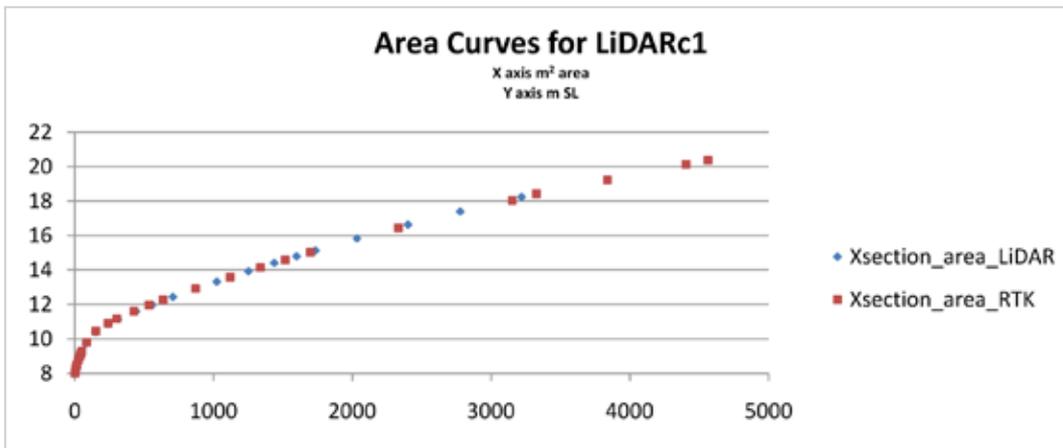


Figure 7: Area curve for cross section LiDARc1

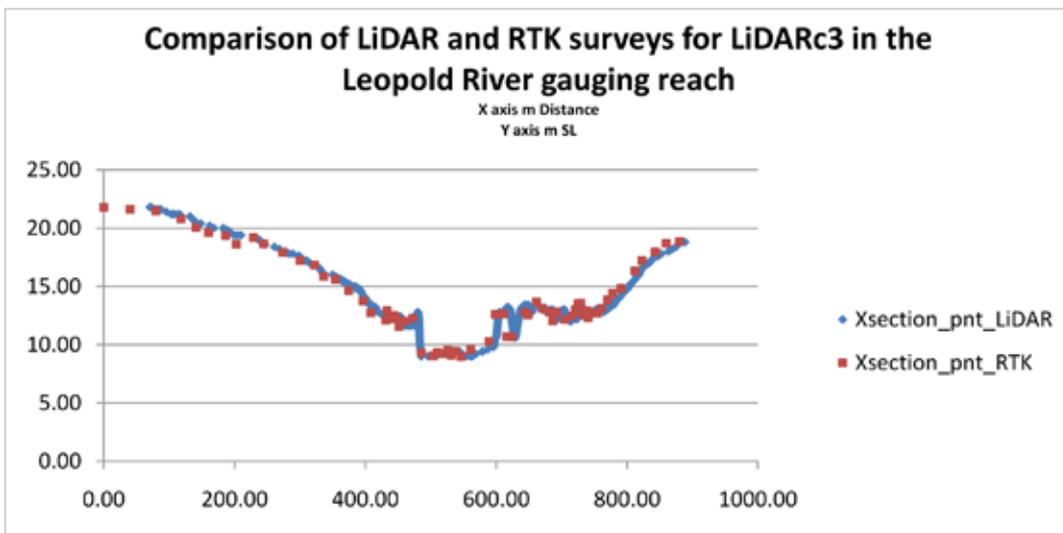


Figure 8: Comparison of LiDAR and RTK surveys for cross section LiDARc3

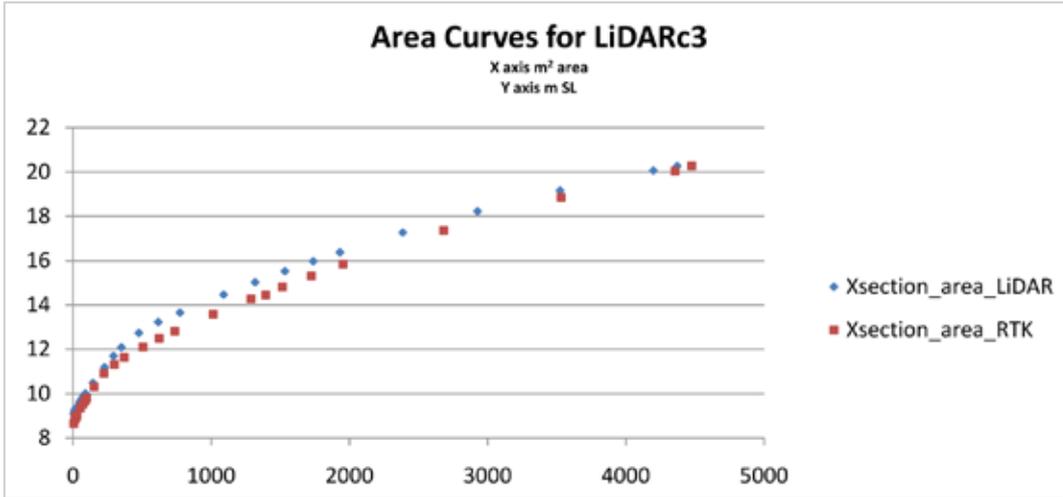


Figure 9: Area curve for cross section LiDARc3

The result of the model calibration with discharge measurements is shown in Figure 10. The gauged rating curve had been “straight-line” extrapolated above 16 metres using a Q2/5 method.

The modelled rating curve produced is similar to the rating curve in the gauged range.

From this analysis it appears that the model can be used to calculate the rating points to extend the rating curve with some confidence.

An assessment of the gauge’s time weighted stream discharge duration and flow weighted yield curves (Figure 11) has the flow rate exceeding the highest measured flow rate (2,500 m³/s) for only 1% of the time (red graph) and 10% of total flows (blue graph).

The opportunity for collecting discharge measurements in this flow range is extremely low and extension of the rating above the highest discharge measurement based on the modelled rating curve appears worthwhile.

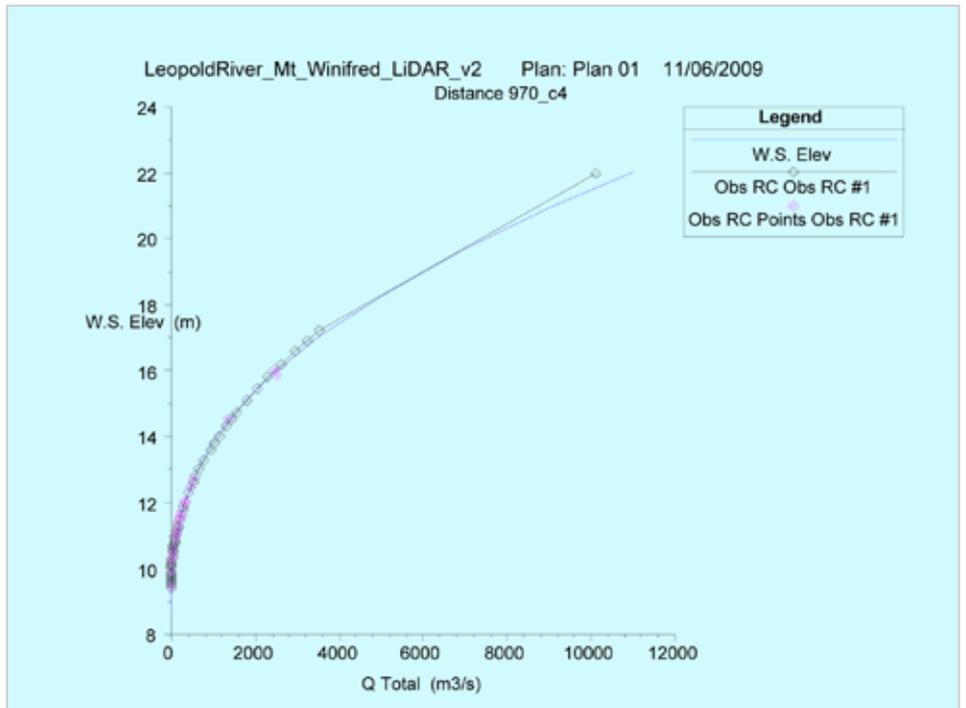


Figure 10: Rating curve for the gauge on the Leopold River showing model rating curve (blue) and rating curve (black) developed from the discharge measurements (pink) completed in 1986/87 wet season.

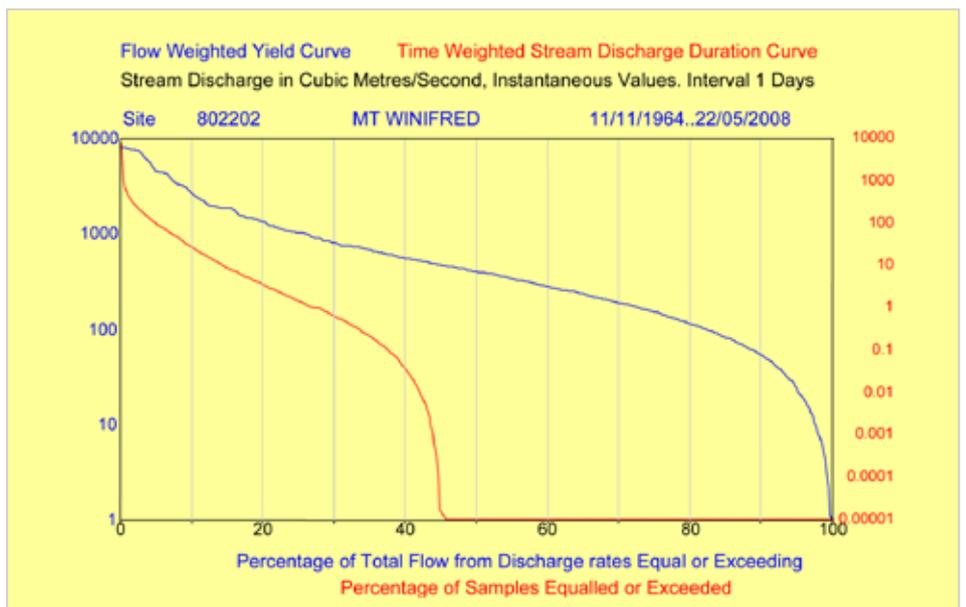


Figure 11: Flow weighted yield curve (blue) and time weighted discharge duration curve (red) for the gauge on the Leopold River.

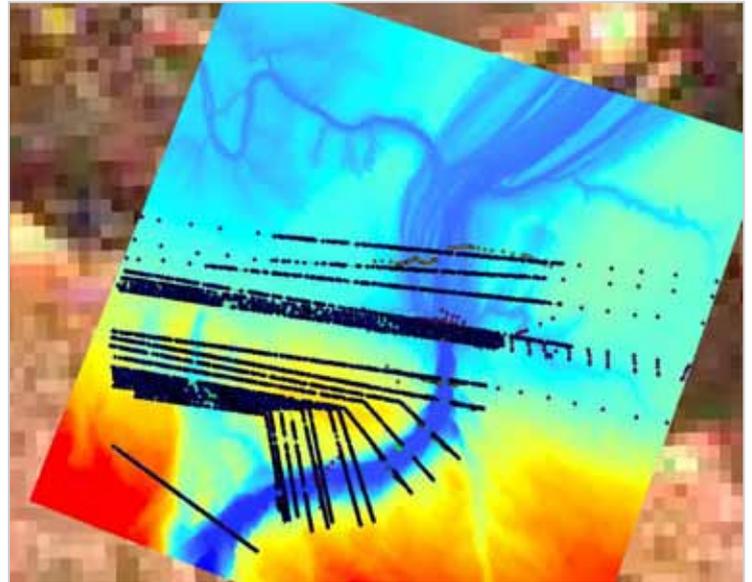
3.2 GEOMORPHIC ATTRIBUTE 2 - Gorge Complex (Hann River at Phillips Range Gauge)

The gauging station at this site has a rating curve defined for the lower flows by discharge measurements and these had been used to estimate flows by a ‘straight line’ extrapolation using Q2/5 transformation. A comparison was made between the measured flow and modelled flow rating and is briefly explained below.

The Hann River, a major tributary to the Fitzroy River, has a gauge (802213) operated for the purpose of flood and water assessment. The gauging reach has a channel set in a gorge with its approach flows draining from an upper floodplain with a main channel. The upper main channel comprises of a sandy bed with banks of sand stabilised with fringing vegetation. The upper floodplain is grassed and has an open distribution of trees with some density. The lower channel is set in the Phillips Range and its geometry is entirely within a gorge.

Although the gauging station has operated for 44 years, flow measurements have been few and most were collected in the 1970’s and 1980’s. These flow measurements are the basis for the gauging station’s current flow rating. Twenty good discharge measurements had been collected. The highest discharge measurement was a flow of 245 m³/s (13.7 m SL). In February 2002, the highest water level was recorded (24.4 m SL), almost eleven metres above the highest discharge measurement.

Figure 12: DTM for the Hann River gauging reach with satellite image, cross sections and cross section points located.



Twenty two cross sections extracted from the DTM (Figure 12) were used in the one-dimensional HEC-RAS model. One of these cross sections included the control for the low flows, a natural rocky shelf set within the gorge. The Manning’s numbers for each channel cross section were derived using the Cowans Method. Elements of channel condition in terms of ‘n’ were assessed and based on material, irregularity, cross sectional variation, effect of obstructions, vegetation and meander. Horizontal and vertical variations in ‘n’ were compiled for each cross section and iterations made to fine tune the calibration of the flow relationship with river height.

The result of calibrating the model rating to the lower discharge measurements is shown in Figure 15. The gauged rating curve had been “straight-line” extrapolated above 14 metres using a Q2/5 method.

The modelled rating curve used to extrapolate the gauged rating will require evidence based data (discharge measurements and or slope data) for further calibration and to provide confidence in the extended part of the rating curve.

An assessment of the gauge’s time weighted stream discharge duration and flow weighted yield curves has the flow rates exceeding the highest gauged flow rate (245 m³/s) for only 3% of the time and 52% of total flows. The opportunity for collecting discharge measurements in this flow range is low however rating curve validation is important due to the significance of total flows above this measured flow. Further calibration of the model rating curve using evidence based data will be worthwhile.



Figure 13: Main Channel – Typical view of cross sections upstream of the gauge on the Hann River, n= 0.036



Figures 14a and 14b: Main Channel – Typical view of cross sections downstream of gauge on the Hann River. n= 0.036
Rocky bank n= 0.07



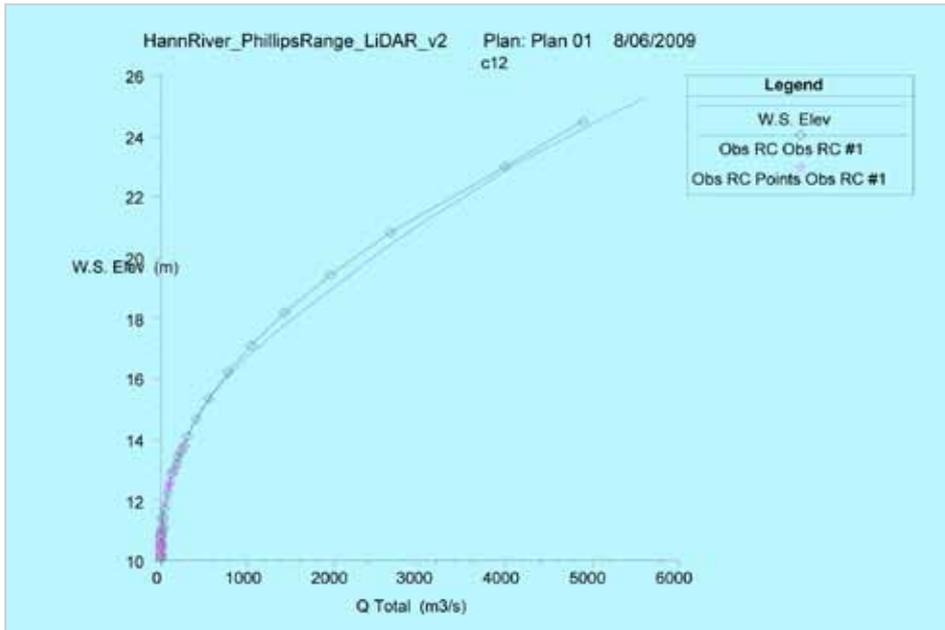


Figure 15: Rating curve for the gauge on the Hann River showing model rating curve (blue) and rating curve (black) developed from the discharge measurements (pink) completed in 1986/87 wet season.

3.3 GEOMORPHIC ATTRIBUTE 3 - Main and extra channels in floodplain

(Fitzroy River at Looma Gauge)

A gauging station on the lower Fitzroy River was selected to develop a rating curve. The gauge (802007) was built in 1997 on the floodplain of the lower Fitzroy River for the purpose of flood assessment and warning.

A rating curve was not thought to be possible without substantial effort to collect discharge measurements and floodplain surveys across an 8 km reach of the river. It was found that in 1987 and 1991 four discharge measurements at nearby Myroodah Crossing were carried out for the Great Northern Highway bridge, floodway and levee designs across the floodplain and main channel near Willare. Myroodah Crossing is only 5 km upstream of the gauge and these discharge measurements were used to check and fine tune the calibration of the model rating curve.

The gauging station is located on the floodplain adjacent to the main channel and records water levels well within the floodplain. The floodplain is made up of numerous complex extra channels with a main channel generally much deeper. The main channel comprises a sandy bed with banks of sand stabilised with fringing vegetation. The floodplain is grassed and has an open distribution

of trees with some density. Although the channel geometry is very complex, the higher flows are well connected across the floodplain to a depth of about 3 to 4 metres. The river floodplain was characterised with two types of channel features identified as a wide, open regular sandy main channel and a wide, grassy, undulating floodplain with clusters of trees. Floodway roughness defined for the higher flows was mainly influenced by floodway irregularity and vegetation. Only minor adjustment to the Mannings numbers was required to obtain a good fit with the discharge measurements. It was found that flows above 4,000 m³/s (~16.7 m SL) are well connected across the floodplain. The main channel is about 100 m wide and 7 metres deep and forms part of the floodplain channel irregularity along

with the channel distributaries when the floodplain becomes a floodway. These channel distributaries in the floodplain can be up to 5 metres deep. *Figure 20* shows the floodway and channel depths.

Eighteen cross sections extracted from the DTM (*Figure 16*) were used in the HEC-RAS model. Each cross section of the floodplain and its main channel was assessed to determine the Mannings roughness number from combining the channel conditions using the Cowans Method.

Seventeen discharge measurements have been collected at this gauge in the low flow range. These and the high flow measurements collected at Myroodah Crossing were used to calibrate the model rating to develop the gauge rating.

Figure 16: DTM for the Fitzroy River gauging reach with satellite image, cross sections and cross section points located. The pink line is the gauging section for the 1987 and 1991 discharge measurements.

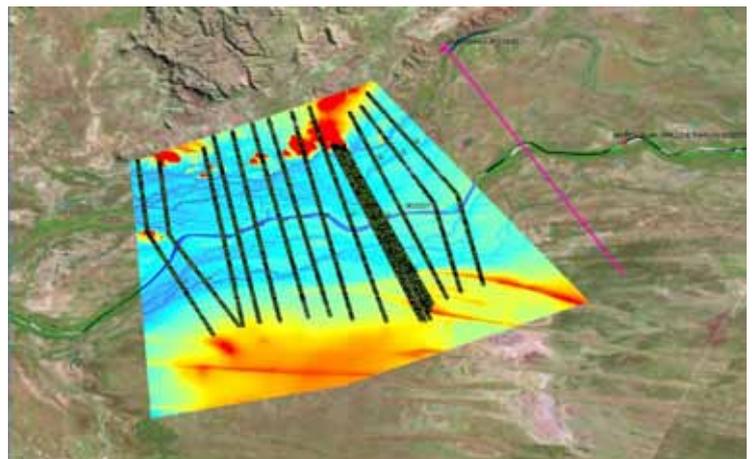




Figure 17: Typical view of the gauge pool in the main channel n= 0.035

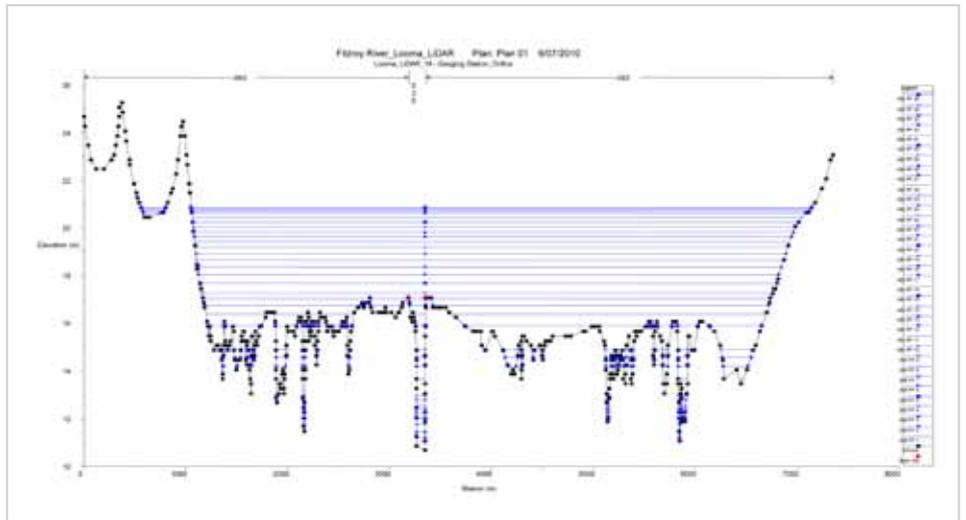


Figures 18: Typical view of the floodplain in the gauging reach n= 0.042



Figures 19: Typical view of the floodplain in the gauging reach n= 0.042

Figure 20: Gauge cross section on the Fitzroy River showing floodway flow depths.



The highest discharge measured by current meters during the gauge’s operation is a flow of 205 m³/s (12.7 m SL). The discharges measured at Myroodah Crossing were flows of:

1. 7,536 m³/s (17.587 m SL),
2. 14,923 m³/s (18.778 m SL),
3. 13,024 m³/s (18.57 m SL) and
4. 17,749 m³/s (18.952 m SL).

The highest recorded flow (based on the new rating curve, *Figure 21*) is about 14,500 m³/s (~18.74mSL) which is significantly less than the discharge measured in 1991 (17,749 m³/s) for the floodway design studies. The flow rates produced by the rating curve between 13.5 m SL and 16.7 m SL are uncertain as the model set up was simple and does not account for the complex array of extra channel levees and ineffective areas.

The annual and peak flows modelled for this gauge have been compared with the flows from gauges at upstream and downstream sites.

Any further development in the rating curve will depend on the use of other available modelling tools, as well as discharge and slope measurements collected. Site access and access across the floodplain during high flows is limited and as such discharge measurements in this range will be difficult to obtain but worthwhile.

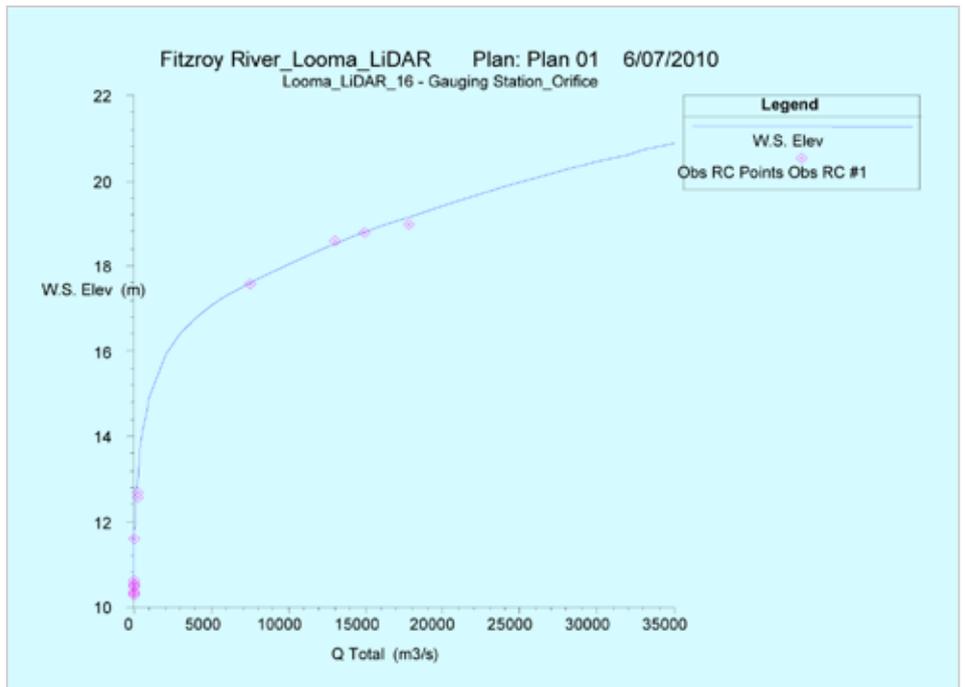


Figure 21: Rating curve for the gauge on the Fitzroy River showing model rating curve (blue) and discharge measurements (pink).

3. Conclusions and Discussion

The application of the methods used in this paper at the gauges in the geomorphic features described has increased our knowledge and understanding of the potential uses of this technology. Variations in the results of different modelling scenarios at the 9 gauges have indicated some areas where the approach appears to be more reliable and in other areas where more research or evidence is required.

Attributes where the method appears to be more reliable are at:

- Simple channel and overbank
- Uniform/simple gorge
- Uniform channel and floodplain
- Medium to higher flow ranges

Attributes where more research or evidence appears to be required are at:

- Complex gorge / Complex rock bar
- Low to medium flows in complex channel floodplain
- Lower flows in general, where channel roughness may have more significance compared to channel geometry
- Sites with a lower number of available or applicable cross sections

Other potential limitations include having a lack of available calibration data. This data, such as slope and discharge measurements, the change to cross sections and accurate channel roughness, needs to be monitored over time, especially for geomorphic features susceptible to cut and fill processes– eg changes to roughness (vegetation) or channel geometry (scour, erosion, deposition).

Advancements in the LiDAR technology, lower cost and increased availability has enabled it to become more cost effective as a tool to assist in rating table development at gauges in the Kimberley and elsewhere in Western Australia. There is also potential for data from projects such as the 1 second DEM to be used.

The use of DTMs and hydraulic models together are a significant advancement in river rating analysis, but it should not be assumed that this will produce a reliable, accurate and long-lasting rating curve. The process described in this paper brings together technical skills and experience in GIS, spatial and hydraulic modelling, as well as more traditional skills in rating curve development. The introduction of modelling using HEC-RAS or other hydraulic modelling tools for rating

analysis is expected to enhance gauge establishment and operation. This is significant, especially in more remote areas of the state where existing methods of rating such as obtaining discharge measurements can take many years (possibly never). Channel flow and gauge height sensitivity, gauging reach stability, flow rating reliability and effect of geometric features on flows can be better understood through the use of these models.

The value of evidence based rating data will increase when used in a modelling approach such as the one described here. It is expected models without this evidence based rating curve data will be calibrated when reach slopes are measured for various peak flow events, and/or discharge measurements are undertaken. It should be viewed as an ongoing process.

There is a need to tie all of the above methods into a rating strategy for the site or region taking into account priorities, funding, resources and individual site requirements (eg accuracy and site access).



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Development of ADCP deployment equipment to optimise their performance for Tasmanian conditions

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Gauging rivers has always presented the Hydrographer with a variety of challenges, but at the end of the day high quality measurements taken over a wide range of stage heights has always been the goal. The relatively recent introduction of ADCP devices to determine discharge has, in general, improved measurement accuracy and reduced the time required to make these measurements, however the fundamentals of “taking a good gauging” haven’t changed.

In Tasmania, we face two main challenges; gauging large, slow rivers often in windy conditions, and smaller but very fast, turbulent mountain rivers. All gauging scenarios need to be handled with the least amount of equipment possible, meaning the equipment must be compact and robust whilst being adaptable and effective in all the conditions encountered on a typical field trip. Our gauging stations fall into two categories, large river installations with permanent cableway systems where access to the opposite bank is generally not possible, and smaller rivers without cableways where it is generally possible to access the opposite bank via a nearby road bridge. A typical field trip would include wade gaugings and several boat-based gauging. In flood conditions gaugings are frequently taken off bridges or on temporary cables. Much of the work is “seat of the pants” stuff with transects being selected on the day, depending on the conditions encountered. Irrespective of conditions, method and how “you beaut” your gear is, a good,

repeatable gauging is still dependent on the operator’s ability to accurately locate the instrument on the transect to take the necessary representative measurements.

In early rounds of BoM funding we were successful in gaining grants to purchase several ADCP instruments, initially three SonTek River Cats and, more recently, two M9 ADCP’s. All were supplied with proprietary platforms, Ocean Science tri-hulls and Hydroboards respectively. These instruments immediately proved to be impressive in their accuracy and time-efficiency, compared to propeller based systems. These factors have allowed a significant improvement the development of our discharge rating curves in a relatively short amount of time.

While the light and compact nature of this technology has obvious benefits in the ease with which these instruments can be transported and deployed, these same attributes create a new set of problems that need to be addressed if ADCP’s are to be used optimally. In our initial work with vessel mounted ADCP’s our standard deployment method was to attach the vessel to a single tether. When deployed by this method, these vessels have a tendency to “swim about” in all but quite high velocities. In low flow conditions, we initially attempted to overcome this problem by tethering from a heavy clock weight and deploying a drogue, either a PET bottle or parachute drogue, behind the vessel. This proved to be a reasonable solution, but the time required for the whole set-up to align at a desired position was quite long,

often up to minutes. Moreover, the boat would still “swim about”, due to fluctuations in current direction and wind, degrading the quality of each reading. In the very strong winds that are common in Tasmania, this set-up was simply not effective. In higher flows, there was a strong tendency for the vessel to move toward the higher flow regions of the river, making accurate positioning of the vessel extremely difficult to achieve, and generally resulted in an over estimation of the discharge.

With these issues in mind, we set about designing deployment systems to improve boat control. Improving boat control has a number of major benefits. A repeatable track greatly improves the reproducibility of results, and reduces the extent of data post-processing as the positioning and orientation of the instrument is more accurately controlled. For stationary boat measurements, improved boat control also allows for rapid and accurate re-positioning of the instrument, greatly reducing the time required to make each measurement. Our aim has been to position the instrument on a straight transect and to reduce the transverse and rotational movement of the boat. The other issue we have tried to address is providing the instrument with a stable vessel that is “sea worthy” at velocities greater than 2.0 ms⁻¹ and in waters with large standing waves. While our proprietary vessels provided a satisfactory instrument platform in relatively flat water conditions, in faster and more turbulent conditions these vessels were less competent due to their design characteristics.

The ADCP Platform 'The Beast'

Both the proprietary tri-hull and body board featured traditional style hulls, with flat decks, and both suffered the same problem. Once the bow submerges the water pressure on the deck drives the vessel underwater quite violently and once submerged, the vessel would often capsize. This presents a significant danger to both the equipment and the operator, and ruins the gauging run, wasting valuable time. As well as this problem, both these types of vessels have a tendency to hobby-horse in waves, and ventilation around the instrument is common with the body-board. In an attempt to address these issues, we have constructed a different style of type tri-hull vessel (*Figure 1*).

Since we don't actually walk around on our boats, and scale model Hydrographers are yet to be genetically engineered, why bother having decks at all? The new design therefore features "upside down hulls". With this design the buoyancy is low down in the hulls and the absence of flat decks encourages any hull that submerges to surface rather than drive down. The other benefit of this design is that it is effectively wave piercing, which helps to reduce the hobby horsing that is typical of traditional designs. The centre of buoyancy is behind centre in all three hulls, allowing the instruments to be located toward the back of the main hull, again discouraging nose-diving. Above the waterline, the hulls are heavily cut back toward the stern, resulting in a forward centre of buoyancy when submerged, again encouraging the hull to surface bow-first.



Hull construction is epoxy/glass over expanded styrene foam. These materials were chosen for their low cost relative to strength. The beams are timber core/uni-directional carbon then streamlined and finished in woven carbon. As we have no in-house capability to fabricate in aluminium, this method was chosen as it is cost effective over the use of outside contractors. The fins and fin cases were constructed in balsa/carbon and carbon epoxy respectively, simply because I had some material left over and, well, they just look good!

This boat has now been tested in a variety of conditions ranging from slow but windy to reasonably high velocity with standing waves. These tests indicate that the vessel is performing to expectations. As a consequence, we are now using our proto-type as a basis for a final model. This will be fundamentally the same but with the above waterline design refined to allow quicker and easier on-site assembly, and built with higher modulus materials to increase strength while reducing weight.

Figure 1: "The Beast" sees daylight for the first time. The fins pivot from the top and are held down with shock cord, and are designed to kick up if they encounter a solid object. The centre of buoyancy is behind centre, in-line with the rear beam.

Traversing the River

Having built a platform that we felt was capable of performing over a wide range of conditions, we started to develop river traversing systems designed to optimise boat control. As described earlier the goal was to develop methods to accurately locate the boat along the transect, and restrict its movement during measurement. We have developed two deployment systems, the first is a temporary system, for sites where there is no cableway infrastructure, and the second a self-levelling system for existing cableways. Apart from the benefit of improved measurement accuracy, both systems allow the operator to reposition the boat very quickly, compared to more traditional set-ups. The importance of this aspect should not be under-estimated in low flow, windy conditions. The time needed to complete a pass can easily be halved over traditional set-ups.

Temporary Cables

Achieving a straight transect with a temporary cable was relatively easy, simply by employing a non-stretch cable and pulling it extremely tight (Figure 2). The system is based around a 6mm Dyneema SK75 (UHMWPE*) cable. This cable has a Dyneema core for high strength and low stretch and a polyester cover for ease of handling. The Dyneema in these cables has a breaking strain of 1500 kg, with a maximum of 4% stretch at breaking point. At normal working loads stretch is negligible. A 5:1 block and tackle system is used to tension the cable, resulting in a tight, straight cable with very low sag. All cables are terminated with core to core soft splices allowing cables to easily connect to anchors with the use of carabina hooks, or to each other with shackles. While, the materials for this set-up were reasonably expensive, we saved money by fabricating the hardware and splicing the rope in-house, and by having a single length of rope manufactured which significantly reduced wastage. *(UHMWPE – ultra high molecular weight polyethylene)

Optimal boat control can now be achieved by attaching the boat to this cable via two solid tethers rather than the standard single point tether. The simplest system is to set the cable approximately 30 cm above the water surface then attach the boat directly to



Figure 2. Temporary cable system and “the Beast” on the Macquarie River attached directly to the cable. This transect length is 50 m long and, due to the shallow opposite bank, anchored at water level while on the near bank anchored about 30 cm above water level. The system uses an endless tag-line rope with the excess length packed away in the blue stuff-bag seen on the foredeck. Note the strainer on the star picket, necessary to withstand the very high tension required for such a long cable.



Figure 3. Measuring discharge of the Macquarie River using a temporary cable and the “the Beast”. The wind is blowing strongly upstream, but due to the solid double tether set-up the boat is facing upstream. Previous attempts to measure under these conditions using a drogue set-up have been unsuccessful. On this occasion, the sectional areas measured were 31.62 and 31.52 m², difference of 0.32%, with the mean velocities of 0.17 and 0.16 m/s respectively (5.9%). The discharges were 5.22 and 4.97 m³/s, a difference of 4.8%, however, it should be noted that over the measurement period the level decreased by 20 mm.

the cable either onto a pair of dolleys or just onto a pair of shackles (Figure 3).

This solution is obviously only possible where the cable can be anchored in an appropriate position and when the river conditions are relatively benign. Achieving this optimal set-up is often not possible, and in flood conditions the use of such a low cable would not be prudent. At this stage we have trialled several set-ups with the boat connected to the cable through a pair of solid bars. While effective, this set-up is time consuming to assemble and lacks versatility. We are currently investigating the use of telescope bars as a solution to problem of solid tethering at a range of cable heights (Figure 4).

We also use these cables when gauging from a bridge. The cable is strung across the bridge and then the boat is attached to the cable via a rock-climbing belay device. The use of the cable and belay device effectively isolate the boat operator from the boat. As I learned the hard way, this type of activity is not without its dangers, and we feel that this practice has significantly reduced the risks involved.



Figure 4. Temporary cable set-up on Lakes Sorell-Crescent Canal. At this site, star pickets have been permanently installed as anchors, and each kit contains a pair of steel collars that the system can be clipped onto. Once the ropes are across the river, complete set-up takes approximately three minutes.

Permanent Cables

Ironically, achieving high levels of boat control from a fixed cable is much more difficult than from a temporary system. To achieve optimal boat-control there are two significant problems that need to be overcome. Firstly, wind makes accurate positioning of the boat virtually impossible, and secondly, the inherent sag in the cable results in a curved path from the boat, unless the tether length is continually adjusted. Additionally, with a traditional single tether/clock-weight/drogue set-up, while reasonable stationary positioning is sometimes possible, the time required for the boat to settle in position makes this method extremely time-consuming.

We have overcome these problems using a pair of bulb shaped hulls attached to the cable through a system that automatically adjusts for the sag of the cable through a pair of counterweights, resulting in the hulls remaining immediately below the cable (Figure 5). By using a reverse purchase system the counterweights can be made significantly heavier than the float. These counterweights work in a similar way to a traditional single point clock-weight system in that the counterweight resists the downstream force on the floats and ADCP vessel. The floats are attached together through a solid bar, and the boat then attached to them through a pair of solid, diagonally braced tether bars. As a consequence, any rotational tendency of the boat either



Figure 5: Trial of the self levelling set-up on the North West Bay River. Note how high the hulls are floating, a further refinement would be to increase their weight, then increase the counter-weights by corresponding amount, possibly by 5kg and 30 kg respectively. The system has a self-adjusting range of 900 mm, sufficient travel for all our permanent cableways.

through wind or changes in current angle is resisted, as if rotation is to occur one counterweight will have to be pushed upstream while the other pulled downstream. This resistance to rotation also means the boat will settle in its new position very rapidly. As can be seen in Figure 6, a very straight path is achieved compared to the more typical path seen when using a clock-weight/drogue set-up. While the system was primarily designed for manually operated cableways, it is particularly effective with motorised systems, such as “The Hornet”. The tether cable winch provides a rapid coarse height adjustment for the system, reducing set-up time, while

the system itself provides a high degree of control for the vessel from these typical very elevated cables.

There is no doubt that ADCP technology provides the Hydrographer with a powerful tool to make discharge measurements. But, like any tool, if they are used, they must be used properly. Less than optimal deployment set-ups result in inconsistent, low quality measurements that inevitably cost time and money. With all our deployment set-ups, we have endeavoured to build compact systems that are adaptable to all gauging scenarios. While some of the raw materials used in these systems are expensive, these costs are largely ameliorated by in-house fabrication and our expectation that, due to their high quality, we will get a lot of use out of them before replacement is necessary. However, when the continual improvements in measurement quality and efficiency in the field is taken into account their cost is easily justifiable.

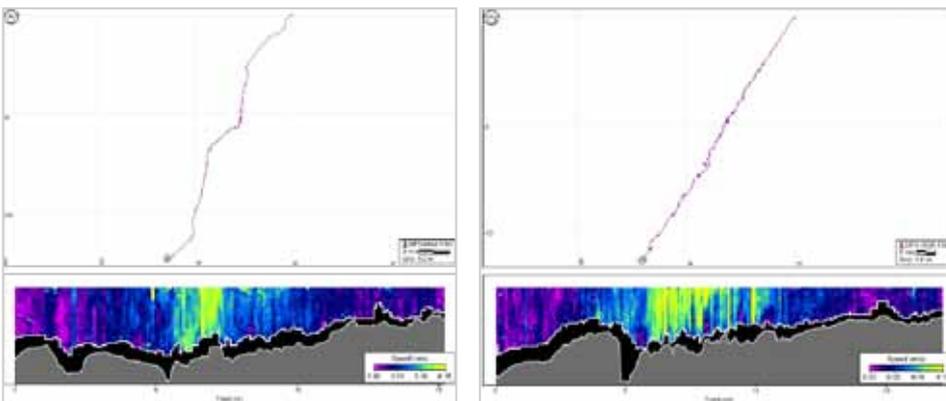
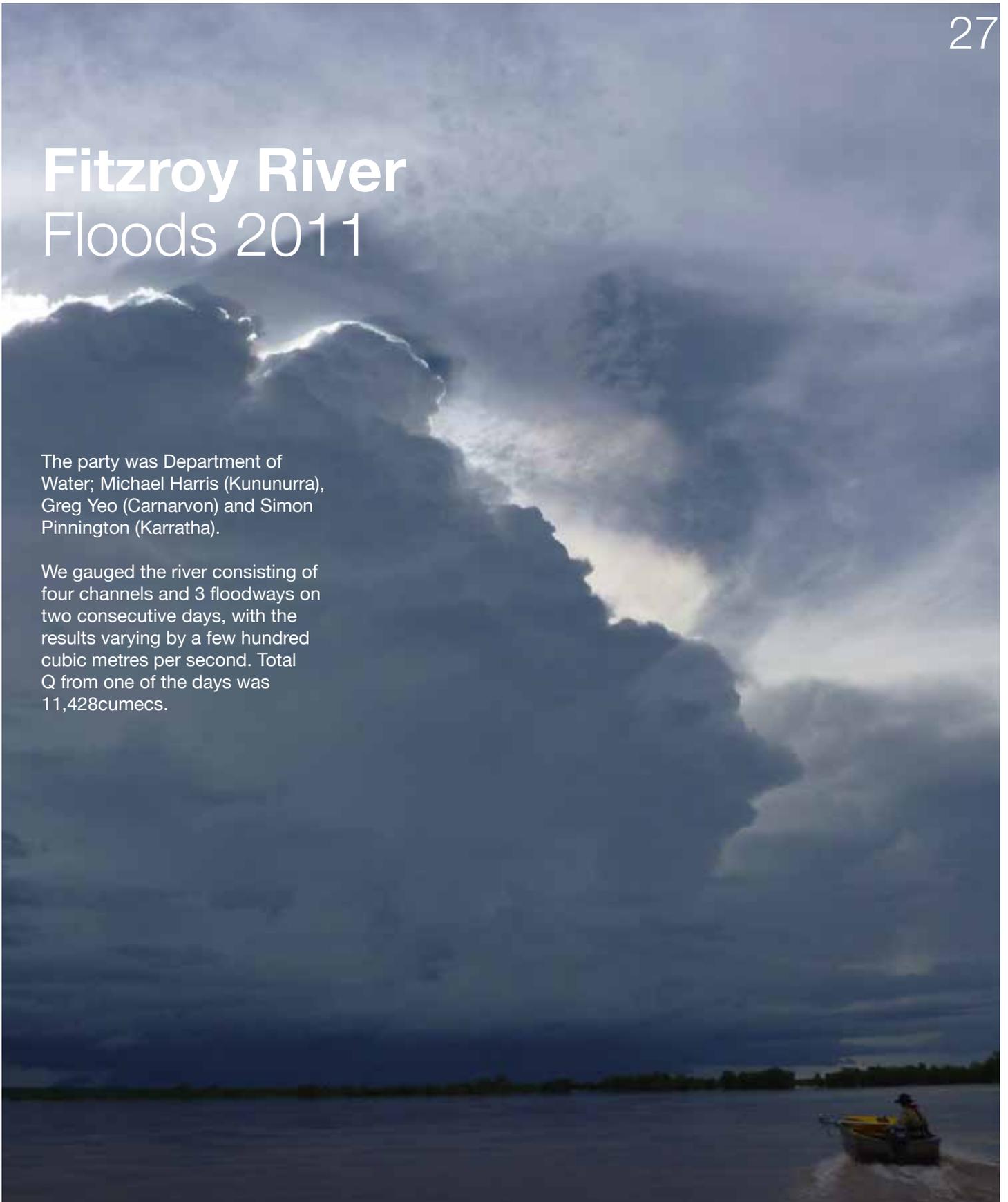


Figure 6: Moving boat track for a clock-weight/drogue set-up compared to self levelling system. In this case, a high quality set of a stationary measurements would not be possible with the traditional set-up

Fitzroy River Floods 2011

The party was Department of Water; Michael Harris (Kununurra), Greg Yeo (Carnarvon) and Simon Pinnington (Karratha).

We gauged the river consisting of four channels and 3 floodways on two consecutive days, with the results varying by a few hundred cubic metres per second. Total Q from one of the days was 11,428cumeecs.



FOR SALE

Gauging Trailers



Manly Hydraulics Laboratory maintains river gauges in the Shoalhaven and Nepean Catchments for the Sydney Catchment Authority. We recently carried out an upgrade of their sites with cableways. Some of the old equipment we removed included 3 trailers which contained traveller units used to conduct flood gaugings on the Shoalhaven River.

The SCA own these units and has kept one of the units for historical purposes and after several discussions with SCA it was decided that the remaining 2 trailers are too good to be scrapped.

We then came up with the idea that we could advertise the trailers with the AHA. There may be Hydrographers out there that could put the trailers to good use. They are not registered but could be easily brought back to good condition. We are not looking to charge for the trailers but would expect that whoever wants the trailers would have to arrange collection from our office here in Mittagong. It would work on a first in best dressed situation.

I have attached a couple of photos and with your permission would like to either put a note on the AHA website or send an email to AHA members.

If this is a possibility please contact me and we can discuss it further.

Regards,
Duncan

DUNCAN MACPHERSON

Hydrographer

Manly Hydraulics Laboratory

P (02) 48 721 858

M 0429 553 063

Cost Effective Ultrasonic Doppler Flow Measurement

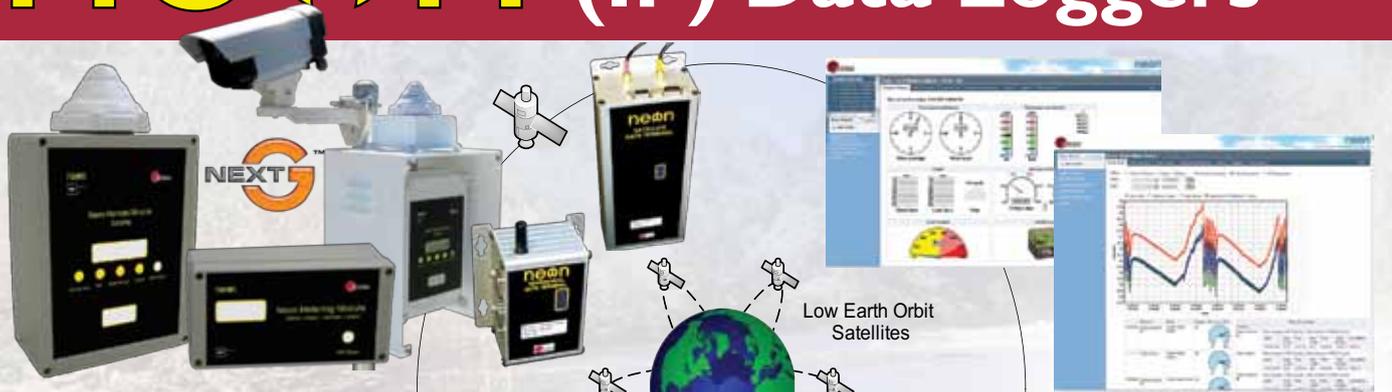
Unidata 6526 Ultrasonic Doppler Instrument

- Ultrasonic velocity measurement
- Depth measurement with barometric compensation
- Temperature measurement
- Computed flow measurement
- Inbuilt data logger
- SDI-12 interface
- 4-20ma interface option
- 2 and 5 meter depth ranges
- Ultra low power consumption
- Starlog 4 open channel and pipe definition software for flow calculation
- Optional LCD display
- Neon IP logger enabled for satellite and cell phone telemetry



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08 9331 8600 | www.unidata.com.au

neon Internet Protocol (IP) Data Loggers



- Field measurement to website technology
- Real Time / Near Real Time IP data loggers
- 8MB local logger memory capacity
- Full range of inputs: analog, digital SDI-12, modulas
- Security camera option
- Central Neon applications software (Windows ASP.net / Windows 2008 secure)
- Scalable from 5 to 5000 loggers



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Discharge Measurement System

Model RQ-30

Special points of interest:

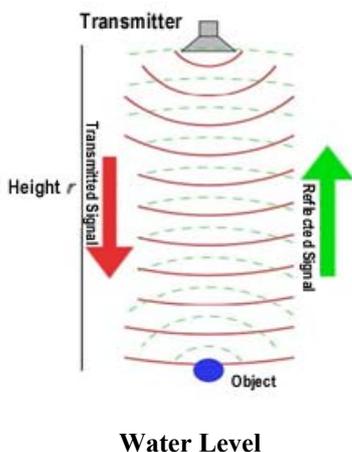
- Easy to install
- Non contact, Real-time discharge measurement
- Robust Construction
- Measures Water level, velocity and calculates discharge
- Maintenance free operation
- Interfaces: 1 x SDI-12 and 1 x RS 485
- Operating Temperature -35° C to 60 °C (-31 °F to 140 °F)
- FCC Approved & Certified
- Adjustable Bandwidth to suit water flow
- Measurement time 0 to 240 seconds

INTRODUCTION

The availability of real-time discharge data has become increasingly important to companies who require detailed data quickly for optimal water-management strategies. The conventional method is the development of a relation called “stage-discharge rating” by periodic measurements of the discharge, using mechanical or acoustic current meters for a range of stages. Complex flow conditions may negate stable stage-discharge ratings and make the use of conventional methods impractical or impossible. These conditions include flow reversals, backwater effects, and hysteresis effects.

The RQ-30 radar sensor measures the stage and the flow velocity and can be used to produce discharge records at stations where conventional methods cannot be used. Furthermore it allows to directly calculate the discharge in the sensor. Two techniques of contact free radar measurement are combined in one system.

The determination of the flow velocity is based on the principle of Doppler frequency shift. The water level is determined by transit time measurement. The measurement values are output via a serial interface or as analog current signals of 4 to 20mA. This allows a simple adoption into any measurement system. The system is installed simply without constructional changes of the channel itself. Existing bridges or buildings can be used to mount the system. The contact free radar technique guaranties a maintenance free operation over years.



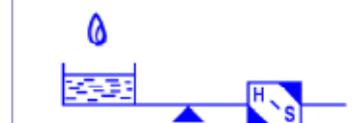
Hydrological Services Pty Ltd

Address:

48-50 Scrivener Street
 Liverpool, NSW, 2170, Australia
 Ph. 61 2 9601 2022 Fax. 61 2 9602 6971
 Web: www.hydrologicalservices.com
 Email: sales@hydrologicalservices.com



Distributed By:



iRIS 150 Compact Multi-Parameter Datalogger



The iRIS 150 is a small, compact datalogger featuring an LCD display and keypad. It can be connected to a wide variety of sensors, and features two analogue (0-5V, 0-20mA) inputs, two digital inputs, SDI-12 serial instrument support and a single digital output for alarm or control purposes.

Primary communication is RS232. This can be connected directly to a PC / laptop or else to a telemetry device such as the iQuest ICE³ 3G for IP based communication or a radio or dial-up modem.

Optional USB slave communication is available via a miniature USB slave connector. The iRIS 150 is shipped with this connector protected behind the label. NOTE: The front panel must be voided to use the USB port.

When not in telemetered mode, the iRIS 150 serves out its own menus via a terminal session, allowing configuration to be performed with any standard terminal software such as HyperTerminal® or iQuest iLink.

Models

To cater to a diverse market, there are two models available:-

- **iRIS 150C** (pictured). Has an external 14 way terminal block fitted to the base of the enclosure. This has an AA-size backup only lithium battery.
- **iRIS 150G**. Has two NG12 compression glands giving cable access to an internal 12 way I/O connector. This has a D-size lithium battery for optional standalone use (this use is I/O and application dependent).

GENERAL DESCRIPTION

LCD / Keypad User Interface

The iRIS 150 has a small graphics LCD with 4 text lines of 19 characters, plus a small set of pictorial icons. This display, in conjunction with the 4 button keypad provides a simple method of viewing general and sensor information as well as running totals etc.

Power Supply

Normally, the unit operates from an external 5-15V DC supply. When the external supply is connected (or the USB interface is active) the internal battery is disconnected. To be able to use the SDI-12 instrumentation port, the external supply must be connected.

The iRIS 150 is fitted with an internal 3.6V lithium backup battery. The size of this depends on the model. Both battery types (AA or D) may be changed in the field by the user. Replacements are available from iQuest.

Enclosure.

The iRIS 150 is housed in a die-cast aluminum case that is powder coated. This provides a cost-effective, lightweight, resilient and waterproof casing whilst maintaining a compact footprint and physical size. Mounting is done through two hollow pillars outside the sealing zone of the enclosure.

LED Indicators.

Five status indicator LEDs are provided on the iRIS 150 to the right of the LCD window. A blue status LED provides a visual indication of program operation and scan status. Three red LEDs provide feedback for the digital I/O and lastly, a single red LED provides indication of communication activity (either RS232/USB or SDI-12). NOTE: The I/O and comms LEDs only operate when external power or USB is connected

RS232 / USB Interface

One DTE configured DB9 male RS232 communication port is provided for interfacing with laptops or other external equipment. A rubber cap provides protection when the port is not in use. The RS232 port operates in an auto-switching mode between terminal and binary modes at a default. A "telemetry" mode is provided where the port will revert to native iQuest protocol at a user-defined speed for telemetry applications.

A USB slave port is also fitted, but requires the front label to be voided with a scalpel to gain access. The RS232 and USB are different physical interfaces to the same communication port. If the USB port is active, the RS232 port is automatically disabled.



iRIS 150C

Logging Memory

Non-volatile 8MB flash storage of over 1 million time/date stamped data points. The storage mode is a circular buffer (i.e. the oldest data is overwritten when the buffer is full). NOTE: Earlier units (prior to serial number AG3-0643) had 2MB of storage

PHYSICAL I/O

Analogue Inputs

Two non-isolated 12-bit uni-polar analogue inputs are included. Range 0-5000mV. Input impedance approx 100kΩ. Referenced to 0V common. Internal 250R resistors are provided for current (0-20mA or 4-20mA) inputs. The mode is selectable by the user via jumper links.

Digital Inputs

Two non-isolated digital inputs operating with either clean contact activation to 0V or a 5 to 30V DC signal. Maximum input frequency is 5kHz in frequency mode. Input debounce timing is user selectable by jumper links.

Digital Output

One digital output configured as open-drain pull-down sinking to 0V (max 300mA @ 30V). This can be used to switch a small external load such as a lamp or relay. On the iRIS 150C version this also controls a switched supply voltage output via an in-built transistor switch.

SDI-12 Interface

The integral SDI-12 interface fully complies with the SDI-12 electrical standard. The firmware support level is to SDI-12 V1.2. NOTE: The SDI-12 interface is only operational when an external supply is connected.

BASIC SPECIFICATION

SIZE: 115mm x 65mm x 56mm (4.5in x 2.6in x 2.2in) (W x H x D)
(Enclosure dimensions - exclude connectors and/or glands)

MASS: iRIS 150C (connector / AA-size battery) 410g (14.4oz).
iRIS 150G (glands / D-size battery) 470g (16.6oz).

POWER SUPPLY: External dc supply: Range 5-15V. Reverse polarity/over voltage protected. Internal lithium battery: AA-size 3.6V, 2400 mA/hr on iRIS 150C or a D-size 19000mA/Hr on iRIS 150G.

COMMUNICATIONS

- Non-isolated DTE RS232 at 1200 - 115200 bps (default 38400 bps)
- SDI-12 instrumentation port.

DATA STORAGE: 8MB flash memory (1,048,576 samples). A typical site with 2 parameters logged every 15 minutes plus battery voltage logged hourly will give 12 years of storage before data overwrite occurs.

ENVIRONMENTAL

Enclosure: IP65 unless the USB port is opened.

Operating: -10°C - +70°C.

Storage: -20°C - +85°C

iQuest (NZ) Ltd reserves the right to alter the specification without notice.



iQuest (NZ) Ltd - a wholly owned subsidiary of the Kisters Group

PO Box 15169, Hamilton 3243, NZ. Tel: +64 7 857-0810 Fax: +64 7 857-0811 Email: iquest@iquest.co.nz Web: www.iquest.co.nz

Issue 4 - 20101111

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WISKI 7 - Fully Automated Hydrological Database for RDBMS Solutions. Robust data management solution for SQL or Oracle platforms.

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Hydstra - Limited Site - Fully functional solution for the budget conscious agency. PC-based.

WaaS (WISKI as a Service) - A perfect solution for consultants and agencies with limited capital funds available.

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KISTERS realizes that every organisation strives to choose the right hydrological data management solution to fit their needs. It's often a delicate balance between the availability of financial, IT and human resources.

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KISTERS' Solutions offer our clients an unparalleled level of both flexibility and scalability to allow them to grow and change without the hassle of needing to change vendors.

KISTERS offers a comprehensive suite of tools and modules to complement your requirements

WATER QUALITY - a system for managing and analysing discreet water quality data
GROUNDWATER - a system for managing bore-related data

WEB - fully integrated web solution for data publishing and data access via the web

TASK SERVER - Real time processing / automation
MODELLING - neuronal forecast, and link and node modelling tools

WDTF - All KISTERS products are WDTF compliant



KISTERS' Time Series Management system (KiTSM) is a core enabling technology for fast and efficient handling of time series data. Find it in many of our data management solutions.





OTT RLS

The Radar Sensor for Hydrometry

Contactless and energy-efficient water level measurement

The new radar sensor OTT RLS is made for the operation at autarkic hydrologic measurement stations: It is flexible and efficient due to its very low power consumption, the wide range of voltage supply and the simple system integration via standardized interfaces.

Even under difficult conditions it measures water levels over its measuring range of 35 m reliably. At the same time its design is inconspicuous and it is rugged and almost maintenance-free – attributes that are a must for a sensor in the tough field use.



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Quantitative Hydrology

